RECIRCULATED PORTIONS OF THE DRAFT ENVIRONMENTAL IMPACT REPORT

SFPUC Alameda Creek Recapture Project

Volume 4

PLANNING DEPARTMENT
CASE NO. 2015-004827ENV
STATE CLEARINGHOUSE NO. 2015062072
DECEMBER 4, 2019

Draft EIR Publication Date:	November 30, 2016
Draft EIR Public Hearing Date:	January 5, 2017
Draft EIR Public Comment Period:	November 30, 2016 — January 30, 2017
Responses to Comments Publication Date:	June 7, 2017
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ACRONYMS AND ABBREVIATIONS

ACA	Alameda Creek Alliance
ACFCD	Alameda County Flood Control and Water Conservation District
ACDD	Alameda Creek Diversion Dam
ACFRW	Alameda Creek Fisheries Restoration Workgroup
ACRP	Alameda Creek Recapture Project
ACPWA	Alameda County Public Works Agency
ACWD	Alameda County Water District
afy	acre-feet per year
AF	acre-feet
ASDHM	Alameda System Daily Hydrologic Model
BART	Bay Area Rapid Transit
BAWSCA	Bay Area Water Supply and Conservation Agency
BO	Biological Opinion
BOS	Board of Supervisors
Caltrans	California Department of Transportation
CCC	Central California Coast
CCSF	City and County of San Francisco
CDFG	California Department of Fish and Game (now called CDFW)
CDFW	California Department of Fish and Wildlife
CDRP	Calaveras Dam Replacement project
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
cfs	cubic feet per second
cm/sec	centimeters per second
CRLF	California red-legged frog
DPS	distinct population segment
DSOD	California Department of Water Resources, Division of Safety of Dams
DWR	California Department of Water Resources
EFH	Essential Fish Habitat
EIR	Environmental Impact Report
EP	Environmental Planning
ERO	Environmental Review Officer
ESA	Environmental Science Associates

FESA	Federal Endangered Species Act
ft/day	feet per day
GIS	geographical information system
gpm/ft	gallons per minute per foot
HY	hydrologic year (same as WY, water year)
I-680	Interstate 680
LIDAR	Light Detection and Ranging
LSCE	Luhdorff and Scalmanini Consulting Engineers
MG	million gallons
MOU	memorandum of understanding
MW	monitoring well
NAVD 88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NGVD 29	National Geodetic Vertical Datum of 1929
NMFS	National Marine Fisheries Service
NOP	Notice of Preparation
NPDES	National Pollutant Discharge Elimination System
ODS	Oliver de Silva, quarry operator
PCEs	primary constituent elements
PG&E	Pacific Gas and Electric Company
Qa	Younger Alluvium
Qg	Stream Channel Gravels
Qoa	Older Alluvium
Qt	Terrace Deposits
QTl	Livermore Gravels
RWQCB	California Regional Water Quality Control Board
SFPUC	San Francisco Public Utilities Commission
SMP	Surface Mining Permit
SVWTP	Sunol Valley Water Treatment Plant
SWP	State Water Project
SWRCB	State Water Resources Control Board
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WSIP	Water System Improvement Program
WY	water year (same as HY, hydrologic year)
Zone 7	Zone 7 Water Agency

CHAPTER 1A
Summary of the Recirculated Portions of the EIR

1A.1 Introduction

The San Francisco Public Utilities Commission (SFPUC) is proposing the Alameda Creek Recapture Project (ACRP or proposed project) as part of improvements to its regional water system. The ACRP is a water supply project that would be located in the Sunol Valley in Alameda County on lands owned by the City and County of San Francisco (CCSF). Under the ACRP, the SFPUC would construct pumping and associated facilities to withdraw water from Pit F2, an existing quarry pit formerly used by quarry operators located adjacent to Alameda Creek about six miles downstream of Calaveras Reservoir. The proposed project would "recapture" water that the SFPUC is required to release or bypass upstream in Alameda Creek as part of operation of the new Calaveras Dam to be completed in 2019. The SFPUC would convey the water pumped from Pit F2 to existing SFPUC facilities for treatment and distribution to its customers in the Bay Area. No construction would occur within the Alameda Creek stream channel. The amount of water SFPUC would pump from Pit F2 would be limited to the portion of water that seeps into Pit F2 that is within the CCSF's existing water rights.

In June 2017, the San Francisco Planning Commission certified an environmental impact report (EIR) for the ACRP in compliance with the California Environmental Quality Act (CEQA) and Chapter 31 of the San Francisco Administrative Code. The EIR was appealed, and the San Francisco Board of Supervisors upheld the appeal and directed the planning department to provide additional information and analysis regarding operational impacts of the ACRP on steelhead fish in Alameda Creek. In response, the San Francisco Planning Department prepared and published this document, the recirculated portions of the EIR. This chapter summarizes the revisions made to the June 2017 EIR that are presented in this document, consistent with CEQA Guidelines section 15088.5(g). The reader is referred to Chapter 1 of the June 2017 EIR for a summary of all other information on the environmental review of the ACRP.

1A.2 Contents of the Recirculated Portions of the EIR

This document consists of the following chapters: Chapter 13, Introduction to Recirculated Portions of the EIR; Chapter 14, Revisions to the Project Description; Chapter 15, Recirculated Portions of Environmental Setting, Impacts, and Mitigation Measures; as well as supporting appendices. The information in this document is either new information to supplement the June 2017 EIR or new information that supersedes and replaces certain portions of that previous document.

The recirculated portions of the EIR focus on the information requested by the San Francisco Board of Supervisors, namely: (1) the project-specific operational impact on steelhead fish due to project-induced changes in Alameda Creek streamflow; and (2) an independent third party review of the groundwater/surface water analysis used in the EIR to support the fisheries impact analysis. This document also contains additional information because subsequent to the June 2017 EIR, the SFPUC revised the proposed operations of the ACRP. Specifically, the SFPUC revised the operating protocols for the ACRP in order to avoid effects on Alameda Creek streamflow during the steelhead migration season in response to concerns raised by the National Marine Fisheries Service (NMFS) and by the California Department of Fish and Wildlife (CDFW).

Therefore, this document also describes the revised project operations and discusses those resource areas that could potentially be affected by the revised project operations. The recirculated portions of the EIR include associated revisions to the applicable setting, regulatory framework, approach to analysis, and impact discussion for those resource areas that could be affected by the revised project operations.

The supporting appendices in this document include: materials to support the CEQA recirculation process (e.g., Notice of Preparation and scoping comments); the report of the independent third party review of the groundwater/surface water analysis interactions; and revised and updated technical appendices related to those resource topics that could be affected by the revised project operations (i.e., fisheries resources, surface water hydrology, and groundwater/surface water interactions).

The San Francisco Board of Supervisors determined that with respect to the June 2017 EIR "as to all other issues, the Board finds the Final EIR adequate, accurate, and objective, and no further analysis is required." Therefore, this document contains only the sections described above. The reader is referred to the June 2017 EIR for all other information on the environmental review of the ACRP.

1A.3 Revisions to the Project Description

The SFPUC revised the operating protocols for the ACRP in response to concerns raised by NMFS and CDFW. Section 14.3, Revised Project Operations, in this document supersedes and replaces Chapter 3, Section 3.6.1, Proposed Operations, in the June 2017 EIR. The revised project operations described in Section 14.3 are used in the revised impact analysis presented in Chapter 15 of this document.

The SFPUC has also revised the schedule for project construction. Instead of an 18-month construction period previously anticipated to occur between the fall of 2017 and the spring of 2019, project construction is now anticipated to have a 20-month duration between 2020 and 2022.

Under the revised operations, the SFPUC estimates that compared to the operations presented in the June 2017 EIR, the average annual recapture volume would be reduced from 7,178 acre-feet per year to 6,045 acre-feet per year. The range of recapture volume would be reduced from a range of 4,878 to 9,161 acre-feet per year to a range of 4,045 to 8,031 acre-feet per year.

The revised project operations would impose more restrictive constraints for pumping water from Pit F2 compared to the operations presented in the June 2017 EIR. In the June 2017 EIR, it was assumed that pumping could occur when water levels in Pit F2 are between 150 and 240 feet elevation, but pumping could also occur with water levels as low as 100-feet elevation during drought periods; under the revised operations, the SFPUC would maintain the water elevation in Pit F2 between 180 and 240 feet under all conditions.

In the June 2017 EIR, project operations provided for pumping from Pit F2 to occur between April 1 and December 31 of each year (if pit water levels are greater than 150 feet). Under the revised operations, the pumping period would be reduced from nine months to five months of each year, with pumping generally limited to occur between July 1 and November 30 (if pit water levels are greater than 180 feet); however, pumping could also occur between May 1 and June 30 but only when there is no streamflow in Alameda Creek above the confluence with San Antonio Creek and the water elevation in the pit is greater than 225 feet.

1A.4 Revisions to the Impact Analysis

The recirculated portions of the environmental impact analysis include the revised analysis of project operations on steelhead fisheries and updated analyses of several other resource topics (listed below) potentially affected by the revised project description.

The revised steelhead analysis replaces Impact BI-11 from the June 2017 EIR and is substantially more detailed. It analyzes project impacts at a daily time step and incorporates quantified estimates of seepage to Pit F2 based on the expanded analysis of groundwater/surface water interactions. Other impacts examined that could be affected by the revised project operations and/or the updated technical analysis include: special-status wildlife species, riparian habitat, groundwater recharge, downstream water users, stability of geologic unit, and energy. Cumulative impacts that could be affected by the revised construction schedule include: transportation, noise, recreation, and hazardous materials.

Table 1A-1 below summarizes the impacts addressed in the recirculated portions of the EIR. As noted in the table, the revised analyses resulted in no changes to the impact significance and no changes to mitigation measures from what was previously identified in the June 2017 EIR.

1A.5 Results of the Third Party Review of Groundwater/ Surface Water Analysis

The San Francisco Planning Department retained the services of Jean E. Moran, PhD and Professor of Earth and Environmental Science at California State University, East Bay to conduct the independent third party review of the adequacy and accuracy of the information related to groundwater characteristics, including characterization of groundwater and surface water interactions used in the EIR analysis of project impacts on streamflow in Alameda Creek that could affect fisheries resources. Specifically, Dr. Moran reviewed Appendix HYD2, Groundwater/Subsurface Water Interactions Technical Memorandum, of the June 2017 EIR and all supporting information used in the preparation of that memorandum as well as other pertinent portions of the EIR and associated administrative record as requested by Dr. Moran.

TABLE 1A-1
SUMMARY OF ACRP IMPACTS AND MITIGATION MEASURES IN RECIRCULATED PORTIONS OF THE EIR

Environmental Impact	Mitigation Measure	Impact Significance June 2017 EIR	Impact Significance Recirculated EIR
Transportation and Circulation			
Impact C-TR: The project, in combination with past, present, and probable future projects, would not substantially affect transportation and circulation.	None required.	LS	LS (No change from June 2017 EIR)
Noise and Vibration			
Impact C-NO: The project, in combination with past, present, and probable future projects, would not substantially affect noise and vibration.	None required.	LS	LS (No change from June 2017 EIR)
Recreation			
Impact C-RE: The project, in combination with past, present, and probable future projects, would not substantially affect recreational resources.	None required.	LS	LS (No change from June 2017 EIR)
Terrestrial Biological & Fishery Resources			
Impact BI-5: Project operations would not have a substantial adverse effect on special-status species.	None required.	LS	LS (No change from June 2017 EIR)
Impact BI-6: Project operations could have a substantial adverse effect on riparian habitat or other sensitive natural community, including wetland habitats.	**Mitigation Measure M-BI-6: Riparian Habitat Monitoring and Enhancement Mitigation** **Mitigation Measure M-BI-6a: Baseline riparian habitat mapping.** Prior to commencing project operations, the SFPUC shall prepare a plan to submit to the Environmental Review Officer (ERO) for review and approval describing quantitative methods for measuring extent of baseline riparian habitat and subsequent changes in extent following commencement of project operations. The SFPUC shall map the extent of tree-supporting riparian alliances (i.e., sandbar and arroyo willow thickets and mixed riparian forest) along Alameda Creek Subreaches A, B, and C1, starting from the confluence with San Antonio Creek and extending downstream to about the northern end of the former Sunol Valley Golf Club (see Figure 5.14-2).	LSM	LSM (No change from June 2017 EIR)

TABLE 1A-1 (Continued)
SUMMARY OF ACRP IMPACTS AND MITIGATION MEASURES IN RECIRCULATED PORTIONS OF THE EIR

Environmental Impact	Mitigation Measure	Impact Significance June 2017 EIR	Impact Significance Recirculated EIR
Terrestrial Biological & Fishery Resources			
Impact BI-6 (cont.)	**Mitigation Measure M-BI-6b: Annual riparian habitat monitoring and reporting.** Once ACRP recapture operations begin, the SFPUC shall conduct annual monitoring within Subreaches A, B, and C1, applying the same mapping protocol used to establish the baseline map (Mitigation Measure M-BI-6a), to document the extent of tree-supporting riparian alliances. A reduction in extent of tree-supporting riparian alliances from the baseline conditions, as calculated below, shall trigger implementation of habitat enhancement measures described in Mitigation Measure M-BI-6c on a 1:1 ratio based on extent. Changes in the extent of tree-supporting woody riparian alliances shall be calculated as the difference in extent between the baseline conditions and a multi-year rolling average based on the current year and the years preceding. The SFPUC shall prepare and submit to the ERO an annual report documenting the annual monitoring of riparian habitat and any associated habitat enhancement activities, with the first year report consisting of baseline monitoring and plan for habitat enhancement (see Mitigation Measure M-BI-6c). In the future, when quarry operations cease, implementation of this mitigation measure shall cease. **Mitigation Measure M-BI-6c: Habitat enhancement, Subreaches B and C1 to achieve no net loss of tree-supporting riparian alliances.** The SFPUC shall develop a habitat enhancement plan to be reviewed and approved by the Environmental Review Officer and shall implement the plan based on the triggers described in Mitigation Measure M-BI-6b. The plan shall be consistent with the SFPUC's Sunol Valley Restoration Report (in prep.) and shall consist of a combination of plantings such as valley oaks and sycamores in the		

TABLE 1A-1 (Continued)
SUMMARY OF ACRP IMPACTS AND MITIGATION MEASURES IN RECIRCULATED PORTIONS OF THE EIR

Environmental Impact	Mitigation Measure	Impact Significance June 2017 EIR	Impact Significance Recirculated EIR
Terrestrial Biological & Fishery Resources (cont.)			
Impact BI-6 (cont.)	floodplain, and protecting and managing natural valley oak and sycamore recruits. Mitigation gains in woody riparian habitat shall be calculated in the same manner as losses are calculated in Mitigation Measure M-BI-6b. To the extent feasible, habitat enhancement shall be implemented in a portion of Subreaches B and C1, and in all cases, within the Sunol Valley. No net loss will be considered to be achieved under this mitigation measure at such time that the SFPUC establishes and maintains woody riparian habitat that fully replaces the baseline extent of woody riparian habitat in accordance with the approved habitat enhancement plan. Upon documentation that this performance standard has been satisfied, the SFPUC may request ERO approval to discontinue the monitoring and enhancement actions required under this mitigation measure. This measure shall be superseded at such time that the SFPUC implements the Sunol Valley Restoration Report that accomplishes the equivalent or greater habitat enhancement. In the future, when quarry operations cease, implementation of this mitigation measure shall cease.		
Impact BI-11: Project operations would not substantially interfere with the movement or migration of special-status fish species, including CCC steelhead DPS.	None required.	LS	LS (No change from June 2017 EIR)
Geology and Soils			
Impact GE-4: The project would not be located on a geologic unit that could become unstable as a result of project operations.	None required.	LS	LS (No change from June 2017 EIR)

TABLE 1A-1 (Continued)
SUMMARY OF ACRP IMPACTS AND MITIGATION MEASURES IN RECIRCULATED PORTIONS OF THE EIR

Environmental Impact	Mitigation Measure	Impact Significance June 2017 EIR	Impact Significance Recirculated EIR
Hydrology and Water Quality			
Impact HY-2: Operation of the ACRP would not substantially alter the movement of subsurface water or substantially affect groundwater recharge in the Sunol Valley such that it would affect the production rate of pre-existing nearby wells.	None required.	LS	LS (No change from June 2017 EIR)
Impact HY-5: Operation of the ACRP would not cause downstream water users, as a result of project-induced flow changes, to alter their operations in a way that would result in significant adverse environmental impacts.	None required.	LS	LS (No change from June 2017 EIR)
Impact C-HY: The project, in combination with past, present, and probable future projects, would not substantially affect hydrology and water quality.	None required.	LS	LS (No change from June 2017 EIR)
Hazards and Hazardous Materials			
Impact C-HZ: The project, in combination with past, present, and probable future projects, would not substantially affect hazards and hazardous materials.	None required.	LS	LS (No change from June 2017 EIR)
Mineral and Energy Resources			
Impact ME-4: Project operations could encourage activities that use large amounts of fuel or energy, or the use of these resources in a wasteful manner.	**Mitigation Measure ME-4: (WSIP PEIR Measure 4.15-2, Incorporation of Energy Efficiency Measures)** Consistent with the Energy Action Plan II priorities for reducing energy usage, the SFPUC will ensure that energy-efficient equipment is used in all WSIP projects. A repair and maintenance plan will also be prepared for each facility to minimize power use. The potential for use of renewable energy resources (such as solar power) at facility sites will be evaluated during project-specific design.	LSM	LSM (No change from June 2017 EIR)

In her initial review of Appendix HYD2 and related EIR materials, Dr. Moran identified some revisions needed in the EIR groundwater/surface water analysis related primarily to the need to quantify certain groundwater parameters and to augment the discussion of ACRP operations. In addition, subsequent to her initial review, the SFPUC developed revised operational protocols for the ACRP. Consequently, the planning department determined that more detailed analysis was required in the groundwater-surface water analysis to address identified revisions needed as well as to analyze implications of the revised ACRP operations. The planning department directed that the EIR consultants prepare a revised Appendix HYD2, which is now included as part of the recirculated portions of the EIR—Appendix HYD2-R—and which supersedes the original Appendix HYD2 in the June 2017 EIR. The revised analysis for operational impacts on steelhead presented in the recirculated portions of the EIR relies on the analysis presented in Appendix HYD2-R.

The planning department then requested that Dr. Moran review Appendix HYD2-R as well as the revised project operations. Dr. Moran's final report presenting the results of her third party review of the EIR is based on review of Appendix HYD2-R, which takes into account the revised project operations.

Dr. Moran's final report states "The variety of data examined and the spatial and temporal data coverage are adequate for addressing the central question of assessment of impacts on stream flow in Alameda Creek due to the Project." Furthermore, the report states "The primary assumptions upon which the analyses are based are largely supported by observations and data, and by the similar results determined using multiple analytical methods. Overall, the analyses provide a reasonably reliable method for predicting creek leakage and seepage (groundwater flow) to and from Pit F2."

Dr. Moran notes that "Pumping from Pit F2 is to take place only between July 1 and Nov 30, when streamwater-groundwater interaction is minimal and stream flow is generated by CDRP [Calaveras Dam Replacement Project] releases." She concludes that "pumping from the pit over that time period should not significantly affect groundwater levels in the project area or elsewhere." Dr. Moran also reports that the conclusion in the EIR that the Livermore Gravels subunit is not considered to have a dynamic influence on groundwater conditions that could affect daily to seasonal impacts of ACRP operations is reasonable. She states, "the analysis in HYD2 uses the available data to make predictions of potential impacts to streamflows using justifiable assumptions and reasonable estimations of aquifer properties and relationships between stream flow and flow through porous media."

CHAPTER 13

Introduction to the Recirculated Portions of the Draft EIR

13.1 Purpose

This document contains the recirculated portions of the draft environmental impact report (EIR) on the San Francisco Public Utilities Commission's (SFPUC) Alameda Creek Recapture Project (ACRP or project). The purpose of the recirculated portions of the Draft EIR is to address significant new information identified subsequent to the June 2017 publication of the EIR on this project, as provided for under California Environmental Quality Act (CEQA) Guidelines section 15088.5 and described below. The recirculated portions of the Draft EIR supplement the previously published Draft EIR on the ACRP, and in some cases, replace portions of it. The San Francisco Planning Department is publishing this document for public review and comment as required by CEQA. The recirculated portions of the Draft EIR, responses to comments on this document, and the previously published Draft EIR (June 2017) together will constitute the Final EIR on the ACRP. Once certified, the Final EIR will be used as an informational document by governmental agencies and the public to aid in the planning and decision-making process on the project in accordance with CEQA requirements.

13.1.1 Overview of the ACRP Environmental Review Process

In compliance with the requirements of the CEQA (California Public Resources Code sections 21000 et seq.), CEQA Guidelines (California Code of Regulations, Title 14, sections 15000 et seq.), and San Francisco Administrative Code Chapter 31, the San Francisco Planning Department has prepared an EIR on the proposed project. The planning department published the Draft EIR on the ACRP on November 30, 2016, received public and agency comments over a 60-day public review period, and then published the Responses to Comments document on June 7, 2017. The San Francisco Planning Commission certified the Final EIR (consisting of the Draft EIR and the Responses to Comments document) in June 2017. However, in response to an appeal on the certification action, the San Francisco Board of Supervisors adopted findings in September 2017, reversing the certification of the Final EIR, and directed the planning department to provide additional information on specific topics. Therefore, consistent with this direction from the board of supervisors, the planning department has prepared this document — a partial revision to the June 2017 EIR — to comply with the CEQA recirculation requirements.

Table 13-1 summarizes the chronology of the entire environmental review process for the ACRP EIR, including the original Draft EIR and Responses to Comments document, the appeal process, the process for recirculating portions of the Draft EIR, and the ultimate certification process. For details regarding the environmental review process for the Draft EIR published in November 2016 and the Responses to Comments document published in June 2017, please see Chapter 2 and Chapter 9, respectively, of those two documents.

TABLE 13-1
SUMMARY OF ACRP EIR CEQA PROCESS

CEQA Process	Date	Location
Original Draft EIR		
Notice of Preparation, publication	June 24, 2015	—
EIR Scoping Period	June 24, 2015 to July 27, 2015	—
EIR Scoping Meeting	July 9, 2015	Sunol, CA
Draft EIR, publication	November 30, 2016	—
Draft EIR Public Review Period	November 30, 2016 to January 30, 2017	—
Public Hearing on Draft EIR	January 5, 2017	San Francisco, CA
Responses to Comments Document on Original Draft EIR		
Responses to Comments Document, publication	June 7, 2017	—
EIR Certification Hearing on the Final EIR before the San Francisco Planning Commission	June 22, 2017	San Francisco, CA
San Francisco Planning Commission Motion No. 19952 certifying the Final EIR	June 22, 2017	
EIR Appeal		
Appeal Letter from Alameda County Water District	July 24, 2017	—
Appeal Hearing before the San Francisco Board of Supervisors	September 5, 2017	San Francisco, CA
San Francisco Board of Supervisors Motion No. M17-148 reversing the Planning Commission's certification	September 19, 2017	
Recirculated Portions of the Draft EIR		
Agency Scoping Meeting on recirculated portions of the Draft EIR	October 3, 2017	Santa Rosa, CA
Notice of Preparation of recirculated portions of the Draft EIR, publication	October 18, 2017	—
Scoping Period, recirculated portions of the Draft EIR	October 18, 2017 to December 6, 2017	—
Scoping Meeting, recirculated portions of the Draft EIR	December 6, 2017	San Francisco, CA
Agency Coordination Meeting on recirculated portions of the Draft EIR	May 30, 2018	Santa Rosa, CA
Presentation to the Alameda Creek Fisheries Restoration Workgroup	September 12, 2019	Livermore, CA
Recirculated portions of the Draft EIR, publication	December 4, 2019	—
Public Review Period on the recirculated portions of the Draft EIR	December 5, 2019 to January 21, 2020	—
Public Hearing on recirculated portions of the Draft EIR	January 9, 2020	San Francisco, CA
Supplemental Responses to Comments on Recirculated Portions of the Draft EIR and Final EIR		
Supplemental Responses to Comment Document on Recirculated Portions of the Draft EIR, publication	To be determined	—
Final EIR Certification Hearing	To be determined	San Francisco, CA

13.1.2 Background on Recirculation

Appeal Process and Board of Supervisors Motion

As indicated on Table 13-1 above, the San Francisco Planning Department published the ACRP Final EIR on June 7, 2017 (referred to hereafter as the "June 2017 EIR"). Two weeks later, on June 22, 2017, the San Francisco Planning Commission found the June 2017 EIR to be adequate, accurate, and objective and certified it in compliance with the CEQA, CEQA Guidelines, and Chapter 31 of the San Francisco Administrative Code. Subsequent to that certification, the Alameda County Water District (ACWD) filed an appeal to the San Francisco Board of Supervisors (Board) on July 24, 2017 requesting that the Board overturn the certification of the June 2017 EIR. The major points in the ACWD appeal letter of July 24, 2017 related to operational impacts on steelhead fish in the lower watershed as a result of project-induced streamflow, asserting: (1) the project would result in potential "take" of Central California Coast (CCC) steelhead; and (2) modeled data showed the project would substantially increase the number of days that streamflow conditions in Alameda Creek at the Niles gage would be non-passable for steelhead.

On July 27, 2017, the National Marine Fisheries Service (NMFS) filed a letter in support of the appeal that contained comments that the planning department considers to be "significant new information" under CEQA Guidelines section 15088.5 (see next section below for further explanation of how such new information is to be handled during the CEQA review process). In its letter, NMFS stated that it "believes the document does not contain sufficient information to conclude the ACRP will not result in substantial effects on streamflow that support the migration of CCC steelhead in Alameda Creek." The letter of July 27, 2017 stated that: (1) the EIR needs to present more clearly the comparison of hydrologic conditions "with" and "without" project conditions; (2) the impacts to steelhead migration is based on an analysis of the long-term operation of the ACRP and does not fully take into account short-term impacts, particularly during dry years; (3) the analysis fails to consider that steelhead do not migrate only during peak flow events, but may migrate anytime within the migration period when instream flows exceed identified minimum flow levels (i.e., 25 cubic feet per second [cfs] for adults, 12 cfs for juvenile/smolts in lower Alameda Creek); (4) the analysis should focus on changes in the amount of time flows exceed these minimum migration thresholds; and (5) review of the data indicates that in some years such as May 2008, ACRP operations will diminish migration opportunities for steelhead, especially out-migrating steelhead smolts.

The letter provides clarification of NMFS's concerns regarding how the project would affect low-flow levels in Alameda Creek; the information in the NMFS letter constitutes significant new information that NMFS had not previously identified. This significant new information from NMFS affects the CEQA evaluation of operational impacts of the project on CCC steelhead (*Oncorhynchus mykiss*) distinct population segment (DPS), a species listed as threatened under the federal Endangered Species Act.

In addition to the appeal letter filed by ACWD and the NMFS letter in support of the appeal, the San Francisco Planning Department and Planning Commission received a number of other letters during the appeal process. The planning department prepared an appeal response memorandum and a supplemental response memorandum with written responses to all substantive comments in those letters,[1] with one exception. The two memoranda did not include responses to those comments related to operational impacts on CCC steelhead related to project-induced changes in streamflow.

On September 19, 2017, the San Francisco Board of Supervisors adopted findings reversing the certification of the June 2017 EIR and directed the planning department to provide additional information and analysis regarding whether the proposed project would result in operational impacts on steelhead fish in the lower watershed as a result of project-induced effects on streamflow in Alameda Creek (see **Appendix BOS** of this document).[2] The Board also directed that in conducting such additional environmental analysis, the planning department enlist an independent third party to review the groundwater/surface water analysis used in the EIR to determine if the analysis adequately and accurately supports the fisheries impact analysis as required by CEQA. The Board determined that with respect to all other issues, the June 2017 EIR is adequate, accurate, and objective, and no further analysis is required. Therefore, consistent with this direction from the Board, the planning department has prepared this document: a partial revision of the June 2017 EIR. It responds to the Board's determination and provides additional information and analysis on operational impacts on steelhead fish in the lower watershed as a result of project-induced effects on streamflow in Alameda Creek in consideration of the significant new information from NMFS.

As directed by the board of supervisors, comments from all organizations and individuals related to operational impacts on steelhead fish in the lower watershed as a result of project-induced effects on streamflow in Alameda Creek are addressed in this document, the recirculated portions of the June 2017 EIR, specifically in Chapter 15, Recirculated Portions of Environmental Setting, Impacts, and Mitigation Measures, Section 15.2, Fisheries Resources. **Appendix APC** provides a list of the names of the agencies, organizations, and individuals who submitted comments related to the ACRP impacts on steelhead during the appeal process, along with a summary of their comments and the location where their comments are addressed in this document.

Additional Significant New Information

Additional "significant new information," as defined under CEQA Guidelines section 15088.5 (see next section below), also became available subsequent to the board of supervisors' directive that the planning department conduct additional analysis regarding whether the proposed project would result in operational impacts on steelhead fish in the lower watershed as a result of project-induced effects on streamflow in Alameda Creek.

On October 17, 2017, NMFS issued a Biological Opinion for the ACWD/Alameda County Flood Control and Water Conservation District's Joint Lower Alameda Creek Fish Passage Improvement

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1 San Francisco Planning Department, Appeal of Final Environmental Impact Report, SFPUC Alameda Creek Recapture Project. Planning Case No. 2015-004827ENV, Board of Supervisors File No. 170893, August 28, 2017, and Appeal of Final Environmental Impact Report Supplemental Responses, September 5, 2017.

2 San Francisco Board of Supervisors, File No. 171000, Motion No. M17-148, September 19, 2017.

Project, which provides new regulatory guidance for steelhead conditions in Lower Alameda Creek. This information is relevant to the regulatory setting of the extended study area for the steelhead analysis in the ACRP EIR, and consequently to the assessment of conditions that could result in an adverse environmental effect. It is therefore is also considered to be “significant new information” under CEQA Guidelines section 15088.5. The new regulatory guidance for steelhead conditions in Lower Alameda Creek is described and addressed in Chapter 15, Section 15.2, of this document.

In response to concerns raised by NMFS during the appeal process and by the California Department of Fish and Wildlife (CDFW) during the scoping process for the recirculated portions of the EIR, the SFPUC has revised the proposed operations of the ACRP to limit pumping during the steelhead fish migration period. These project changes are important to assessing the issues raised by NMFS and CDFW as well as the new regulatory guidance provided by NMFS. Consequently, this document includes the analysis of the physical environmental effects associated with the revised project operations, particularly with respect to the changes in operational impacts on streamflow in Alameda Creek and steelhead migration habitat, but also with respect to other potentially affected resource topics such as terrestrial biological resources and downstream water users. This document describes the revised project operations in Chapter 14, Revisions to the Project Description, and analyzes the impacts of these project revisions in Chapter 15.

13.1.3 CEQA Requirements for Recirculation

Section 15088.5 of the CEQA Guidelines includes the following subsections relevant to the recirculated portions of the EIR:

(a) A lead agency is required to recirculate an EIR when significant new information is added to the EIR after public notice is given of the availability of the draft EIR for public review under Section 15087 but before certification. As used in this section, the term "information" can include changes in the project or environmental setting as well as additional data or other information. New information added to an EIR is not "significant" unless the EIR is changed in a way that deprives the public of a meaningful opportunity to comment upon a substantial adverse environmental effect of the project or a feasible way to mitigate or avoid such an effect (including a feasible project alternative) that the project’s proponents have declined to implement.

(c) If the revision is limited to a few chapters or portions of the EIR, the lead agency need only recirculate the chapters or portion that have been modified.

(d) Recirculation of an EIR requires notice pursuant to Section 15087, and consultation pursuant to Section 15086.

(f) The lead agency shall evaluate and respond to comments as provided in Section 15088. Recirculating an EIR can result in the lead agency receiving more than one set of comments from reviewers.

    (2) When an EIR is revised only in part and the lead agency is recirculating only the revised chapters or portions of the EIR, the lead agency may request that reviewers limit their comments to the revised chapters or portions of the recirculated EIR. The lead agency need only respond to (i) comments received during the initial circulation

period that relate to chapters or portions of the document that were not revised and recirculated, and (ii) comments received during the recirculation period that relate to the chapters or portions of the earlier EIR that were revised and recirculated. The lead agency's request that reviewers limit the scope of their comments shall be included either within the text of the revised EIR or by an attachment to the revised EIR.

(3) As part of providing notice of recirculation as required by Public Resources Code Section 21092.1, the lead agency shall send a notice of recirculation to every agency, person, or organization that commented on the prior EIR. The notice shall indicate, at a minimum, whether new comments may be submitted only on the recirculated portions of the EIR or on the entire EIR in order to be considered by the agency.

(g) When recirculating a revised EIR, either in whole or in part, the lead agency shall, in the revised EIR or by an attachment to the revised EIR, summarize the revisions made to the previously circulated draft EIR.

This document conforms to CEQA Guidelines for recirculation, including the provisions listed above. With respect to section 15088.5(f)(2), the comments received during the initial circulation period that relate to chapters or portions of the document that are not revised and recirculated by this document have been fully responded to in writing in the Responses to Comments document on the original Draft EIR published on June 7, 2017. Those published responses are already included as part of the June 2017 EIR and are not reproduced in the recirculated portions of the EIR, consistent with the San Francisco Board of Supervisors' finding that "as to all other issues, the Board finds the Final EIR adequate, accurate, and objective, and no further analysis is required." Consequently, and consistent with section 15088.5(f)(2), the planning department is requesting that reviewers limit any new comments on the EIR to those issues addressed in the revised chapters or portions of this recirculated EIR.

13.1.4 Contents of the Recirculated Portions of the EIR

In addition to this new Chapter 13, Introduction to the Recirculated Portions of the EIR, this document contains the following new sections to the EIR: Chapter 14, Revisions to the Project Description; Chapter 15, Recirculated Portions of Environmental Setting, Impacts, and Mitigation Measures; and relevant supporting appendices. Revised and updated technical appendices relate to those resource topics that could be affected by the revised project operations, namely fisheries resources, surface water hydrology, and groundwater/surface water interactions (Appendix BIO2-R; Appendix HYD1-R; and Appendix HYD2-R, respectively). Other new appendices in the recirculated portions of the EIR include materials to support the CEQA recirculation process (e.g., Notice of Preparation and scoping comments), and, as described below, the results of the independent third party review of the groundwater/surface water interactions analysis.

The information in this document is either new information to supplement the June 2017 EIR or new information that supersedes and replaces certain portions of that previous document; the description of each section identifies whether it contains supplemental information or whether it is a replacement of a section.

The recirculated portions of the impact analysis focus on the single issue identified by the San Francisco Board of Supervisors: the project-specific operational impact on threatened CCC steelhead due to project-induced changes in Alameda Creek streamflow. However, this document also discusses those resource areas that could be affected by the revised project operations, including terrestrial biological resources and downstream water users. The recirculated portions of the EIR include associated revisions to the applicable setting, regulatory framework, approach to analysis, and impact discussion for those resource areas that could be affected by the revised project operations, also taking into consideration the significant new information provided by NMFS.

This document does *not* contain the information that was previously determined by the San Francisco Board of Supervisors to be adequate, accurate, objective, and in compliance with CEQA. The reader is referred to the June 2017 EIR for information related to the following: aspects of the project description that have remain unchanged (i.e., location, setting, background, objectives, construction); plans and policies; all construction-related impacts; all operational impacts not affected by the revised project operations; growth inducement; unavoidable significant impacts; significant irreversible environmental changes; and evaluation of alternatives.

13.2 Third Party Review of Groundwater/Surface Water Analysis

As part of the motion that reversed the certification of the June 2017 EIR, the San Francisco Board of Supervisors directed the San Francisco Planning Department to conduct an independent third party review of the groundwater/surface water analysis used in the EIR to determine if the analysis adequately and accurately supports the fisheries impact analysis as required by CEQA. The final report of the independent third party review is included in **Appendix TPR** of this document.

The San Francisco Planning Department retained the services of Jean E. Moran, PhD, and Professor of Earth and Environmental Science at California State University, East Bay to conduct the independent third party review of the adequacy and accuracy of the information related to groundwater characteristics, including characterization of groundwater and surface water interactions used in the EIR analysis of project impacts on streamflow in Alameda Creek that could affect fisheries resources. Specifically, Dr. Moran reviewed Appendix HYD2, Groundwater/Subsurface Water Interactions Technical Memorandum, of the June 2017 EIR and all supporting information used in the preparation of that memorandum as well as other pertinent portions of the EIR and associated administrative record as requested by Dr. Moran.

In her initial review of Appendix HYD2 and related EIR materials, Dr. Moran identified some revisions needed in the EIR groundwater/surface water analysis related primarily to the need to quantify certain groundwater parameters and to augment the discussion of ACRP operations. In addition, subsequent to her initial review, the SFPUC developed revised operational protocols for the ACRP. Consequently, the planning department determined that more detailed analysis was required in the groundwater-surface water analysis to address identified revisions needed as well as to analyze implications of the revised ACRP operations. The planning department directed that the EIR consultants prepare a revised Appendix HYD2, which is now included as part of the recirculated portions of the EIR—**Appendix HYD2-R**—and which supersedes the original Appendix HYD2. The revised analysis for operational impacts on steelhead presented in the recirculated portions of the EIR is based on the Appendix HYD2-R.

The planning department then requested that Dr. Moran review Appendix HYD2-R as well as the revised project operations. Dr. Moran's final report presenting the results of her third party review of the EIR is based on review of Appendix HYD2-R, which takes into account the revised project operations.

13.2.1 Summary of Appendix HYD2-R

The recirculated portions of the Draft EIR include a revised and expanded version of Appendix HYD2 (referred to as Appendix HYD2-R), a technical report that discusses groundwater and surface water conditions and interactions in the ACRP EIR study area. The revised Appendix HYD2-R provides a substantially more detailed characterization of the groundwater and surface water hydrology in the Sunol Valley for use in the EIR impact analysis. A short abstract of the report is presented below, but the reader is referred to Appendix HYD2-R for the complete report, including descriptions of regional and local geology, methodology for quantification of groundwater characteristics, and graphic representation of data and results.

Appendix HYD2-R provides a description and quantification of groundwater-surface water interactions that are relevant to the proposed ACRP operation based on empirical data including groundwater levels, surface water elevations, Alameda Creek streamflow; observations from other field studies; and analytical and numerical methods to quantify groundwater movement. Previous streamflow studies and mining experience have indicated significant surface water losses from Alameda Creek occur between Welch Creek and San Antonio Creek. These losses from surface flows to the subsurface accumulate in existing quarry pits, including Pit F2. Seepage from the creek directly into Pit F2 also occurs but is restricted by a slurry cut-off wall that partially surrounds the quarry. Monitoring well data and mapping indicate limited available storage space in the shallow aquifer. The data also indicate when the stream no longer provides recharge into the summer and fall periods, and when groundwater levels decline to seasonal low elevations due to seepage losses into adjacent quarry pits and by movement out of Sunol Valley through Niles Canyon.

In the quantitative analysis of groundwater flow upstream of the quarry reach of Alameda Creek, Appendix HYD2-R found that the range of volumetric flow in the shallow aquifer varied between 0 and 1 cfs at the same time streamflow varied from 0 to 2,250 cfs. This is consistent with an aquifer of limited volume and a creek serving as the predominant source of recharge, which are key characteristics of the groundwater and surface water interactions in the project area. Similarly, seepage from the creek into Pit F2 was found to range from 0 to about 1 cfs. A mass balance that incorporated continuous pit volume changes along with precipitation, evaporation and runoff produced a good match providing a means to assess the effects of variable pit levels on seepage from Alameda Creek into Pit F2 under the scenarios evaluated. Results were also consistent with previous field observations of stream losses through the same reach that were part of studies concerning aquatic habitat restoration of Alameda Creek in the Sunol Valley.

13.2.2 Summary of Third Party Review of Appendix HYD2-R

The purpose of the third party review of Appendix HYD2-R is to provide an independent review of the analyses and model of groundwater and surface water interactions used in the ACRP EIR, with particular focus on Appendix HYD2-R. The report provides an assessment of the data, analytical methods, assumptions, and interpretations presented in Appendix HYD2-R, then determines the adequacy of the characterization of surface water-groundwater exchange.

The report states "The variety of data examined and the spatial and temporal data coverage are adequate for addressing the central question of assessment of impacts on stream flow in Alameda Creek due to the Project." Furthermore, the report states "The primary assumptions upon which the analyses are based are largely supported by observations and data, and by the similar results determined using multiple analytical methods. Overall, the analyses provide a reasonably reliable method for predicting creek leakage and seepage (groundwater flow) to and from Pit F2."

Dr. Moran notes that "Pumping from Pit F2 is to take place only between July 1 and Nov 30, when streamwater-groundwater interaction is minimal and stream flow is generated by CDRP releases."[3] She concludes that "pumping from the pit over that time period should not significantly affect groundwater levels in the project area or elsewhere." Dr. Moran also reports that the conclusion in the EIR that the Livermore Gravels subunit is not considered to have a dynamic influence on groundwater conditions that could affect daily to seasonal impacts of ACRP operations is reasonable. She states, "the analysis in HYD2 [now referred to as Appendix HYD2-R] uses the available data to make predictions of potential impacts to streamflows using justifiable assumptions and reasonable estimations of aquifer properties and relationships between stream flow and flow through porous media."

Dr. Moran points out certain limitations and sources of uncertainty in Appendix HYD2-R. These include reliance on data and interpretation from many previous studies, absence of data for future with-CDRP conditions, uncertainty in the volume of water in the quarry pits, and the limited information on aquifer heterogeneity. The reader is referred to **Appendix TPR** for the complete report by the independent third party reviewer.

13.3 CEQA Recirculation Process

13.3.1 Notice of Preparation and Scoping

On October 18, 2017, the planning department issued a Notice of Preparation (NOP) of the Recirculated Portions of an Environmental Impact Report to governmental agencies, organizations, and persons interested in the proposed project, notifying them of the preparation and recirculation of portions of the ACRP EIR (see **Appendix NOP2**). During a 30-day public scoping period that started on October 18, 2017 and ended on November 17, 2017, the planning department received written comments from two state agencies, two regional agencies, and one non-governmental organization, as listed in Section 13.5, below. No individual citizens submitted scoping comments. Copies of the comment letters are included in Appendix NOP2.

In addition, in response to a request received in a written scoping comment, the planning department held a public scoping meeting on December 6, 2017 at its offices at 1650 Mission

[3] CDRP stands for the Calaveras Dam Replacement Project, which when completed will be subject to regulatory permits requiring the SFPUC to make releases from Calaveras Reservoir and to allow bypass flows around the Alameda Creek Diversion Dam. See Chapter 14 for further discussion.

Street, San Francisco to receive oral comments on the scope of the recirculated portions of the EIR. The planning department also extended the scoping period by an additional 19 days through December 6, 2017. Representatives from one state agency, three regional agencies, one non-governmental organization, and one individual participated in the scoping meeting, either in person or by telephone. Two persons presented oral comments. Transcripts of the scoping meeting are also included in Appendix NOP2.

All written and oral comments received on the NOP of a recirculated portion of the EIR are summarized below in Section 13.5. The planning department has considered all comments made by the public and agencies during (and after) the scoping period in preparing the recirculated portions of the EIR on the proposed project.

13.3.2 Consultation Concerning Recirculated Portions of the EIR

As part of the CEQA recirculation process and consistent with CEQA Guidelines section 15086, the planning department and the SFPUC have consulted with and requested comments on the recirculated portions of the EIR from responsible and trustee agencies with resources affected by the project (i.e., CDFW), federal agencies which exercise authority over resources that may be affected by the project (i.e., NMFS), and other members of the public who have filed a written request with the planning department. In addition to the scoping meeting described above, the planning department and the SFPUC conducted several meetings with these agencies and other stakeholders to solicit comments, to provide revised and updated information, and to present preliminary results of the revised analysis of operational impacts on steelhead prior to the publication of the recirculated portions of the Draft EIR (see Table 13-1, above).

On October 3, 2017, the planning department facilitated a meeting at the CDFW offices in Santa Rosa to notify responsible and trustee agencies of its intent to recirculate a limited portion of the EIR on the ACRP and to solicit agencies comments on the scope of the recirculated portion of the EIR. Meeting attendees included representatives of CDFW, NMFS, and SFPUC, with the EIR consultants representing the planning department. Items discussed at the meeting included background on the ACRP, an overview of the hydrologic model developed specifically for use in the Alameda Creek watershed, and background on the CEQA process to date. The meeting also included a question and answer period and an opportunity for the agencies to provide comments on the scope of the recirculated portions of the EIR.

On May 30, 2018, the planning department facilitated a second consultation meeting at the CDFW offices in Santa Rosa. The purpose of this meeting was to respond to NMFS and CDFW comments on the ACRP EIR, to explain the approach to the revised steelhead impact analysis, and to continue consultation with CDFW as a CEQA trustee agency for this project. Meeting attendees included representatives of CDFW, NMFS, SFPUC, and the planning department, along with EIR consultants with expertise in fisheries biology and groundwater hydrology. Items discussed at the meeting include a presentation of the proposed project (including certain new operational protocols), a description of the hydrogeology and surface water/subsurface water interactions in the project area, and a discussion of the revised and augmented hydrologic analysis to be used for the steelhead impact analysis. One outcome of this meeting is that CDFW submitted an additional scoping letter (see Section 13.4, below), and the planning department prepared written responses to these comments and sent them to CDFW in October 2019.[4]

On November 1, 2018, the SFPUC met with NMFS and CDFW to present and explain the revised ACRP project operations. The SFPUC developed these revised project operations to avoid pumping during the steelhead migration season in response to concerns raised by CDFW. See Chapter 14, Revisions to the Project Description, for a description of the revised project operations.

On September 12, 2019, the planning department, its consultants, SFPUC, and Dr. Jean Moran made a presentation to the Alameda Creek Fisheries Restoration Workgroup. The SFPUC described the revised project operations. Luhdorff & Scalmanini Consulting Engineers, the planning department's groundwater consultant, summarized the revised groundwater and surface water analysis in Appendix HYD2-R, and Dr. Moran presented the results of the independent third party review of the groundwater/surface analysis (as required by the Board of Supervisors resolution). ESA, the planning department's CEQA consultant, described the contents of the recirculated portions of the EIR, the revised steelhead impact analysis, and the preliminary impact conclusions. People attending this meeting included representatives from NMFS, CDFW, SFPUC, ACWD, Alameda County Resource Conservation District, Zone 7 Water Agency, Alameda Creek Alliance, Bay Area Water Supply & Conservation Agency, East Bay Regional Park District, Trout Unlimited, and Caltrout. Appendix ACFRW includes a copy of the agenda, presentation, and sign-in sheets of this meeting.

13.3.3 Public Review of Recirculated Portions of Draft EIR

The San Francisco Planning Department published the recirculated portions of the Draft ACRP EIR on December 4, 2019. The public review period extends from December 5, 2019 to January 21, 2020, a 48-day period during which time the planning department will accept comments on the recirculated portions of the Draft EIR. On December 4, 2019, the planning department also distributed notices of availability of the recirculated portions of the Draft EIR, published notification of its availability in a newspaper of general circulation in San Francisco, and posted notices at the project site.

The recirculated portions of the Draft ACRP EIR was distributed to local, state, and federal agencies and to interested organizations for review and comment. Copies of the recirculated portions of the Draft ACRP EIR were made available for public review at the following locations: (1) San Francisco Planning Department, 1660 Mission Street, 1st Floor, Planning Information Center, San Francisco, California; (2) San Francisco Main Library, 100 Larkin Street, San Francisco, California; and (3) Alameda County Main Library, 2450 Stevenson Boulevard, Fremont, California. Electronic copies of the recirculated portions of the Draft EIR can be accessed through the internet on the planning department website, at the following address: https://sfplanning.org/environmental-review-documents. All documents referenced in the recirculated portions of the Draft EIR and all

4 San Francisco Planning Department, Chris Kern, Senior Planner. Memorandum to Sean Cochran, Marcia Grefsrud, Craig Weightman, California Department of Fish and Wildlife, regarding Responses to Scoping Letters from California Department of Fish and Wildlife, October 28, 2019.

portions of the June 2017 EIR are available for review at the San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, CA 94103 as part of Case File Number 2015-004827ENV.

Written comments on the recirculated portions of the Draft EIR should be sent by mail to: Chris Kern, Environmental Planning, San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, CA 94103; or by email to: chris.kern@sfgov.org.

Members of the public are not required to provide personal identifying information when they communicate with the planning commission or the planning department. All written or oral communications, including submitted personal contact information, may be made available to the public for inspection and copying upon request and may appear on the department's website or in other public documents.

During the public review period, the planning department will conduct a public hearing to receive oral comments on the recirculated portions of the Draft EIR. The public hearing is scheduled to be held before the San Francisco Planning Commission on January 9, 2020 at San Francisco City Hall. Call 415-558-6422 the week of the public hearing for a recorded message giving a more specific time for the hearing. A court reporter will be present at the public hearing to transcribe the oral comments verbatim and prepare a written transcript of hearing.

As indicated in CEQA Guidelines, section 15088.5(f)(2) and described above, the planning department is requesting reviewers of the recirculated portions of the Draft EIR to "limit their comments to the revised chapters or portions of the recirculated EIR."

13.3.4 Responses to Comments Document and Final EIR

After the close of the public review period on the recirculated portions of the June 2017 EIR, the planning department will review all written and oral comments submitted on the recirculated portions of the June 2017 EIR and prepare a Supplemental Responses to Comments document. The Supplemental Responses to Comments document will present all written and oral comments received on the recirculated portions of the June 2017 EIR and will include the planning department's written responses to all substantive comments. The Supplemental Responses to Comments document will be released for public review, circulated to all persons, organizations, and agencies submitting comments on the recirculated portions of June 2017 EIR, and posted on the planning department's website.

Together, the recirculated portions of the June 2017 EIR, the responses to comments on the recirculated portion of the June 2017 EIR (i.e., the Supplemental Responses to Comments document), and the June 2017 EIR (Draft EIR and its responses to comments document) will constitute the complete Final EIR on the ACRP, in compliance with CEQA, CEQA Guidelines, and Chapter 31 of the San Francisco Administrative Code.

The San Francisco Planning Commission will hold a public hearing to consider the adequacy of the Final EIR in complying with the requirements of CEQA. If the Commission finds that the Final EIR complies with CEQA requirements, it will certify the Final EIR.

If the Final EIR is certified, the SFPUC will then review and consider the certified Final EIR before taking an approval action on the proposed project. If the SFPUC decides to approve the project, it will adopt CEQA findings, including adopting or rejecting mitigation measures and alternatives to avoid or reduce significant impacts, and a mitigation monitoring and reporting program (MMRP) (CEQA Guidelines Sections 15091 and 15092). Consistent with CEQA Guidelines section 15097, the MMRP is a program designed to ensure implementation of the mitigation measures identified in the Final EIR to reduce or avoid the project's significant environmental effects, and which, as part of the CEQA process, has been adopted by decision-makers and made conditions of project approval. Because the ACRP EIR does not identify any significant adverse impacts that cannot be mitigated to less-than-significant levels, the project approval findings for this project will not need to include a statement of overriding considerations if identified mitigation measures or alternatives are adopted that mitigate all significant effects (CEQA Guidelines section 15093[b]).

13.4 Summary of Scoping Comments on Recirculated Portions of the EIR

The planning department received written scoping comments on the recirculated portions of the EIR from the agencies and organization listed in **Table 13-2**, and persons providing oral comment at the scoping meeting are also listed in this table. **Table 13-3** summarizes all scoping comments received and indicates where in the EIR (including the June 2017 EIR and the recirculated portions of the EIR) those comments are addressed. Copies of these scoping comment letters and the scoping meeting transcript are included in Appendix NOP2.

TABLE 13-2
LIST OF AGENCIES AND ORGANIZATIONS SUBMITTING SCOPING COMMENTS ON THE RECIRCULATED PORTIONS OF ACRP EIR

Agency / Organization	Name and Title of Person Submitting Comments	Comment Date
Federal and State Agencies		
California Department of Fish and Wildlife (CDFW)	Craig Weightman, Acting Regional Manager, Bay Delta Region	11/14/2017
California Department of Fish and Wildlife (CDFW)	Sean Cochran, District Fisheries Biologist, Bay Delta Region (oral comments at Scoping Meeting)	12/6/2017
California Department of Fish and Wildlife (CDFW)	Sean Cochran, District Fisheries Biologist, Bay Delta Region	6/22/2018
California Department of Transportation (Caltrans)	Patricia Maurice, District Branch Chief,	11/20/2017
Regional and Local Agencies		
Alameda County Water District (ACWD)	Robert Shaver, General Manager	11/16/2017
Alameda County Water District (ACWD)	Thomas Nieser, Water Resources Planning Manager (oral comments at Scoping Meeting)	12/6/2017
Alameda County Water District (ACWD)	Robert Shaver, General Manager	12/6/2017
Alameda County Flood Control and Water Conservation District, Zone 7 (Zone 7)	Elke Rank	10/31/2017
Non-Governmental Organizations		
Alameda Creek Alliance	Jeff Miller, Director	11/15/2017

TABLE 13-3
SUMMARY OF WRITTEN AND ORAL SCOPING COMMENTS SUBMITTED ON THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Federal and State Agencies		
CDFW (11/14/2017)	1. The hydrologic analysis in the original EIR did not summarize results of the Alameda System Daily Hydrologic Model (ASDHM) on a daily basis. It is important that the revamped analysis summarizes and depicts modeled daily patterns of flow across all water year types used in the analysis to determine if project stream flow patterns are appreciably different without project conditions (Calaveras Dam Replacement scenario), and whether it reduces stream flows at locations or during time periods that might negatively impact steelhead.	Section 15.2, Fisheries Resources, revised approach to analysis and revised hydrologic analysis of flows (Section 15.2.3.2), and revised Impact BI-11 (Section 15.2.3.3)
CDFW (11/14/2017), cont'd	2. Our primary concern is whether the ACRP will restrict adult steelhead from being able to migrate upstream and access spawning areas above the project, and if it will restrict steelhead smolts from being able to outmigrate through the affected stream area to San Francisco Bay. To assess this, the EIR should compare modeled with and without ACRP stream flows to estimate passage flows in the area downstream of the project for steelhead adults and smolts. There are already sources available to estimate minimum passage flow conditions including channel cross-section stage discharge relationships incorporated in the ASDHM (229 total through entire watershed), and fish passage studies done in the Sunol Valley area of Alameda Creek and in the flood control channel. Comparisons should be made and summarized across each hydrologic year in the analysis, but need not extend outside the migration time period considered relevant for each life stage.	Section 15.2, Fisheries Resources, revised approach to analysis and revised hydrologic analysis of flows (Section 15.2.3.2), and revised Impact BI-11 (Section 15.2.3.3)
CDFW (11/14/2017), cont'd	3. We would ideally like the ASDHM to be further refined to account for total volume of water in the shallow Sunol aquifer, and volume of water recaptured by quarry operations. Generating these estimates, would help ensure that recapture operations are balanced and do not result in overdraft. CDFW recommends that the EIR provide a feasible method to measure total volume of water recaptured compared to total volume of water available in the aquifer.	Appendix HYD2-R (aquifer volume) Appendix HYD1-R (quarry discharges)
CDFW (11/14/2017), cont'd	4. Please be advised that proposing the recapture of creek underflow that resurfaces in quarries will require a Lake and Streambed Alteration Agreement (LSAA) since there is a direct connection to water being pumped from quarries and streamflow in Alameda Creek.	Chapter 14, Revisions to the Project Description (project approvals, Section 14.4)
CDFW (11/14/2017), cont'd	5. CDFW recommends recapture be further restricted. Instead of not permitting pumping from December through March only, pumping should also not be permitted in April and May. Pumping in April and May overlaps with the smolt outmigration time period and could reduce surface flow in Alameda Creek and prevent smolts from being able to outmigrate to the bay. CDFW recommends recapture operations be permitted in June through November only.	Chapter 14, Revisions to the Project Description (revised operations, Section 14.3)
CDFW (11/14/2017), cont'd	6. CDFW recommends that the SFPUC explore mechanisms to gain assurance that the quarry operators will curtail pumping during critical time periods for steelhead, namely, January through May which corresponds to time periods when adult steelhead migrate into the Alameda Creek for spawning and smolts migrate downstream to San Francisco Bay. Removal of water from Pit F2 by SFPUC or the quarry operators during this time period could result in increased streambed percolation upstream of the quarries and a reduction in flows for migrating steelhead, even when accounting for the additional discharge provided to the stream by the quarry operations. The EIR should therefore include conditions that curtail pumping from Pit F2 during this time period.	Section 15.2, Fisheries Resources, revised impact analysis of flows Impact BI-11 (Section 15.2.3.3) Appendix HYD1-R (quarry NPDES discharges) Appendix HYD2-R (seepage analysis) Chapter 14, Revisions to the Project Description (revised operations, Section 14.3)

TABLE 13-3 (Continued)
SUMMARY OF WRITTEN AND ORAL SCOPING COMMENTS SUBMITTED ON THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Federal and State Agencies (cont.)		
CDFW (11/14/2017), cont'd	7. The original Draft EIR in Table 3-5 indicates that in dry years proposed recapture volumes will be greater than SFPUC bypass flows that infiltrate pond F2. Additionally, the Draft EIR also indicates the SFPUC would reserve the right to roll over unutilized recapture from previous years to years where there is additional storage available in supply reservoirs for recapture. CDFW is concerned such practices will create an imbalance and could create further reductions in streamflow during dry and critically dry drought years. We recommend proposed recapture be reduced during dry years to levels less than average infiltration of bypass flows to pit F2, and that the roll over recapture option is removed. The EIR should specifically indicate that roll-over recapture will not occur.	Chapter 14, Revisions to the Project Description (revised operations, Section 14.3) Appendix HYD2, rev (seepage analysis)
Sean Cochran, CDFW (12/6/17 scoping meeting)	The key thing that we would like to get at with this analysis that the previous EIR really didn't thoroughly document, that we at least see, is the recapture operation's effect on kind of how it affects streamflow at specific times, not necessarily volumes of flow, you know, across a particular time period. So really what we want to address, really what we can kind of see as the major shortcoming in the previous EIR's analysis is it didn't look into how the timing of the streamflow with the ACRP would affect steelhead. And that's what we're — kind of really would like to get from the recirculated modeling analysis.	Section 15.2, Fisheries Resources, revised hydrologic analysis of flows and impact analysis (Section 15.2.3.2), and revised Impact BI-11 (Section 15.2.3.3)
CDFW (6/22/2018)	We are pleased to hear that per consultation with an outside subject matter expert SFPUC has chosen to do accounting for total volume of water in the Sunol Valley groundwater basin. However, there are groundwater accounting concerns we raised in our comment letter dated November 14, 2017 (attachment 1) that are not yet addressed. In the following comments we will interchange the terms groundwater, subsurface flow and creek underflow, but in our opinion the correct characterization of water in this shallow confined aquifer is subterranean streamflow.	Appendix HYD2-R
CDFW (6/22/2018), cont'd	At this time there are no plans to estimate the proportion of Calaveras Dam Replacement Project (CDRP) prescribed releases that percolate into the shallow Sunol Valley groundwater basin upstream of Node 6 that is recaptured in quarry Pit F2. In Appendix HYD1 in the original EIR titled Surface Water Hydrology Report for the SFPUC Alameda Creek Recapture Project it makes it clear that the hydrologic analysis makes an assumption that all Alameda Creek flow losses between Welch Creek (node 4) and San Antonio Creek (node 6) are assumed to infiltrate to quarry Pit F2. This is a flawed assumption that we fear could result in a mass imbalance between water recapture in Pit F2 and replenishing inputs from the Sunol Valley aquifer. This will be discussed further in this document.	Appendix HYD2-R (seepage analysis) Appendix HYD1-R (ASDHM assumptions)
CDFW (6/22/2018), cont'd	To us it seems logical only a portion of underflow in the Sunol Valley upstream of San Antonio Creek would reach Pit F2, and that some of this water would traverse the whole basin and remerge as streamflow in Alameda Creek at the top of Niles Canyon. In the most recent ACRP meeting Tom Elson of Luhdorff and Scalmanini Consulting Engineers presented data that directly confirmed this showing that at groundwater monitoring wells 9 and 10 Alameda Creek is a gaining stream, with groundwater inputs from Sunol Valley underflow. We highly recommend incorporating both the above factors into a more detailed groundwater and surface water hydrology model.	Appendix HYD2-R (seepage analysis)

TABLE 13-3 (Continued)
SUMMARY OF WRITTEN AND ORAL SCOPING COMMENTS SUBMITTED ON THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Federal and State Agencies (cont.)		
CDFW (6/22/2018), cont'd	This is similar to comment 5 in our November 2017 letter regarding recapture timeframe and Pit F2 water levels. Based on the description of the ACRP in the original project EIR, SFPUC would recapture water from Pit F2 between April and December, and no water recapture would occur from January through March. During the water recapture period water surface levels in Pit F2 could be drawn as low as 100 feet above mean sea level (msl), but would usually be maintained above 150 feet above msl. Water levels during months where water recapture would not occur would rise and be maintained between 200 and 240 feet above msl. With no true estimate of groundwater replenishment rates to Pit F2, it is in our opinion an unknown whether recapturing an average annual amount of 7,178 acre-feet is sustainable. CDFW is concerned that this project could result in extended periods of water drawdown in quarry Pit F2. This could potentially have significant negative effects on streamflow. A misconception of this project has been characterization of the connection between streamflow, underflow, and water in quarry Pit F2. The ACRP project team acknowledges a connection between streamflow and water in Pit F2 when water surface levels in the quarry rise above the Livermore geologic deposits. When water is below these deposits the project team has portrayed them as isolated systems, with continued seepage of aquifer underflow to Pit F2, but no direct effect of one on the other. We however would characterize this as a more complex relationship. Continued drawdown of Pit F2 below the Livermore deposits affects the time it takes aquifer seepage to replenish the pit and establish a direct connection to the aquifer. Sustainable operation of this system should take this into account and would make withdrawals from Pit F2 during only the summer and fall, when streamflow is ephemeral, and water levels in the aquifer decrease. The recapture amount should be such that when winter rains begin, there would be a high likelihood that input from the aquifer would refill the pit and establish a direct connection with the Sunol aquifer for at least a portion of the adult migration and smolt outmigration period. This operational strategy would better mimic natural patterns in streamflow and groundwater, and reduce streamflow losses during a critical period for steelhead.	Chapter 14, Revisions to the Project Description (revised operations, Section 14.3) Appendix HYD2-R (seepage analysis)
CDFW (6/22/2018), cont'd	This comment is similar to the previous, but in our November 2017 letter we raised concerns that the project EIR stated SFPUC planned to roll over unutilized recapture across years. This comment still remains unaddressed, but fits in with our concerns that there is not detailed enough groundwater modeling to look at groundwater inflows to Pit F2 and create a mass balance water model.	Chapter 14, Revisions to the Project Description (revised operations) Appendix HYD2-R (groundwater and mass balance analysis)
CDFW (6/22/2018), cont'd	In the May 30, 2018 ACRP meeting Tim Ramirez of SFPUC presented several project protections we presume were measures to protect streamflow for outmigrating steelhead smolts including halting recapture operations when water in Pit F2 was above the Livermore gravels (>225 feet above msl) and when streamflow at the Siphon bridge was >10 cfs. Chris Fitzer of ESA also presented a series graphs with hydrologic modeling output for the CDRP scenario for the spring of 2008 (dry water year) with separate breakouts of streamflow at node 5 (upstream of pit F2), natural accretion between nodes 5 and 7, and the net streamflow gain from quarry discharge from pit F2 (factoring in downstream percolation loss). The objective of this was to make a point that streamflow losses upstream of Pit F2 may make smolt outmigration not feasible from upstream areas, despite quarry discharge gains downstream. Both Chris and Tim cited previous steelhead migration studies in Sunol indicated that a 10 cfs flow was needed to aid steelhead smolts in passage over critical riffles. While we appreciate the detailed examination of hydrologic model output and consideration of measures to protect steelhead smolts, we	Chapter 14, Revisions to the Project Description (revised operations, Section 14.3) Section 15.2, Fisheries Resources, revised analysis of operational impacts on steelhead, Impact BI-11 (Section 15.2.3.3) Appendix HYD2-R (seepage rates) Appendix HYD1-R (quarry NPDES discharges)

TABLE 13-3 (Continued)
SUMMARY OF WRITTEN AND ORAL SCOPING COMMENTS SUBMITTED ON THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Federal and State Agencies (cont.)		
CDFW (6/22/2018), cont'd	think the most effective method to prevent project impacts to steelhead smolts is to start water recapture operations annually in June after the smolt outmigration season has ended as we previously suggested in our November 2017 comment letter. Even as flows at node 5 decrease to levels that might be considered marginal for migration of steelhead smolts from upstream, there will be steelhead smolts actively migrating below this site. Any reduction in streamflow within the ACRP project reach or below is an impact that will affect the likelihood these fish will successfully make it to San Francisco Bay. The ACRP, as proposed, would affect streamflow in two ways by reducing quarry NPDES discharge to Alameda Creek, but more importantly by potentially drawing down the Sunol aquifer and increasing percolation losses from the stream channel upstream of the project.	
CDFW (6/22/2018), cont'd	If the project goes forward with the current proposal to recapture water from Pit F2 from April through December, we would like to see detailed summaries of streamflow model results to determine project effects not just across all years in the analysis, but a detailed breakdown within respective years, with particular emphasis on dry years. What will be most critical is assessing effects to outmigrating smolts in April and May (see comment 2 in our November 2017 letter). We would like this summary to take into account passage flows required for steelhead smolts in the stream from node 9 upstream through the project reach, and to summarize the results in a way where one can discern for respective years whether the project results in any reductions in migration opportunity. Exceedance curves alone while informative do not provide this level of detail. Alameda County Water District (ACWD) is required to provide minimum bypass flows which are inclusive of CDRP contributions below their facilities at Niles Cone in April and May for smolt outmigration based on measured flow at node 9, which is the location of the Alameda Creek Niles USGS gage. These bypasses are required under a NMFS biological opinion (SWR-2013-9696). Any reduction in ACWD's ability to meet these minimum bypass flows due to a reduction in streamflow at node 9 from this project will be an impact.	Chapter 14, Revisions to the Project Description (revised operations, Section 14.3) Section 15.2, Fisheries Resources, revised approach to analysis (Section 15.2.3.2) and revised analysis of operational impacts on steelhead, Impact BI-11 (Section 15.2.3.3)
CDFW (6/22/2018), cont'd	A general comment to take into consideration. A lot of presumptions regarding this project rely on estimating the quantity, timing and water quality of quarry discharges, both under existing and future conditions. Frankly there are a lot of unknowns surrounding the effects of the quarry discharge on the stream environment. The project team has raised valid questions about water quality of quarry discharge including temperature suitability and discharges not being estimated on an hourly basis. In light of not having specific measurements to assess true negative/positive effects of quarry discharge on steelhead, we think it is best to view increases in streamflow due to quarry discharge during the smolt outmigration timeframe as an improvement in conditions versus any with project conditions that result in appreciable loss in streamflow from reduced discharge by the quarry operators.	Appendix HYD1-R (quarry NPDES discharges) Section 15.2, Fisheries Resources, revised hydrologic analysis of flows, Impact BI-11 (Section 15.2.3.3)
CDFW (6/22/2018), cont'd	Although the focus of the meeting was to brief us on measures added to the analyses to better assess the ACRP's potential impacts on Central California Coast steelhead trout we also expressed need to apply for a Lake and Streambed Alteration Agreement due to the recapture of streamflow from Alameda Creek. The presentation on groundwater interaction lent further support to the characterization of the water in Pit F2 as being subterranean streamflow. Furthermore, analysis presented in the EIR discloses the potential for significant effects which should be addressed in a Lake and Streambed Alteration Agreement pursuant to Fish & Game Code section 1600 et seq.	Chapter 14, Revisions to the Project Description (Section 14.4.1, Additional Required Permits)

TABLE 13-3 (Continued)
SUMMARY OF WRITTEN AND ORAL SCOPING COMMENTS SUBMITTED ON THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Federal and State Agencies (cont.)		
CDFW (6/22/2018), cont'd	We request that the City Planning and SFPUC address all our comments from this document and comments from our November 14, 2017 letter (attachment 1). We are flexible as far as response format, which could range from presenting information at another ACRP meeting, or a response in the form of a technical document, or modeling output in an excel file. We request that you hold at least one more ACRP meeting with CDFW and NMFS staff to present information that responds to our previous comments, new results and get additional feedback. In our opinion, this analysis currently is not refined enough [to] recirculate the EIR.	Section 13.3.2, Consultation Concerning Recirculated Portions of the EIR
Caltrans (11/20/2017)	Please be advised that any work or traffic control that encroaches onto the State right-of -way requires an Encroachment Permit that is issued by Caltrans.	Section 13.1.4, Contents of the Recirculated Portions of the EIR (This issue was addressed in EIR Section 5.6, Transportation and Circulation and is outside the scope of the recirculated portions of the EIR.)
Regional and Local Agencies		
ACWD (11/16/2017)	The ACRP will rely on the slow and steady percolation of surface water from Alameda Creek into the Sunol Valley Groundwater Basin, and into Pit F2, from where it will be pumped to surface water storage or treatment. Pit F2 will effectively act as a depression in southern Sunol Valley, and the dewatering of Pit F2 could facilitate recapture by increasing the percolation from Alameda Creek into Pit F2.	Appendix HYD2-R (seepage analysis)
ACWD (11/16/2017), cont'd	The disparity between bypass and release rates and recapture rates with implementation of the ACRP may have significant impacts to a variety of types of resources and therefore, should be analyzed in sufficient detail so that potential impacts can be understood and mitigated as necessary. Some release or bypass water would be recaptured; however, additional water originating from sources other than Calaveras Reservoir and the Alameda Creek Diversion Dam, such as local groundwater and surface water drainages, also might be captured, pumped and delivered to storage or treatment as a result of the ACRP. Due to this proposed mechanism of operations, it is incorrect to define the ACRP strictly as a "recapture" facility. Rather, the ACRP would act as an alternative water supply or management system to compensate for lost yield from Calaveras Dam and Alameda Creek Diversion Dam.	Chapter 14, Revisions to the Project Description (revised operations, Section 14.3) Section 13.1.4, Contents of the Recirculated Portions of the EIR. (This issue was addressed in EIR Chapter 5 under all resource topics, and with the exception of steelhead impacts, is outside the scope of the recirculated portions of the EIR.)
ACWD (11/16/2017), cont'd	The EIR must use a more robust, process-based hydrologic model capable of estimating the impacts on surface water flow rates, groundwater storage, and varying streamflow loss rates to Pit F2 as a result of the proposed operations of the ACRP throughout the project area, in Niles Canyon, and out to the San Francisco Bay. In addition, as is often the case with surface water and groundwater interactions, controlled physical tests should be conducted and would likely be more conclusive in analyzing these interactions and how they might impact Alameda Creek streamflows and associated fish passage.	Appendix HYD2-R (quantification of groundwater characteristics)

TABLE 13-3 (Continued)
SUMMARY OF WRITTEN AND ORAL SCOPING COMMENTS SUBMITTED ON THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Regional and Local Agencies (cont.)		
ACWD (11/16/2017), cont'd	ACWD requests that the independent third party reviewer be provided the record in BOS File No. 170839 related to the methodology used in the EIR, and that this information be incorporated into the analysis of operational effects on Alameda Creek streamflows and associated impacts on steelhead. Specifically, the third party reviewer should evaluate the portion of the August 23, 2017 memorandum from Horizon Water and Environment regarding the hydrologic methodologies to the ACRP EIR.	Section 13.2, Third Party Review of Groundwater/ Surface Water Analysis Appendix TPR
ACWD (11/16/2017), cont'd	The July 27, 2017 NMFS comment letter to the BOS should be addressed in the recirculated EIR.	Table 13-3, under NMFS (7/27/2017)
ACWD (11/16/2017), cont'd	ACWD requests that Planning work with NMFS, ACWD and other watershed stakeholders, as well as the independent third party consultant, to develop a model that is robust enough to analyze the dynamic surface water to groundwater processes in the Sunol Valley under the proposed future operations of the ACRP.	Section 13.3.2, Consultation Concerning Recirculated Portions of the EIR Appendix HYD2-R Section 13.1.4, Contents of the Recirculated Portions of the EIR. (This issue was addressed in EIR Appendix HYD1, and with the exception of how it relates to steelhead impacts, development of a model is outside the scope of the recirculated portions of the EIR.)
ACWD (11/16/2017), cont'd	ACWD requests that Planning conduct a scoping meeting pursuant to CEQA Guidelines section 15082(c) so that ACWD and other interested parties can provide input on: 1) the additional information and analysis of the operational impacts on steelhead as a result of Project-induced changes in Alameda Creek streamflows, and 2) the independent third party review of the groundwater-surface water model to determine its adequacy and accuracy to analyze Alameda Creek streamflows and related fisheries issues.	Section 13.3.1, Notice of Preparation and Agency Scoping and Consultation
ACWD (11/16/2017), cont'd	The modeling approach used in the recirculated EIR to analyze impacts of ACRP should provide sufficient detail to analyze impacts associated with the differing rates of Project releases, bypasses, and recaptures on Alameda Creek streamflows and the following related resources: • Anadromous fish passage in the Alameda Creek Flood Control Channel, Niles Canyon, and Sunol Valley. • Aquatic and riparian habitat in Niles Canyon and Sunol Valley.	Section 15.2, Fisheries Resources, revised hydrologic analysis of flows (Section 15.2.3.2), and revised impact analysis Impact BI-11 (Section 15.2.3.3) Sections 5.14 and 15.3.1 for impacts on riparian habitats
ACWD (11/16/2017), cont'd	ACWD requests the following components be included in both: 1) the independent third party review of the surface water/groundwater analysis; and 2) the additional information and analysis on operational impacts on steelhead in the lower watershed as a result of Project-induced effects on Alameda Creek streamflows: a) Calculation of daily groundwater seepage rates and surface water recharge from Alameda Creek and San Antonio Creek into Pit F2.	Appendix HYD2-R (seepage analysis, quantification of groundwater characteristics) Appendix TPR Section 15.2, Fisheries Resources, revised hydrologic analysis of flows

TABLE 13-3 (Continued)
SUMMARY OF WRITTEN AND ORAL SCOPING COMMENTS SUBMITTED ON THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Regional and Local Agencies (cont.)		
ACWD (11/16/2017), cont'd	b) Quantification of the daily changes in groundwater storage as well as the amounts of release and bypass water that will actually percolate into the Sunol Valley Groundwater Basin. Quantification of the daily amounts of water that originates from sources besides Calaveras Dam releases and ACDD bypasses and that will be pumped out of Pit F2 at the various times of operation.	Appendix HYD2-R (seepage analysis, quantification of groundwater characteristics) Appendix HYD1-R (ASDHM inputs)
ACWD (11/16/2017), cont'd	Because the proposed ACRP will operate differently in different hydrologic years, because groundwater levels will influence ACRP recapture rates, and because dry year ACRP pumping will exceed bypass, release, and recharge rates during dry years, the analysis needs to evaluate the impacts of the ACRP on surface water flows in Alameda Creek during dry, average, and wet years. Specifically, the hydrologic model needs to be able to provide a detailed accounting of daily inputs and withdrawals into and out of the Sunol Valley Groundwater Basin using the carryover accounting methodology described in the EIR, and to apply this methodology to extended cycles of floods and droughts. While the model has a limited hydrologic timeframe, it should at a minimum extend through 2016, thus capturing the recent drought and post-drought recovery. Ideally the analysis would also include an extended, multiple year droughts like the 1987-1992 drought. All analyses of the ACRP should be performed under future buildout levels of demands to analyze Project impacts under conditions with the highest stress to the surface water and groundwater resources.	Chapter 14, Revisions to the Project Description (revised operations, Section 14.3) Section 15.2, Fisheries Resources, revised hydrologic analysis of flows (Section 15.2.3.2), and revised impact analysis Impact BI-11 (Section 15.2.3.3) Appendix HYD1-R (ASDHM study period) Section 13.1.4, Contents of the Recirculated Portions of the EIR. (These issues were addressed in EIR section 5.16 and Appendices HYD1 and HYD2. With the exception of how these issues relate to steelhead impacts, these topics are outside the scope of the recirculated portions of the EIR.)
ACWD (11/16/2017), cont'd	This cumulative impacts analysis should include projects that are being pursued by the Alameda Creek Fisheries Workgroup including the ACWD/ACFC's Joint Lower Alameda Creek Fish Passage Improvements Project, ACFC's projects in the Lower Alameda Creek, SFPUC's projects in Niles Canyon, and PG&E's plans to address fish passage in Sunol Valley.	Section 13.1.4, Contents of the Recirculated Portions of the EIR. (Cumulative projects addressed in cumulative impact analysis are described in Section 5.1 of the June 2017 EIR and this issue is outside the scope of the recirculated portions of the EIR.)
ACWD (11/16/2017), cont'd	Additionally, the recirculated portions of the EIR should evaluate the impacts to fish passage in Lower Alameda Creek by considering the October 5, 2017 Biological Opinion from NMFS for the Joint Lower Alameda Creek Fish Passage Improvements Project as part of the physical environmental conditions or CEQA baseline.	Section 13.1.2, Background on Recirculation Section 15.2, Fisheries Resources, revised regulatory framework (Section 15.2.2.5)

TABLE 13-3 (Continued)
SUMMARY OF WRITTEN AND ORAL SCOPING COMMENTS SUBMITTED ON THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Regional and Local Agencies (cont.)		
ACWD (11/16/2017), cont'd	ACWD believes that, to be assured that the current proposal for operations of the ACRP will avoid all impacts to steelhead migration, more detailed analyses must be carried out.	Chapter 14, Revisions to the Project Description (revised operations, Section 14.3) Section 15.2, Fisheries Resources, revised analysis Impact BI-11 (Section 15.2.3.3)
ACWD (11/16/2017), cont'd	ACWD requests the scope of the recirculated EIR contain a description of an adaptive monitoring plan, which will provide additional information and analysis regarding the operational impacts to steelhead. At a minimum, this adaptive monitoring plan should include the installation of a USGS gage in the vicinity of the confluence of Alameda Creek and Arroyo de la Laguna so the impacts of the operation of ACRP on surface water flow through the Sunol Valley can be identified to facilitate adjustments to ACRP operations to minimize these impacts.	Section 15.2.2, Fisheries Resources, revised regulatory framework (Section 15.2.2.4)
ACWD (11/16/2017), cont'd	The recirculated EIR should identify the water supplies that would be captured as a result of ACRP operations and include an analysis of the impacts to both surface water and groundwater in the affected area. This analysis should include the impacts of adding an additional point of diversion to SFPUC's Calaveras Reservoir water rights, to determine if this additional and proposed Project operations would change downstream Alameda Creek streamflows in any way that would impact other legal users of Alameda Creek water, including both steelhead and ACWD. This evaluation should clearly evaluate the changes in surface water flows in Alameda Creek and groundwater conditions in the Sunol Valley with the ACRP in operation, when compared to the future conditions scenario in the NMFS's Biological Opinion for Calaveras Reservoir. The projected future operations of Calaveras Reservoir without the ACRP were permitted by NMFS with the assumption that all of the water stored in and conveyed from Calaveras Reservoir would be diverted only at the reservoir or the ACDD. The ACRP would add an additional point of diversion downstream from the existing points of diversion, and would divert water from sources besides ACDD bypasses and Calaveras Reservoir releases, and proposed operations with these changes were not evaluated or authorized by NMFS's Biological Opinion for Calaveras Reservoir.	Chapter 14, Revisions to the Project Description (revised operations, Section 14.3) Appendix HYD1-R (surface water) Appendix HYD2-R (groundwater) Section 15.2, Fisheries Resources, revised hydrologic analysis of flows (Section 15.2.3.2), and revised impact analysis Impact BI-11 (Section 15.2.3.3) Section 15.3, Hydrology and Water Quality, revised analysis of impacts on downstream users (Section 15.3.2) Section 15.2, Fisheries Resources, revised approach to analysis
ACWD (11/16/2017), cont'd	ACWD wishes to work together collaboratively with and to provide consultation to Planning and SFPUC staff as they consider revising and recirculating this EIR as directed by the Board of Supervisors in Motion M17-148. ACWD would like to meet with Planning staff and other concerned parties as part of this scoping process.	Section 13.3.2, Consultation Concerning Recirculated Portions of the EIR
ACWD (12/6/2017)	ACWD fully supports Planning retaining a third party specialist to conduct an independent review of the modeling methodology used for the EIR. Surface water and groundwater interactions are complex and dynamic physical processes. Upon request by ACWD, Planning has provided ACWD with a scope of work for the third party specialist. The memo, "Scope of Work for	Section 13.2, Third Party Review of Groundwater/ Surface Water Analysis Appendix TPR

TABLE 13-3 (Continued)
SUMMARY OF WRITTEN AND ORAL SCOPING COMMENTS SUBMITTED ON THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Regional and Local Agencies (cont.)		
ACWD (12/6/2017), cont'd	Third Party Independent Review of ACRP EIR Conceptual Groundwater Model," dated October 11, 2017 (Scope of Work) is attached and sets forth a review process that does not appear to be truly independent, as requested in Motion 17-148. The Scope of Work indicates that Planning provides the reviewer with specific, and limited, documents and establishes the key questions of the review; moreover, the Scope of Work describes the report preparation process whereby the peer reviewer shall incorporate Planning's comments and revisions into the peer reviewer's draft and final reports.	
ACWD (12/6/2017), cont'd	Will Planning provide the independent third party reviewer with the full record in Board of Supervisors File No. 170839, including the information submitted by National Marine Fisheries Service (NMFS) and ACWD during the appeal process, in order to evaluate the concerns regarding the existing methodology?	Section 13.2, Third Party Review of Groundwater/ Surface Water Analysis Appendix TPR
ACWD (12/6/2017), cont'd	ACWD requests that the third party reviewer be provided the record in Board of Supervisors File No. 170839 related to the methodology used in the EIR, including the information submitted by NMFS and ACWD during the appeal process, and that this information be incorporated into the analysis of operational effects on Alameda Creek flows and associated impacts on steelhead. Additionally, ACWD requests the peer reviewer be given freedom, after adequate time to review the entire record, to establish their own questions and to prepare a truly independent report of their review.	Section 13.2, Third Party Review of Groundwater/ Surface Water Analysis Appendix TPR
ACWD (12/6/2017), cont'd	On November 30, 2017, ACWD received a memorandum dated the same day, from ESA to Planning which describes a calculation error that impacts the modeling results for Alameda Creek flow estimates presented in the Project EIR. The correction of these errors changes the resulting analysis of the Project impacts to Alameda Creek flows, and the significance of these changes is an indication of the sensitivities of the model to input variables such as quarry discharges. Will Planning provide complete documentation of the original basis for the quarry discharge inputs previously used in the modeling for the EIR, as well as complete documentation for the new information that formed the basis for correcting the error in the modeling? ACWD requests that Planning provide complete documentation of the original basis for the quarry discharge inputs previously used in the modeling for the EIR, as well as complete documentation for the new information that formed the basis for discovering the error in the model that Planning corrected.	Appendix HYD1-R (revised post-processing of ASDHM data, quarry discharges)
ACWD (12/6/2017), cont'd	In previous comments, ACWD and others have asserted that the EIR must use a more robust, process-based hydrologic model capable of estimating the impacts on surface water flows rates, groundwater storage, and varying streamflow loss rates to Pit F-2 as a result of the proposed operations of the ACRP throughout the project area, in Niles Canyon, and to the San Francisco Bay.	Appendix HYD2-R (with respect to the quarry reach of the Sunol Valley, as deemed necessary to determine project-induced changes in streamflow that could affect steelhead migration). Other aspects of this comment regarding Niles Canyon to the bay are outside the scope of this EIR.

TABLE 13-3 (Continued)
SUMMARY OF WRITTEN AND ORAL SCOPING COMMENTS SUBMITTED ON THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Regional and Local Agencies (cont.)		
ACWD (12/6/2017), cont'd	The November 30, 2017, ESA memorandum seems to underscore previously identified deficiencies in the model. The model does not provide consistent, understandable results when subjected to minor changes to input variables, which indicates the model is not robust enough to confidently analyze such a complex system. For example in the memo, the act of increasing quarry discharges to Alameda Creek at times exhibits decreased net streamflow. Finally, the Notice of Preparation for Recirculating the EIR does not include a description of this revision to the modeling, even though ACWD and NMFS have requested that Planning revise the modeling approach to address these identified concerns.	Appendix HYD1-R (ASDHM and post processing)
ACWD (12/6/2017), cont'd	Will Planning commit to working with NMFS, ACWD, and other watershed stakeholders, as well as the independent third party consultant, to develop a model that is robust enough to analyze the dynamic surface water to groundwater processes in the Sunol Valley under the proposed future operations of the ACRP? ACWD requests that Planning commit to working with NMFS, CDFW, ACWD, and other watershed stakeholders, as well as the independent third party consultant, to develop a model that is robust enough to analyze the dynamic surface water to groundwater processes in the Sunol Valley under the proposed future operations of the ACRP.	Section 13.3.2, Consultation Concerning Recirculated Portions of the EIR Section 13.2, Third Party Review of Groundwater/ Surface Water Analysis Appendix TPR Appendix HYD2-R (surface water-groundwater interactions) Chapter 14, Revisions to the Project Description (revised operations, Section 14.3)
Thomas Nieser, ACWD (12/6/2017 scoping meeting)	Most of the issues that our agency had as well as some of the other commenters were related to our concerns about the sufficiency of the modeling analysis that was done, not the work per se but the model itself, the technique, the methodology. And what we noticed in the NOP for this Recirculated EIR is that there's no real description of any significant revision to that modeling or that process, even though we feel that it would address most of the comments that were really kind of brought us to here, where we are today.	Appendix HYD1-R (ASDHM and post processing) Appendix HYD2-R (quantification of groundwater characteristics)
Thomas Nieser, ACWD (12/6/2017 scoping meeting), cont'd	Is the Planning Department committed to working with NMFS and ACWD and other agencies in the watershed as well as — I know there's an independent third party expert — to develop a more robust model to more thoroughly analyze the dynamic surface water and groundwater situation in Sunol Valley that's a result of — or that will be affected by the proposed ACRP project. That is a major area of concern. We feel it's fundamental to addressing the outstanding comments and really what we're all here about.	Section 13.3.2, Consultation Concerning Recirculated Portions of the EIR Appendix HYD2-R Chapter 14, Revisions to the Project Description (revised operations, Section 14.3)
Thomas Nieser, ACWD (12/6/2017 scoping meeting), cont'd	We were provided the scope of work that was given for the third party expert. Thank you very much. We had a look at that. We are very familiar with the selected expert, Dr. Moran. ACWD's worked with her in the past, and we respect her very much. But looking at the scope of work, it seems to step away from a true third party independent review and it's somewhat scripted. It's got a lot of specifics. It appears to sort of prescribe the record of information that's supposed to be included in that review as well as a lot of coordination, working with the planning group on the process. So it almost seems more like	Section 13.2, Third Party Review of Groundwater/ Surface Water Analysis Appendix TPR

TABLE 13-3 (Continued)
SUMMARY OF WRITTEN AND ORAL SCOPING COMMENTS SUBMITTED ON THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Regional and Local Agencies (cont.)		
Thomas Nieser, ACWD (12/6/2017 scoping meeting), cont'd	a collaborator in the study rather than an independent review. So frankly, a comment is that it didn't appear to be outwardly an independent review on our part. But obviously that could be just how we're reading it. We do have questions about the work specifically in the list of information that will be provided for the third party specialist, independent third party specialist. Will she be provided with the full record of the Board of Supervisors File No. 170839, including the information submitted by NMFS and ACWD during the appeal process?	
Thomas Nieser, ACWD (12/6/2017 scoping meeting), cont'd	If the third party specialist sort of comes to a similar conclusion that we made during the initial CEQA and finds that the fundamental methodology for the analyses, the modeling, is not sufficient to provide adequate detail for parties such as our to figure whether or not we're being impacted, is the Planning Department up to revising the modeling as a result of that recommendation? Anything else that you can provide for the role? It seems — in terms of how input from the specialist would be handled by the planning group?	Section 13.2, Third Party Review of Groundwater/ Surface Water Analysis Appendix TPR
Thomas Nieser, ACWD (12/6/2017 scoping meeting), cont'd	My last questions are surrounding that memo that was received. We received the data. Appreciated that. There wasn't a tremendous amount of detail in it. It's clear that the change was made but not necessarily what the basis or the assumptions of the change that resulted in some changed streamflow data. We did notice it appears to significantly address a number of the concerns that we had raised in the preliminary CEQA, which is an interesting outcome. So we're assuming that there will be more supporting documentation for both the basis of the original assumptions for the quarry discharges as well as the modified data that we received, why — it's a pretty significant change, sort of a doubling of the amount of water that's being discharged in Alameda Creek. So we're hoping we'll get full information as to what the assumptions were for the original data set and then the revised data set.	Appendix HYD1-R (quarry NPDES discharges, and ESA memorandum dated 11/30/2017 on EIR Post-processing Corrections)
Thomas Nieser, ACWD (12/6/2017 scoping meeting), cont'd	The San Francisco Water Department did a system modeling, and then ESA did a post processing for change in downstream operations as a result of this future operation. And the question is, when you've got these quarry discharges pulling water out of Sunol basin and discharging it so that they can continue to do their gravel operations, was that extraction of water from Sunol factored back into the Planning Department's modeling? And — which would affect sort of the re-operation of how maybe Calaveras Reservoir or deliveries of that reservoir would work, resulting storage levels. I think it's roughly 120,000 acre-feet over the whole period that gets taken out of Sunol. And I'm just questioning if that was sufficiently reflected by going back into the initial modeling and then fed back into the ESA model. So we've got one model feeding another. Was the process done to take the changed output back to the head works of the original model and get them to sort of converge to a consistent result? We would like to get some more knowledge as to how that was exactly modeled.	Section 15.2, revised hydrologic analysis of flows Appendix HYD1-R (ASDHM and post processing)
Thomas Nieser, ACWD (12/6/2017 scoping meeting), cont'd	One final comment back to the modeling element is that, with that component, you know, presumably it's going to affect the sort of carryover accounting and the sort of accounting system that's documented in the planned operation of the ACRP. So it's basically the same question. How does that carryover accounting factor in the quarry operations for the ESA analysis?	Chapter 14, Revisions to the Project Description (revised operations, Section 14.3) Appendix HYD1-R (quarry NPDES discharges)

TABLE 13-3 (Continued)
SUMMARY OF WRITTEN AND ORAL SCOPING COMMENTS SUBMITTED ON THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Regional and Local Agencies (cont.)		
Zone 7 (10/31/2017)	1. The project should not result in operational changes to upstream (Zone 7) or downstream (ACWD and ACPWA) water supply or flood protection agencies. 2. The analysis should address any potential flooding impacts. Of particular concern in this region is the Sunol Glen Elementary School. 3. Zone 7 has nearly completed a major update to the Stream Management Master Plan. 4. The EIR should include adequate analysis on any potential impacts on groundwater resources and management.	Section 13.1.4, Contents of the Recirculated Portions of the EIR. (These issues were addressed in EIR section 5.16, including Impacts HY-2, HY-4, and HY-5, and are outside the scope of the recirculated portions of the EIR.)
Non-Governmental Organizations		
Alameda Creek Alliance (11/15/2017)	We request that the Planning Department, SFPUC and the independent third party consultant meet with the Alameda Creek Fisheries Restoration Workgroup as part of the scoping process, to initiate this analysis and evaluation of the model.	Section 13.3.2, Consultation Concerning Recirculated Portions of the EIR Appendix ACFRW

13.5 Document Organization

This document containing the recirculated portions of the EIR is organized to augment, complement, and/or replace sections of the June 2017 EIR and follows the sequential numbering of the volumes and chapters, as shown below.

Volume 1, Original Draft EIR, published November 30, 2016

- **Chapter 1, Summary.** This chapter presents a summary of the proposed project, identifies potentially significant environmental impacts and mitigation measures, and describes the alternatives considered in this EIR. It also addresses areas of controversy and issues to be resolved.
- **Chapter 2, Introduction and Background.** This chapter provides project background information and describes the purpose and organization of the EIR, as well as the environmental review process.
- **Chapter 3, Project Description.** This chapter describes the proposed project, including the project objectives, project components, project construction, and project operations. The chapter also lists required permits and approvals.
- **Chapter 4, Plans and Policies.** This chapter describes applicable land use plans and policies and their relevance to the project, and then discusses the project's consistency with those plans.
- **Chapter 5, Environmental Setting, Impacts, and Mitigation Measures.** This chapter is divided into sections covering each environmental resource topic. Each section describes the

environmental and regulatory setting, the criteria used to determine impact significance, and the approach to the analysis for that resource topic. The section then presents an analysis of potential environmental impacts and the project-specific mitigation measures that have been developed to address significant and potentially significant impacts. Each resource section also includes an evaluation of cumulative impacts with respect to that resource topic. The criteria used to determine the significance of project impacts are based primarily on the San Francisco Planning Department's Initial Study Checklist,[5] which in turn, is based on CEQA Guidelines Appendix G. In order to address the specific hydrologic issues pertinent to the ACRP, the Planning Department included one additional criterion to address the potential for ACRP operations to affect downstream water users in a manner that would result in adverse environmental effects. This chapter contains the following sub-sections and environmental resource topics:

5.1 Impact Overview
5.2 Land Use
5.3 Aesthetics
5.4 Population and Housing
5.5 Cultural Resources
5.6 Transportation and Circulation
5.7 Noise and Vibration
5.8 Air Quality
5.9 Greenhouse Gas Emission
5.10 Wind and Shadow
5.11 Recreation
5.12 Utilities and Service Systems
5.13 Public Services
5.14.1 Terrestrial Biological Resources
5.14.5 Fisheries Resources
5.15 Geology and Soils
5.16 Hydrology and Water Quality
5.17 Hazards and Hazardous Materials
5.18 Mineral and Energy Resources
5.19 Agriculture and Forestry Resources

- **Chapter 6, Other CEQA Issues.** This chapter discusses growth-inducing effects, summarizes the cumulative impacts, identifies the significant environmental effects that cannot be avoided if the proposed project is implemented, and describes the significant irreversible impacts.
- **Chapter 7, Alternatives.** This chapter describes the alternatives to the proposed project and compares their impacts to those of the proposed project. This chapter also identifies the environmentally superior alternative and summarizes the alternatives that were considered but screened from further analysis.
- **Chapter 8, EIR Authors and Consultants.** This chapter lists the EIR authors, consultants, project sponsors, and organizations and persons consulted.

Volume 2, Appendices to Original Draft EIR, published November 30, 2016

- **Draft EIR Appendices.**
  - **Appendix NOP.** Notice of Preparation and Scoping Report
  - **Appendix WSIP.** WSIP PEIR Mitigation Measures, Applicability to the Proposed Project
  - **Appendix AQ.** Emissions Calculations for Air Quality and Greenhouse Gas Emissions Analyses

[5] San Francisco Planning Department, 2015. *Environmental Review Guidelines, Appendix B: Initial Study Checklist*. Revised August 10, 2015.

  - **Appendix BIO1.** Terrestrial Biological Resources Supporting Documentation
  - **Appendix BIO2.** Alameda Creek Fisheries Habitat Assessment Report
  - **Appendix HYD1.** Surface Water Hydrology Report
  - **Appendix HYD2.** Groundwater/Subsurface Water Interactions Technical Memorandum

Volume 3, Responses to Comments document, published June 7, 2017

- **Chapter 9, Introduction to Responses to Comments.** This chapter describes the purpose of the RTC document, the environmental review process, and the organization of the entire EIR.
- **Chapter 10, List of Persons Commenting.** This chapter lists the persons, agencies, and organizations that submitted comments on the Draft EIR and describes the coding and organization of comments.
- **Chapter 11, Responses to Comments.** This chapter presents the substantive comments received on the Draft EIR together with responses to those comments. The comments and responses in this chapter are organized by topic, covering several of the environmental topics addressed in Chapter 5 of the EIR. Similar comments on the same topic received from multiple commenters are grouped together, for which a single comprehensive response is provided.
- **Chapter 12, Draft EIR Revisions.** This chapter presents changes and revisions to the Draft EIR. The Planning Department has made changes and revisions to the Draft EIR either in response to comments received on the Draft EIR and/or as necessary to clarify statements and conclusions made in the Draft EIR. In all cases, changes are provided to clarify or correct content in the Draft EIR or to add information received after the release of the Draft EIR. None of the changes and revisions in Chapter 12 affect the analysis or conclusions presented in the Draft EIR.
- **Responses to Comments Appendices.**
  - **Appendix COM**. Written Comments on Draft EIR, Coded
  - **Appendix PH.** Public Hearing Transcripts, Coded

Volume 4, Recirculated Portions of the Draft EIR, published December 4, 2019

- **Chapter 1A, Summary of Recirculated Portions of the EIR**. As required by CEQA Guidelines section 15088.5, this chapter summarizes the revisions made to the previously circulated Draft EIR using the same format as the previous summary. This chapter augments and supersedes portions of EIR Volume 1, Chapter 1, Summary.
- **Chapter 13, Introduction to Recirculated Portions of the EIR.** This chapter explains the purpose of the recirculated portions of the EIR, and it includes summaries of all comments made during the appeal process relevant to the recirculated portions of the EIR as well as during the scoping period for the recirculated portions of the EIR. For each comment, this chapter directs the reader to the section of the EIR that addresses the comment.
- **Chapter 14, Revisions to Project Description.** This chapter describes the changes in proposed project operations that the SFPUC developed subsequent to and in response to

the appeal process. It replaces and supersedes Section 3.6, Project Operations, in EIR Volume 1, Chapter 3.

- **Chapter 15, Recirculated Portions of Environmental Setting, Impacts, and Mitigation Measures.** This chapter augments and supersedes portions of Chapter 5 in EIR Volume 1. As directed by the San Francisco Board of Supervisors, it specifically addresses operational impacts on steelhead fish in the lower watershed as a result of project-induced effects on streamflow in Alameda Creek. This chapter also addresses the impacts, if any, of the revisions to the project description on the resource topics analyzed in EIR Chapter 5.
- **Appendices.** Supporting appendices for the recirculated portions of the EIR include the following:
  - **Appendix BOS**. San Francisco Board of Supervisors Motion Regarding Recirculation
  - **Appendix APC**. Appeal Process Comments Related to Steelhead Impacts
  - **Appendix NOP2.** Notice of Preparation for Recirculated Portions of the EIR, Scoping Comments, and Public Hearing Transcripts
  - **Appendix TPR**. Third Party Review of the Groundwater/Surface Water Analysis Used in the EIR
  - **Appendix ACFRW**. Alameda Creek Fisheries Restoration Meeting, September 12, 2019
  - **Appendix BIO2-R**. Revised Alameda Creek Fisheries Habitat Assessment Report (updates Appendix BIO2 in EIR Volume 2)
  - **Appendix HYD1-R**. Revised Surface Water Hydrology Report (replaces and supersedes Appendix HYD1 in EIR Volume 2)
  - **Appendix HYD2-R**. Revised Groundwater/Surface Water Interactions (replaces and supersedes Appendix HYD2 in EIR Volume 2)

Volume 5, Supplemental Responses to Comments document (publication date to be determined)

CHAPTER 14
Revisions to the Project Description

14.1 Introduction

This chapter describes the revisions to the San Francisco Public Utilities Commission's (SFPUC) Alameda Creek Recapture Project (ACRP or project). The SFPUC revised and clarified the operating protocols for the ACRP in response to concerns raised by the National Marine Fisheries Services (NMFS) and California Department of Fish and Wildlife (CDFW). Section 14.3, Revised Project Operations, below, supersedes and replaces EIR Chapter 3, Section 3.6.1, Proposed Operations, and is the basis for the revised impact analysis presented in Chapter 15 of this document. This introductory Section 14.1 summarizes the project description to orient the reader as well as to provide context for the revisions to the project operations described in Section 14.3, below. Section 14.1.1, Project Overview, generally describes the project. The information in Section 14.1.1 is unchanged from the general description of the project found in EIR Chapters 2 and 3.

14.1.1 Project Overview

The SFPUC is proposing the ACRP as one component system-wide improvements to its regional water system known as the Water System Improvement Program (WSIP). The ACRP is a water supply project located in the Sunol Valley in Alameda County on lands owned by the City and County of San Francisco (CCSF) as part of its Alameda Watershed. The ACRP would be implemented following completion of the SFPUC's Calaveras Dam Replacement Project (CDRP), also a WSIP project, which when completed will restore Calaveras Reservoir to its historical capacity. The CDRP is currently under construction and is scheduled for completion in the December 2019. The ACRP would be operated in conjunction with the future operation of the restored Calaveras Reservoir. **Figure 14-1** (an updated version of EIR Figure 2-2) shows the project location, including the downstream location of the ACRP project area relative to the CDRP and provides an overview of the ACRP.

The future operations of Calaveras Dam and Reservoir are subject to federal and state permit requirements. Specifically, when the CDRP is completed, the SFPUC will be required to make releases from Calaveras Dam and to bypass creek flow around the Alameda Creek Diversion Dam (ACDD) in accordance with instream flow schedules set forth by NMFS in its March 5, 2011 biological opinion for this project.[1] The releases and bypasses are designed to improve conditions for native aquatic species, including threatened Central California Coast steelhead (*Oncorhynchus*

[1] National Marine Fisheries Service (NMFS), *Biological Opinion for Calaveras Dam Replacement Project in Alameda and Santa Clara Counties,* Tracking No. 2005/07436, March 5, 2011.

mykiss) in Upper Alameda Creek downstream of Calaveras Dam and the ACDD. The ACRP would "recapture" some of the water that it is required to release and bypass under the permits for the CDRP in order to use this water in its regional water system.

Under the ACRP, the SFPUC would construct pumping and associated facilities to withdraw water from Pit F2, an existing quarry pit formerly used by quarry operators located adjacent to Alameda Creek and about six miles downstream of Calaveras Reservoir. The SFPUC would convey the recovered water to existing SFPUC facilities for treatment and distribution to its customers in the Bay Area. Pit F2 passively collects water originating upstream from Alameda Creek through natural subsurface percolation and seepage, so the SFPUC would not construct any facilities within the Alameda Creek stream channel or actively divert water from the creek. SFPUC would recover water that passively percolates or seeps into Pit F2. In addition, under the ACRP, the amount of water the SFPUC would pump or "recapture" from Pit F2 would be limited to the portion of the bypassed and released water that the SFPUC otherwise would have stored in Calaveras Reservoir but for implementation of the instream flow schedules established for the CDRP.

The key objectives of the ACRP are: (1) to recapture the water that would have otherwise been stored in Calaveras Reservoir due to the release and bypass of flows from Calaveras Dam and the ACDD, respectively, to meet instream flow requirements, thereby maintaining the historical annual transfers from the Alameda Watershed system to the SFPUC regional water system in accordance with the CCSF's existing water rights; and (2) to minimize impacts on water supply to the SFPUC's wholesale and retail customers during droughts, system maintenance, and in the event of water supply problems or transmission disruptions in the other parts of the SFPUC regional water system.

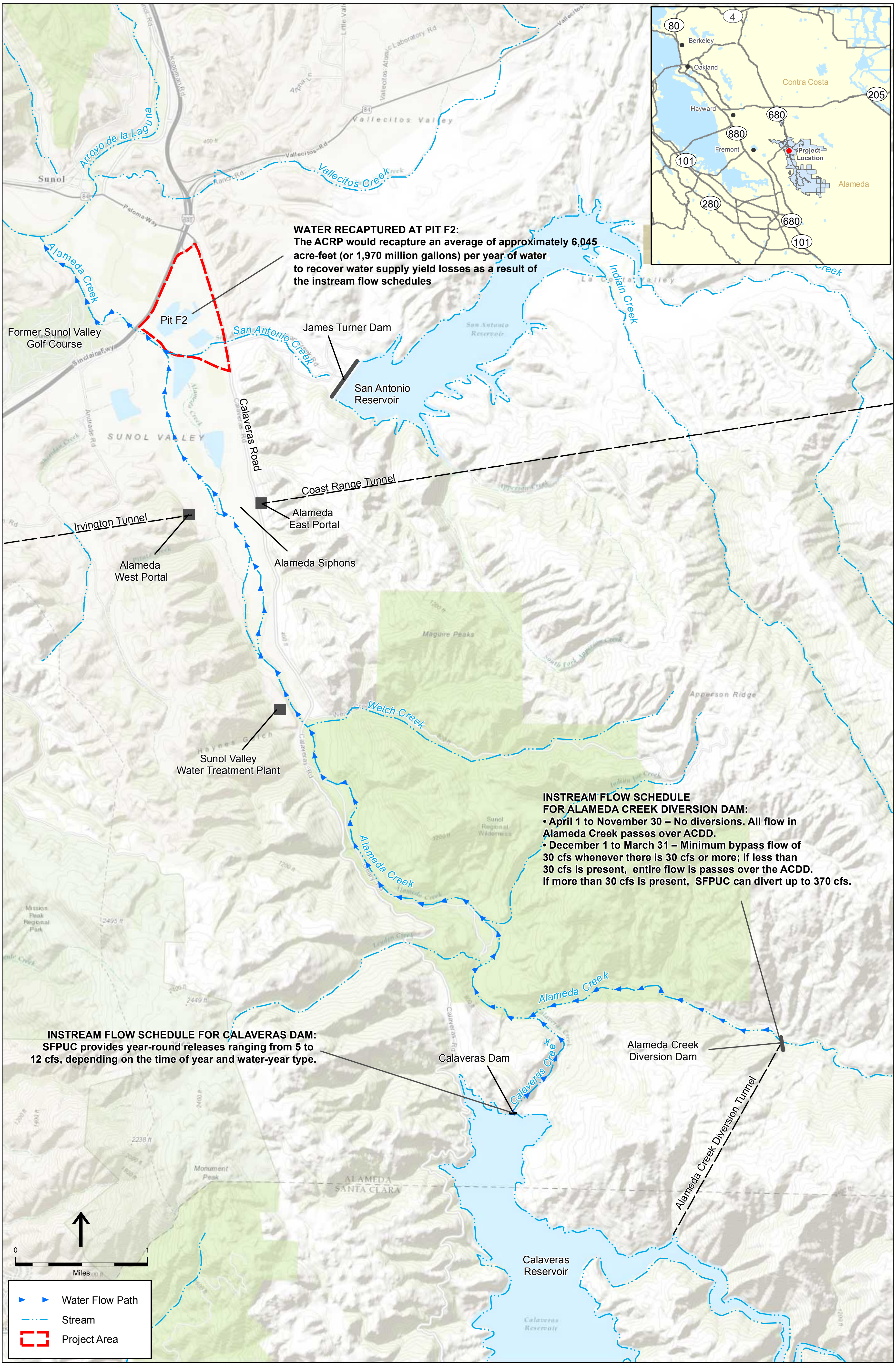
The detailed project description is presented in EIR Chapter 3, and the only changes to that description are presented below in Sections 14.2, 14.3, and 14.4.

14.2 Revised Construction Schedule

(This section supersedes and replaces EIR Section 3.5.12, Construction Schedule.)

Project construction would generally occur Monday through Saturday between 7 a.m. and 7 p.m. Truck hauling and deliveries would occur Monday through Friday between 7 a.m. and 7 p.m.; hauling and deliveries would not occur on Saturdays or Sundays. Construction is expected to begin in 2020 and to be completed in 2022, with an overall duration of 20 months.[2]

2 SFPUC, *Final Conceptual Engineering Report for Alameda Creek Recapture Project*, November 21, 2014.



SOURCE: ESA, 2015

SFPUC Alameda Creek Recapture Project

Figure 14-1
Project Location and Overview of Alameda Creek Recapture Project

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14.3 Revised Project Operations

14.3.1 Proposed Operations

(This section supersedes and replaces EIR Sections 3.6.1.1 to 3.6.1.2. Section 14.3.1.1 Recapture Volumes replaces EIR Section 3.6.1.1; and Section 14.3.1.2 replaces EIR Section 3.6.1.2, Operating Parameters (EIR Chapter 3, pp. 3-25 to 3-29) in their entirety. EIR Sections 3.6.1.3, Pumping Scenarios, and 3.6.1.4, Power Demand, remain unchanged.)

14.3.1.1 Recapture Volumes

Recapture operations under the ACRP would occur after implementation of the instream flow schedules required as part of the regulatory permits for future operations of Calaveras Reservoir and the ACDD. ACRP operations would not commence until the CDRP is completed and SFPUC implements the instream flow schedules of bypasses at ACDD and releases from Calaveras Reservoir (referred to as "bypasses and releases"). The proposed project would recapture the portion of bypasses and releases as needed and as available at the existing quarry Pit F2 in the Sunol Valley, downstream of the compliance points for the bypasses and releases below the ACDD and Calaveras Dam, respectively. The project would take advantage of the natural infiltration of water into the ground in the vicinity of Pit F2 and its detention in the pit as the means by which the water would be recaptured. Using the proposed ACRP facilities described in EIR Chapter 3, Section 3.4, the SFPUC would then pump water from Pit F2, and the recaptured water would be transferred to the regional water system for municipal use. The recapture operation of the ACRP would be conducted within the CCSF's existing pre-1914 appropriative water rights. The volume of recaptured water would be tracked daily to ensure the operation is conducted within these water rights.

The SFPUC used the Alameda System Daily Hydrologic Model (ASDHM) framework[3] to estimate the volume of water that the SFPUC would recapture to offset the loss of water supply yield from the Alameda Watershed due to the bypasses and releases, without expanding the CCSF's existing water rights. The SFPUC estimated the ACRP recapture volume using historical hydrology for the period October 1995 to September 2013 and accounting for future ACDD and Calaveras Reservoir operations, including the bypasses and releases. The volume of water bypassed and released, and subsequently available for recapture, would vary from year to year based on precipitation (i.e., water year types) and the specific requirements of the instream flow schedules. For the hydrologic period of October 1995 to September 2013, the SFPUC estimates that under the ACRP, there would be an average annual recapture volume of 6,045 acre-feet per year, with a range of 4,045 to 8,031 acre-feet per year.[4] This estimated average recapture volume is less than the estimated average loss of yield associated with the bypasses and releases, and for the purposes of this EIR, assumes future water years, on average, will be similar to the modeled hydrologic period.

3 See Appendix HYD1-R for a description of the Alameda System Daily Hydrologic Model.

4 The recapture volumes presented in this EIR are calculated values derived from the ASDHM, which used 18 years of hydrological data to estimate recapture volumes under those historical conditions. Although the recapture volumes appear precise, the reader should keep in mind that these are estimates based on modeled values.

Table 14-1 summarizes the proposed recapture volumes based on the 18-year historical hydrology period. To determine the recapture volume, the SFPUC conducted a series of calculations taking into account the daily volume of bypasses and releases, available storage in Calaveras Reservoir, and operating parameters at the recapture location, Pit F2. The average annual volume of water to be bypassed and released (i.e., the annual sum of daily bypasses and releases) under the CDRP permit requirements is shown in Table 14-1, Row 1; this is the amount potentially available for recapture. Table 14-1, Row 2 presents the estimated portion of Pit F2 inflow from the bypasses and releases, and Row 3 presents the estimated volume of water proposed for recapture on an average annual basis.

TABLE 14-1
SIMULATED CDRP BYPASSES AND RELEASES AND ACRP RECAPTURE VOLUMES UNDER REVISED OPERATIONS (acre-feet per year)

Operational Parameter	18-year Hydrologic Period		Wet Year		Dry Year	
	Average	Range	Average	Range	Average	Range
1. CDRP Bypasses and Releases (annual sum of daily flows)	14,695	8,238 – 26,185	18,345	11,142 – 26,185	10,133	8,238 – 14,570
2. Portion of Pit F2 Inflow from Bypasses and Releases	8,691	6,749 – 10,348	9,615	8,546 – 10,348	7,536	6,749 – 8,568
3. ACRP Recapture Volume, revised operations	6,045	4,045 – 8,031	5,396	4,045 – 8,031	6,856	6,187 – 7,258

NOTE: CDRP bypasses and releases, infiltration into Pit F2, and ACRP recapture based on 18-years of historical hydrology and simulated future operation of CDRP from October 1995 to September 2013.

SOURCE: SFPUC 2019

While the volume of water available for recapture is generally based on the volume of bypassed and released water, the project's calculated recapture volume is limited by available storage in Calaveras Reservoir and Pit F2 operating parameters (see Section 14.3.1.2, below). The amount of water the SFPUC would recapture from Pit F2 would be limited to the portion of the bypassed and released water that the SFPUC otherwise would have stored in Calaveras Reservoir but for implementation of the instream flow schedules established for the CDRP. For example, on a day when Calaveras Reservoir fills to capacity, the volume of bypassed and released water available for recapture is zero; the calculated water available for recapture starts accumulating again when Calaveras Reservoir storage recedes and there is unused storage capacity in the reservoir. Thus, the amount of water available for recapture on any given day is the lesser of the volume of water bypassed and released, or available (unused) storage volume in Calaveras Reservoir. Stated otherwise, at any time, the sum of water stored in Calaveras Reservoir and the volume of water available for recapture in Pit F2 would not exceed the total available capacity of the reservoir. The estimated volume of water proposed for recapture on an average annual basis is presented in Table 14-1, Row 3. This portion of the bypassed and released water would be recaptured from Pit F2, and it is less than or equivalent to the volume of water that is the loss of yield to the SFPUC regional water system.

Water downstream of the bypass and release compliance points fills Pit F2 by natural infiltration. Other sources of water in the watershed also contribute to water entering Pit F2. Table 14-1, Row 2 presents the estimated portion of Pit F2 inflow from the bypasses and releases only. In addition to bypasses and releases, inflow to Pit F2 from other sources in the watershed includes contributions from the downstream watersheds below Calaveras and San Antonio Reservoirs as well as direct contributions from watersheds east of the quarry reach. Therefore, the total annual inflow to Pit F2 from all sources (i.e., infiltration of bypasses and releases plus other watershed sources) would be greater than the volume of water shown in Table 14-1, Row 2.

As shown on Table 14-1, the *average* annual volume of water proposed for recapture during the modeled period (Row 3, 18-year Hydrologic Period) is less than the *average* inflow from bypasses and releases during the same period (Row 2, 18-year Hydrologic Period). Likewise, during both wet and dry years, the *average* annual volume of water proposed for recapture (Row 3, Wet Year) is less than the *average* inflow from bypasses and releases (Row 2, Wet Year).[5].

On average, the total annual volume of the portion of bypassed and released water that infiltrates into Pit F2 would exceed the volume of water recaptured. This excess volume represents the portion of bypassed and released water that infiltrates into Pit F2 but is not proposed for recapture.

14.3.1.2 Operating Parameters

The SFPUC has developed strict operating protocols for the ACRP in order to avoid effects on Alameda Creek streamflow during the steelhead migration season. The SFPUC would maintain the elevation in Pit F2 between 180 feet and 240 feet.[6] Nearly all pumping for the recapture operations would occur between July 1 and November 30 of each year, outside of the migration period for steelhead in Alameda Creek. From December 1 to April 30 of each year, no pumping from Pit F2 for recapture operations would occur, with one exception. The exception during this period would be for safety purposes, which could occur if the water levels in Pit F2 reach an elevation of 240 feet and there is a danger of the pit spilling and flooding; in this event, the SFPUC would pump the water from Pit F2 until the water level is brought down to an elevation of 230 feet.

No pumping from Pit F2 would occur from May 1 to June 30 under either of the following two conditions: (1) streamflow in Alameda Creek just above its confluence with San Antonio Creek is greater than zero,[7] <u>or</u> (2) the water elevation in Pit F2 is less than 225 feet elevation, even if the flow at Alameda Creek above San Antonio Creek is zero.[8] In other words, pumping could occur in

[5] Under the revised operations with the reduced period of pumping and the higher operating water levels in Pit F2, the volume of recaptured water would be less than assumed in the June 2017 EIR. The likelihood of recapturing water stored from previous years (i.e., carryover operations) is greatly reduced and would be expected to occur rarely. Based on 18 years of modeling, the volume of pumping from Pit F2 is only greater than Pit F2 inflow from bypasses and releases in hydrologic year 2012 (by 330 acre feet) (although total Pit F2 inflow in hydrologic year 2012 is greater than the recaptured volume). In all other hydrologic years of the study period, the amount of water the SFPUC would recapture from Pit F2 would be less than the portion of Pit F2 inflow from bypassed and released water in that hydrologic year.

[6] All water levels in Pit F2 are described in terms of elevation relative to NAVD88.

[7] When there is no streamflow in Alameda Creek above its confluence with San Antonia Creek (i.e., streamflow is zero), there is no connectivity in Alameda Creek between the Sunol Valley and upper or lower Alameda Creek, and under these conditions, the creek is not an active migration corridor for steelhead.

[8] A Pit F2 water surface elevation of 225 feet is used as the threshold for pumping in May and June because this elevation represents the approximate contact point between the permeable stream channel gravels and the older, impermeable alluvium and Livermore Gravels. When water levels in the pit are above 225 feet, there is limited potential for the pit to accept seepage from the adjacent aquifer. Therefore, there is limited potential for the pit to drawdown water levels from the adjacent aquifer, which could indirectly affect streamflow within the creek. See Appendix HYD2-R for a discussion of the hydrogeologic properties of these two geologic units.

May and June only when there is no streamflow in Alameda Creek above the confluence with San Antonio Creek and the water elevation in the pit is greater than 225 feet. At no time of the year would the SFPUC draw down the water levels in Pit F2 below an elevation of 180 feet. **Figure 14-2** schematically depicts the revised ACRP operational protocols for each month of the year compared to the monthly operations previously proposed in the June 2017 EIR. **Figure 14-3** is a cross-section of Pit F2 and shows the revised operating range of water levels.

MONTH	REVISED OPERATIONS	JUNE 2017 EIR OPERATIONS	REMARKS
Oct	Pumping permitted if pit water levels greater than 180 ft	Pumping permitted if pit water levels greater than 150 ft	Pumping period reduced from 9 months to 5 months, with additional pumping in May and June only under specified conditions
Nov			
Dec	No Pumping*		
Jan		No Pumping	No pumping period extended from December to June compared to January to March
Feb			
Mar			
Apr		Pumping permitted if pit water levels greater than 150 ft	
May	No pumping if pit water levels less than 225 ft or if flow at San Antonio Creek is greater than zero		Pit Level will not be drawn down below 180 ft compared to 150 feet
Jun			
Jul	Pumping permitted if pit water levels greater than 180 ft		Recapture volume reduces from an average of about 7,200 acre-feet/yr to about 6,000 acre-feet/yr
Aug			
Sep			

No Pumping | Revised Operations | Pumping Permitted up to Specified Limit

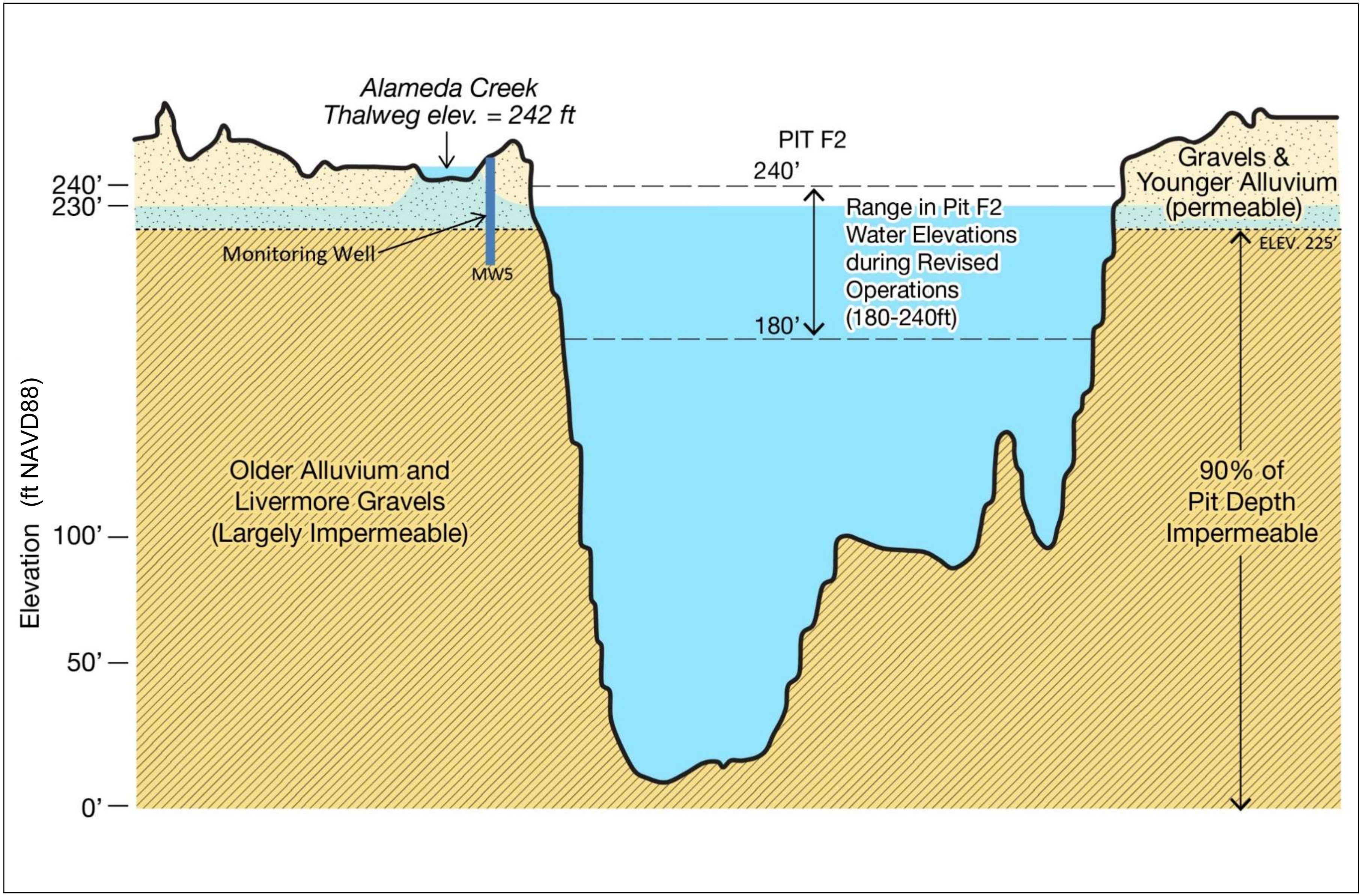
*The only exception during this period would be for safety purposes, in which case pumping could occur if the water levels in Pit F2 reach an elevation of 240 feet and there is a danger of the pit spilling and flooding. In this case, pumping water from Pit F2 would be conducted until the water level is brought down to an elevation of 230 feet.

SOURCE: SFPUC, 2019.

Figure 14-2
Schematic of Revised ACRP Operations Compared to June 2017 EIR

In addition to the above constraints, the SFPUC would pump only when the SFPUC's accounting of water credits and withdrawals shows that the CCSF has the right to divert the water. As part of the future joint operation of Calaveras Reservoir and the ACRP, the SFPUC would maintain an accounting system to track the water credits under CCSF's water rights in the Alameda Watershed. The pumping from Pit F2 would be limited by those credits associated with the space available in Calaveras Reservoir at all times. Regardless of water rights, pumping from Pit F2 would only occur within the timeframes and conditions described above.

SFPUC would use four pumps on floating barges to pump water from Pit F2 directly to the Sunol Valley Water Treatment Plant (SVWTP) or San Antonio Reservoir. It is anticipated that, in most cases, the water withdrawn from Pit F2 would be conveyed to the SVWTP and thereby reduce the volume of water conveyed from Calaveras Reservoir to SVWTP, enabling the SFPUC to conserve water in Calaveras Reservoir and maintain the historical annual transfers from the Alameda Watershed system to the regional water system. The SFPUC would pump water from Pit F2 at a flow rate of approximately 30 cubic feet per second (cfs), which is based on the minimum flow rate



SOURCE: ESA/Orion, 2019.

SFPUC Alameda Creek Recapture Project

Figure 14-3

Schematic of Revised ACRP Operating Protocols needed to operate the SVWTP.[9] If the recaptured water is conveyed to San Antonio Reservoir, the water would be used to fill the available storage at that reservoir and subsequently would be treated at the SVWTP for delivery to the SFPUC service area.[10] It is anticipated that on average, the ACRP would operate for approximately 101 days a year. The various pumping scenarios are described in EIR Chapter 3, Section 3.6.1.3 and remain unchanged.

In general, the SFPUC intends to operate Pit F2 within an upper and lower limit of water elevations in Pit F2, based on the relationship of water elevation to water volume. The operating elevations would range from 240 to 180 feet. At its lowest point, the bottom of Pit F2 is roughly 10 feet above msl. SFPUC would manage water elevations in Pit F2 by using a water level sensor in Pit F2 to monitor water elevations.[11] **Figure 14-4** depicts the proposed normal operating scenario, showing the anticipated variation in water elevations in Pit F2 over the course of a water year in comparison to the previously proposed operating scenario in the June 2017 EIR. **Figure 14-5** (same as Figure 3-5 in the June 2017 EIR) shows the Pit F2 water depth-to-volume relationship developed from 2006 LIDAR data, which can be used to estimate the volume of water stored in the quarry pit based on the water level in the pit.

To avoid the potential for instability of the quarry pit slopes, water levels in Pit F2 would be controlled in accordance with the recommendations presented in the geotechnical evaluation report prepared for the proposed project.[12] The proposed maximum rate of drawdown of 30 cfs would be acceptable from a slope stability standpoint under the proposed normal operating drawdown condition (drawdown from 240 to 180 feet).

Any excess water in Pit F2 would be managed by the quarry operators as under existing conditions. If needed to create a dry work area for aggregate extraction, the quarry operators remove water that seeps into the active pits by pumping it into inactive pits, inactive areas of active pits, and other storage ponds. The quarry operator's general practice is to conserve water within the pits for use in aggregate processing and discharge water to the creek only when absolutely necessary.

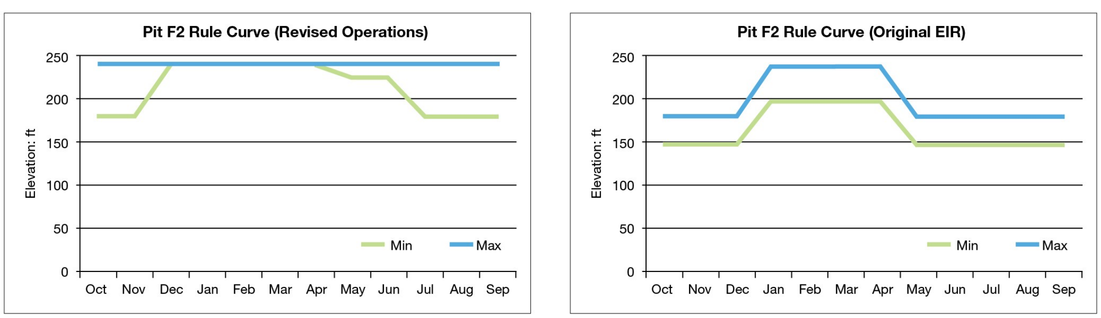


Figure 14-4
Revised Operation Scenario Compared to Original EIR

9 If the flow rate from Pit F2 is less than 30 cfs (e.g., if one or more of the ACRP pumps are out of service), SFPUC would augment the inflow into SVWTP with another water supply source (i.e., water stored in San Antonio Reservoir or Calaveras Reservoir) to provide the minimum flow rate.

10 SFPUC, *Final Conceptual Engineering Report for Alameda Creek Recapture Project*, November 21, 2014.

11 Ibid.

12 T&R/RYGG, 2014. *Final Geotechnical Evaluation, Alameda Creek Recapture Project, Sunol California. SFPUC Project No. CUW 352.01*. December 23, 2014.

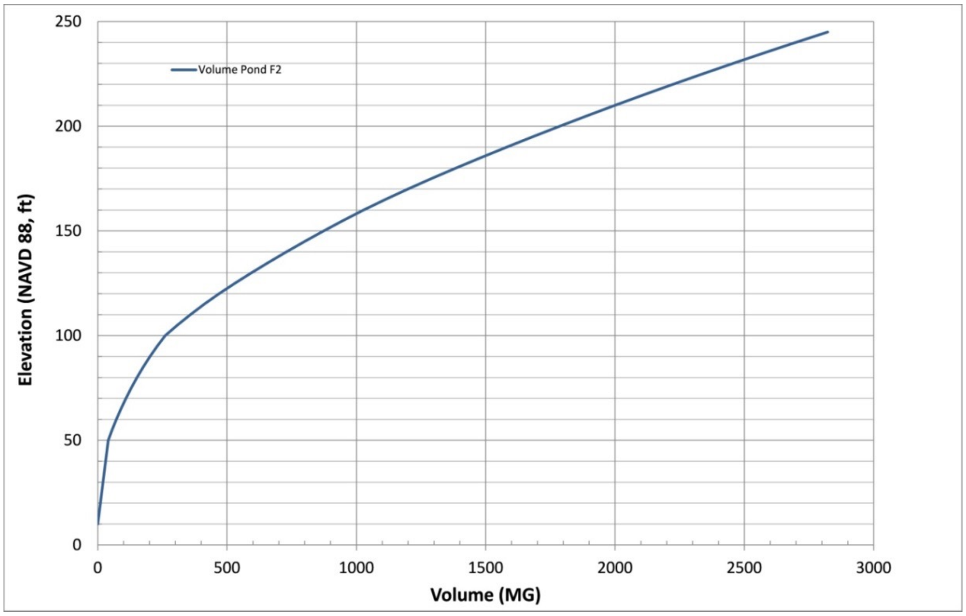


Figure 14-5
Pit F2 Water Elevation to Volume Relationship
(same as Figure 3-5)

14.4 Additional Required Permits

(This section augments EIR Chapter 3, Section 3.7.)

14.4.1 State

- California Department of Fish and Wildlife – Lake and Streambed Alteration Agreement pursuant to Fish & Game Code section 1600 et seq.

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CHAPTER 15

Recirculated Portions of the Environmental Setting, Impacts, and Mitigation Measures

15.1 Introduction

This chapter contains the recirculated portions of the environmental impact analysis of the Alameda Creek Recapture Project (ACRP or project) environmental impact report (EIR). It augments and, in some cases, replaces sections of Chapter 5 of the June 2017 EIR. The chapter includes the response to the San Francisco Board of Supervisor's request that the EIR provide additional analysis regarding whether the project would result in operational impacts on steelhead fish in Alameda Creek as a result of project-induced changes to streamflow. In addition, due to the revisions to the project operations (described in Chapter 14), this chapter discusses if and how the revised project operations affect the impact analyses of any other resource topics addressed in the June 2017 EIR.

This chapter is organized as follows: Section 15.1 is the Introduction; Section 15.2 is Fisheries Resources; and Section 15.3 is Other Resource Topics Affected by the Revised Project Description. Section 15.2 describes the revised approach to the fisheries analysis and presents the revised impact analysis of project operations on steelhead fish in Alameda Creek. Specifically, it revises Impact BI-11 of the June 2017 EIR, Section 5.14.7.4, pp. 5.14-144 to 5.14-148. The revised fisheries analysis presents much of the same information in the June 2017 EIR including, Sections 5.14.5 (Setting, Fisheries Resources), 5.14.6 (Regulatory Framework, Fisheries Resources), and 5.14.7.1 (Significance Criteria), which are included and updated as necessary to provide context for the revised steelhead impact analysis. Other impacts related to fisheries resources in the June 2017 EIR Section 5.14.7 (i.e., Impacts BI-9, BI-10, BI-12, and C-BI-2) are not revised because the revised project operations would have no effect on those impacts and the Board of Supervisors found those impact analyses to be adequate.

The other resource topics affected by the revised project operations described in Section 15.3 include how project-induced changes in streamflow could affect terrestrial biological resources (Impacts BI-5 and BI-6) and hydrology (Impacts HY-2, HY-5, and C-HY), as well as various other resource topics that are incidentally affected by the revised operations (Impacts GE-4 and ME-4) and changes in the construction schedule (Impacts C-TR, C-NO, C-RE, and C-HZ). None of the other impacts in the June 2017 EIR would be affected by the revised operation and changes in construction schedule; and as such, the Board of Supervisors found those impact analyses to be adequate, accurate, and objective, and no further analysis or discussion is required.

15.2 Fisheries Resources

15.2.1 Setting, Fisheries Resources

(This section replaces the June 2017 EIR Section 5.15.5, Setting, Fisheries Resources. To assist the reader, the large portions of unchanged text from the previous Section 5.15.5 are shown in gray tone.)

15.2.1.1 Definitions

Primary and Extended Study Areas

For purposes of assessing fish habitat in Alameda Creek, two discrete study areas have been identified; a primary study area and an extended study area (see **Figure 15.2-1**). They consist of all aquatic habitats that could be directly or indirectly affected by the construction and operation of the ACRP.

Primary Study Area

The stream reaches immediately adjacent to and downstream of the project area could be affected by construction and operation of the proposed project and comprise the primary study area. This area includes the Alameda Creek channel from the confluence with San Antonio Creek downstream approximately 1.6 miles to the confluence with Arroyo de la Laguna. The primary study area has been further divided into Subreaches A, B, and C based on physical habitat characteristics (see **Figure 15.2-2**).

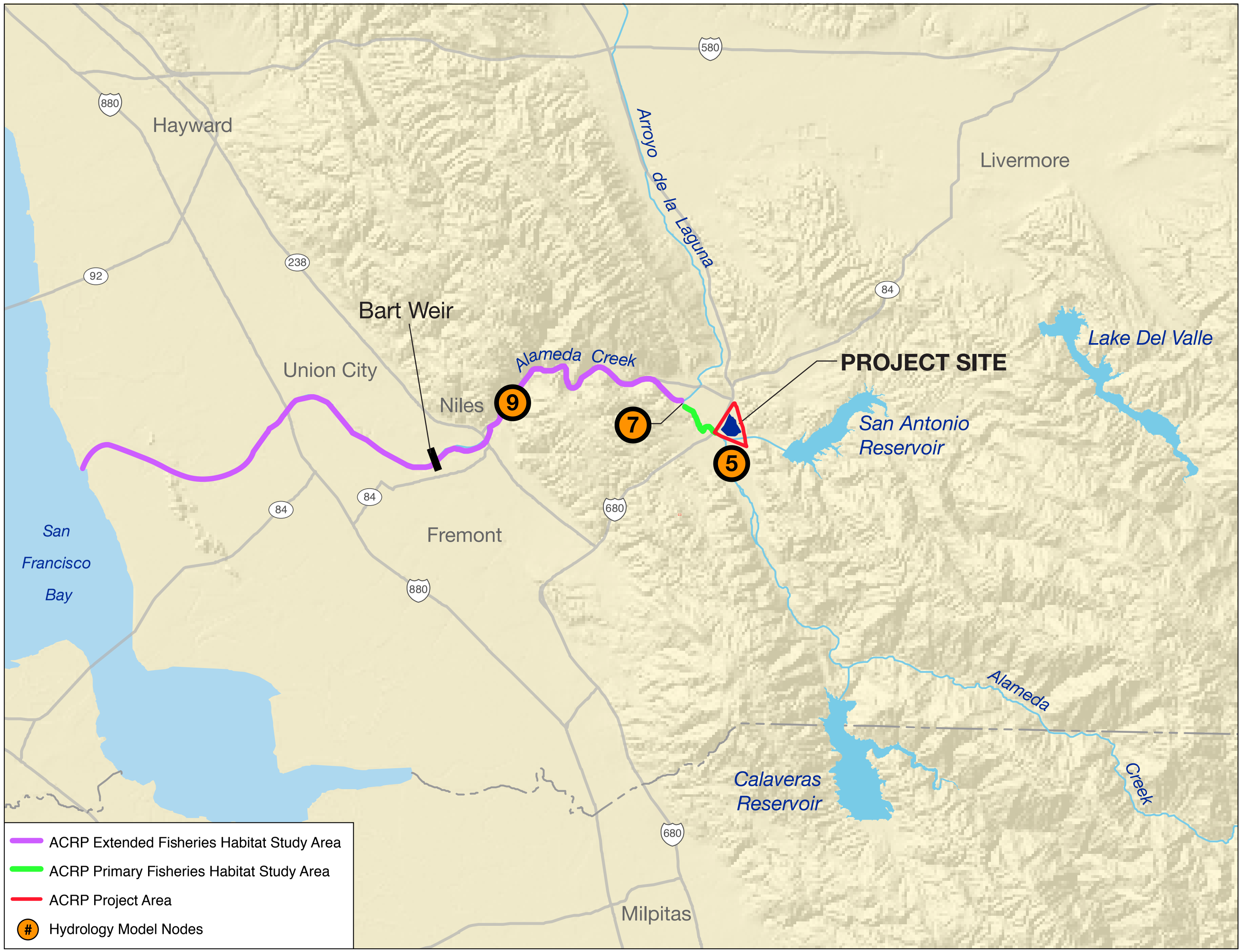
Extended Study Area

The extended study area includes the segments of the Alameda Creek main stem from the Arroyo de la Laguna confluence downstream approximately 16.5 miles to San Francisco Bay. Streamflow and the related fisheries habitat conditions in the extended study area are strongly influenced by operation of other water projects in the watershed including Del Valle Reservoir and water deliveries to the Alameda County Water District (ACWD) from the South Bay Aqueduct via Vallecitos Creek, which enters Arroyo de la Laguna just upstream of the Alameda Creek confluence. While operation of the proposed ACRP has the potential to influence flow conditions in Alameda Creek in the extended study area, the potential influence is greatly diminished due to the effects of these other water projects in the Arroyo de la Laguna watershed (see Appendix HYD1-R for description of other water projects in this watershed).

15.2.1.2 Information Sources and Survey Methodology

Literature Review

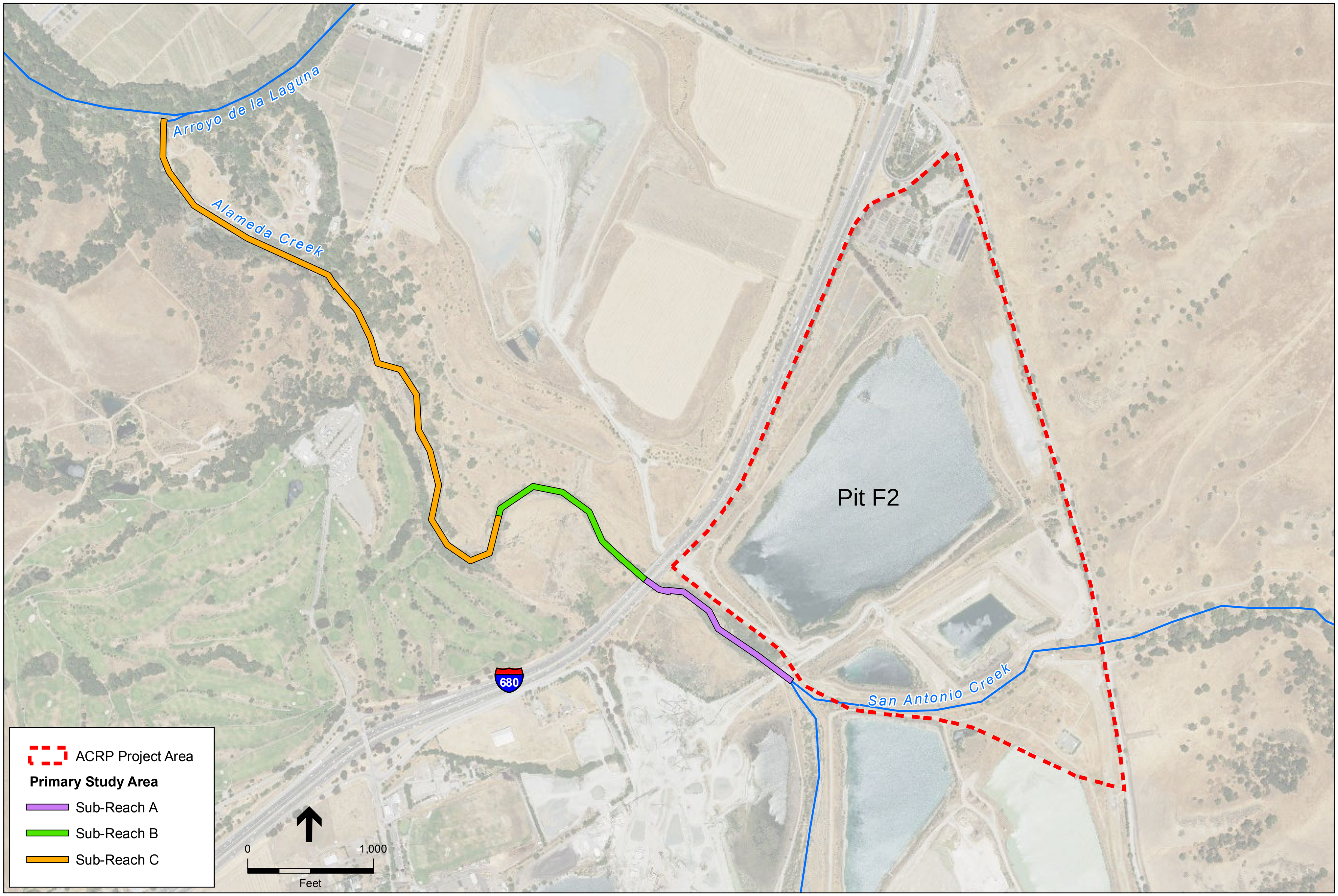
The Alameda Creek watershed has been studied in detail to support the Calaveras Dam Replacement Project (CDRP), and the potential for restoration of an anadromous fishery within Alameda Creek is the focus of the Alameda Creek Fisheries Restoration Workgroup (ACFRW); a



SOURCE: SFPUC, 2019

SFPUC Alameda Creek Recapture Project

Figure 15.2-1
Fisheries and Aquatic Habitat Study Area



SOURCE: ESA, 2015; Date of aerial photo is 2014.

SFPUC Alameda Creek Recapture Project

Figure 15.2-2
Primary Study Area Sub-Reaches

multi-agency stakeholder group formed in 1999 to develop and implement a strategy to restore steelhead trout to Alameda Creek. The ACFRW is composed of numerous community and citizens' groups, local water management and flood control agencies, state and federal resource agencies, and others. Numerous studies have been prepared detailing the potential for restoration of anadromous fish within Alameda Creek, and in support of the CDRP Environmental Impact Report (EIR). The following documents were reviewed for information on current and potential future environmental conditions in the primary and extended project areas as they relate to the ACRP:

- *Alameda Creek Recapture Project, Alameda Creek Fisheries Habitat Assessment Report* (see Appendix BIO2-R of the recirculated portion of the EIR (Recirculated EIR);[1]
- *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed;*[2]
- *Ecology, Assemblage Structure, Distribution, and Status of Fishes in Streams Tributary to the San Francisco Estuary, California;*[3]
- *Calaveras Dam Replacement Project Fisheries Technical Report 2008 (ETJV, 2008); Biological Assessment and Essential Fish Habitat Assessment for the Calaveras Dam Replacement Project;*[4]
- *Technical Memorandum: Calaveras Dam Replacement Project: Cumulative Impact Analysis – Central California Coast Steelhead. Appendix J Calaveras Dam Replacement Project FEIR;*[5]
- *Final Environmental Impact Report for the Calaveras Dam Replacement Project;*[6]
- *National Marine Fisheries Service Biological Opinion for the Calaveras Dam Replacement Project;*[7]
- *Streambed Alteration Agreement for the Calaveras Dam Replacement Project (Notification No. 1600-2010-0322-R3);*[8]
- *Evaluating Priority Life History Tactics for Reintroduced Alameda Creek Steelhead. Prepared for: Alameda Creek Fisheries Restoration Workgroup;*[9]

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1 San Francisco Public Utilities Commission. 2016. *San Francisco Public Utilities Commission Alameda Creek Recapture Project, Alameda Creek Fisheries Habitat Assessment Report*. Prepared by ESA. November 2016. (See Appendix BIO2-R).

2 Gunther, A.J., J.M. Hagar, and P. Salop, 2000. *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed*. Prepared for the Alameda Creek Fisheries Restoration Workgroup. February 7, 2000.

3 Leidy, R.A., 2007. *Ecology, Assemblage Structure, Distribution, and Status of Fishes in Streams Tributary to the San Francisco Estuary, California.* San Francisco Estuary Institute, April 2007. Contribution No. 530.

4 EDAW & Turnstone Joint Venture (ETJV), 2008. *Calaveras Dam Replacement Project Fisheries Technical Report*. Prepared by Hagar Environmental Science and Thomas R. Payne and Associates for EDAW & Turnstone Joint Venture and SFPUC.

5 San Francisco Planning Department, 2011. *Technical Memorandum: Calaveras Dam Replacement Project: Cumulative Impact Analysis – Central California Coast Steelhead. Appendix J Calaveras Dam Replacement Project FEIR.* San Francisco Planning Department File No. 2005.0161E, State Clearinghouse No. 2005102102. Certified January 27, 2011.

6 San Francisco Planning Department, 2011. *Final Environmental Impact Report for the Calaveras Dam Replacement Project*. San Francisco Planning Department File No. 2005.0161E, State Clearinghouse No. 2005102102. Certified January 27, 2011.

7 National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.

8 California Department of Fish and Game (CDFG), 2011. *Streambed Alteration Agreement for Calaveras Dam Replacement Project*. Notification No. 1600-2010-0322-R3. June 28, 2011.

9 McBain and Trush, 2012. *Evaluating Priority Life History Tactics for Reintroduced Alameda Creek Steelhead*. Prepared for: Alameda Creek Fisheries Restoration Workgroup.

- *Joint Lower Alameda Creek Fish Passage Improvements, Draft Initial Study with Mitigated Negative Declaration/Environmental Assessment with Finding of No Significant Impacts;*[10]*; and*
- *National Marine Fisheries Service Biological Opinion for the Joint Lower Alameda Creek Fish Passage Improvements Project*.[11]

Analysis of 2008 Habitat Characterization Study Survey Data

In 2008, the SFPUC conducted a detailed habitat characterization of Alameda Creek from its confluence with Arroyo de La Laguna to its confluence with Calaveras Creek, then along Calaveras Creek upstream to Calaveras Dam. The habitat characterization was conducted during a series of experimental water releases from Calaveras Reservoir. Crews of five or more SFPUC biologists conducted the surveys. Continuous longitudinal measurements of habitat types were recorded, and at every tenth habitat unit, the first occurrence of a given habitat unit, and around potential migration barriers, a full habitat characterization was conducted, including measurements of width and depth, substrate and shelter, band and riparian characteristics, spawning and pool tailout characteristics, barrier assessment, and streamflow measurements. This method was repeated during four successive experimental water releases from Calaveras Reservoir between May 1, 2008 and July 3, 2008. The data collected along Alameda Creek from its confluence with Arroyo de La Laguna upstream to its confluence with San Antonio Creek were synthesized to characterize fish habitat conditions in the primary study area as part of this analysis.

2015 Fisheries Habitat Survey

A focused visual survey of the primary study area and reconnaissance survey of the extended study area were conducted on May 27, 2015. Aquatic habitat types, riparian vegetation cover, and instream characteristics were noted and mapped. Potential habitat and barriers to movement for steelhead were also noted during the survey. The extended study area was characterized via spot-checks at accessible locations along Niles Canyon and the Alameda Creek flood control channel.

Historical Hydrological Records Review

The existing conditions have been characterized based on observation of conditions on the ground and review of historical records of stream discharge, water discharges, and water levels in surface and groundwater bodies. These sources include stream gages, monitoring wells, and quarry NPDES discharge records and are described in more detail in the *Surface Water Hydrology Report for Proposed Alameda Creek Recapture Project* (see Appendix HYD1-R) and in *Groundwater-Surface Water Interactions ACRP Biological Resources Study Area Technical Report* (see Appendix HYD2-R).

10 Hanson Environmental, 2016. *Alameda County Water District and Alameda County Flood Control & Water Conservation District Joint Lower Alameda Creek Fish Passage Improvements, Draft Initial Study with Mitigated Negative Declaration/Environmental Assessment with Finding of No Significant Impacts*. October 2016.

11 National Marine Fisheries Service (NMFS), 2017. *Biological Opinion for the Joint Lower Alameda Creek Fish Passage Improvements Project*. Santa Rosa, CA.

Alameda System Daily Hydrologic Model (ASDHM)

Future hydrologic conditions in the Alameda Creek watershed were projected using the Alameda System Daily Hydrologic Model (ASDHM) in combination with additional post-processing steps to estimate daily quarry discharge to Alameda Creek.[12] The methods used to make the projections are described in the *Surface Water Hydrology Report for the SFPUC Alameda Creek Recapture Project* (see Appendix HYD1-R). The ASDHM is a spreadsheet model that enables estimation of mean daily discharge values at various locations on Alameda Creek and one of its tributaries. The ASDHM was first developed by the SFPUC in 2009 and has subsequently been expanded and refined. The model was further refined for the ACFRW, and the agencies and stakeholders that comprise the workgroup.

The current version of the ASDHM enables estimation of mean daily discharge values at one location (or node) in Calaveras Creek below Calaveras Dam, and 11 locations (nodes) in Alameda Creek between the Alameda Creek Diversion Dam and Coyote Hills Regional Park, close to the point at which the flood control channel discharges into San Francisco Bay. The model is described fully in a draft technical memorandum entitled *Overview of Methods, Models and Results to Develop Unimpaired, Impaired and Future Flow and Temperature Estimates along Lower Alameda Creek for Hydrologic Years 1996-2009*.[13]

The SFPUC updated the model to include the ACRP. Additional post-processing steps to the output of ASDHM were conducted to refine simulated flows downstream of Node 6 in support of this analysis. The hydrology used in the analysis was for the 18-year period from Water Year 1996 to Water Year 2013. A detailed description of the ASDHM application to the revised steelhead analysis is provided in *Surface Water Hydrology Report for Proposed Alameda Creek Recapture Project* (see Appendix HYD1-R).

Surface and Subsurface Water Interactions

Surface and subsurface water interactions have been assessed through the analysis of monitoring well and streamflow data to show how subsurface water (including pit water surface elevations) responds to flows in Alameda Creek and vice versa. A detailed description of these interactions is provided in Appendix HYD2-R, *Groundwater-Surface Water Interactions, ACRP Biological Resources Study Area*.

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[12] For the purposes of the CEQA analysis, ESA/Orion used the ASDHM outputs and conducted additional analyses and refinement of streamflow data, referred to as "post-processing." The post-processing was conducted at locations downstream of Node 6 to better simulate streamflow in the reach adjacent to and downstream of the ACRP project site in order to evaluate potential effects of the project on resources dependent upon streamflow. The CEQA analysts determined that for the purposes of the impact analyses, streamflow in this reach would be better represented if both the gains (Hanson's quarry NPDES discharge) and additional losses that occur between San Antonio Creek (Node 6) and Arroyo de la Laguna (Node 7) were accounted for in the streamflow estimates at these locations (See Appendix HYD1-R, Section 4.3, *Post-Processing of ASDHM*).

[13] Dhakal, Buckland and McBain, 2012. *Overview of Methods, Models and Results to Develop Unimpaired, Impaired and Future Flow and Temperature Estimates along Lower Alameda Creek for Hydrologic Years 1996-2009.*

15.2.1.3 Alameda Creek Fish Habitat

Existing Conditions

Alameda Creek Watershed

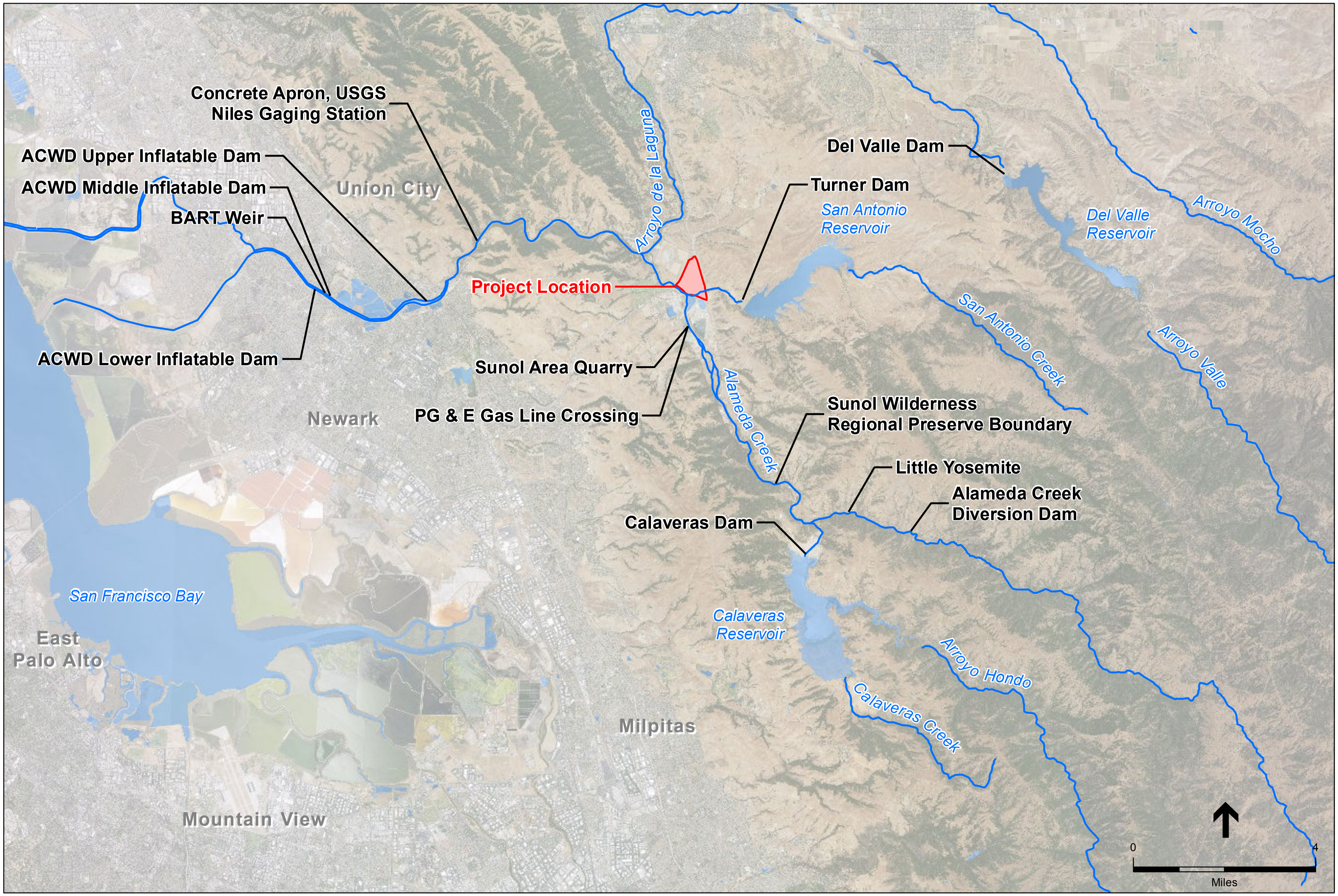
Appendix HYD1-R provides a detailed description of the surface water hydrology of the project area, and specifically the Alameda Creek watershed, from its headwaters near Mount Hamilton northward all the way to San Francisco Bay. This information is also summarized in Appendix BIO2-R. Additional supporting information on the groundwater hydrology in the project area is included in Appendix HYD2-R.

Past and Present Influences on Fisheries Habitat Conditions

As discussed above, the hydrologic and fisheries habitat conditions in Alameda Creek adjacent to and downstream from the proposed ACRP have been and are currently influenced by a number of historical and existing facilities and operations under the jurisdiction of several different entities, including the SFPUC, ACWD, Alameda County Flood Control and Water Conservation District (ACFCD), California Department of Water Resources (DWR), and Zone 7 Water Agency, among others. The natural and unimpaired flow conditions that existed pre-20th century have been substantially altered by the construction and operation of many of these facilities. Some of these facilities are direct barriers to fish migration, while other facilities pose varying degrees of control/influence over habitat conditions. The major structures, facilities, and fish passage barriers or obstacles are listed below (see **Figure 15.2-3**):[14]

- Upstream from or adjacent to the proposed project area:
  - Calaveras Dam and Reservoir;
  - Alameda Creek Diversion Dam (ACDD)(including a new fish ladder constructed as part of CDRP) and diversion tunnel;
  - Sunol Valley aggregate mining operations;
  - Sunol Valley historic stream relocation and channelization;
  - Turner Dam and San Antonio Reservoir (barriers to fish passage in upper San Antonio Creek);
  - Sunol Valley infiltration galleries; and
  - Pacific Gas and Electric Company (PG&E) gas pipeline crossing protection covering (concrete mat).
- Downstream from the proposed ACRP:
  - Del Valle Dam and Reservoir/South Bay Aqueduct, including DWR SWP releases;
  - Quarry Lakes recharge facilities;
  - Various channelized and culverted stream segments;

[14] Two historic structures—the Niles and Sunol Dams, both located on Alameda Creek downstream of the Sunol quarries, were removed in 2006 by the SFPUC, which improved fish movement conditions and increased the fish habitat. The East Bay Regional Park District also removed two small barriers from Sunol Wilderness Regional Preserve (Sunol Wilderness) in recent years.



SOURCE: ESA, 2015

SFPUC Alameda Creek Recapture Project

Figure 15.2-3
Major Facilities and Fish Passage
Barriers/Obstacles in the Alameda Creek Watershed

- Expanding urban development of the Tri-Valley Area;
- USGS Niles gaging station (11179000) weir/apron;
- ACWD's inflatable dams (see below for description of ACWD's Joint Lower Alameda Creek Fish Passage Improvements Project);
- BART weir; and
- ACFCD channelization project.

Reach-by-Reach Habitat Characterization

This section summarizes the results of the 2015 field surveys and analysis of the 2008 SFPUC habitat characterization data in the primary study area, both of which are described in detail in Appendix BIO2 and Appendix BIO2-R. In general, the entire primary fisheries study area, in which Alameda Creek and its tributaries are located, has intermittent flows due to the hydrologic regime described in Section 5.16. In addition, this portion of the Sunol Valley has been heavily influenced by sand and aggregate mining activities, including relocation of the channel in some locations, discharges to the creek from dewatering of active mining areas, and the Sunol Infiltration Gallery (formerly used for golf course irrigation water supply through a lease with the SFPUC). More detailed descriptions of habitat conditions throughout the primary and extended study areas are provided in Appendix BIO2 and Appendix BIO2-R, Alameda Creek Recapture Project, Alameda Creek Fisheries Habitat Assessment Report.[15]

Primary Study Area

Subreach A extends from the confluence of San Antonio and Alameda creeks to the I-680 bridge crossing. During the May 2015 survey, both San Antonio and Alameda Creeks were dry at the confluence, but water was present in Alameda Creek approximately 550 feet below the confluence. This inflow of water was a result of discharges associated with the adjacent quarry operations. Quarry discharges do not follow a specific pattern, nor are they regulated to provide certain flows at any given time (although all discharges are authorized under permits issued by the Regional Water Quality Control Board and there is a maximum discharge rate). In general, substrate was dominated by silt and fine sediment in pools and glide areas which had emergent vegetation, with some gravels and more complex channel structure in the isolated riffles interspersed throughout the subreach. Heavy riparian vegetation, wood debris flows, and debris dams in the channel combined to create pools, glides, and occasional riffles. During the 2008 SFPUC habitat characterization surveys, temperatures were near or above thermal limits for steelhead (approximately 73 to 77 degrees Fahrenheit[16]) during all experimental flow releases during May and June.

Subreach B extends from the I-680 culvert downstream approximately 1,700 feet. During the May 2015 survey, this reach of Alameda Creek was dominated by slow moving water (glide or pool habitat), had high levels of algal cover, dense riparian vegetation on banks, and was both lower gradient and wider than Subreach A. The 2008 surveys of this reach found no riffle habitat,

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15 ESA. 2016. *Alameda Creek Recapture Project, Alameda Creek Fisheries Habitat Assessment Report*. Prepared for San Francisco Public Utilities Commission. Prepared by Environmental Science Associates. November 2016. (See Appendix BIO2-R)

16 Gunther, A.J., J.M. Hagar, and P. Salop. 2000. *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed*. Prepared for the Alameda Creek Fisheries Restoration Workgroup. February 7, 2000. The report expresses the thermal range as 23 to 25 °C.

less than 10 percent substrate greater than 2.5 inches, and a maximum recorded depth of 4.6 feet. Temperatures during the May-June 2008 surveys conducted by SFPUC in Subreach B were also sub-optimal for steelhead, and at lower flows were above thermal limits.

Subreach C begins where the primary channel of Alameda Creek becomes braided and there is intermittent inflow of subsurface water into the open creek channel. This reach is characterized by riffle, run, and pool complexes with less dense riparian vegetation on the margins, slightly greater gradient, and increased habitat complexity when compared with Subreaches A or B. The 2008 surveys conducted by SFPUC showed that riffles in this reach were a more dominant habitat feature than in either Subreach A or B, and that there was more habitat complexity in this reach with sections of braided channel and up to 15 percent boulders in some riffles, along with an overall greater abundance of cobbles. Flows in this reach were unpredictable, but in general were found to increase below Subreach B, where subsurface water appears to resurface into the channel, then decrease throughout the remainder of the reach to the confluence with Arroyo de la Laguna. This pattern was observed during the May 2015 survey, with flows midway through the reach and a completely dry channel at the Arroyo de la Laguna confluence. Temperatures varied widely in this reach but tended to be lower than in Subreach A and B, likely the result of thermally buffered surface water inputs from the subsurface.

Extended Study Area

Niles Canyon begins downstream from the Arroyo de la Laguna confluence, Alameda Creek flows approximately 6.5 miles through Niles Canyon to Niles Junction (near the crossing of Highway 238). The stream channel is relatively confined within the steep walled canyon and, with the exception of Highway 84 and a rail line, there is little development on the narrow floodplain and surrounding hills. There is a relatively well developed riparian zone throughout Niles Canyon. There are two major tributaries in this reach, Sinbad Creek and Stonybrook Creek. The reach is a perennial stream characterized by large, moderately deep pools and runs separated by short, shallow riffles. The substrate is highly variable, ranging from sand, gravel, and cobble-dominated riffles and glides to cobble-boulder and silt and sand pools.

Historically, Alameda Creek in Niles Canyon was likely an intermittent to perennial stream characterized by low flows during late summer and fall. Low dry season flows were derived primarily from upstream subsurface flows (shallow groundwater that enters the canyon below Sunol) that may have been relatively cool due to the limited exposure to warm atmospheric conditions in the shady canyon. Additionally, cool groundwater may have existed historically in the lower segments of Arroyo de la Laguna due to artesian flow from the Livermore Valley. During this low flow condition, some pools may have thermally stratified and provided critical thermal refuge (cool water layer on the bottom of pools) during summer months (June to August), but overall this reach likely would not have provided desirable habitat for juvenile steelhead to reside over the last half of summer and early fall.[17]

Alameda Creek through Niles Canyon now serves as a conveyance for imported water supply from the South Bay Aqueduct turnout in Vallecitos Creek, which is tributary to Arroyo de la Laguna just

[17] McBain and Trush, 2008, *Alameda Creek Population Recovery Strategies and Instream Flow Assessment for Steelhead.* Prepared for the Alameda Creek Fisheries Restoration Workgroup.

upstream from the Alameda Creek confluence. As a result, summer base flows in Niles Canyon have increased and become less variable, thereby increasing overall water temperatures, reducing thermal buffering that historically occurred with subsurface flows, reducing potential pool stratification, and subsequently reducing potential rearing habitat for steelhead.

Lower Alameda Creek begins downstream from the mouth of Niles Canyon, flowing approximately 10 miles across a broad low-gradient plain to San Francisco Bay. Historically, before extensive urbanization of the floodplain, the stream channel was relatively unconfined and the creek would migrate and form different courses and distributary channels.[18,19] These channels were tidally influenced in their lower sections and likely provided valuable estuarine habitat function for rearing juveniles or for smolts during their transition to the higher salinity of bay water.[20]

The lower Alameda Creek channel was extensively modified beginning in the 1950s as a result of floods that inundated the surrounding urbanizing area and instream aggregate extraction, and the channel served increasingly as a flood control and water conveyance facility. Following floods in the 1950s, the lower reaches of Alameda Creek (i.e., downstream of Niles Canyon) were rerouted in the 1960s into a trapezoidal flood control channel confined between artificial levees. To maintain flood control capacity, sediment and vegetation has been periodically removed from the channel. The historical floodplain has been largely converted to residential, commercial, and industrial urban uses. Commercial salt production was carried out in an extensive system of evaporation ponds that removed historic wetlands and natural tidal channels – the ponds currently are being planned for restoration to those former conditions (South Bay Salt Ponds Restoration Project). Restoration activities have been ongoing at Coyote Hills Regional Park on the southern side of the channel for many years, and flood gates connect wetlands in the park to the channel in its lower reach. Water supply and flood control structures were incorporated into the channel, including a bank-to-bank grade control structure at the BART and Southern Pacific Railway rail crossings (i.e., the BART weir – see Figure 15.2-3) and a series of inflatable dams for water supply impoundment (including flows imported from the Sacramento – San Joaquin Delta via the South Bay Aqueduct) owned and operated by ACWD. These features prevent fish migration and impair other habitat functions.

As discussed above, the BART weir is a complete barrier to all migrating anadromous fish species with the possible exception of Pacific lamprey (*Lampetra tridentata*).[21] The middle and upper ACWD inflatable dams are also major migration obstacles/barriers in lower Alameda Creek. The ACWD permanently removed the lower rubber dam from the Alameda Creek flood control channel in 2009.

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18 Gunther, A.J., J.M. Hagar, and P. Salop, 2000. *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed.* Prepared for the Alameda Creek Fisheries Restoration Workgroup. February 7, 2000.

19 Leidy, R.A., 2007. Ecology, *Assemblage Structure, Distribution, and Status of Fishes in Streams Tributary to the San Francisco Estuary, California.* San Francisco Estuary Institute, April 2007. Contribution No. 530.

20 Gunther, A.J., J.M. Hagar, and P. Salop, 2000. *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed.* Prepared for the Alameda Creek Fisheries Restoration Workgroup. February 7, 2000.

21 Gunther, A.J., J.M. Hagar, and P. Salop, 2000. *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed.* Prepared for the Alameda Creek Fisheries Restoration Workgroup. February 7, 2000.

The concrete foundation was left in place for grade control stabilization and a low-flow fish ladder was installed in a notch through the foundation to allow continuous fish passage.

Aquatic habitat conditions in lower Alameda Creek are characterized by low summer flows, high summer water temperature, substrate with a large silt component, extensive stands of emergent vegetation, and tidal mixing with increased salinity in the lower sections near the Bay and freshwater flows in the higher lying reaches above the BART weir. Some sections may be dry during the summer.[22]

Quarry Pit F2

Quarry Pit F2 currently is not likely to provide habitat for native fish species. While there are no data on any fish species that may occur in the pit, there are no known stocking records and the pit has no surface connectivity to natural waterways, such as Alameda Creek or San Antonio Creek.[23]

With-CDRP Conditions

The with-CDRP conditions reflect completion of the CDRP and implementation of the instream and bypass flow schedules required by the CDRP permit conditions.[24,25] See Appendix HYD1-R for a discussion of the instream and bypass flow schedules and a comparison of the assumptions under the existing and with-CDRP conditions.

Future operation of Calaveras Reservoir and the ACDD will influence streamflow and will therefore also influence the aquatic habitat and fish community in Calaveras Creek and Alameda Creek downstream from these facilities. Under the CDRP, future operation of Calaveras Reservoir and Dam and the ACDD will include the following provisions designed to improve habitat conditions for steelhead and other native fishes in the watershed:

- Bypass flows at the ACDD and flow releases from Calaveras Reservoir pursuant to the flow schedule identified in the NMFS Biological Opinion and CDFW streambed alteration agreement (Fish and Game Code 1600) for the CDRP; and
- Operational procedures for Calaveras Dam releases to avoid cone valve testing during spawning and egg incubation periods and implement flow release ramping criteria.

Alameda Creek Streamflow Simulations

Estimates of daily flows in Alameda Creek under the with-CDRP conditions (and the with-project conditions; see below) were made by using the ASDHM output, in combination with additional post-processing, as summarized below (see Section 15.2.3.2, *Approach to Analysis*) and described in detail in Appendix HYD1-R. Estimated daily flows are provided for Alameda Creek above the San Antonio

22 Hanson Environmental Inc., 2002. *Air and Water Temperature Monitoring Within Alameda Creek: 2001-2002*. Draft October 1, 2002.
23 Note that several large fish, believed to be non-native largemouth bass, were observed in Pit F2 during the May 2015 reconnaissance survey.
24 National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.
25 California Department of Fish and Game (CDFG), 2011. *Streambed Alteration Agreement for Calaveras Dam Replacement Project*. Notification No. 1600-2010-0322-R3. June 28, 2011.

Creek confluence (Node 5), above the Arroyo de la Laguna confluence (Node 7), and in Niles Canyon (Node 9) for Water Year (WY) 1996 to WY 2013. ASDHM simulations assume up to a 17 cfs loss to the subsurface upstream of the San Antonio Creek confluence (i.e., between Node 4 and Node 5). The post-processing of ASDHM output conducted for this EIR includes incorporation of daily estimates for streamflow gains from quarry NPDES discharges (estimated daily values using post-processing steps), and up to a 7.5 cfs streamflow loss to the subsurface between San Antonio Creek and Arroyo de la Laguna (i.e., between Node 6 and Node 7). Although the estimated 17 cfs and 7.5 cfs losses to the subsurface used in the ASDHM model and during post-processing are based on experimental and observed streamflow data conducted in dry conditions, they represent a conservative simplification of complex interactions between surface and subsurface flows. The actual subsurface losses likely vary day-to-day depending on the saturated conditions of the aquifer during wet or dry periods.

However, the magnitude of losses are not expected to significantly vary because the 17 cfs loss was measured after flow was considered stable in the creek.[26] For a water year in which a drier condition occurs, it is possible that the losses to subsurface may be slightly greater than 17 cfs for certain days in the beginning of that water year. Similarly, during very wet, rainy periods, losses to the subsurface may be slightly less than 17 cfs for certain days. However, since the loss was estimated when the flow was considered stable in the creek, the use of 17 cfs loss was considered reasonable in the development of the ASDHM.

Further, post-processing conducted to develop daily estimates for quarry NPDES discharges relies on historical NPDES records in the absence of any direct measurement of discharge flows. Therefore, the analysis necessarily assumed that future quarry operations will be similar to past operations. Node 9 plots include additional flows entering Alameda Creek from Arroyo de la Laguna. Additional discussion of surface flow and subsurface flow interactions, as well as quarry NPDES discharge post-processing steps under the with-CDRP conditions are described in Appendices HYD1-R and HYD2-R.

Reach-by-Reach Habitat Characterization

Primary Study Area (Subreaches A, B, and C)

For the purposes of the EIR, the fisheries impact analysis assumes that in addition to completion of the CDRP and implementation of the CDRP instream flow schedules, existing human-made barriers to anadromous steelhead migration would be removed or other measures would be taken to allow steelhead passage into the watershed; this is referred to as the "adjusted existing conditions." Due to limiting factors, specifically water temperatures, steelhead are not expected to spawn or rear within the primary or extended study areas, but would be expected to migrate through the study areas during adult winter upstream spawning migrations and late spring juvenile out-migrations to San Francisco Bay. Implementation of the instream flow schedules required by NMFS and CDFW

26 Meaning flow did not vary at any monitoring location during the constant Calaveras releases.

permit requirements upon completion of the CDRP are anticipated to increase the suitability of migratory habitat throughout the primary study area.[27]

The main migration impediments for steelhead in the Sunol Valley are located upstream of the primary study area between the Welch Creek confluence and the San Antonio Creek confluence where wide channel areas create shallow riffles under low flow conditions. Passage assessments conducted for the CDRP indicate that the most problematic riffles, given the current channel shape, could be passable and meet NMFS passage guidelines at 44 cfs for adult steelhead and 13 cfs for juvenile steelhead. Based on modeled simulations of streamflow in the Sunol Valley, implementation of the NMFS instream flow schedules will increase the annual percentage of time (dry and normal/wet years) that adult steelhead (immigrating and emigrating) can pass these shallow riffle locations.[28]

To address these passage impediments in the Sunol Valley, the SFPUC has committed, as part of the CDRP, to physically modifying locations within the Sunol Valley reach that require flows substantially greater than 40 cfs for adult steelhead passage. Physical modifications of these shallow areas are proposed to create conditions that would allow for adult upstream passage and juvenile downstream passage at flows of approximately 20 cfs and 10 cfs, respectively. Since adult steelhead will not have access to upper Alameda Creek until the BART weir fish ladder is completed, the schedule for remediating these barriers will match the return of steelhead to the upper watershed. With these future modifications, it is expected that passage opportunities for immigrating and emigrating adults through the Sunol Valley will be improved. Therefore, NMFS has concluded that with the combination of ACDD bypasses to Alameda Creek, releases from Calaveras Reservoir to Calaveras Creek, and the proposed modifications to passage impediments in the Sunol Valley, the number of days available for steelhead adult and juvenile passage through the Sunol Valley to upstream and downstream habitats in Alameda Creek each year is expected to fall within the range of natural hydrological variability that steelhead would otherwise encounter during winter and spring migrations.[29]

Niles Canyon and Lower Alameda Creek

As discussed above, in addition to completion of the CDRP and implementation of the CDRP instream flow schedules, this analysis assumes that all fish passage barriers would be removed and steelhead would have access to upper portions of the watershed under the adjusted existing conditions. However, the reaches of Alameda Creek within the extended study area would not be expected to provide necessary spawning or rearing habitat functions for steelhead; the tidally

[27] National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.
[28] National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.
[29] National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.

influenced habitats toward the mouth of the creek may provide only limited transition habitat for steelhead smolts that are emigrating to the Bay.[30,31,32]

Under the adjusted existing conditions, with implementation of the CDRP instream flow schedules, minimum flows necessary to meet upstream and downstream passage objectives in Niles Canyon are likely to be achieved during the winter and spring, because it is assumed that no significant barriers will remain and the augmented flows, in combination with flows from the Arroyo de la Laguna watershed, would generally not limit passage opportunities.[33] In the Alameda Creek Flood Control Channel (the lowermost 13 miles of Alameda Creek), ACWD operates two inflatable dams and several water diversions. The water diversions have a combined capacity of approximately 370 cfs. Thus, fish passage through this reach is strongly dependent on the operation of ACWD facilities. Since the publication of the June 2017 EIR, ACWD completed an initial study with mitigated negative declaration/environmental assessment with finding of no significant impacts[34] and NMFS completed a Biological Opinion[35] for the Joint Lower Alameda Creek Fish Passage Improvements Project. This project proposes to construct fishways at two inflatable dam drop structures, as well as to construct fish screens at ACWD's Shinn Pond intakes (design flow rate of 425 cfs). Construction of the Joint Lower Alameda Creek Fish Passage Improvements Project is scheduled to occur over a four-year period (2019 through 2022). Upon completion of the project, ACWD will modify operation of the water diversion facilities in the flood control channel to provide bypass flows for the protection of steelhead.[36] A description of the ACWD bypass flow schedules is provided below under Section 15.2.2, *Regulatory Framework, Fisheries Resources*.

CDRP instream flows, when combined with flows from Arroyo de la Laguna through Niles Canyon, are expected to provide suitable conditions for adult upstream migration and smolt downstream migration. It is assumed that these flows will arrive at the upstream end of the Alameda Creek Flood Control Channel, and furthermore, under the adjusted existing conditions, it is assumed that ACWD will provide bypass flows (see below) at its water diversion facilities for fish passage through the flood control channel.[37,38]

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30 Gunther, A.J., J.M. Hagar, and P. Salop, 2000. *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed.* Prepared for the Alameda Creek Fisheries Restoration Workgroup. February 7, 2000.

31 McBain and Trush, 2008, *Alameda Creek Population Recovery Strategies and Instream Flow Assessment for Steelhead.* Prepared for the Alameda Creek Fisheries Restoration Workgroup.

32 National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.

33 National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.

34 Hanson Environmental, 2016. *Alameda County Water District and Alameda County Flood Control & Water Conservation District Joint Lower Alameda Creek Fish Passage Improvements, Draft Initial Study with Mitigated Negative Declaration/Environmental Assessment with Finding of No Significant Impacts*. October 2016.

35 National Marine Fisheries Service (NMFS), 2017. *Biological Opinion for the Joint Lower Alameda Creek Fish Passage Improvements Project*. Santa Rosa, CA.

36 National Marine Fisheries Service (NMFS), 2017. *Biological Opinion for the Joint Lower Alameda Creek Fish Passage Improvements Project*. Santa Rosa, CA.

37 National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.

38 National Marine Fisheries Service (NMFS), 2017. *Biological Opinion for the Joint Lower Alameda Creek Fish Passage Improvements Project*. Santa Rosa, CA.

15.2.1.4 Alameda Creek Fish Community

Alameda Creek currently provides habitat for a diverse assemblage of native and non-native fishes. A total of 14 native and at least 13 non-native fish species have been observed in nontidal portions of the Alameda Creek watershed during the past century.[39,40] Several other species may have also occurred in the watershed based on collections in tidal portions, evidence from archaeological investigations, and other accounts.

Many collections from the watershed include widely distributed species typical of streams in the region, such as California roach (*Lavinia symmetricus*), Sacramento sucker (*Catostomus occidentalis*), pikeminnow (*Ptychocheilus grandis*), steelhead/rainbow trout (*Oncorhynchus mykiss*), Pacific lamprey (*Lampetra tridentata*), and prickly sculpin (*Cottus asper*). Non-native resident species present in the watershed include goldfish (*Carassius auratus*), carp (*Cyprinus carpio*), largemouth bass (*Micropterus salmoides*), smallmouth bass (Micropterus dolomieu), white catfish (*Ameiurus catus*), brown bullhead (*Ictalurus nebulosus*), black bullhead (*Ameiurus melas*), bluegill (*Lepomis macrochirus*), green sunfish (*Lepomois cyanellus*), western mosquitofish (*Gambusia affinis*), inland silverside (*Menidia beryllina*), and golden shiner (*Notemigonus crysaleucas*).[41,42]

Primary Factors Limiting Fish Populations

The distribution and abundance of fish species within the Alameda Creek watershed appears to be largely consistent with the regional distribution of different species in habitat zones and habitat preferences of those species. The extent of fish habitat in the primary study area is limited by lack of streamflow during the summer. This is likely a natural condition, given the alluvial substrate in the Sunol Valley and low summer streamflow present in Alameda Creek under unimpaired conditions. During the May 2015 survey, several pools were noted in the primary study area and non-native predators (e.g., largemouth bass, bullfrogs) were also observed.

Rainbow trout are currently limited to upper watershed areas (upstream of the primary study area) where they find suitable micro-habitat structure and substrate conditions along with adequately cool water temperatures. As discussed above, anadromous species including steelhead are excluded from the primary study area by passage obstacles downstream in the flood-control (lower Alameda Creek) reach and Niles Canyon. Chinook salmon (*Oncorhynchus tshawytscha*) are occasionally observed downstream of the BART weir, but they are not able to migrate above it.

[39] Gunther, A.J., J.M. Hagar, and P. Salop, 2000. *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed.* Prepared for the Alameda Creek Fisheries Restoration Workgroup. February 7, 2000.

[40] Leidy, R.A., 2007. Ecology, *Assemblage Structure, Distribution, and Status of Fishes in Streams Tributary to the San Francisco Estuary, California.* San Francisco Estuary Institute, April 2007. Contribution No. 530.

[41] Gunther, A.J., J.M. Hagar, and P. Salop, 2000. *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed.* Prepared for the Alameda Creek Fisheries Restoration Workgroup. February 7, 2000.

[42] Leidy, R.A., 2007. Ecology, *Assemblage Structure, Distribution, and Status of Fishes in Streams Tributary to the San Francisco Estuary, California.* San Francisco Estuary Institute, April 2007. Contribution No. 530.

Special-status Fish Species

Special-status fish species are legally protected or are otherwise considered sensitive by federal, state, or local resource conservation agencies and organizations. Special-status fish species include:

- Species listed as threatened or endangered under the Federal Endangered Species Act (FESA) or California Endangered Species Act (CESA);
- Species identified by NMFS or CDFW as species of special concern; and
- Species fully protected in California under the California Fish and Game Code

Three special-status fish species have been identified as having the potential to occur in the Alameda Creek watershed. However, as described in **Table 15.2-1** below, all three species are unlikely to occur under existing conditions because of downstream passage obstacles and/or unsuitable habitat conditions.

TABLE 15.2-1
SPECIAL-STATUS FISH SPECIES WITH POTENTIAL TO OCCUR IN THE ACRP FISHERIES STUDY AREAS

Species	Status[1]		Habitat Requirements	Potential to Occur in the ACRP Fisheries Primary and Extended Study Areas Under Existing Conditions
	NMFS	CDFW		
California Central Coast steelhead DPS *Oncorhynchus mykiss*	T	--	Requires cold, freshwater streams with suitable gravel for spawning. Rears in rivers and tributaries and in the San Francisco Bay.	Not expected to occur in the study areas. Potential for occurrence in the primary study area is currently restricted by downstream barriers. Individuals periodically occur downstream of the BART weir (downstream-most fish barrier) in the extended study area.
River lamprey *Lampetra ayresi*	--	SSC	Requires cool, freshwater streams with suitable gravel for spawning.	Not expected to occur in the study areas. A river lamprey was reported in the watershed in 1966, but there are no recent occurrences. Potential for occurrence in the study areas is limited by downstream barriers.
Sacramento perch *Archoplites interruptus*	--	SSC	Spawning has been reported to extend from spring to late summer, depending on location and water temperature. Occurs among aquatic plants or congregating in shallow waters in schools among or near inshore vegetation.	Not expected to occur in the study areas. Records indicate that Sacramento perch historically occurred in Alameda Creek;[43] no recent known occurrences in the study areas.

ACRONYMS:
CDFW = California Department of Fish and Wildlife; DPS = Distinct Population Segment; NMFS = National Marine Fisheries Service.

[1] Legal Status Definitions:
Federal Listing Categories (NMFS): T Threatened (legally protected)
State Listing Categories (CDFW): SSC Species of Special Concern (no formal protection)

SOURCE: ESA, 2016. *Alameda Creek Recapture Project, Alameda Creek Fisheries Habitat Assessment Report.* Prepared for San Francisco Public Utilities Commission. Prepared by Environmental Science Associates.

[43] Leidy, R.A., 2007. Ecology, *Assemblage Structure, Distribution, and Status of Fishes in Streams Tributary to the San Francisco Estuary, California.* San Francisco Estuary Institute, April 2007. Contribution No. 530.

Adjusted Existing Conditions

As described above, the fisheries analysis assumes that in addition to completion of the CDRP and implementation of the CDRP instream flow schedules, the existing human-made barriers to anadromous steelhead migration would be removed or other measures would be taken to allow fish migration and steelhead access to the upper Alameda Creek watershed prior to or concurrent with ACRP operations. These conditions were determined to represent the most appropriate baseline scenario for fisheries resources in terms of identifying potential impacts of ACRP operations on fisheries and would provide the most conservative CEQA impact analysis.

Habitat conditions for the common native and non-native fish community in Alameda Creek are expected to improve under the adjusted existing conditions; however, conditions will remain altered and modified from the natural, unimpaired conditions, and the common fish community is not expected to markedly change under this future condition.[44]

Central California Coast Steelhead

As described above, this fisheries analysis provides a conservative impact evaluation and assumes the worst-case scenario for fisheries as part of the baseline conditions. This means that it is assumed that steelhead will have returned to the Alameda Creek watershed prior to or concurrent with ACRP operations. Therefore, as part of the Setting for the adjusted existing conditions, the regulatory status, life history, and status of steelhead in the primary and extended study areas are presented below.

Regulatory Status

Central California Coast (CCC) steelhead distinct population segment (DPS) (*Oncorhynchus mykiss*) is listed as threatened under FESA, and at present occurs downstream of the BART weir in the ACRP extended study area.

Life History

Steelhead have a highly flexible life history and may follow a variety of life-history patterns including residents (non-migratory) at one extreme and individuals that migrate to the open ocean (anadromous) at another extreme. Steelhead are unique among Pacific salmon in that ocean migrating individuals may return to the ocean after spawning and return to freshwater to spawn one or more times.

Eggs (laid in gravel nests called redds), alevins (gravel dwelling hatchlings), fry (juveniles newly emerged from stream gravels), and young juveniles all rear in freshwater until they become large enough to migrate to the ocean to finish rearing and maturing to adults. Status reviews of steelhead in California document much variation in life history.[45] Although variation occurs, in coastal California, steelhead usually live in freshwater for one to two years, then spend an additional two or three years in the ocean before returning to their natal stream to spawn. Adult steelhead typically

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[44] San Francisco Planning Department, 2011. *Final Environmental Impact Report for the Calaveras Dam Replacement Project*. San Francisco, CA. San Francisco Planning Department File No. 2005.0161E, State Clearinghouse No. 2005102102. Certified January 27, 2011.

[45] Shapovalov, L. and A.C. Taft. 1954. *The Life Histories of the Steelhead Rainbow Trout and Silver Salmon.* State of California, Department of Fish and Game. Fish Bulletin No. 98.

immigrate to tributaries of San Francisco Bay between November and April, peaking in January and February.[46] Adult steelhead are generally not present in streams between May and October.

During the adult migration season, the timing of upstream immigration typically correlates with seasonal high flows and associated lower water temperatures. The minimum stream depth necessary for successful upstream migration is about 5 inches.[47] The preferred streamflow for upstream migration is in the range of 1 to 3 cfs, with a maximum streamflow, beyond which upstream migration is not likely to occur, of 8 cfs.[48] Most spawning takes place from January through April. Steelhead may spawn more than one season before dying (iteroparity), in contrast to other species of the genus *Oncorhynchus*. Most adult steelhead in a run are first time spawners.

Steelhead select spawning sites with gravel substrate and with sufficient streamflow to maintain circulation through the gravel and provide a clean, well-oxygenated environment for incubating eggs. Preferred streamflow is in the range of 1 to 3 cfs for steelhead and preferred gravel substrate is in the range of 0.25 to 4 inches in diameter.[49] Typically, sites with preferred features for spawning occur most frequently in the pool tail/riffle head areas where flow accelerates out of the pool into the higher gradient section below. In such an area, the female will create a pit, or redd, by undulating her tail and body against the substrate.

Steelhead fry generally rear in edgewater habitats and move gradually into pools and riffles as they grow larger. Cover is an important habitat component for juvenile steelhead, both as a velocity refuge and as a means of avoiding predation. Steelhead, however, tend to use riffles and other habitats not strongly associated with cover during summer rearing more than other salmonids. Young steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles.

Temperature is also an important factor for steelhead/rainbow trout, particularly during the over-summer rearing period.[50,51] The upper lethal temperature for Pacific salmonids is in the range 23.9 to 25 °C for continuous long-term exposure.[52] Some researchers indicate an upper lethal temperature for Pacific salmonids as low as 22.9°C;[53] however, steelhead can survive for short periods at elevated temperatures, especially if abundant food and dissolved oxygen exist.

46 Fukushima L., and E.W. Lesh. 1998. Adult and juvenile anadromous salmonid migration timing in California streams. California Department of Fish and Game 84(3):133-145.

47 Bell, M. C., 1991. *Fisheries handbook of engineering requirements and biological criteria.* U.S. Army Corps of Engineers, Office of the Chief of Engineers, Portland, OR.

48 Bell, M. C., 1991. *Fisheries handbook of engineering requirements and biological criteria.* U.S. Army Corps of Engineers, Office of the Chief of Engineers, Portland, OR.

49 Bjornn, T. C. and Reiser, D. W., 1979. Habitat Requirements of Anadromous Salmonids. In *Influences of Rangeland Management on Salmonid Fishes and Their Habitats* (Meehan), Ed., American Fisheries Society, Bethesda, MD.

50 Gunther, A.J., J.M. Hagar, and P. Salop. 2000. *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed.* Prepared for the Alameda Creek Fisheries Restoration Workgroup. February 7, 2000.

51 Hanson Environmental Inc. 2002. *Air and Water Temperature Monitoring Within Alameda Creek: 2001-2002.* Draft October 1, 2002.

52 Gunther, A.J., J.M. Hagar, and P. Salop. 2000. *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed.* Prepared for the Alameda Creek Fisheries Restoration Workgroup. February 7, 2000.

53 Hanson Environmental Inc. 2002. *Air and Water Temperature Monitoring Within Alameda Creek: 2001-2002.* Draft October 1, 2002.

Temperature data suggest that summer and early-fall temperatures in Niles Canyon are within the range considered to be highly stressful or unsuitable for juvenile steelhead.[54]

Juvenile steelhead emigrate episodically from natal streams during fall, winter, and spring high flows, with peak migration occurring in April and May.[55] Emigrating CCC steelhead use tributaries of San Francisco Bay and portions of the San Francisco Bay for rearing and as a migration corridor to the ocean. Although data regarding the emigration timing of steelhead smolts from Alameda Creek is lacking, steelhead smolts in other streams within the DPS including those draining to San Francisco Bay, typically emigrate from March through June.[56] NMFS assumes that steelhead from Alameda Creek emigrate within this same time period.[57]

Based on information from other central California coastal steelhead streams, and SFPUC's studies of adfluvial[58] *O. mykiss* above Calaveras and San Antonio Reservoirs, the expected migration timing for each steelhead life stage is presented in **Table 15.2-2**.

TABLE 15.2-2
EXPECTED MIGRATION TIMING FOR STEELHEAD IN ALAMEDA CREEK

Life Stage	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept
Adult Immigration												
Juvenile Emigration												
Post-spawn Adult Emigration												

SOURCE: Gunther, A.J., J.M. Hagar, and P. Salop. 2000. *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed.* Prepared for the Alameda Creek Fisheries Restoration Workgroup. February 7, 2000.
National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.

Status in the Primary and Extended Study Areas

As discussed above, steelhead formerly inhabited the Alameda Creek watershed prior to construction of dams and other water resource and flood control infrastructure.[59,60] The presence of migratory barriers, notably a grade control weir at the BART crossing, prevents upstream movement of steelhead to potential spawning and rearing habitat, and currently, steelhead can no longer complete their lifecycle in the watershed. Sightings of migratory *O. mykiss* have been

54 Hanson Environmental Inc. 2002. *Air and Water Temperature Monitoring Within Alameda Creek: 2001-2002.* Draft October 1, 2002.

55 Fukushima L., and E.W. Lesh. 1998. Adult and juvenile anadromous salmonid migration timing in California streams. California Department of Fish and Game 84(3):133-145.

56 Fukushima L., and E.W. Lesh. 1998. Adult and juvenile anadromous salmonid migration timing in California streams. California Department of Fish and Game 84(3):133-145.

57 National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.

58 Life history strategy in which adult fish spawn and juveniles subsequently rear in streams but migrate to lakes for feeding as subadults and adults.

59 Gunther, A.J., J.M. Hagar, and P. Salop, 2000. *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed.* Prepared for the Alameda Creek Fisheries Restoration Workgroup. February 7, 2000.

60 Leidy, R.A., 2007. Ecology, *Assemblage Structure, Distribution, and Status of Fishes in Streams Tributary to the San Francisco Estuary, California.* San Francisco Estuary Institute, April 2007. Contribution No. 530.

periodically reported downstream of the BART weir, adjacent to the inflatable dam operated by the ACWD.

Steelhead along the central California coast enter freshwater to spawn when winter rains have been sufficient to raise streamflows. Increased streamflow during runoff events also appears to provide cues that stimulate migration and allows better conditions for fish to pass obstructions and shallow areas on their way upstream. When anadromous steelhead become re-established in Alameda Creek, operation of the ACDD and Calaveras Dam will influence streamflow and water temperature in Alameda Creek, which in turn will influence steelhead during its various life history stages. Higher flows may enable upstream migrating adults and downstream migrating adult steelhead and steelhead smolts to pass critical riffles and other migration obstacles. Reduced streamflows may result in higher water temperature, while releases from a restored Calaveras Reservoir may result in lower water temperatures, and could affect steelhead migrating later in the spring.

Both the primary and extended study areas are anticipated to function only as migratory habitat for steelhead if they are restored to the upper watershed, with adults migrating through both study areas during winter months, and the majority of repeat spawners, young-of-year, or older smolt returning downstream during precipitation events in the spring. The primary limiting factors for all life stages of steelhead in Alameda Creek are flows, water temperature, and both natural and man-made barriers. In both the primary and extended study areas, water temperatures are currently and are expected to continue to be under with-CDRP conditions generally too high during summer months (June to August) to support steelhead rearing and over-summering steelhead are not expected to occur in these portions of Alameda Creek.[61] This expectation has been supported by fisheries data which show that both the primary and extended study areas support a warm-water fish assemblage.[62]

Additional detailed discussion on steelhead life history and potential life history strategies in Alameda Creek is provided in Appendix BIO2-R, *Alameda Creek Fisheries Habitat Assessment Report*.

15.2.2 Regulatory Framework, Fisheries Resources

(This section replaces the June 2017 EIR Section 5.15.6, Regulatory Framework, Fisheries Resources in its entirety.)

15.2.2.1 Federal Regulations

Endangered Species Act

Under FESA, the Secretary of the Interior and the Secretary of Commerce have joint authority to list a species as threatened or endangered (16 U.S. Code [USC] 1533[c]). USFWS has jurisdiction over plants, wildlife, and resident fish, while NMFS has jurisdiction over anadromous fish and

61 EDAW & Turnstone Joint Venture (ETJV), 2008. *Calaveras Dam Replacement Project Fisheries Technical Report 2008*. Prepared by Hagar Environmental Science and Thomas R. Payne and Associates for EDAW & Turnstone Joint Venture and SFPUC.

62 Leidy, R.A., 2007. Ecology, *Assemblage Structure, Distribution, and Status of Fishes in Streams Tributary to the San Francisco Estuary, California.* San Francisco Estuary Institute, April 2007. Contribution No. 530.

marine fish and mammals. The act is discussed in June 2017 EIR Subsection 5.14.2, Regulatory Framework, in Section 5.14, Biological Resources.

On January 5, 2006, the CCC steelhead DPS, including all naturally spawned anadromous steelhead populations below natural and manmade impassable barriers, were listed as threatened under FESA by NMFS (71 FR 834). If construction of ACRP were to require fill in federally jurisdictional waters, the SFPUC would be required to obtain a CWA Section 404 permit from the U.S. Army Corps of Engineers (USACE). Before issuing a Section 404 permit, the USACE is required under Section 7 of FESA to consult with NMFS and/or USFWS if a federally listed species may be affected by a proposed project to be permitted. No placement of fill in federally jurisdictional water is proposed as part of the ACRP.

Magnuson-Steven Fisheries Conservation Act

In response to growing concern about the status of U.S. fisheries, the Sustainable Fisheries Act of 1996 (Public Law 104-297) was passed by Congress to amend the Magnuson-Stevens Fishery Conservation and Management Act (Public Law 94-265), the primary law governing marine fisheries management in the federal waters of the United States. Under the Sustainable Fisheries Act, consultation is required by NMFS on any activity that might adversely affect designated Essential Fish Habitat (EFH). EFH includes those habitats that fish rely on throughout their life cycles. It encompasses habitats necessary to allow sufficient production of commercially valuable aquatic species to support a long-term sustainable fishery and contribute to a healthy ecosystem. Alameda Creek has been designated as EFH downstream of the primary study area, in the extended study area, and the CDRP Biological Opinion (described above) includes conservation recommendation for EFH.

15.2.2.2 State Regulations

California Endangered Species Act

Pursuant to CESA and Section 2081 of the California Fish and Game Code, a permit from CDFW is required for projects that could result in take of a state-listed threatened or endangered species. CESA is described in June 2017 EIR Subsection 5.14.3, Regulatory Framework, Terrestrial Biological Resources. There are no fish species listed as threatened or endangered under CESA in the ACRP study area.

California Fish and Game Code

Section 1602

All diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources are subject to regulation by CDFW under Section 1602 of the California Fish and Game Code. As indicated in EIR Chapter 14, it is anticipated that the ACRP will require a 1600 permit.

15.2.2.3 Regional and Local Agreements, Plans, and Groups Relevant to the Protection of Fisheries Resources in the Alameda Creek Watershed

The following agreements and plans are applicable to the environmental setting for the ACRP or provide useful background information.

Alameda Watershed Management Plan

The Alameda Creek watershed is one of three major contributors of water to the SFPUC regional water system. As such, the primary watershed goal of the SFPUC is to maintain and improve source water quality to protect public health and safety. Secondary goals include the maximization of water supply and the preservation and enhancement of ecological resources.

The purpose of the *Alameda Watershed Management Plan*[63] (WMP) is to provide a policy framework for the SFPUC to make consistent decisions about the activities, practices, and procedures that are appropriate on SFPUC watershed lands. To aid the SFPUC in its decision-making, the plan provides a comprehensive set of goals, policies, and management actions, which integrate all watershed resources and reflect the unique qualities of the watersheds. The WMP remains the primary comprehensive plan and SFPUC policy document for land and resource management of the SFPUC Alameda Creek watershed lands, including all SFPUC lands within the study area.

WMP policies established for aquatic resources include the protection and enhancement of aquatic resources and habitat (AR1 – AR4), water quality (AR5), fisheries resources (AR6), impact assessment for future projects (AR7), and management and coordination (AR8 – AR10). WMP actions and guidelines are included for aquatic zone protection and fishery resources. Aquatic zone protection actions and guidelines are included for assessment prior to new activities (aqu1), stream channels and banks (aqu6 – aqu8). Fishery resources actions and guidelines are included for fish migration (fis1 – fis4), habitat management (fis5 – fis7), and future studies and monitoring (fis8).

SFPUC Alameda Watershed Habitat Conservation Plan

See June 2017 EIR Section 5.14.3.3.

SFPUC Water Enterprise Environmental Stewardship Policy

On June 27, 2006, the SFPUC established a mission and policy for long-term management of SFPUC-owned lands and their natural resources, including the Alameda Creek watershed, as a fundamental component of the Water Enterprise mission. The policy states that "the SFPUC is committed to responsible natural resources management that maintains the integrity of the natural resources, restores habitats for native species, and enhances ecosystem function. It is the policy of the SFPUC to operate the SFPUC water system in a manner that protects and restores native fish and wildlife downstream of SFPUC dams and water diversions, within SFPUC reservoirs, and on SFPUC watershed lands. Releases from SFPUC reservoirs will (consistent with the SFPUC

[63] SFPUC, 2001. Final Alameda Watershed Management Plan.

mission…, existing agreements, and applicable state and federals laws), mimic the variation of the seasonal hydrology (e.g., magnitude, timing, duration, and frequency) of their corresponding watersheds in order to sustain the aquatic and riparian ecosystems upon which these native fish and wildlife species depend." The policy commits the SFPUC to monitoring of habitats, collaboration with interested and affected parties, and various strategies for implementation of the policy (e.g., updating the Alameda Watershed Management Plan, developing the Habitat Conservation Plan for the watershed, developing and implementing the Watershed and Environmental Improvement Program for the watershed, participating in local forums including the Alameda Creek Fisheries Restoration Workgroup). The policy commits the SFPUC to "ensure that the policy guides development of project descriptions, alternatives and mitigation for all SFPUC projects during the environmental review process under the CEQA and/or NEPA."

Alameda Creek Fisheries Restoration Workgroup

The Alameda Creek Fisheries Restoration Workgroup is a multi-agency stakeholder group formed in 1999 to develop and implement a strategy to restore steelhead trout to Alameda Creek. The SFPUC is one of the agencies that have executed a Memorandum of Understanding (MOU) that have formally agreed to collaborate to pursue steelhead restoration in the Alameda Creek watershed while minimizing the impacts to water supply operations. Other participating agencies include Alameda County Flood Control District, Alameda County Resource Conservation District, Alameda Creek Alliance, ACWD, California State Coastal Conservancy, CDFW, East Bay Regional Park District, NMFS, PG&E, and the Zone 7 Water Agency.

15.2.2.4 CDRP Regulatory Permit Requirements

National Marine Fisheries Service CDRP Biological Opinion

On March 5, 2011, NMFS issued a Biological Opinion for the construction and operation of the CDRP.[64] In the Biological Opinion, NMFS concluded that the construction and future operation of the CDRP will not jeopardize the continued existence of CCC steelhead. The Biological Opinion describes an operational plan for the replacement Calaveras Dam and ACDD, developed by SFPUC in coordination with NMFS and CDFW, which provides suitable instream flow conditions for CCC steelhead below these facilities.

The Biological Opinion also describes an adaptive management implementation plan that was prepared by the SFPUC for the purpose of achieving specific goals that will support broader steelhead population targets within the watershed. Components of the adaptive management implementation plan will also assist in evaluating the performance of the future management scheme as part of the CDRP operations and in addressing uncertainties within the watershed that will influence the recovery of steelhead within the Alameda Creek watershed. The adaptive management implementation plan includes: (1) steelhead conservation measures (actions to protect and enhance

[64] National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.

future steelhead in the Alameda Creek watershed); (2) data collection, investigations, and analyses to inform future steelhead management decisions; and (3) a steelhead monitoring program.

The steelhead monitoring program describes several biological response components, including steelhead migration through the ACRP primary study area. For each biological response component, the adaptive management implementation plan includes a description of measurement points, measurement parameters, measurement intervals, performance criteria, and contingency action(s). Specifically, the NMFS CDRP Biological Opinion adaptive management implementation plan includes the following biological response monitoring requirements for steelhead monitoring:[65]

> ***2.2.2 BIOLOGICAL RESPONSE MONITORING***
>
> ***Steelhead Migration*****:** *Monitoring will be conducted to determine migration success into, out of, and within the primary study area and to estimate the relative success of in and out migration of adult and juvenile steelhead.*
>
>> ***Measurement Points:*** *Several locations in the primary study area below Calaveras Dam and the Alameda Creek Diversion Dam, including the Sunol Valley and Little Yosemite, to document and evaluate passage conditions associated with the proposed minimum flow schedules and natural flow accretions. Also evaluate the operation of the ladder and screen at the Alameda Creek Diversion Dam.*
>>
>> ***Measurement Parameters:*** *Monitoring the timing and movement of adult immigration shall be coordinated with the resource agencies and other entities in the watershed (e.g., Alameda County Water District and operation of the ladders in the Alameda Creek Flood Control Channel). The SFPUC shall provide radio tags or other devices and coordinate monitoring to detect the movement of adults within the portions of the watershed under its jurisdiction. Although outside SFPUC jurisdiction, SFPUC recommends that radio tags or other devices be applied to adult fish captured/trapped at the future BART weir ladder(s). The movements of tagged fish shall be monitored, at either fixed detection sites or manual tracking, as they move through the watershed.*
>>
>> *To evaluate movement patterns of juvenile steelhead within Alameda Creek, timing of migration and relative abundance by size class shall be monitored using downstream migrant traps (e.g. rotary screw traps – locations TBD after consultation with NMFS and CDFG). Pit tags will be employed to assess migrational success and survival rates.*
>>
>> ***Measurement Interval:*** *During February, March, April and May; continuing through June only if significant numbers of fish are being collected in late May.*
>>
>> ***Performance Criteria:*** *Suitable migration conditions for adult steelhead without substantial flow-related interference that causes biologically relevant delay. Natural features such as Little Yosemite will be further evaluated to also consider physical conditions (e.g., vertical jump height) that may create interference regardless of flow conditions (see Section 2.1.2 above). Evidence of downstream moving juvenile steelhead undergoing the process of smoltification. Fish monitoring data will be used in conjunction with physical (e.g. streamflow) data.*

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65 National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.

***Contingency Action(s):** In the short term, if fish stranding is documented, implement fish relocation activities. In the long term and as detailed in Section 2.1.1, contingency actions include SFPUC provision of specific funding amounts in support of NMFS and CDFG modification of physical features in the stream channel (e.g., modification of bedrock and boulder features the Little Yosemite reach) as described above in Section 2.1.1.*

California Department of Fish and Wildlife Streambed Alteration Agreement

On June 28, 2011 CDFW issued a streambed alteration agreement for the construction and operation of the CDRP.[66] The agreement describes an operational plan for the replacement Calaveras Dam and ACDD, which was developed by SFPUC in coordination with NMFS and CDFW and which provides suitable instream flow conditions for Central California Coast steelhead below these facilities. The streambed alteration agreement also describes a number of conditions that are required in order to avoid, minimize, and compensate for impacts to sensitive resources.

15.2.2.5 ACWD Regulatory Permit Requirements

National Marine Fisheries Service ACWD Biological Opinion

As described above, since the publication of the June 2017 Draft EIR for the ACRP, ACWD completed an initial study with mitigated negative declaration/environmental assessment with finding of no significant impacts[67] and NMFS completed a Biological Opinion [68] for the Joint Lower Alameda Creek Fish Passage Improvements Project, which proposes to construct fishways at the two inflatable dam drop structures, as well as construct fish screens at ACWD's Shinn Pond intakes (design flow rate of 425 cfs). Construction of the Joint Lower Alameda Creek Fish Passage Improvements Project is scheduled to occur over a four-year period (2019 through 2022). Upon completion of the project, ACWD will modify operation of the water diversion facilities in the flood control channel to provide bypass flows for the protection of steelhead.[69]

The Joint Lower Alameda Creek Fish Passage Improvements Project Biological Opinion incorporates the following bypass operations for three seasonal periods:[70,71]

1) Steelhead In-Migration period from January 1 through March 31:
    - bypass flow requirements of 20 to 25 cfs;
2) Steelhead Out-Migration period from April 1 through May 31:

[66] California Department of Fish and Game (CDFG), 2011. *Streambed Alteration Agreement for Calaveras Dam Replacement Project*. Notification No. 1600-2010-0322-R3. June 28, 2011.
[67] Hanson Environmental, 2016. *Alameda County Water District and Alameda County Flood Control & Water Conservation District Joint Lower Alameda Creek Fish Passage Improvements, Draft Initial Study with Mitigated Negative Declaration/Environmental Assessment with Finding of No Significant Impacts*. October 2016.
[68] National Marine Fisheries Service (NMFS), 2017. *Biological Opinion for the Joint Lower Alameda Creek Fish Passage Improvements Project*. Santa Rosa, CA.
[69] National Marine Fisheries Service (NMFS), 2017. *Biological Opinion for the Joint Lower Alameda Creek Fish Passage Improvements Project*. Santa Rosa, CA.
[70] See Appendix HYD1-R, Section 7.2 *ACWD's Alameda Creek Operations*, in particular Table HYD7-1 *ACWD Minimum Bypass Flows and Conditions of Bypass*.
[71] National Marine Fisheries Service (NMFS), 2017. *Biological Opinion for the Joint Lower Alameda Creek Fish Passage Improvements Project*. Santa Rosa, CA.

- bypass flow requirements of 5 to 12 cfs;

3) Outside of Peak Migration Periods from June 1 through December 31:
   - bypass flow requirements of 5 cfs.

The ACWD NMFS Biological Opinion also states that during certain conditions, water releases from Calaveras Reservoir and bypass flows at the ACDD as part of the CDRP operations may, at times, contribute to flow further downstream in Alameda Creek at Niles Gage. If this occurs, pursuant to the Biological Opinion, ACWD must bypass any such flows contributing to total flow at Niles Gage.

In order for ACWD to implement bypass stream flow requirements, the total streamflow through the flood control channel would be measured as an average daily flow downstream of the Rubber Dam 1/Drop Structure at the Sequoia Road Bridge Gage. This stream gage will be used to document flows in the flood control channel and for compliance with bypass requirements. ACWD's bypass rules do not require ACWD to release water from storage to meet bypass flow requirements. However, as noted on Table 1 of the ACWD NMFS Biological Opinion,[72] bypass streamflow amounts are based on the flow in Alameda Creek upstream of ACWD's facilities and measured at the Niles Gage.

15.2.3 Impacts and Mitigation Measures — Fisheries Resources

(This section replaces the following specific sections of the June 2017 EIR.)

- 5.14.7.1, Significance Criteria (only as relevant to Impact BI-11; the remaining criterion continues to be relevant to the other fisheries resources impacts)
- 5.15.7.2 Approach to Analysis (Operational Impacts)
- 5.14.7.4 Operational Impacts — Fisheries Resources
  – Impact BI-11: Project operations would not interfere with the movement or migration of special-status fish species, including CCC steelhead DPS.

15.2.3.1 Significance Criteria

The project would have a significant impact related to fisheries resources if the project were to:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations or by the CDFW, USFWS, or NMFS; or
- Interfere substantially with the movement of any native resident or migratory fish species.

[72] National Marine Fisheries Service (NMFS), 2017. *Biological Opinion for the Joint Lower Alameda Creek Fish Passage Improvements Project*. Santa Rosa, CA.

15.2.3.2 Approach to Analysis

Operational Impacts

The analysis of long-term, operational impacts on steelhead is made relative to the adjusted existing conditions — the baseline conditions under which the ACRP would necessarily operate, because the ACRP is reliant on implementation of the CDRP instream flow schedules. The adjusted existing conditions include with-CDRP conditions (i.e., completion of the CDRP, restoration of the historical capacity of Calaveras Reservoir, and implementation of the instream flow schedules required by the CDRP permit conditions[73,74]), plus the existing human-made barriers to anadromous steelhead migration would be removed or other measures would be taken to allow fish migration and steelhead access to the upper Alameda Creek watershed prior to or concurrent with ACRP operations (even though these actions have not yet occurred under the existing conditions). In other words, the baseline conditions for this analysis assume that steelhead will have returned to the Alameda Creek watershed prior to or concurrent with ACRP operations. These conditions represent a conservative approach to the fisheries impact analysis. In the analysis below, "with-CDRP conditions" is used to refer to the hydrologic conditions in which the CDRP instream flow schedules are implemented, and "adjusted existing conditions" is used to refer to the baseline conditions for the fisheries analysis.

The analysis focuses on migration requirements for adult and juvenile steelhead and compares Alameda Creek surface water flows in the study area under the adjusted existing conditions to those that would occur under the proposed project (with-ACRP or with-project conditions). The analysis is based on hydrologic modeling and post processing of modeling results to simulate operational effects of the proposed project on Alameda Creek surface water flows (as summarized below and described in detail in Appendix HYD1-R) and analysis of surface and subsurface water interactions in the Sunol Valley (as described in Appendix HYD2-R). Impact conclusions are based on an assessment of project-related changes compared to the adjusted existing conditions in the context of the expected seasonal, life-stage specific habitat requirements of CCC steelhead DPS. Specifically, the project would be considered to result in a substantial adverse effect on fisheries resources if it altered habitat functions in a manner to which they no longer provided primary constituent elements for CCC steelhead as defined in the adopted recovery plan for this species, as follows:

- Freshwater Adult Upstream Migration Corridors and Spawning Habitat:
  - sufficient base flow for holding adults and for spawning;
  - adequate stream flows during and following storms for adult attraction and upstream passage; and
  - periodic high flow events that maintain channel form, geometry, and other geomorphic functions.

73 National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.
74 California Department of Fish and Game (CDFG), 2011. *Streambed Alteration Agreement for Calaveras Dam Replacement Project*. Notification No. 1600-2010-0322-R3. June 28, 2011.

- Freshwater Smolt Outmigration Corridors:
  - sufficient base flow for downstream movement of juveniles
  - adequate streamflows during and following storms (for smolt outmigration).

Hydrologic Analysis of Alameda Creek Streamflows

Similar to the June 2017 EIR analysis, the revised CEQA analysis compares the adjusted existing conditions to the with-project (ACRP) conditions. However, the revised analysis, under both of these scenarios, uses updated ASDHM model outputs to reflect the revised project operations (see Chapter 14, Revisions to the Project Description), and revised post-processing assumptions (compared to those used in the June 2017 EIR) to better reflect quarry NPDES discharges and allow streamflows to be estimated on a daily time-step.[75]

Revised ACRP Operations

Subsequent to the June 2017 EIR, the SFPUC revised project operations by placing additional restrictions on pumping from Pit F2 (see Chapter 14, Revisions to the Project Description). In brief, no pumping would occur during the December 1 to June 30 steelhead migration window except for limited pumping from May to June, and pumping could occur between July 1 and November 30 if pit levels are greater than elevation 180 feet. At all times, Pit F2 would be operated at a water surface elevation range of 180 feet to 240 feet. The SFPUC would only pump water from Pit F2 in May and June if: (1) Pit F2 water levels are greater than 225 feet and (2) there is no surface flow in Alameda Creek at the San Antonio Creek confluence. For a detailed discussion of the proposed Pit F2 operational range and its potential for impact on the adjacent aquifer see Appendix HYD1-R and Appendix HYD2-R. The updated ASDHM model outputs used in this analysis reflect the revised ACRP operations.

Model Scenarios Analyzed

Four scenarios, derived from the ASDHM, were examined in the June 2017 EIR to characterize the effects of the ACRP on surface water hydrology: (1) pre-2001 conditions, (2) existing conditions (2015), (3) with-CDRP conditions, and (4) with-project (ACRP) conditions. The pre-2001 conditions and existing conditions (2015) scenarios were both included to provide context of the baseline conditions under typical SFPUC operating conditions prior to restrictions on Calaveras Dam operations in 2001 and baseline conditions at the time of publication of Notice of Preparation. However, as described above, for the ACRP CEQA analysis, the steelhead impact analysis compares the adjusted existing conditions to the with-project (ACRP) conditions. For a detailed breakdown of the attributes of all four scenarios see Appendix HYD1-R.

The updated hydrological analysis used to support the revised steelhead impact analysis evaluates three model scenarios: (1) CDRP BO, (2) with-CDRP conditions, and (3) with-project (ACRP), as shown in **Table 15.2-3** and depicted in **Figures 15.2-4, 15.2-5**, and **15.2-6**, respectively.

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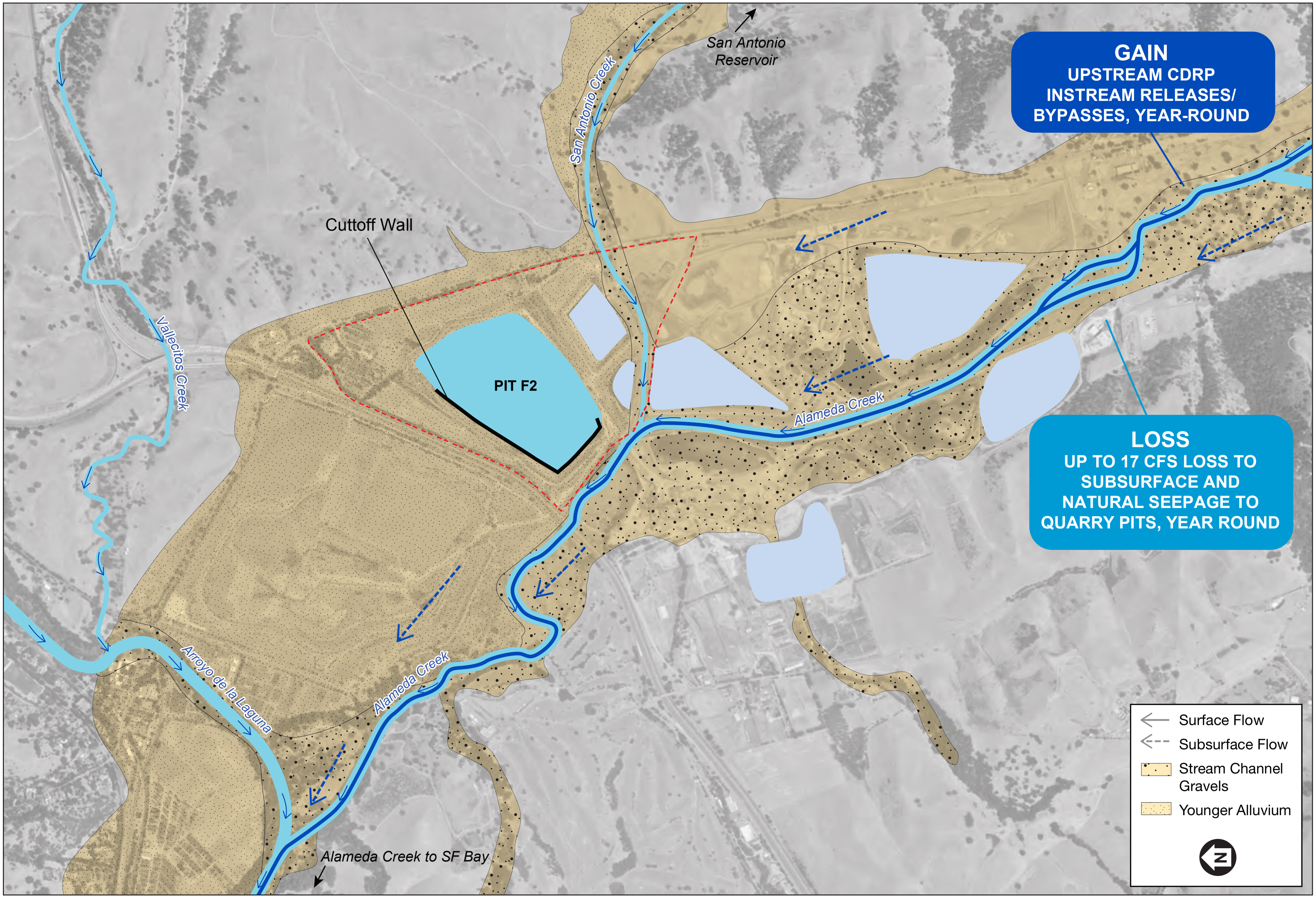
[75] National Marine Fisheries Service (NMFS), 2017. *Letter to the City and County of San Francisco regarding June 22, 2017 Planning Commission Decision Regarding the Final EIR for the ACRP*. Santa Rosa, CA. NMFS requested analysis be conducted on daily time-step.

TABLE 15.2-3
ATTRIBUTES OF SCENARIOS ANALYZED IN THE RECIRCULATED EIR

<table>
<tr><th>Parameter</th><th>CDRP Biological Opinion Conditions</th><th>With-CDRP Conditions</th><th>With-Project (ACRP) Conditions</th></tr>
<tr><td>Representative year</td><td colspan="3">2019 to 2020 (following completion of the CDRP and the Calaveras Reservoir refill period)</td></tr>
<tr><td>Hydrologic period used in analysis</td><td colspan="3">WY 1996 to WY 2013</td></tr>
<tr><td>Calaveras Reservoir and Dam</td><td colspan="3">• New dam completed
• Historical capacity of Calaveras Reservoir restored to nominal capacity = 96,850 acre-feet
• Maximum pool elevation = 756 feet</td></tr>
<tr><td>Instream flow releases/spills from Calaveras Reservoir below Calaveras Dam</td><td colspan="3">Implementation of instream flow schedule:
• Dry year releases: May –Oct: 7 cfs; Nov - Dec: 5 cfs; Jan –April: 10 cfs, annual average.
• Wet/normal year releases: May – Sept: 12 cfs, Oct: 7 cfs; Nov –Dec: 5 cfs, Jan – April: 12 cfs</td></tr>
<tr><td>Alameda Creek Diversion Dam (ACDD)</td><td colspan="3">• Fish ladder and bypass structure operational
• Minimum and Maximum diversion rates of Alameda Creek water to Calaveras Reservoir = 30 cfs to 370 cfs</td></tr>
<tr><td>ACDD bypass flows</td><td colspan="3">• Gate on diversion tunnel closed from April 1 to Nov 30, and all flow in Alameda Creek passes over ACDD.
• Diversion of up to 370 cfs from December 1 to March 31.
• Minimum bypass flow of 30 cfs whenever there is 30 cfs or more; if less than 30 cfs is present, entire flow passes over the ACDD or through the new fish ladder</td></tr>
<tr><td>Quarry pit operations
Hanson Aggregates:
• SMP-24 (Pits F2, F3-East, F3-West)
• SMP-32
• SMP-33
Oliver de Silva
• SMP-30 (Pits F4, F5, F6)</td><td>• Quarry pit operations not included in streamflow estimates</td><td colspan="2">• SMP-24 pits used to store and manage water to support active mining on SMP-32 and aggregate processing, with excess water discharged under NPDES permit to Alameda Creek. Daily discharge estimates incorporated into With-CDRP and With-Project conditions.
• SMP-30 Pit F6 in active use for aggregate extraction, with infrequent discharges from SMP-30 to Alameda Creek. Daily Discharge estimates not incorporated into With-CDRP and With-Project Conditions.</td></tr>
<tr><td>Loss of surface flow in Alameda Creek to subsurface between Welch Creek and Arroyo de la Laguna confluences</td><td>• 0 to 17 cfs (maximum) between Welch Creek and San Antonio Creek confluences</td><td colspan="2">• 0 to 17 cfs (maximum) between Welch Creek and San Antonio Creek confluences, and
• 0 to 7.5 cfs (maximum) between San Antonio Creek and Arroyo de la Laguna confluences, depending on streamflow[76]</td></tr>
<tr><td>Alameda Creek Recapture Project</td><td>• Not in operation</td><td>• Not in operation</td><td>• Pumping of water from Pit F2 by SFPUC and transfer to SVWTP or San Antonio Reservoir for municipal water supply</td></tr>
</table>

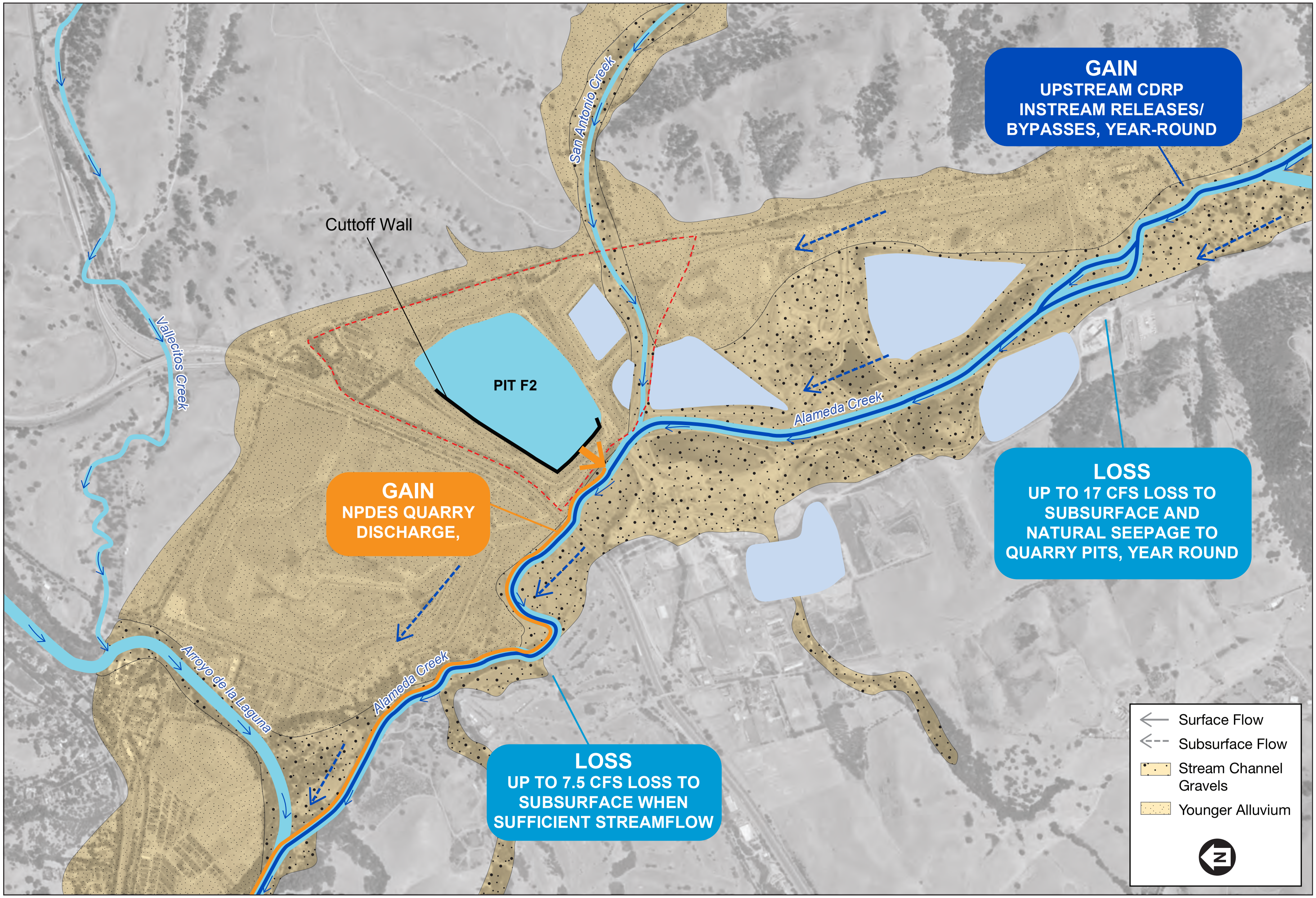
[76] Post-processing in June 2017 EIR included an error, which forced a fix loss rate of 7.5 cfs even when flow was < 7.5 cfs. Post-processing has been corrected in Recirculated Portions of EIR.



SOURCE: ESA, 2019

SFPUC Alameda Creek Recapture Project

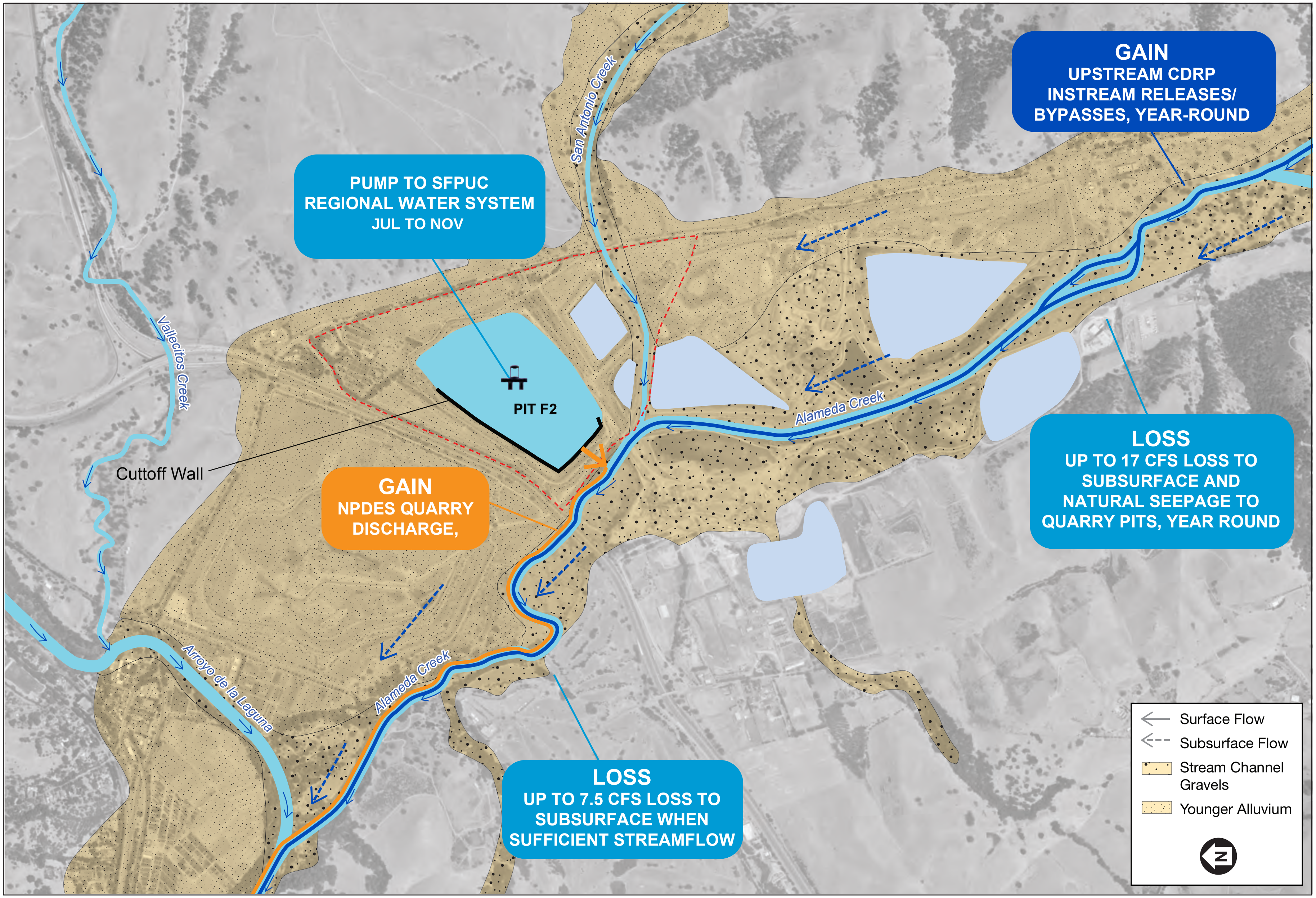
Figure 15.2-4
ASDHM and Post-Processing Attributes for the
CDRP BO Scenario



SOURCE: ESA, 2019

SFPUC Alameda Creek Recapture Project

Figure 15.2-5
ASDHM and Post-Processing Attributes for the Adjusted Existing Condition (With-CDRP) Scenario



SOURCE: ESA, 2019

SFPUC Alameda Creek Recapture Project

Figure 15.2-6
ASDHM and Post-Processing Attributes for the With-Project (ACRP) Scenario

Impacts to fisheries under the with-project condition are made relative to the adjusted existing conditions (i.e., with-CDRP conditions plus barriers removed), rather than pre-2001 or existing conditions. The reason for using a future baseline condition is that the adjusted existing conditions represent the baseline under which the ACRP would actually operate and reflect the most conservative CEQA assumption for potential impacts on steelhead; the ACRP is reliant on implementation of the CDRP instream flow schedules in order to recapture released and bypassed flow.

For the revised analysis, one additional scenario was included to allow comparison with conditions analyzed in the CDRP Biological Opinion[77], which provides the regulatory baseline established by the National Marine Fisheries Service for steelhead conditions in the Alameda Creek watershed. This scenario, referred to as the CDRP BO condition, is similar to the with-CDRP scenario in that it represents the conditions that will exist when the CDRP has been completed and in operation. However, the streamflow simulations for the two scenarios differ: the CDRP BO scenario is based entirely on the ASDHM output, while the with-CDRP conditions scenario includes additional post-processing steps to account for quarry NPDES discharges from Pit F2 and a 7.5 cfs loss in Alameda Creek streamflow to the subsurface between the San Antonio Creek confluence and the confluence with Arroyo de la Laguna.

ASDHM and Post-Processing Refinements

For the purposes of the CEQA analysis, ESA/Orion conducted post-processing of the updated ASDHM outputs downstream of Node 6 to simulate streamflow in the reach adjacent to and downstream of the ACRP project site in order to evaluate potential effects of the project on resources dependent upon streamflow. The CEQA analysts determined that for the purposes of the impact analyses, streamflow in this reach would be better represented if both the gains (Hanson's quarry NPDES discharges) and additional losses that occur between San Antonio Creek (Node 6) and Arroyo de la Laguna (Node 7) were accounted for in the ASDHM output. Post-processing assumptions and methodology is described in detail within Appendix HYD1-R, Section 4.3, *Post-Processing of the ASDHM* and summarized briefly below.

Losses to the Subsurface. The ASDHM assumes a loss in streamflow to the subsurface of up to 17 cfs between the Welch Creek confluence (Node 4) and the San Antonio Creek confluence (Node 5). As noted earlier, the studies of losses to the groundwater from Alameda Creek showed that up to an additional approximately 7.5 cfs of surface water is lost to the subsurface between the San Antonio Creek (Node 6) and Arroyo de la Laguna confluences (Node 7).[78,79] This loss to the subsurface was not represented in the ASDHM as used for the Alameda Creek Fisheries Restoration Workgroup, however it was incorporated by the CEQA team for ACRP as part of the post-processing of the ASDHM data to better reflect hydrologic conditions within the quarry reach of the Sunol Valley.

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77 National Marine Fisheries Service (NMFS), 2011. Biological Opinion for Calaveras Dam Replacement Project in Alameda and Santa Clara Counties. Tracking No. 2005/07436. March 5, 2011.

78 Trihey and Associates, Inc., 2003. *Sunol Valley Surface Flow Study, Fall 2001.* Prepared for the Office of the City Attorney, City and County of San Francisco.

79 Entrix, Inc., 2004. Alameda Creek Juvenile Steelhead Downstream Migration Flow Requirements: Phase 1 Field Survey Results.

The workgroup decided not to include additional losses below the confluence with San Antonio Creek because it was generally assumed that the gain in flow from quarry NPDES discharge canceled this loss out. Because the reach between the NPDES discharge point (550 feet downstream of Node 6) and Arroyo de la Laguna confluences (Node 7) is downstream of Pit F2, the ACRP project site, a more detailed representation of physical processes occurring in the reach was necessary for the EIR impact analysis in order to distinguish differences among scenarios downstream of the project site. See Appendix HYD1-R, Section 4.3.1, *Losses to the Subsurface* for a discussion of streamflow losses and their integration into the ASDHM output.

Gains from Quarry NPDES Discharges to Alameda Creek. As described above, Hanson Aggregates maintain safe water levels in their pits and ponds by discharging excess water from the quarry Pit F2 to Alameda Creek in accordance with its NPDES permit. As a result, much of the time, Alameda Creek gains water at the NPDES discharge location, approximately 550 feet downstream of Node 6. Although it was assumed that NPDES discharges from the quarries might continue in the future, the amount and timing of the discharge is sporadic so the SFPUC excluded quarry NPDES discharges, as well as losses in this reach, for all ASDHM model runs except for the existing conditions.

As with the Alameda Creek streamflow losses between the confluence with San Antonio Creek and the confluence with Arroyo de la Laguna, the CEQA team determined that an accurate characterization of the ACRP project site required the estimation of quarry NPDES discharges for the other scenarios analyzed. Appendix HYD1-R, Section 4.3.2, *Gains from Quarry NPDES Discharges to Alameda Creek* contains a description of the assumptions and methodology used to develop quarry NPDES discharge estimates for the existing, pre-2001, with-CDRP, and with-project scenarios.[80]

The methodology for generating quarry NPDES discharge estimates under the two future scenarios (with-CDRP and with-project) differ from the methods used for the pre-2001 and existing conditions. Under future conditions, to determine the potential daily impact of project operations on steelhead migration, the CEQA analysis required a comparison of streamflow conditions at the daily time-step; whereas, the CEQA analysis only used the pre-2001 conditions to examine seasonal and annual changes in streamflow as it relates to downstream water users, and not for steelhead migration. As such, refinement to a daily time-step was not required for the pre-2001 conditions. For the existing conditions, quarry NPDES discharges were derived directly from Hanson Aggregates NPDES reporting records.

The refinements to the quarry NPDES discharge estimation methodology to the daily time-step under the with-CDRP and with-project conditions is the result of a request from regulatory agencies for a daily comparison in streamflow between the two future scenarios. The resulting revisions to the post-processing assumptions and methodology reflect a more accurate characterization of the potential impact of the project when examined at a daily time-step. See Appendix HYD1-R, Section 4.3.2, *Gains from Quarry NPDES Discharges to Alameda Creek* for a detailed discussion of quarry NDPES discharge post-processing rationale and methodology.

80 While the CDRP Biological Opinion condition is included in the subsequent analysis it does not account for quarry NPDES discharge or the 7.5 cfs loss in streamflow to the subsurface between San Antonio Creek and the Arroyo de la Laguna confluence.

Lastly, in order to validate that the refinements in the post processing assumptions for the with-CDRP conditions approximate those conditions analyzed in the NMFS CDRP Biological Opinion, which serves as the regulatory baseline for steelhead conditions in the Alameda Creek watershed, a comparison of the NMFS CDRP Biological Opinion and with-CDRP (adjusted existing) conditions was reviewed and evaluated. The results of this comparison showed that the two conditions are nearly identical and confirm that the refinements to the model post-processing assumptions approximate conditions evaluated in the NMFS CDRP Biological Opinion and provide an appropriate condition to compare with the with-project (ACRP) conditions. A detailed description of the comparison is provided in Appendix HYD1-R, Section 4.4, *Post-Processing Validation for Fisheries Analysis*.

Other Refinements to Streamflow Data

In addition to the changes described above related to the revised project operations and revised assumptions for estimating quarry NPDES discharges under the with-CDRP and with-project conditions, two other refinements have been made as part of this revised analysis, resulting in changes in the reported daily, monthly, and annual streamflow values for the four scenarios presented in the June 2017 EIR.

First, the CEQA analysts found a minor calculation error in some of the streamflow estimates for Alameda Creek that were presented in the June 2017 EIR after the Planning Department published the June 2017 EIR and the Appeal Response memoranda in August 2017. The error occurred when ESA adjusted the original ASDHM output to include the quarry NPDES discharge and up to 7.5 cfs loss of surface water to the subsurface downstream of the San Antonio Creek confluence and upstream of the Arroyo de la Laguna confluence. The calculation error only affected the streamflow estimates made for Node 8 (just downstream of the Arroyo de la Laguna confluence) and Node 9 (at the USGS gage at Niles) in the June 2017 EIR. The error more often underestimated rather than overestimated flows downstream, but the nature of the error affected the four scenarios analyzed to variable degrees. This error was addressed in the following document: Davis, J., Leidy, G, and Hsiao, J., 2017. *Memo to Chris Kern, San Francisco Planning Department regarding Alameda Creek Recapture Project (ACRP) EIR Modeling Corrections*, November 30, 2017. However, subsequent to that memo, the post-processing data for all scenarios were further revised and updated as described within Appendix HYD1-R, Section 4, Analytical Methods.

Second, modifications were made to the calculation methodology used to convert daily data to annual volumes. While the underlying post-processed daily streamflow data for the existing and pre-2001 conditions remains unchanged from the June 2017 EIR, the annual volumes shown for the existing and pre-2001 conditions are slightly different than contained in the June 2017 EIR. In summarizing the daily streamflow data as annual volumes, the June 2017 EIR methodology did not account for the additional days during leap years. Given the small number of leap years within the 18-year period of record, this error had little impact on annual streamflow volumes - this discrepancy is corrected within the recirculated document. This calculation modification also applies to the with-CDRP and with-project conditions, however, as described above, the underlying data for these two scenarios has been updated in the revised impact analysis.

Alameda Creek Streamflow Simulations (Daily Hydrographs)

Daily hydrograph plots of representative water year conditions were developed to show predicted hydrologic conditions that migrating steelhead would be anticipated to experience in Alameda Creek in the primary and extended study areas under the adjusted existing (with-CDRP) conditions and with-project (ACRP) conditions. The analysis then determined if the daily hydrographs under with-project conditions were indicative of substantial adverse effects on steelhead compared to the adjusted existing conditions.

Migration Opportunity Threshold Conditions

As stated above, impact conclusions are based on an assessment of project-related changes compared to the adjusted existing (with-CDRP) conditions in the context of the expected seasonal, life-stage specific habitat requirements of CCC steelhead DPS. In order to analyze potential operations-related changes in streamflows and associated potential impacts on migration, threshold conditions were identified to be representative of primary constituent elements for CCC steelhead DPS freshwater migration. As discussed above, the NMFS CDRP Biological Opinion concluded that adult upstream passage and juvenile downstream passage would be provided in the Sunol Valley (primary study area) with flows of approximately 20 cfs and 10 cfs (with physical modifications required as part of the CDRP Biological Opinion), respectively.[81] In the extended study area (Niles Canyon and Lower Alameda Creek Channel), flow requirements for adult upstream passage and juvenile downstream passage have not been identified; however, NMFS has commented that steelhead may migrate anytime within the migration period when instream flows exceed identified minimum flow levels of 25 cfs for adults and 12 cfs for juveniles/smolts in the Lower Alameda Creek channel.[82] Based on this information, migration opportunity threshold conditions used in the revised analysis are as follows:

- Primary Study Area (Sunol Valley, Nodes 5 and 7)
  - 20 cfs December – April (adults), 10 cfs March – June (juveniles)
- Extended Study Area (Niles Canyon, Node 9)
  - 25 cfs December – April (adults), 12 cfs March – June (juveniles)

It is important to note that the above threshold values are used as representative flows for the purposes of this EIR only, and that actual passage conditions for migrating steelhead are much more variable due to a range of factors (e.g., fish size and fitness, specific geometry of the channel, specific depth and velocity relationships, length and associated characteristics of critical passage features, etc.). Further, migrating steelhead utilize a range of flow conditions for passage; these include sufficient base flows for holding and movement and adequate stream flows during and following storms for attraction and passage (including over critical features).

[81] National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.

[82] National Marine Fisheries Service (NMFS), Gary Stern, San Francisco Bay Branch Supervisor, North-Central Coast Office, 2017. *Letter to the City and County of San Francisco regarding June 22, 2017 Planning Commission Decision Regarding the Final EIR for the ACRP*. July 27, 2017, Santa Rosa, CA.

Migration opportunity threshold condition values are used to identify the number of days the threshold conditions would be met or exceeded under the adjusted existing (with-CDRP) conditions compared to the with-project (ACRP) conditions. For those days where there was a change in streamflow between scenarios based on threshold conditions, the magnitude of change in daily flow was also evaluated. The analysis then determines if the number of days and/or the specific days that migration opportunity threshold values would be exceeded under with-project conditions would result in a substantial adverse effect on steelhead migration compared to the adjusted existing (with-CDRP) conditions.

15.2.3.3 Operational Impacts — Fisheries Resources

Impact BI-11: Project operations would not substantially interfere with the movement or migration of special-status fish species, including CCC steelhead DPS. (Less than Significant)

Physical barriers to fish movement, most notably the BART weir, currently prevent steelhead from accessing the upper Alameda Creek watershed. This analysis, however, assumes that under the adjusted existing conditions, current efforts to remove fish passage barriers will be successful and that steelhead will gain access to the upper watershed and be present throughout the reaches of Alameda Creek within the primary and extended study areas when ACRP operations commence. It also assumes that Calaveras Dam and ACDD will be operating consistent with the NMFS CDRP Biological Opinion, which also included an adaptive management implementation plan. The SFPUC prepared the adaptive management implementation plan for the purpose of achieving specific goals that will support broader steelhead population targets within the entire watershed.[83]

Due to life history requirements and limiting factors (specifically, warm summer water temperatures), even with implementation of the CDRP instream flow schedules under the adjusted existing (with-CDRP) conditions, steelhead are not expected to spawn or rear within the reaches of Alameda Creek within the primary and extended study areas. However, steelhead would be likely to migrate through the study areas during winter spawning migrations and spring out migrations (approximately December through June). Implementation of the CDRP instream flow schedules, particularly the bypasses at the ACDD, are expected to increase the suitability of migratory habitat throughout the primary and extended study areas.

As described above, under the with-CDRP conditions, Calaveras Reservoir will operate at full capacity, and instream flow requirements and bypassed flow at the ACDD will be implemented as scheduled. During winter (December to February) and spring (March to May) months, Alameda Creek streamflows (as augmented by bypasses at ACDD and releases from Calaveras Dam) would be expected to exceed Alameda Creek loss rates to the subsurface (maximum of 17 cfs between Welch and San Antonio Creeks and 7.5 cfs between San Antonio Creek and Arroyo de la Laguna) into the alluvium and mining pits. Eventually no storage space would be available in the shallow alluvium (stream channel gravels) and further losses to the subsurface would not occur. Under these rainy season conditions, an active stream is generally expected to occur through all the

83 National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.

subreaches. Saturation of the alluvium and associated increases in surface flows during the winter and spring is expected to occur more regularly under the with-CDRP conditions than under the pre-2001 or existing conditions because of implementation of the CDRP instream flow schedules.

Due to its location, operation of the proposed ACRP would not have an effect on flow in Alameda Creek upstream of the San Antonio Creek confluence; therefore, fish habitat in that reach of Alameda Creek would be unaffected by the ACRP. However, the ACRP could affect flow in the creek downstream of Pit F2 (immediately downstream of the San Antonio Creek confluence), which could in turn affect conditions for steelhead migration. The ACRP could affect steelhead migratory habitat if the recapture operations were to affect streamflows in the creek during the steelhead migration period. There are two ways in which ACRP operations could affect streamflows in Alameda Creek: one is if the ACRP pumping would change the rate of streamflow losses to the subsurface, and the other is if the ACRP would affect the quarry NPDES discharges. These effects are discussed further below under *Surface and Subsurface Water Interactions* and *Quarry Operations*, respectively.

Surface and Subsurface Water Interactions

Provided below is a summary description of surface and subsurface water interactions in the study area. A detailed description of these interactions can be found in Appendix HYD2-R.

Groundwater in the Sunol Valley is recharged primarily by Alameda Creek. Alameda Creek streamflow downstream of the USGS gage below Welch Creek splits into subsurface and surface components where surface water initially infiltrates the shallow alluvium. Water in the saturated zone then flows under the prevailing down-valley gradient governed by the hydraulic properties of the aquifer materials. The fraction of streamflow that enters the subsurface in Alameda Creek through the quarry reaches follows two pathways. The first pathway is lateral seepage into quarry pits through the coarse streambed and alluvium materials comprising the shallow aquifer (referred to herein as stream “seepage”). A second pathway is for subsurface water flow to follow the stream channel along the stream axis past San Antonio Creek and the quarry pits, including Pit F2, to the confluence of Alameda Creek and Arroyo de la Laguna where it exits the valley as surface flow (referred to herein as stream “leakage”). The term “leakage” is used in this section as a refinement of the more general term “loss to the subsurface” when discussing the surface streamflow that migrates to the subsurface in the specific vicinity of Pit F2.

The revised analysis in Appendix HYD2-R quantifies the leakage from Alameda Creek and seepage into Pit F2. The results shows that most of the seepage rate values are less than or equal to 1 cfs for the with-CDRP scenario (about 92-percent of the time). In the with-ACRP scenario, the seepage rates range from positive to negative with most positive values clustering around 0 to 0.5 cfs. The seepage rates for both scenarios are consistent with an aquifer of limited volume with Alameda Creek serving as the predominant source of recharge. In summary, there is a finite and limited potential to affect streamflow with a maximum seepage into Pit F2 from Alameda Creek of less than 1 cfs, with the greatest seepage (albeit < 1 cfs) occurring during the highest streamflow events. Seepage and related stream leakage quantities are constrained by aquifer thickness and hydraulic properties and stream stage.

Quarry Operations

As summarized above under *Setting* (Section 15.2.1) and discussed in detail in Appendix HYD1-R, the NPDES discharges from the quarries would be expected to increase from an average annual volume of 3,436 acre-feet under existing conditions to 6,739 acre-feet per year under with-CDRP conditions; this is because more water would need to be managed by the quarry operators under with-CDRP conditions. Based on historical records of quarry NPDES discharges, it is assumed this additional water would be discharged to Alameda Creek by the quarry operators under their NPDES permits. When the proposed ACRP is in operation, the SFPUC would pump an average of 6,045 acre-feet per year from Pit F2 to the regional water system for municipal use, theoretically making some of the NPDES discharges by the quarry operators unnecessary. Under with-project conditions, the volume of water discharged from the quarries in summer (June to August) and fall (September to November) months, under their NPDES permits, is expected to be less than what is expected under with-CDRP conditions but similar to the volume of water discharged under existing conditions (3,436 acre-feet per year on average under existing conditions versus 3,870 acre-feet per year on average under with-project conditions); this is because it is assumed less water will need to be managed by the quarry operators under the with-project conditions.

Additionally, it is important to note that streamflow simulations included in the analysis in the NMFS Biological Opinion for CDRP[84] did not assume any quarry NPDES discharges (or changes to quarry NPDES discharges). As a result, it is assumed that NMFS did not consider these variable quarry NPDES discharges identified in this EIR analysis to be an important contributing source for streamflows during and following storms for adult attraction and upstream passage, and juvenile outmigration through the primary and extended study areas. Nevertheless, as stated above, for the purposes of this EIR, the quarry NPDES discharges are factored into this analysis through post-processing steps to determine more precisely potential impacts of the proposed project on Alameda Creek streamflow downstream of the project site.

Migration Opportunity Days Analysis

Migration opportunity days, defined as the number of days the threshold conditions would be met or exceeded, were calculated for the with-CDRP (adjusted existing conditions) and the with-project (ACRP) conditions for each water year in the 18-year model period of record. This analysis also calculates the change in number of migration opportunity days for each year in the 18-year period, total days for each scenario, and average days per year for each scenario. For those days where there was a change between scenarios based on a threshold condition, the magnitude of the change (increase or decrease) in daily flow was also calculated. The migration opportunity days analyses were conducted for the following four scenarios:

- Primary Study Area : December to April, adult migration period
- Primary Study Area : March to June, juvenile migration period
- Extended Study Area: December to April, adult migration period

[84] National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.

- Extended Study Area: March to June, juvenile migration period

Primary Study Area (Sunol Valley, Node 7): 20 cfs December – April (Adults)

Migration opportunity days for adult steelhead (December 1 through April 30) in the primary study area (as represented by Node 7, Alameda Creek downstream of the project site and above Arroyo de la Laguna) for adjusted existing (with-CDRP) compared to with-ACRP conditions are shown in **Table 15.2-4**. The magnitude of change in streamflow for those days where there was a change between scenarios based on the threshold condition of 20 cfs is depicted in **Figure 15.2-7**.

Figure 15.2-7 and subsequent similar bar graphs showing the magnitude of change in streamflow, display each day chronologically by water year identified in the "change in days" column of the corresponding table (e.g., for Figure 15.2-7, see Table 15.2-4). The "change in days" column shows the net change in number of migration opportunity days when comparing streamflow between the with-project and adjusted existing conditions for each migration season at a specific node. In other words, a migration opportunity day is a day in which streamflow in Alameda Creek is greater than the passage threshold at a given node. The "change in days" metric is the difference in the number of migration opportunity days between the two scenarios; calculated as with-ACRP conditions minus adjusted existing conditions. Negative numbers in Table 15.2-8 indicate a decrease in migration opportunity days under the with-ACRP conditions, with respect to the adjusted existing conditions, positive numbers indicate an increase.

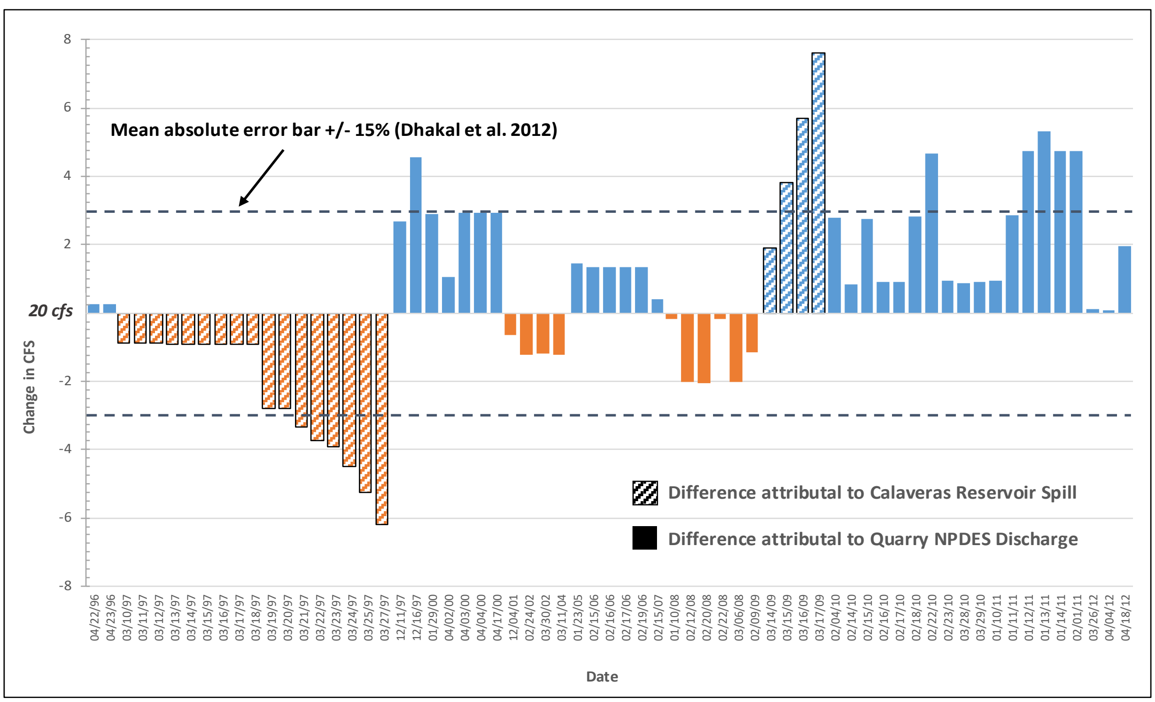
In Figure 15.2-7, each bar on the figure represents one day in which the streamflows differed enough between the two scenarios to result in a change in migration opportunity. Increases in migration opportunity days under the with-project conditions, with respect to the adjusted existing condition, are shown in blue, whereas, decreases are shown in orange. The magnitude of change in streamflow relative to the threshold condition is reflected by the height of the bar. For example, in Table 15.2-4, it shows that in HY 1997, the with-project conditions had 17 fewer migration opportunity days compared to the adjusted existing conditions (with-CDRP), as represented by negative 17. This same information is depicted in Figure 15.2-7 as 17 orange bars in 1997, where the magnitude of streamflow on those days is represented as the decrease in cfs compared to the threshold condition.

Figure 15.2-7 and subsequent similar bar graphs also indicate the cause of differences in migration opportunity days between the adjusted existing conditions and with-project conditions. Differences attributable to modeled differences in quarry NPDES discharges are shown in solid colors, while differences attributable to modeled spills from Calaveras Reservoir are shown in a colored striped pattern. These two causes of differences in migration opportunity days are explained further below.

For most years, the number of opportunity days was the same or similar between scenarios. Average opportunity days per year for the 18-year period of record was 69 days under both scenarios, indicating no change in the number of opportunity days would occur over the long term. The greatest decrease in opportunity days was a deficit of 17 days in the 1997 water year, and the greatest increase was 10 days and 6 days in the 2010 and 2011 water years, respectively.

TABLE 15.2-4
MIGRATION OPPORTUNITY DAYS – ADULTS: DEC 1 TO APRIL 30, 20 CFS AT NODE 7, ADJUSTED EXISTING (CDRP) COMPARED TO WITH-PROJECT (ACRP) CONDITIONS

HY	Migration Period		Opportunity Days at Node 7 flow >= 20cfs (CDRP)	Opportunity Days at Node 7 flow >= 20cfs (ACRP)	Change in Days
1996	12/01/95	4/30/1996	109	111	2
1997	12/1/1996	4/30/1997	112	95	-17
1998	12/1/1997	4/30/1998	122	124	2
1999	12/1/1998	4/30/1999	104	104	0
2000	12/1/1999	4/30/2000	57	62	5
2001	12/1/2000	4/30/2001	35	35	0
2002	12/1/2001	4/30/2002	46	43	-3
2003	12/1/2002	4/30/2003	51	51	0
2004	12/1/2003	4/30/2004	45	44	-1
2005	12/1/2004	4/30/2005	112	113	1
2006	12/1/2005	4/30/2006	118	122	4
2007	12/1/2006	4/30/2007	24	25	1
2008	12/1/2007	4/30/2008	43	38	-5
2009	12/1/2008	4/30/2009	34	37	3
2010	12/1/2009	4/30/2010	90	100	10
2011	12/1/2010	4/30/2011	99	105	6
2012	12/1/2011	4/30/2012	18	21	3
2013	12/1/2012	4/30/2013	14	14	0
		Total	***1233***	***1244***	
		Average	***69***	***69***	

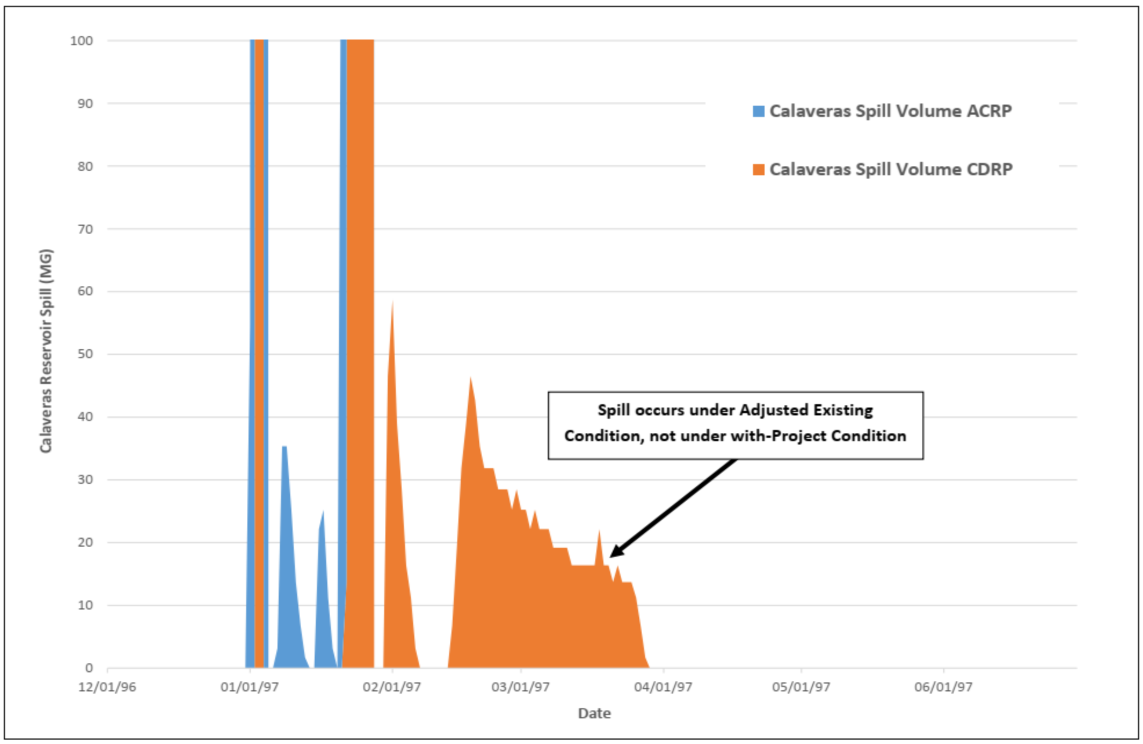


SFPUC Alameda Creek Recapture Project

SOURCE: SFPUC 2019

Figure 15.2-7
Magnitude of Increase or Decrease in flow around 20 cfs Threshold
Adjusted Existing compared to with-Project Conditions
Node 7, December 1 to April 30

A review of the post-processed model results of the magnitude of increase or decrease in flow around the 20 cfs threshold condition for those days that changed shows that the 17-day deficit in 1997 occurred as the result of the model predicting a reservoir spill at Calaveras Dam (see **Figure 15.2-8**), upstream of the proposed ACRP, under the with-CDRP scenario. The model also predicted a spill in 2009, in which the with-project (ACRP) scenario shows a three-day increase in opportunity days compared to the with-CDRP scenario. While spills could occur under prolonged wet conditions, the SFPUC operates the reservoir to minimize spills from Calaveras Dam in advance of and during wet weather events through a number of means (e.g., reduce or eliminate diversions from ACDD, implement increased releases from Calaveras Dam, etc.). The day to day operational decisions are not (and cannot be) reflected in the model (or post-processing). Thus, this type of event is not useful to consider in a comparison between scenarios because it is not expected to be representative of future conditions and instead is a product (artifact) of the model. For a detailed discussion of Calaveras Reservoir dynamics, as it relates to modeled spill events under the with-CDRP and with-project conditions, see Appendix HYD1-R, Section 4.2.1, *Modeled Spill from Calaveras Reservoir*.



SOURCE: SFPUC 2019

SFPUC Alameda Creek Recapture Project

Figure 15.2-8
Modeled Calaveras Reservoir Spill
December 1, 1996 to June 30, 1997

As shown in Figure 15.2-8, modeled spill from Calaveras Reservoir occurs under both the adjusted existing (with-CDRP) and with-project conditions. Thus, modeled unregulated spill has the potential to cause increases and decreases in migration opportunity days. Both increases and decreases in migration opportunity days associated with modeled spills, given the operational controls described above, should be considered artifacts of the model and equally unlikely to occur under future conditions.

Modeled spill events occur slightly more frequently under with-project conditions. This increased frequency occurs because Calaveras Reservoir elevations are generally higher under with-project conditions in the early portions of a water year, as the ACRP would be used to meet a portion of the water demand instead of Calaveras Reservoir. This causes both an increase in modeled spill under the with-project condition, and a shift in the timing of spill events between the two scenarios (with spill under adjusted existing conditions generally occurring later in the spring after the reservoir has more time to fill). The inconsistency in the timing of spills between the adjusted existing and with-project conditions can cause changes in migration opportunity days between the two scenarios. Changes in migration opportunity days attributable to the timing of Calaveras Reservoir spills are distinguished from changes caused by quarry NPDES discharge and shown in Figure 15.2-7 and Figure 15.2-10.[85]

While unregulated spill from Calaveras Reservoir can cause changes in migration opportunity days between the adjusted existing and with-project scenarios, the majority of opportunity day variability is driven by modeled differences in quarry NPDES discharges between the two scenarios. A brief discussion of how differences in quarry NPDES discharge assumptions drive variations in migration opportunity days between the adjusted existing and with-project conditions is provided below. For a detailed discussion of the assumptions and methodology governing quarry NPDES discharge estimates under the adjusted existing (with-CDRP) and with-project conditions please see Appendix HYD1-R, Section 4.3.2, Gains from Quarry NPDES Discharges to Alameda Creek.

Quarry NPDES discharges, under the adjusted existing and with-project conditions, are derived from the relationship between Pit F2 inflow and the Pit F2 water surface elevation. In brief, quarry NDPES discharge are assumed to occur when the volume of Pit F2 inflow causes exceedance of a Pit F2 operational water surface elevation for a given day (See Appendix HYD1-R, Section 4.3.2). Differences in the assumptions governing Pit F2 water surface elevation operational ranges, under the adjusted existing and with-project conditions, may cause the volume of water available for discharge to differ between scenarios.[86]

Figure 15.2-9 below shows modeled water surface elevations for Pit F2 under the with-project and adjusted existing conditions for the adult migration season during the 2010 water year. As shown in Table 15.2-4 above, the 2010 water year saw a 10-day increase in adult migration opportunity days under the with-project condition, compared to the adjusted existing conditions. The 2010 water year is included below because it showed the greatest increase in migration opportunity days under the with-project condition over the 18-year period of record, with respect to the adjusted existing scenario. However, the 2010 Pit F2 water surface elevation dynamics are exemplary of a pattern that occurs in all years, albeit with varying levels of influence on the migration condition within the creek.

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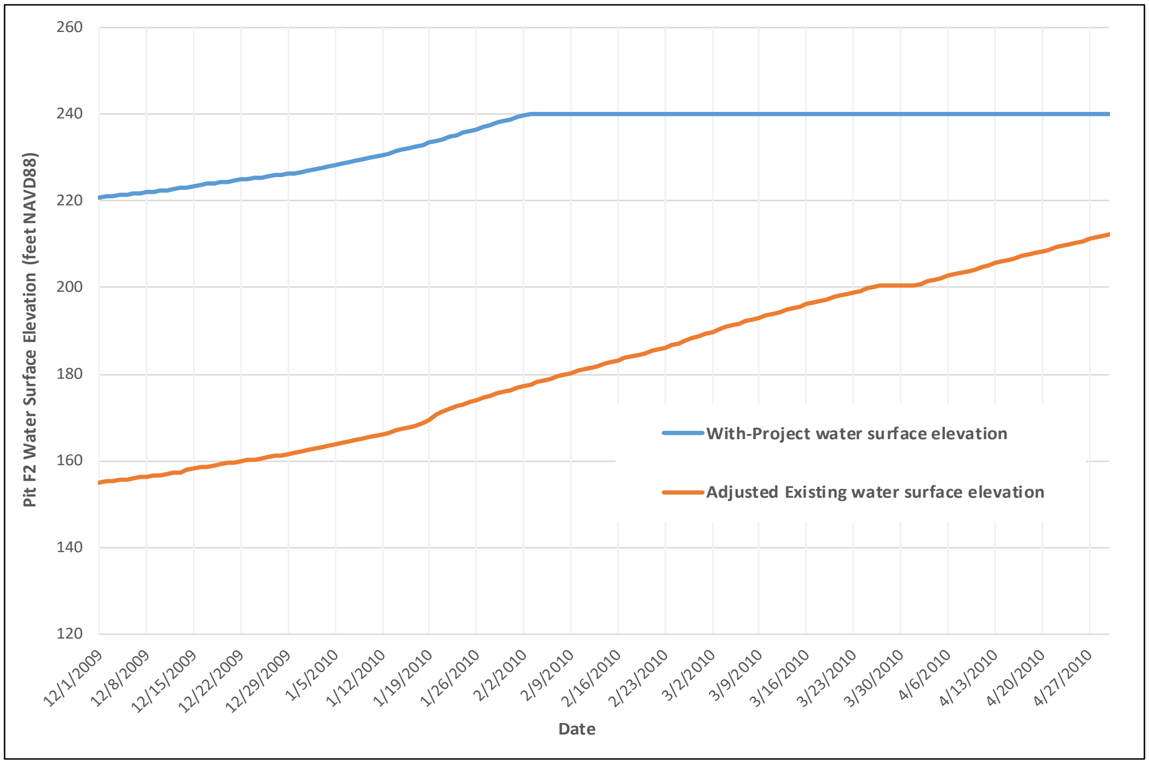
85 Even when spill from Calaveras Reservoir is the primary driver of change in migration opportunity days, differential quarry NPDES discharges between the two scenarios may still contribute to differences in observed flow, albeit at a lesser magnitude.

86 Pit F2 water surface elevations for the adjusted existing condition are assumed to fluctuate between 150 feet and 220 feet (NAVD88) over the course of a water year. Under the with-project condition, the SFPUC will maintain water surface elevations in Pit F2 between 180 feet and 240 feet (NAVD88). See Appendix HYD1-R, Section 4.3.2, for background on these Pit F2 water surface elevation operational ranges.



SFPUC Alameda Creek Recapture Project

SOURCE: ESA 2019, SFPUC 2019

Figure 15.2-9
Modeled Pit F2 Water Surface Elevation
December 1, 2009 to April 30, 2010

Figure 15.2-9 shows that during the 2010 adult migration season Pit F2 water surface elevations under the adjusted existing conditions rose from approximately 155 feet to 211 feet (NAVD88). Whereas over the same period, the water surface elevation under with-project conditions rose from 220 feet (NAVD88) to a maximum of 240 feet (NAVD88) in early February 2010. The maximum water surface elevation in Pit F2 is 240 feet, thus once this elevation is reached, there is no additional storage for inflow and any remaining inflow into the pit would need to be discharged. Under the adjusted existing conditions, the pit continues to fill over the course of the migration season without reaching the maximum operational elevation (i.e., there is storage to accept additional inflow). The lack of storage under the with-project condition during the 2010 water year led to increased quarry NPDES discharge estimates during this period of 10 days, relative to the adjusted existing conditions. The comparison of Pit F2 elevations during the 2010 water year is helpful in showing how the difference in assumptions between the adjusted existing and with-project conditions can drive changes in quarry NPDES discharge estimates.

Differences in the operational ranges between scenarios can cause Pit F2 to fill more rapidly under the with-project condition, compared to the adjusted existing conditions. The operational range is larger under the adjusted existing conditions (150 feet to 220 feet, a difference of 70 feet) than under with-project condition (180 feet to 240 feet, a difference of 60feet). The 10-foot difference in operational range between scenarios, means that under the adjusted existing conditions, Pit F2 will typically fill at a slower rate and require more inflow to fill. The rapid filling of Pit F2 under the with-project conditions during the winter/spring period (December to June) typically generates a greater volume of water for discharge relative to the adjusted existing conditions. The pattern of increased discharge from December to June under the with-project conditions (when the ACRP is not in operation) is what drives the increases in migration opportunity days and is also apparent below for the other threshold conditions — juveniles in the study area and adults and juveniles in the extended study area.

Lastly, as shown in Figure 15.2-7, much of the magnitude of the increase or decrease in change in streamflow between scenarios falls within the mean error bar, which is plus or minus 15 percent.[87] The magnitude of change for 50 of the 65 days (approximately 83 percent) shown on Figure 15.2-7 falls within the plus or minus 15 percent mean error bar. Overall, these results indicate that when compared with the adjusted existing conditions, the proposed project under the revised operating protocol would not result in a substantial change in adult steelhead migration opportunity days within the primary study area.

Primary Study Area (Sunol Valley, Node 7): 10 cfs March – June (Juveniles)

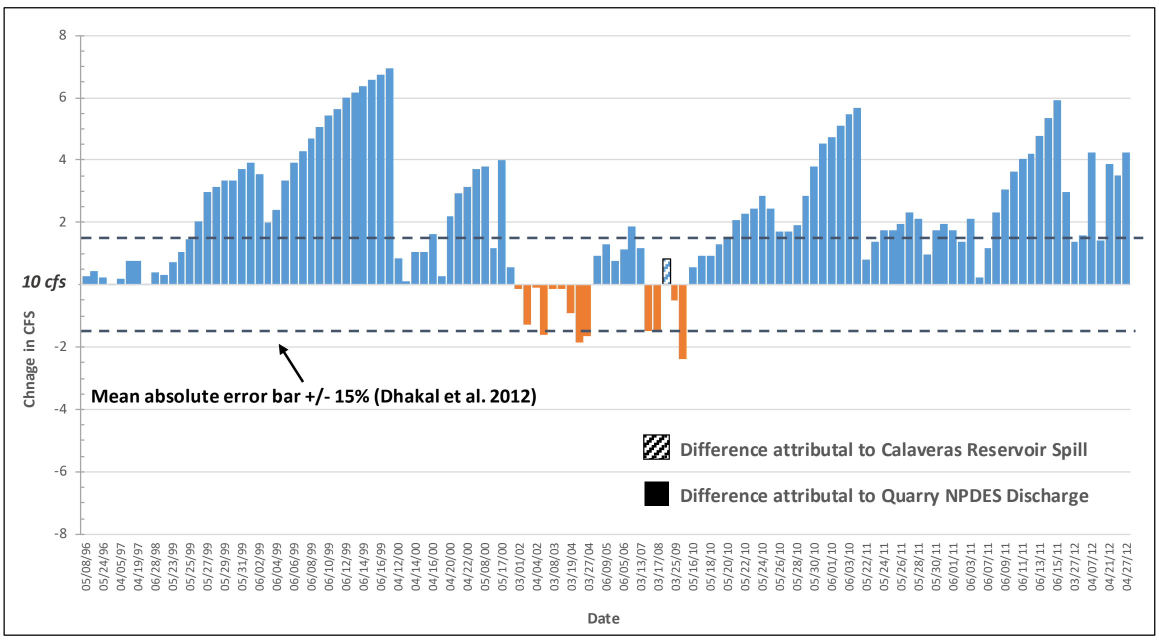
Migration opportunity days for juvenile steelhead (March 1 through June 30) in the primary study area (as represented by Node 7, Alameda Creek downstream of the project site and above Arroyo de la Laguna) for adjusted existing conditions compared to with-ACRP conditions are shown in **Table 15.2-5**. The magnitude of change in streamflow for those days where there was a change between scenarios based on the threshold condition of 10 cfs is depicted in **Figure 15.2-10**.

Similar to the adult period for the primary study area, for most years, the number of opportunity days were the same or similar between scenarios. Average opportunity days per year for the 18-year period of record was 51 under the adjusted existing conditions and 56 under the with-project conditions, indicating that a net increase in number of opportunity days would occur over the long term under the with-project condition. The greatest reduction in migration opportunities days under the with-ACRP condition compared to the adjusted existing conditions was four days in both the 2002 and 2004 water years. The greatest increase in migration opportunities days under the with-ACRP compared to the adjusted existing conditions was 27, 20, and 23 days in the 1999, 2010, and 2011 water years, respectively. As shown above in Figure 15.2-9 for water year 2010, the filling of the Pit F2 under the with-project conditions, compared with the adjusted existing conditions, occurs earlier in the hydrologic year and typically generates a greater volume of water for discharge during the December to June period. Pit F2 has a larger capacity for storage under with-project conditions, relative to the adjusted existing conditions, because the operational range is larger under adjusted existing conditions (150 feet to 220 feet) relative to with-project conditions (180 feet to 240 feet). The comparison in water surface elevations under these two scenarios for the 2010 water year shown in Figure 15.2-9 is very similar to the relationship between Pit F2 water surface elevations in the 1999 and 2011 water years over the same period. As with the 2010 water year, differences in migration opportunity days between these two conditions for the 1999 and 2011 water years are caused by the increased amount of water available for discharge in the December to June period under the with-project conditions.

[87] Dhakal, Buckland and McBain, 2012. *Overview of Methods, Models and Results to Develop Unimpaired, Impaired and Future Flow and Temperature Estimates along Lower Alameda Creek for Hydrologic Years 1996-2009.*

TABLE 15.2-5
MIGRATION OPPORTUNITY DAYS – JUVENILES: MAR 1 TO JUNE 30, 10 CFS AT NODE 7, ADJUSTED EXISTING (CDRP) COMPARED TO WITH-PROJECT (ACRP) CONDITIONS

HY	Migration Period		Opportunity Days at Node 7 flow >= 10cfs (CDRP)	Opportunity Days at Node 7 flow >= 10cfs (ACRP)	Change in Days
1996	3/1/96	6/30/96	77	80	3
1997	3/1/97	6/30/97	34	38	4
1998	3/1/98	6/30/98	118	120	2
1999	3/1/99	6/30/99	82	109	27
2000	3/1/00	6/30/00	44	57	13
2001	3/1/01	6/30/01	19	20	1
2002	3/1/02	6/30/02	32	28	-4
2003	3/1/03	6/30/03	64	63	-1
2004	3/1/04	6/30/04	22	18	-4
2005	3/1/05	6/30/05	86	88	2
2006	3/1/06	6/30/06	95	98	3
2007	3/1/07	6/30/07	13	14	1
2008	3/1/08	6/30/08	17	15	-2
2009	3/1/09	6/30/09	23	22	-1
2010	3/1/10	6/30/10	76	96	20
2011	3/1/11	6/30/11	84	107	23
2012	3/1/12	6/30/12	24	32	8
2013	3/1/13	6/30/13	0	0	0
		total	***910***	***1005***	
		average	***51***	***56***	



SFPUC Alameda Creek Recapture Project

SOURCE: SFPUC 2019

Figure 15.2-10
Magnitude of Increase or Decrease in flow around 10 cfs Threshold
Adjusted Existing compared to with-Project Conditions
Node 7, March 1 to June 30

A review of the increase in days shows that changes on these days likely occurred primarily as a result of differences in quarry NPDES discharges between the scenarios. As described above, the more rapid filling of Pit F2 during the non-pumping periods under the with-project scenario results in increased pit water surface levels and the associated need to increase quarry NPDES discharges during this period. This phenomenon is especially pronounced in the juvenile outmigration period because quarry NPDES discharges make up a greater proportion of the streamflow required to meet the 10 cfs juvenile passage threshold, relative to the higher streamflow thresholds required for adult passage (20 cfs at Node 7). For example, from March 1 to June 30 of the 1999 water year, Table 15.2-5 shows a 27-day increase in migration opportunity days under the with-project condition compared to the adjusted existing scenario. Daily average quarry NPDES discharge during this period under the with-project condition was 15.5 cfs, and under the adjusted existing conditions, 8.3 cfs. Thus, under the with-project condition, quarry NPDES discharges have a greater potential to result in increased migration opportunities for juveniles at Node 7.[88]

Overall, these results indicate that when compared with the adjusted existing conditions, the proposed project under the revised operating protocol would not result in a substantial change in juvenile steelhead migration opportunity days between March 1 and June 30 in the Sunol Valley, downstream of the project site (i.e., Node 7). The primary driver of change between scenarios is the increased quarry NPDES discharge predicted to occur under the with-project condition during spring months due to non-operation of ACRP. Modeled Calaveras Reservoir spill has only a minor effect on the change in migration opportunity days (one day during the 2009 water year).

Additionally, a review of the post-processed model results of the magnitude of increase or decrease in flow of around 10 cfs for those days that changed shows that a many of the magnitude of change in days falls within the mean error bar. The magnitude of change for 47 of the 121 days (approximately 39 percent) shown on Figure 15.2-10 falls within the plus or minus 15 percent mean error bar.

Overall, these results indicate that when compared with the adjusted existing conditions, the proposed project under the revised operating protocol would not result in a substantial change in juvenile steelhead migration opportunity days within the primary study area.

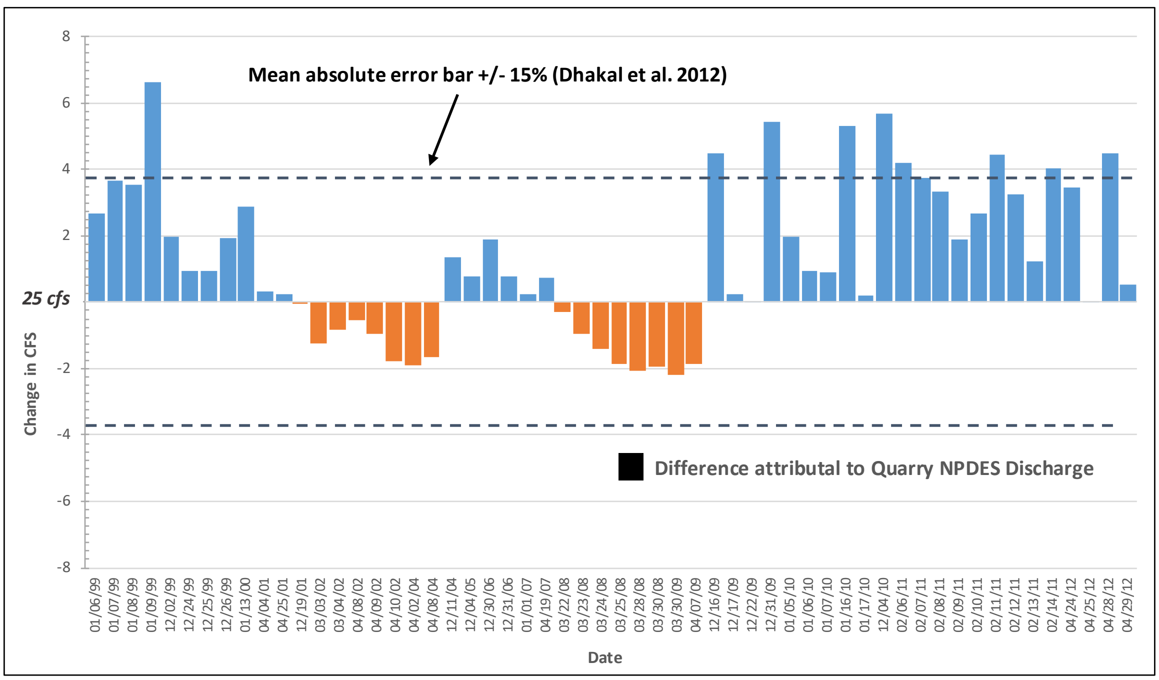
Extended Study Area (Node 9): 25 cfs December – April (Adults)

Migration opportunity days for adult steelhead (December 1 through April 30) in the extended study area (as represented by Node 9, Alameda Creek near the Niles gage) for adjusted existing compared to with-ACRP conditions are shown in **Table 15.2-6**. The magnitude of change in streamflow for those days where there was a change between scenarios based on the threshold condition of 25 cfs is depicted in **Figure 15.2-11**.

88 It is important to note that under both the with-project and adjusted existing conditions there is a 7.5 cfs loss in streamflow to the subsurface between Nodes 6 and 7. As this loss occurs under both conditions, the relative increases in streamflow due to quarry NPDES discharge under the with-project, compared to the adjusted existing conditions, remain.

TABLE 15.2-6
MIGRATION OPPORTUNITY DAYS – ADULTS: DEC 1 TO APRIL 30, 25 CFS AT NODE 9, ADJUSTED EXISTING (CDRP) COMPARED TO WITH-PROJECT (ACRP) CONDITIONS

HY	Migration Period		Opportunity Days at Node 9 flow >= 25cfs (CDRP)	Opportunity Days at Node 9 flow >= 25cfs (ACRP)	Change in Days
1996	12/1/1995	4/30/1996	142	142	0
1997	12/1/1996	4/30/1997	151	151	0
1998	12/1/1997	4/30/1998	151	151	0
1999	12/1/1998	4/30/1999	147	151	4
2000	12/1/1999	4/30/2000	126	131	5
2001	12/1/2000	4/30/2001	120	122	2
2002	12/1/2001	4/30/2002	116	110	-6
2003	12/1/2002	4/30/2003	126	126	0
2004	12/1/2003	4/30/2004	100	98	-2
2005	12/1/2004	4/30/2005	132	133	1
2006	12/1/2005	4/30/2006	138	139	1
2007	12/1/2006	4/30/2007	108	112	4
2008	12/1/2007	4/30/2008	97	91	-6
2009	12/1/2008	4/30/2009	96	94	-2
2010	12/1/2009	4/30/2010	119	128	9
2011	12/1/2010	4/30/2011	141	151	10
2012	12/1/2011	4/30/2012	90	94	4
2013	12/1/2012	4/30/2013	95	95	0
		total	***2195***	***2219***	
		average	***122***	***123***	



SFPUC Alameda Creek Recapture Project

SOURCE: SFPUC 2019

Figure 15.2-11
Magnitude of Increase or Decrease in flow around 25 cfs Threshold
Adjusted Existing compared to with-Project Conditions
Node 9, December 1 to April 30

Similar to the adult period for the primary study area, for most years, the number of opportunity days were the same or similar under both scenarios. Average opportunity days per year for the 18-year period of record was 122 under the adjusted existing conditions and 123 under the with-ACRP conditions, indicating a one-day net increase under with-project conditions over the long term. The greatest change was a deficit of -6 days in 2002 and 2008 water years and an increase of 9 and 10 days in the 2010 and 2011 water years, respectively. The differential patterns of Pit F2 fill, and quarry NPDES discharges, described above for Node 7 also apply to the changes in migration opportunity days shown for Node 9. Overall there are fewer changes in migration opportunity days at Node 9, compared to Node 7, because of the contribution of additional streamflow from Arroyo de la Laguna, downstream of Node 7.

A review of the post-processed model results of the magnitude increase or decrease in flow around the 25 cfs threshold for those days that changed shows that all of the magnitude decrease change (deficit) days and most of the increase days fall within the mean error bar. The magnitude of change for 47 of the 56 days (approximately 84 percent) shown on Figure 15.2-11 falls within the plus or minus 15 percent mean error bar.

Overall, these results indicate that when compared with the adjusted existing conditions, the proposed project under the revised operating protocol would not result in a substantial change in adult steelhead migration opportunity days between December 1 and April 30 in the extended study area (i.e., Node 9).

Extended Study Area (Node 9): 12 cfs March – June (Juveniles)

Migration opportunity days for juvenile steelhead (March 1 through June 30) in the extended study area (as represented by Node 9, Alameda Creek near the Niles gage) for adjusted existing conditions compared to with-ACRP conditions are shown in **Table 15.2-7**. The magnitude of change in streamflow for those days where there was a change between scenarios based on the threshold condition of 12 cfs is depicted in **Figure 15.2-12**.

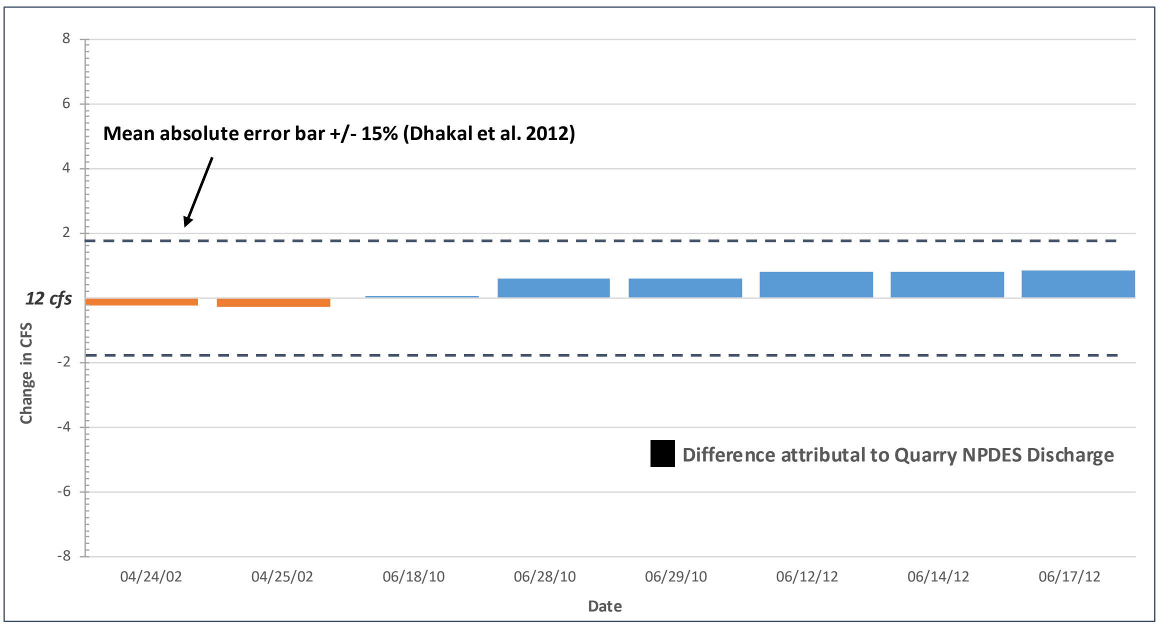
Similar to the juvenile period for the primary study area, for most years, the number of opportunity days were the same or similar under both scenarios. Average opportunity days per year for the 18-year period of record was 119 under the adjusted existing conditions and 120 under the with-ACRP conditions, indicating a net increase of one day under with-project over the long term. The greatest change was a deficit of 2 days in the 2002 water year and an increase of 33 days in both the 2010 and 2012 water years.

A review of the post-processed model results of the magnitude increase or decrease in flow around the 12 cfs threshold for those days that changed shows that all of the magnitude decrease change (deficit) days falls within the mean error bar.

Overall, these results indicate that when compared with the adjusted existing conditions, the proposed project under the revised operating protocol would not result in a substantial change in juvenile steelhead migration opportunity days between March 1 and June 30 in the extended study area (i.e., Node 9).

TABLE 15.2-7
MIGRATION OPPORTUNITY DAYS – JUVENILES: MAR 1 TO JUNE 30, 12 CFS AT NODE 9, ADJUSTED EXISTING (CDRP) COMPARED TO WITH-PROJECT (ACRP) CONDITIONS

HY	Migration Period		Opportunity Days at Node 9flow >= 12cfs (AEC)	Opportunity Days at Node 9 flow >= 12cfs (WP)	Change in Days
1996	3/1/96	6/30/96	122	122	0
1997	3/1/97	6/30/97	122	122	0
1998	3/1/98	6/30/98	122	122	0
1999	3/1/99	6/30/99	122	122	0
2000	3/1/00	6/30/00	122	122	0
2001	3/1/01	6/30/01	116	116	0
2002	3/1/02	6/30/02	111	109	-2
2003	3/1/03	6/30/03	122	122	0
2004	3/1/04	6/30/04	122	122	0
2005	3/1/05	6/30/05	122	122	0
2006	3/1/06	6/30/06	122	122	0
2007	3/1/07	6/30/07	122	122	0
2008	3/1/08	6/30/08	122	122	0
2009	3/1/09	6/30/09	120	120	0
2010	3/1/10	6/30/10	119	122	3
2011	3/1/11	6/30/11	122	122	0
2012	3/1/12	6/30/12	118	121	3
2013	3/1/13	6/30/13	99	99	0
		total	***2147***	2151	
		average	***119***	120	



SFPUC Alameda Creek Recapture Project

SOURCE: SFPUC 2019

Figure 15.2-12
Magnitude of Increase or Decrease in flow around 12 cfs Threshold
Adjusted Existing compared to with-Project Conditions
Node 9, March 1 to June 30

Alameda Creek Streamflow Simulations (Daily Hydrographs)

Hydrographs were developed for a range of water year types[89] for Nodes 5, 7, and 9 focusing on the specific period for steelhead migration in Alameda Creek (December through June), based on life-stage timing described above (see Table 15.2-1). **Figures 15.2-13**, **15.2-14**, **and 15.2-15** depict December through June hydrographs for Very Wet (2006), Wet (2003), Dry (2008), and Very Dry (2007) water year types, respectively.[90] Theses plots show predicted hydrologic conditions that migrating steelhead would be anticipated to experience in Alameda Creek in the primary and extended study areas under the adjusted existing (with-CDRP) conditions compared to the with-project (ACRP) condition.

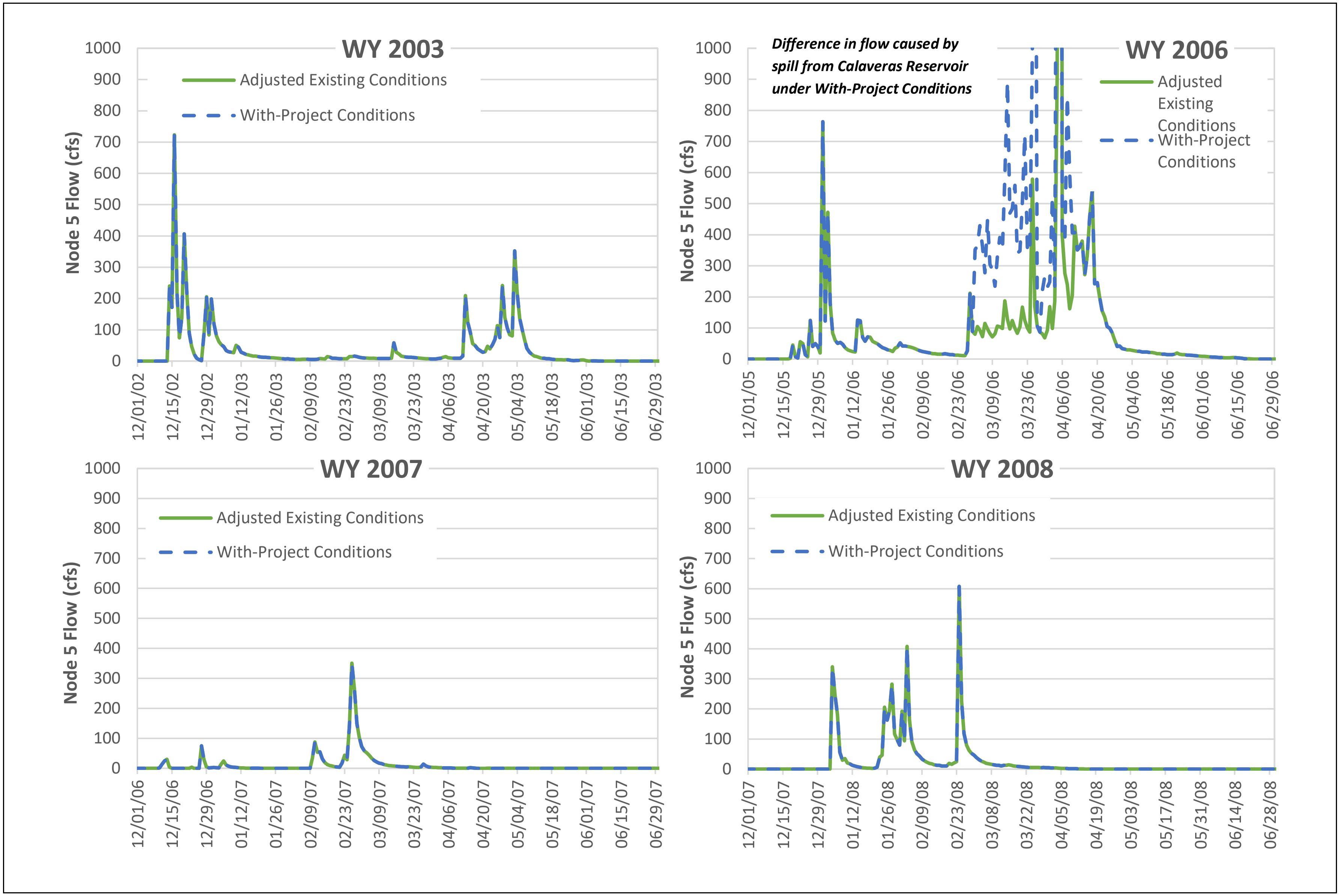
Similar to the results for migration opportunity days above, hydrographs were the same or similar under both scenarios for most conditions. The only differences are in the 2006 water year (very wet) and are the result of a reservoir spill at Calaveras Dam, upstream of the proposed ACRP, under the with-project (ACRP) scenario. While spills occur under both scenarios, Calaveras Reservoir begins spilling earlier in the water year under the with-project compared with the adjusted existing conditions. Under the with-project condition, Calaveras Reservoir was modeled to spill from March 2, 2006 to April 29, 2006, whereas under the adjusted existing conditions, the reservoir was modeled to spill from April 5, 2006 to April 29, 2006.

As discussed above, this type of event is not useful for a comparison between scenarios because it is a product (artifact) of the model. While spills could occur under prolonged wet conditions, SFPUC would implement diversion structure and reservoir management measures in advance of and during wet weather events to minimize spills from Calaveras Dam (see Appendix HYD1-R, Section 4.2.1, *Modeled Spill from Calaveras Reservoir*). Further, as depicted in the plots, precipitation-generated streamflows in Alameda Creek are predicted to regularly exceed several hundred cfs during the December through June migration period. Under both the adjusted existing and with-ACRP conditions, precipitation-generated winter and spring flows bypassed at the ACDD (plus Calaveras Dam releases and local watershed accretions) would be expected to provide adequate streamflows during and following storms for adult attraction and upstream passage, and juvenile outmigration through the primary and extended study areas, consistent with functioning primary constituent elements for migration.

Effects of Carryover

As described in Chapter 14, Revisions to the Project Description, ACRP operations would include the potential for recapture operations to pump water stored from previous hydrologic years (referred to as carryover or rollover). However, the likelihood of recapturing water stored from previous years would be expected to occur rarely. In all but one year within the 18-year study period, the volume of water proposed for pumping from Pit F2 would be *less* than the inflow to Pit F2 from the CDRP bypasses and releases during that hydrologic year (see Table 14-1).

[89] Water Year types were defined based on flow exceedance probabilities.
[90] Water year classifications: WY 2006 – Very Wet (24% percent flow exceedance), WY 2003 – Wet (53% percent flow exceedance), WY 2008 – Dry (65% percent flow exceedance) WY 2007 – Very Dry (82% percent flow exceedance).

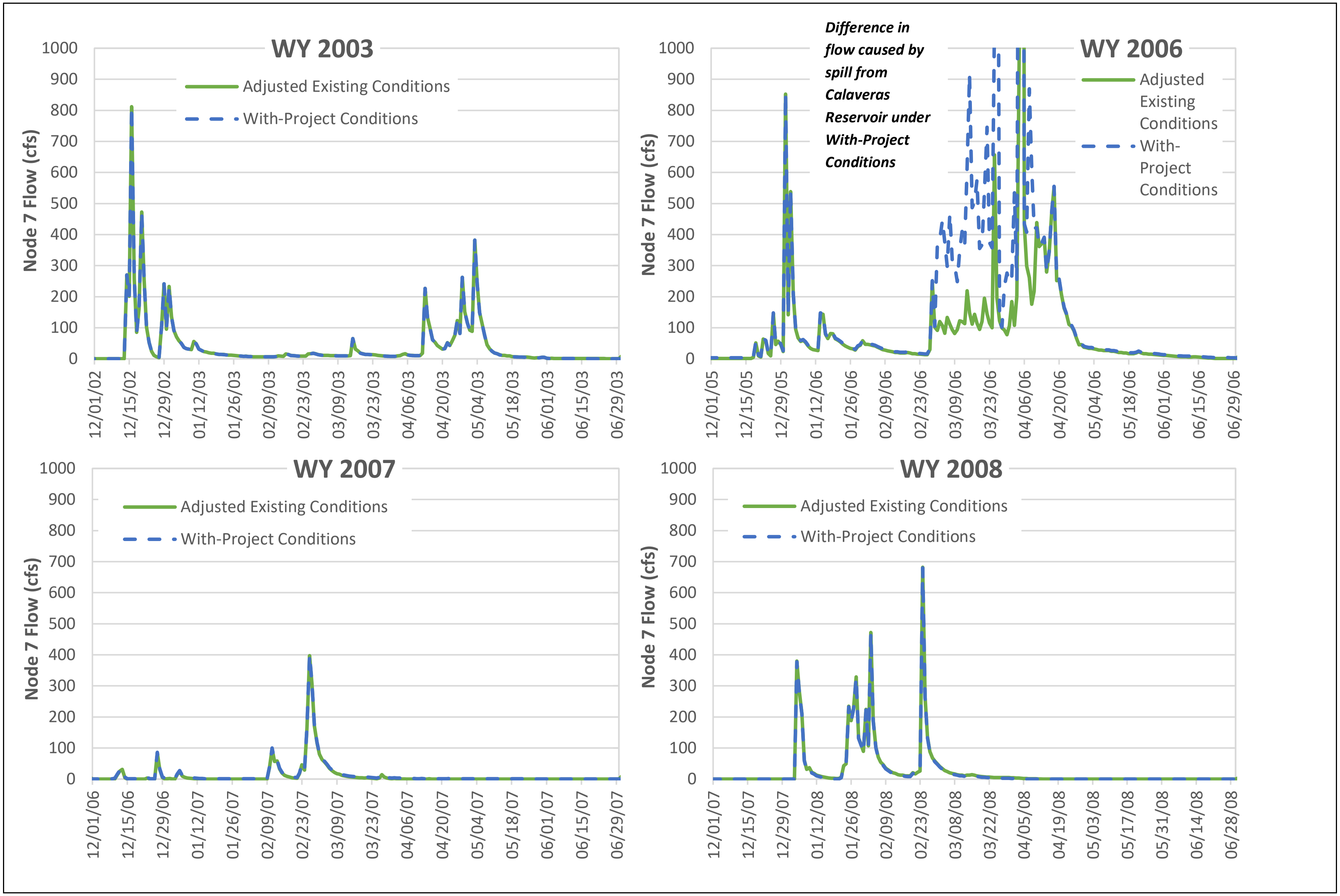


SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet file provided by Amod Dhaka on November 8, 2018.

SFPUC Alameda Creek Recapture Project

Figure 15.2-13

Modeled Stream Flow during the Typical Migration Window
Alameda Creek above San Antonio Creek (Node 5)

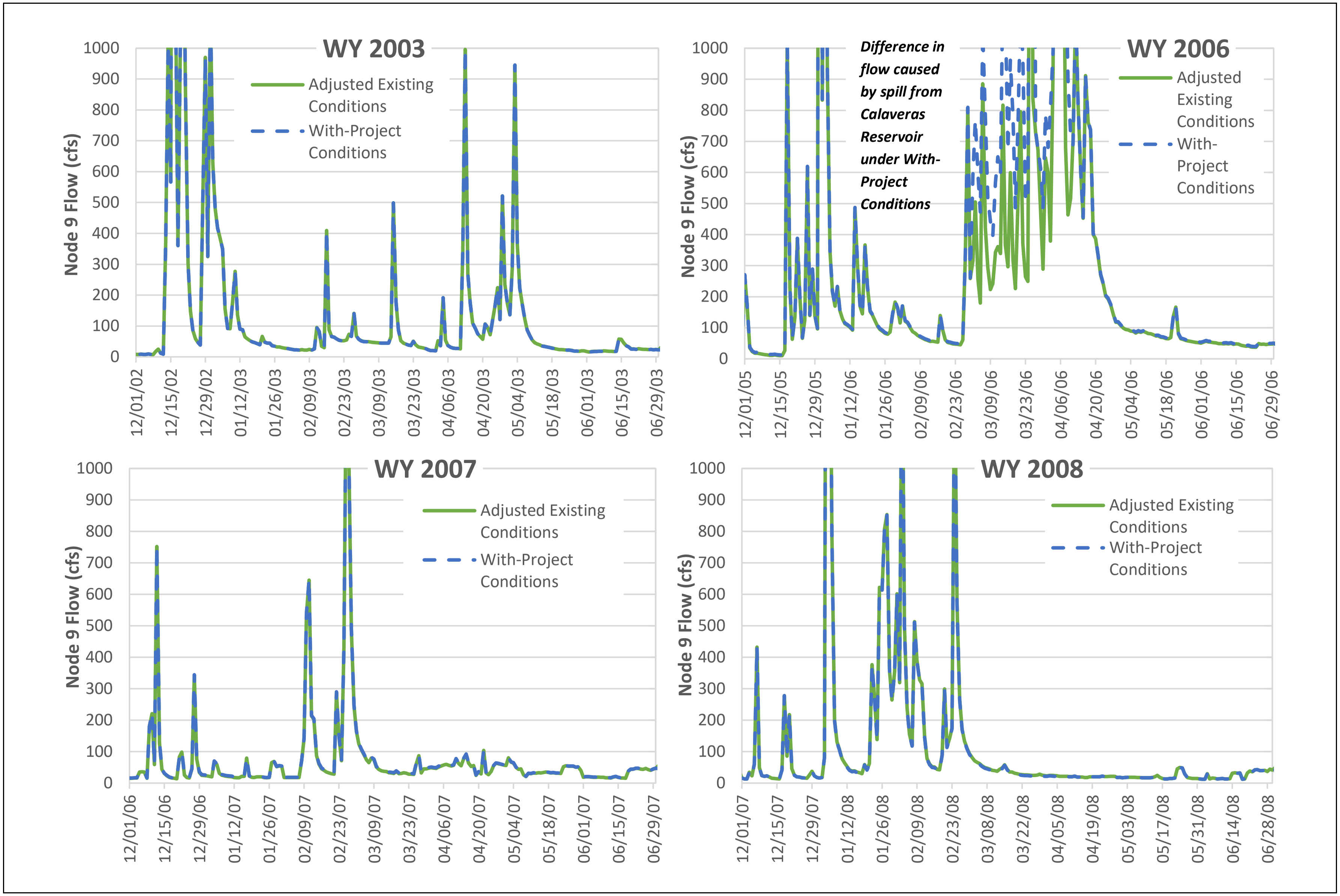


SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet file provided by Amod Dhaka on November 8, 2018.

SFPUC Alameda Creek Recapture Project

Figure 15.2-14

Modeled Stream Flow during the Typical Migration Window
Alameda Creek above Arroyo de la Laguna (Node 7)



SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet file provided by Amod Dhaka on November 8, 2018.

SFPUC Alameda Creek Recapture Project

Figure 15.2-15

Modeled Stream Flow during the Typical Migration Window
Alameda Creek at Niles Canyon (Node 9)

Based on 18 years of modeling, the volume of pumping from Pit F2 is only greater than Pit F2 inflow from bypasses and releases in hydrologic year 2012 (by approximately 331 acre-feet), although total Pit F2 inflow[91] in hydrologic year 2012 is greater than the recaptured volume. The analysis of migration opportunity days at Nodes 7 and 9 above includes hydrologic year 2012, and therefore, the analysis accounts for the consequences of carryover operations on Alameda Creek streamflow. Estimates of Pit F2 inflow from bypasses and releases that are not ultimately recaptured during project operations for the 18-year study period are summarized below in **Table 15.2-8** for each hydrologic year in the 18-year study period. The negative value in hydrologic year 2012 (-331 acre-feet) represents the one year in which carryover would occur.

TABLE 15.2-8
SIMULATED PIT F2 INFLOW FROM BYPASSES AND RELEASES THAT IS NOT RECAPTURED[a] (acre-feet per year)

Hydrologic Year	Pit F2 Inflow from Bypasses and Releases not Recaptured (acre-feet per year)	Water Year Type
1996	4,363	Wet
1997	2,018	Wet
1998	6,303	Wet
1999	4,864	Wet
2000	2,779	Wet
2001	69	Dry
2002	1,288	Dry
2003	2,381	Dry
2004	521	Dry
2005	3,677	Wet
2006	4,846	Wet
2007	243	Dry
2008	509	Dry
2009	3,073	Wet
2010	4,320	Wet
2011	5,951	Wet
2012	(-331)	Dry
2013	761	Dry
Average	***2,646***	-
Minimum	***(-331)***	-
Maximum	***6,303***	-

[a] The volumes in the table indicate the difference in volume of water that enters Pit F2 from CDRP releases and bypasses less the volume of water pumped for recapture for each hydrologic year. A positive number indicates that Pit F2 inflow from releases and bypasses is greater than the recapture volume for that year; a negative number indicates that Pit F2 inflow from releases and bypasses is less than the recapture volume for that year.

SOURCE: SFPUC 2019

The potential for carryover operations to affect streamflow in Alameda Creek or subsurface conditions in the aquifer adjacent to Pit F2 is negligible. As stated above, over the 18-year period of record, the annual recapture volume would be greater than Pit F2 inflow from bypasses and

[91] In addition to inflow from CDRP bypasses and releases, other sources of inflow to Pit F2 include contributions from the downstream watersheds below Calaveras and San Antonio Reservoirs and direct contributions from watershed east of the quarry reach.

releases only for one year, hydrologic year 2012. In all other years, there is substantially more water entering Pit F2 from bypasses and releases than is proposed for recapture, and on average, as shown in Table 15.2-8, Pit F2 inflow from bypasses and releases would exceed recapture volumes by 2,646 acre-feet per year.

Even though pumping of carryover water could occur during the 2012 hydrologic year, this pumping would still be constrained by the ACRP operating protocols that restrict the range of water levels in Pit F2 to between 180 feet and 240 feet. That is, conformance with the revised operating protocols of Pit F2, regardless of carryover operations, would be protective of the adjacent aquifer conditions, thereby minimizing potential effects on Alameda Creek streamflow, as described above in this impact analysis.

Impact Summary and Significance Determination

Based on the hydrologic modeling (ASDHM and post-processing) that was conducted to conservatively simulate operational effects to Alameda Creek surface water flows, as well as the analysis of historical flow data and the analysis of surface and subsurface water interactions (see Appendices HYD1-R and HYD2-R), operation of the proposed ACRP is not anticipated to result in substantial changes to winter and spring flows or associated aquatic habitat conditions for migrating steelhead in Alameda Creek compared to the adjusted existing conditions.

Migration opportunity threshold analysis demonstrated that for most years, the number of migration opportunity days was the same or similar under both the adjusted existing and with-project conditions, with average opportunity days per year for the 18-year period of record showing no substantial change (or in some cases a net increase in migration opportunity days under with-project conditions) in most comparisons. The greatest decreases and increases occurred as the result of differences in quarry NPDES discharges between the with-project and adjusted existing conditions. Reservoir spills at Calaveras Dam, upstream of the proposed ACRP, also contributed to differences in migration opportunity days between scenarios, though to a much lesser degree. Spill events are not useful in a comparison between scenarios because they are not expected to be representative of future conditions. and instead are a product (artifact) of the model. While spills could occur under prolonged wet conditions, the SFPUC would implement diversion structure and reservoir management measures in advance of and during wet weather events to minimize spills from Calaveras Dam through a number of means (e.g., reduce or eliminate diversions from ACDD, implement increased releases from Calaveras Dam, etc.). These operational decisions are not represented in the model (or post-processing).

Review of the data relating to increases or decreases in flow that affect the number of migration opportunity days shows most changes are within the mean error bar.

Hydrographs developed for a range of water year types[92] focusing on the specific period for steelhead migration in Alameda Creek (December through June) show predicted hydrologic conditions that migrating steelhead would be anticipated to experience in Alameda Creek were the same or similar under both scenarios. Further, as depicted in the plots, precipitation-generated

[92] Water Year types were defined based on flow exceedance probabilities.

streamflows in Alameda Creek are predicted to regularly exceed several hundred cfs during the December through June migration period, allowing steelhead adequate opportunity for passage. Under both the adjusted existing and with-ACRP conditions, precipitation-generated winter and spring flows bypassed at the ACDD (plus Calaveras Dam releases and local watershed accretions) would be expected to provide adequate streamflows during and following storms for adult attraction and upstream passage, and juvenile outmigration through the primary and extended study areas, consistent with functions of the primary constituent elements for steelhead migration.

Analysis of carryover operations show that in only one year (hydrologic year 2012) during the 18-year period of record does the proposed recapture volume exceed inflow into the pit from bypasses and releases. During this hydrologic year, carryover operations are not expected to influence water surface elevations within Pit F2 such that the required range of operating water levels in the pit (180 feet to 240 feet) would still be maintained. Thus, no impacts to the adjacent aquifer is expected to result from carryover operations, and therefore no direct impact on streamflow in Alameda Creek is expected to result.

Analysis of surface and subsurface interactions indicates that the 17 and 7.5 cfs loss rates included in the streamflow simulations (ASDHM and post-processing) are considered to be conservative for most years, and ACRP operations are not expected to affect (or exacerbate) this loss rate.

Based on the analysis provided above, project operations would not substantially interfere with the movement or migration of special-status fish species, including CCC steelhead DPS, and this impact would be ***less than significant***.

Mitigation: None required.

15.3 Other Resource Topics Affected by the Revised Project Description

15.3.1 Terrestrial Biological Resources

15.3.1.1 Setting, Terrestrial Biological Resources

(This section updates relevant portions of Chapter 5, Section 5.14.2, Setting, Terrestrial Biological Resources, of the June 2017 EIR pertaining to terrestrial biological resources to address the revisions to estimated streamflow conditions contained in Appendix HYD1-R.)

Table 5.14-1 (pp. 5.14-9 to 5.14-14), Summary of Hydrological and Riparian Conditions along Alameda Creek Subreaches A, B, and C under Existing, With-CDRP, and With-Project Conditions, is replaced with **Table 5.14-1 (revised)**, which is the same as Table HYD7-1 (revised) in Appendix HYD1-R. Specifically, the revised tables update the streamflow estimates for the various subreaches under each of the three scenarios.

As compared to the June 2017 EIR, Section 5.14.2.5, under *Comparison Between Existing Conditions and with-CDRP—Riparian Habitats*, the average annual stream flow volumes in Alameda Creek at Subreach A (Node 6) are expected to be about 11 percent—rather than 12 percent—lower under with-CDRP conditions compared to existing conditions.[93] Also, during the three-month period of July-August-September, the average flow volume at this location will be about three times as much under with-CDRP conditions compared to existing conditions (rather than twice as much as indicated in the June 2017 EIR, see page 5.14-35). Changes in quarry NPDES discharge post-processing methodology for the with-CDRP conditions created an increase in discharge during the July to September period, relative to discharges over the same period within the June 2017 EIR. For a discussion of the assumptions and methodology governing quarry NPDES discharges under the with-CDRP conditions see Appendix HYD1-R, Section 4.3.2, Gains from Quarry NPDES Discharges to Alameda Creek.

Under the Section 5.14.2.8, *California Red-legged Frog*, regarding predicted Alameda Creek conditions under the with-CDRP scenario, the decreases in average monthly flow volumes between December and June range between 0 percent to -48 percent (rather than -6 to -37 percent indicated in the June 2017 EIR) and the increases in monthly flow volumes between July and November range between 144 percent and 212 percent (rather than 63 to 98 percent indicated in the June 2017 EIR, see page 5.14-47). These differences in streamflow between the June 2017 EIR and the recirculated analysis are the result of refinements to the with-CDRP conditions quarry NPDES discharge post-processing methodology. It is important to note that the average annual quarry discharge under the with-CDRP conditions in the June 2017 EIR is similar to the average

[93] Quarry discharge estimates under all scenarios are post-processed into daily ASDHM streamflow data at Node 6 given its close proximity to the discharge point. This imposes a geographical incongruity between the Node 6 data as derived directly from the ASDHM and the Node 6 data used in this analysis. As such, subsequent references to Node 6 are referred to as Node 6˚ to denote the incorporation of quarry NPDES discharge estimates approximately 550 feet downstream of the original ASDHM Node 6 location.

TABLE 5.14-1 (REVISED)
SUMMARY OF HYDROLOGICAL AND RIPARIAN CONDITIONS ALONG ALAMEDA CREEK SUBREACHES A, B, AND C UNDER EXISTING, WITH-CDRP, AND WITH-PROJECT CONDITIONS
(See Figure 5.14-1a and 1b for Location of Subreaches)

Location	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Subreach A	**Surface Water**. Surface water conditions in this reach are represented by Node 6˚ in the ASDHM. Average annual flow volume at Node 6˚ = 40,104 acre-feet per year, including quarry NPDES discharges. Live stream in wet months. Average total flow volume over the 18-year study period of 834 acre-feet (min: 21 acre-feet, max: 1,534 acre-feet) in dry-season 3-month period of July, August and September, entirely attributable to quarry NPDES discharges.	**Surface Water**. Average annual flow at Node 6˚ = 35,545 acre-feet per year, including quarry NPDES discharges. Live stream in wet months. Average post-processed ASDHM total flow volume over the 18-year study period of 2,445 acre-feet (min: 2,017 acre-feet, max: 2,823 acre-feet) in dry-season 3-month period of July, August and September, entirely attributable to quarry NPDES discharges.	**Surface Water**. Average annual flow volume at Node 6˚ = 37,600 acre-feet per year, including quarry NPDES discharges. Live stream in wet months. Average post-processed ASDHM flow volume over the 18-year study period of 87 acre-feet (min: 12 acre-feet, max: 348 acre-feet) in dry-season 3-month period of July, August and September, entirely attributable to quarry NPDES discharges.
	Subsurface Water. Subsurface water conditions in this reach are represented by measurements in MW5.[94] Subsurface water levels at MW5 have varied seasonally from at or above the projected creek thalweg[95] elevation of 242 feet elevation in the winter and spring to 223 feet at the end of the dry season in the fall. Altered water management by ODS[96] since 2012 has raised minimum elevations in the fall from 223 feet to about 230 feet. Subsurface water elevations fluctuate within the observed range as a function of hydrology and mining activities, including timing and duration of precipitation through spring, timing and magnitude of dewatering activities by mining operators, and in recent years, water management practices such as by ODS.	**Subsurface Water**. Subsurface water levels at MW5 will vary seasonally from at or above the thalweg elevation of 242 feet in the winter and spring to 230 feet at the end of the dry season in the fall.[1] Fluctuations will occur within this range and will resemble existing conditions as a function of hydrology and mining activities.	**Subsurface Water**. Subsurface water levels at MW5 would vary seasonally from at or above the thalweg elevation of 242 feet in the winter and spring to 230 feet at the end of the dry season in the fall.[1] Fluctuations will occur within this range and will resemble existing conditions as a function of hydrology, mining activities, and variations in ACRP operations.
	Pools. Live stream through pools in wet months. Pools persist through dry months.	**Pools.** Live stream through pools in wet months. Pools persist longer in dry months. Pools will be larger in the dry months than under existing conditions due to greater quarry NPDES discharges.	**Pools.** Live stream through pools in the wet months. Pools persist in dry months. Pools would be larger at the start of the dry season due to increased discharge under the with-project condition from December to June relative to the existing and with-CDRP conditions. However, in some places pools may dry out at a faster rate in the dry season compared to with-CDRP conditions and existing conditions due to ACRP recapture and projected smaller quarry discharges. In some years, about one in three of the

94 Quarry operator, Oliver de Silva (ODS).
95 Thalweg is the path of a line connecting the lowest points of cross-sections along a streambed.
96 Alameda Creek Monitoring Well 5.

TABLE 5.14-1 (REVISED) (Continued)
SUMMARY OF HYDROLOGICAL AND RIPARIAN CONDITIONS ALONG ALAMEDA CREEK SUBREACHES A, B, AND C UNDER EXISTING, WITH-CDRP, AND WITH-PROJECT CONDITIONS
(See Figure 5.14-1a and 1b for Location of Subreaches)

Location	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Subreach A (cont.)			hydrologic base period, ACRP would have limited operations leading to a wetter condition. The range from dry to wetter conditions as a function of ACRP operations would produce pooling that is consistent with variability seen under existing conditions.
	Instream Wetlands. Instream wetlands are of two types: **perennial instream wetlands** occupy margins of more or less permanent pools and other perennial reaches of the creek. Perennial instream wetlands are the result of the combination of surface and subsurface flows. In Subreach A, perennial instream wetlands exist only because of the additional contribution of quarry NPDES discharges and would not exist due to surface flows alone. **Seasonal instream wetlands** occupy the periphery of pools, isolated seasonal pools within the floodplain, and other low areas subject to seasonal saturation or inundation from surface flows or groundwater seepage, generally drying in the dry season.	**Instream Wetlands.** The extent of instream perennial wetlands around the margins of permanent pools and other perennial reaches of the creek could increase compared to existing conditions because of increased CDRP releases, potentially replacing seasonal wetlands in these areas. The extent of isolated seasonal pools and the instream seasonal wetlands they support would not change substantially from existing conditions because the seasonal pattern of groundwater elevations would not change substantially due to instream flow schedules.	**Instream Wetlands.** The extent of instream perennial wetlands around the margins of permanent pools and other perennial reaches of the creek could increase from December to June compared to with-CDRP and existing conditions, although seasonal wetlands may replace areas supporting perennial wetlands to some extent. During the dry season instream perennial wetlands around the margins of permanent pools may dry at a faster rate compared with with-CDRP and existing conditions due to decreases in quarry NPDES discharge under the with-project condition during late-summer months. However, the extent of isolated seasonal pools and the seasonal wetlands they support would not change substantially from with-CDRP or existing conditions. No net loss of wetlands expected, although the proportion (seasonal vs. perennial) could vary slightly.
	Woody Riparian Vegetation. Tree-supporting riparian alliances (including willow thicket and riparian forest alliances) and dense mulefat thicket are found in areas along the low-flow channel. Dense vegetative growth depends on consistent access to surface or shallow groundwater supplied by quarry NPDES discharges, especially during the dry summer months. Sparse mulefat thicket alliance is found in the floodplain away from the low-flow channel.	**Woody Riparian Vegetation.** Tree-supporting riparian alliances could increase compared to existing conditions due to increased dry-season flows attributable to increased quarry NPDES discharges. Extent of mulefat thicket would not change except that some might be replaced by tree-supporting alliances. Density of mulefat could increase along the low-flow channel.	**Woody Riparian Vegetation.** Tree-supporting riparian alliances could decrease compared to existing and with-CDRP conditions due to reduction in dry-season quarry NPDES discharges. Mulefat thicket alliance could replace tree-supporting alliances and mulefat density could decrease in some areas.
Subreach B	**Surface Water.** Live flow in wet months. Average ASDHM annual flow volume lower than at Node 6˚ (40,104acre-feet per year) in Subreach A due to streamflow losses to groundwater. Lower total dry-season flow volume in July, August and September in Subreach B than at Node 6˚ for the same reason. Dry-season flow and pooling attributable to quarry NPDES discharges.	**Surface Water.** Live flow in wet months. Average ASDHM annual flow volume lower than at Node 6˚ (35,545 acre-feet per year) in Subreach A due to streamflow losses to groundwater. Lower total dry-season flow volume in July, August and September than at Node 6˚ for the same reason. Greater dry-season flow compared to existing conditions due to expected increased quarry NPDES discharges.	**Surface Water.** Live flow in wet months. Average ASDHM annual flow volume lower than at Node 6˚ (37,600 acre-feet per year) in Subreach A due to streamflow losses to groundwater. Lower total flow volume in July, August and September than at Node 6˚ for the same reason. Lower dry-season flow volume compared to existing or with-CDRP conditions because of expected reduced dry season quarry NPDES discharges.

TABLE 5.14-1 (REVISED) (Continued)
SUMMARY OF HYDROLOGICAL AND RIPARIAN CONDITIONS ALONG ALAMEDA CREEK SUBREACHES A, B, AND C UNDER EXISTING, WITH-CDRP, AND WITH-PROJECT CONDITIONS
(See Figure 5.14-1a and 1b for Location of Subreaches)

Location	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Subreach B (cont.)	**Subsurface Water.** Subsurface water conditions in this reach are represented by measurements in MW6. Subsurface water levels at MW6[97] have varied seasonally from at or above the projected creek thalweg elevation of 236 feet elevation in the winter and spring to 221 feet in the fall. Altered water management by ODS since 2012 has raised minimum elevations to about 227 feet.	**Subsurface Water**. Subsurface water levels at MW6 will vary seasonally from the thalweg elevation of 236 feet in the winter and spring to 227 feet in the fall.[1] Fluctuations will occur within this range and will resemble existing conditions as a function of hydrology and mining activities.	**Subsurface Water**. Subsurface water levels at MW6 would vary seasonally from as high as the thalweg elevation of 236 feet in the winter and spring to 227 feet in the fall.[1] Fluctuations will occur within this range and will resemble existing conditions as a function of hydrology, mining activities, and variations in ACRP operations.
	Pools. Live stream through pools in wet months. Pools persist through dry months.	**Pools**. Live stream through pools in wet months. Pools persist longer in dry months. Pools will be larger than under existing conditions due to greater quarry discharges and greater subsurface flow.	**Pools**. Live stream through pools in wet months. Pools persist in dry months. Pools would be larger at the start of the dry season due to increased discharge under the with-project condition from December to June relative to the existing and with-CDRP conditions. However, in some places pools may dry out at a faster rate in the dry season compared to with-CDRP conditions. In some years, about one in three of the hydrologic base period, ACRP would have limited operations leading to a wetter condition. The range from dry to wetter conditions as a function of ACRP operations would produce pooling that is consistent with variability seen under existing conditions.
	Instream Wetlands. Instream perennial wetlands occupy margins of permanent pools and other perennial reaches of the creek. Instream seasonal wetlands occupy the periphery of permanent pools, isolated seasonal pools within the floodplain, and other low areas subject to seasonal saturation or inundation from surface flows or groundwater seepage, generally drying in the dry season.	**Instream Wetlands.** The extent of instream perennial wetlands around the margins of permanent pools and other perennial reaches of the creek could increase compared to existing conditions. The extent of seasonal pools and the instream seasonal wetlands they support will not change substantially from existing conditions.	**Instream Wetlands.** The extent of instream perennial wetlands could increase from December to June compared to with-CDRP and existing conditions, although instream seasonal wetlands may replace areas supporting perennial wetlands somewhat. During the dry season instream perennial wetlands around the margins of permanent pools may dry at a faster rate compared with with-CDRP and existing conditions due to decreases in quarry NPDES discharge under the with-project condition during late-summer months. However, the extent of isolated seasonal pools and the instream seasonal wetlands they support would not change substantially from with-CDRP or existing conditions. No net loss of wetlands expected, although the proportion (seasonal vs. perennial) could vary slightly.

97 Alameda Creek Monitoring Well 6, see Figure 5.16-13 for location.

TABLE 5.14-1 (REVISED) (Continued)
SUMMARY OF HYDROLOGICAL AND RIPARIAN CONDITIONS ALONG ALAMEDA CREEK SUBREACHES A, B, AND C UNDER EXISTING, WITH-CDRP, AND WITH-PROJECT CONDITIONS
(See Figure 5.14-1a and 1b for Location of Subreaches)

Location	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Subreach B (cont.)	**Woody Riparian Vegetation.** Tree-supporting willow and riparian forest alliances and dense mulefat thickets found in areas along the low-flow channel. Dense growth depends on consistent access to surface or shallow groundwater supplied by quarry NPDES discharges, especially during the dry summer months. Sparse mulefat thicket alliance found in the floodplain away from the low-flow channel.	**Woody Riparian Vegetation.** Tree-supporting willow and riparian forest alliances could increase compared to existing conditions due to increased dry-season quarry NPDES discharges. Extent of mulefat thicket alliance would not change except that a small amount might be replaced by tree-supporting riparian vegetation because of increased dry-season flows.	**Woody Riparian Vegetation.** Tree-supporting willow and riparian forest alliances could decrease compared to existing and with-CDRP conditions due to reduction in dry-season quarry NPDES discharges. Mulefat thicket could replace tree-supporting alliances.
Subreach C1	**Surface Water.** Live flow in wet months. Average annual flow volume lower than at Node 6˚ (40,104 acre-feet per year) and in Subreach B due to streamflow losses to groundwater. Lower total flow volume in dry-season July, August and September than at Node 6˚ and in Subreach B for the same reason. Dry-season flow and pooling attributable to quarry NPDES discharges.	**Surface Water.** Live flow in wet months. Average annual flow volume lower than at Node 6˚ (35,545 acre-feet per year) and in Subreach B due to streamflow losses to groundwater. Lower total flow volume in dry-season July, August and September than at Node 6˚ and in Subreach B for the same reason. Greater dry-season flows compared to existing conditions due to increased quarry NPDES discharges.	**Surface Water.** Live flow in wet months. Average annual flow volume lower than at Node 6˚ (37,600acre-feet per year) and in Subreach B due to streamflow losses to groundwater. Lower total flow volume in July, August and September than at Node 6˚ and in Subreach B for the same reason. Lower dry-season flow volume compared to existing or with-CDRP conditions because of reduced dry-season quarry NPDES discharges.
	Subsurface Water. Subsurface water conditions in the downstream portion of this subreach are represented by measurements in MW8. Groundwater levels at MW8 have varied seasonally within a narrow range from at or above the projected creek thalweg elevation of 224 feet in the winter and spring to 220 feet in the fall. In the absence of a monitoring well in the upstream portion of this reach, using the aquifer profile, it can be inferred that the subsurface water in the upstream portion of this subreach would fluctuate similar to Subreach B and the downstream portion similar to Subreach C2. Streambed gravels are thin and the aquifer has less storage capacity than in upstream reaches.	**Subsurface Water**. Subsurface water levels at MW8 will vary seasonally from at or above the thalweg elevation of 224 feet in the winter and spring to 220 feet in the fall. Subsurface water levels in average years could be comparable to subsurface water levels in wetter years under existing conditions. Fluctuations will occur within this range and will resemble existing conditions as a function of hydrology and mining activities.	**Subsurface Water**. Subsurface water levels at MW8 would vary seasonally from at or above the thalweg elevation of 224 feet in the winter and spring to 220 feet in the fall. Fluctuations will occur within this range and will resemble existing conditions as a function of hydrology, mining activities, and variations in ACRP operations.
	Pools. Live stream through pools in wet months. Pools probably persist through dry months. Water-bearing streambed gravels are thin and the pools may extend to their base.	**Pools.** Live stream through pools in wet months. Pools persist in dry months. Pools could be larger than under existing conditions due to greater quarry discharges and greater subsurface flow. Live flow may persist longer through pools in dry months.	**Pools**. Live stream through pools in wet months. Pools persist in dry months. Pools would be smaller and possibly dry out in the dry season compared to with-CDRP conditions and somewhat smaller in the dry season compared to existing conditions due to ACRP recapture and smaller quarry discharges ACRP recapture and

TABLE 5.14-1 (REVISED) (Continued)
SUMMARY OF HYDROLOGICAL AND RIPARIAN CONDITIONS ALONG ALAMEDA CREEK SUBREACHES A, B, AND C UNDER EXISTING, WITH-CDRP, AND WITH-PROJECT CONDITIONS
(See Figure 5.14-1a and 1b for Location of Subreaches)

Location	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Subreach C1 (cont.)			projected smaller quarry discharges. In some years, about one in three of the hydrologic base period, ACRP would have limited operations leading to a wetter condition. The range from dry to wetter conditions as a function of ACRP operations would produce pooling that is consistent with variability seen under existing conditions.
	Instream Wetlands. Instream perennial wetlands occupy margins of permanent pools and other perennial reaches of the creek. Instream seasonal wetlands occupy the periphery of permanent pools, isolated seasonal pools within the floodplain, and other low areas subject to seasonal saturation or inundation from surface flows or groundwater seepage, generally drying in the dry season.	**Instream Wetlands.** The extent of instream perennial wetlands around the margins of permanent pools and other perennial reaches of the creek could increase compared to existing conditions. The extent of seasonal pools and the instream seasonal wetlands they support will not change substantially from existing conditions.	**Instream Wetlands.** The extent of instream perennial wetlands around the margins of permanent pools and other perennial reaches of the creek could increase from December to June compared to with-CDRP and existing conditions Instream seasonal wetlands may replace areas supporting instream perennial wetlands to some extent. During the dry season instream perennial wetlands around the margins of permanent pools may dry at a faster rate compared with with-CDRP and existing conditions due to decreases in quarry NPDES discharge under the with-project condition during late-summer months. Other than this small effect, the extent of seasonal pools and the instream seasonal wetlands they support would not change substantially from with-CDRP or existing conditions. No net loss of wetlands expected, although the proportion (seasonal vs. perennial) could vary slightly.
	Woody Riparian Vegetation. Tree-supporting willow and riparian forest alliances, and dense mulefat thickets found along the low-flow channel. Dense growth depends on consistent access to surface or shallow groundwater supplied by quarry NPDES discharges, especially during the dry summer months. Sparse mulefat thicket alliance found in the floodplain away from the low-flow channel.	**Woody Riparian Vegetation.** Tree-supporting willow and riparian forest alliances could increase compared to existing conditions due to increased dry-season quarry NPDES discharges. Extent of mulefat thicket would not change except that some might be replaced by dense woody riparian vegetation because of increased dry-season flows.	**Woody Riparian Vegetation.** Tree-supporting willow and riparian forest alliances could decrease compared to existing and with-CDRP conditions due to reduction in dry-season quarry NPDES discharges. Mulefat thicket alliance could replace tree-supporting alliances.
Subreach C2	**Surface Water.** Surface water conditions in this reach are represented by Node 7 in the ASDHM. Average annual flow volume at Node 7 = 38,277 acre-feet per year, about 5 percent lower than at Node 6˚. Average total flow volume over the 18-year study period of 16 acre-feet (min: 0 acre-feet, max: 275 acre-feet) in dry-season 3-month period of July, August and September, entirely attributable to quarry NPDES discharges.	**Surface Water.** Average ASDHM annual flow volume at Node 7 = acre-feet per year, about 8 percent lower than at Node 6˚. Average ASDHM total flow volume over the 18-year study period of 1,093 acre-feet (min: 650 acre-feet, max: 1,465acre-feet) in dry-season 3-month period of July, August and September, entirely attributable to quarry NPDES discharges.	**Surface Water.** Average ASDHM annual flow at Node 7 = 36,540acre-feet per year, about 3 percent lower than at Node 6˚. During the dry-season 3-month period of July, August and September, losses between Node 6˚ and 7 are always greater than NPDES discharges, thus no streamflow input at Node 6˚ reaches Node 7.

TABLE 5.14-1 (REVISED) (Continued)
SUMMARY OF HYDROLOGICAL AND RIPARIAN CONDITIONS ALONG ALAMEDA CREEK SUBREACHES A, B, AND C UNDER EXISTING, WITH-CDRP, AND WITH-PROJECT CONDITIONS
(See Figure 5.14-1a and 1b for Location of Subreaches)

Location	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Subreach C2 (cont.)	**Subsurface Water.** Subsurface water conditions in this reach are represented by measurements in MW10. Subsurface water levels at MW10 have varied seasonally within a narrow range from at or above the projected creek thalweg elevation of 215 feet in the winter and spring to 211 feet in the fall. Streambed gravels are thin and the aquifer has less storage capacity than in upstream reaches. Groundwater elevations higher than 215 feet may occasionally occur as a result of inundation from nearby Arroyo de la Laguna.	**Subsurface Water.** Subsurface water levels at MW10 will vary seasonally from 215 feet in the winter and spring to 211 feet in the fall. Subsurface water levels in average years could be comparable to ground water levels in wetter years under existing conditions. Fluctuations will occur within this range and will resemble existing conditions as a function of hydrology and mining activities.	**Subsurface Water.** Subsurface water levels at MW10 will vary seasonally from 215 feet in the winter and spring to 211 feet in the fall. Little change from existing conditions due to the limited aquifer thickness. Fluctuations will occur within this range and will resemble existing conditions as a function of hydrology, mining activities, and variations in ACRP operations.
	Pools. Live stream through pools in wet months. Pools may persist through dry months as permeable streambed gravels are thin.	**Pools.** Live stream through pools in wet months. Pools will persist through dry months. Extent of pools in average years will be similar to extent of pools in wetter years under existing conditions.	**Pools.** Live stream through pools in wet months. Pools may persist through dry months. Little change from existing conditions.
	Instream Wetlands. Instream perennial wetlands occupy margins of permanent pools and other perennial reaches of the creek. Instream seasonal wetlands occupy isolated seasonal pools within the floodplain and other low areas subject to seasonal saturation or inundation from surface flows or groundwater seepage, generally drying in the dry season.	**Instream Wetlands**. Slight increases in groundwater water levels may more consistently support instream perennial wetlands. The extent of seasonal pools and the instream wetlands they support will not change substantially from existing conditions.	**Instream Wetlands**. Little change from with-CDRP and existing conditions.
	Woody Riparian Vegetation. Tree-supporting willow and riparian forest alliances dominate most of this Subreach. Dense growth depends primarily on consistent access to shallow groundwater rather than from quarry NPDES discharges. Sparse mulefat thickets found in the floodplain in the upstream portion of subreach.	**Woody Riparian Vegetation.** Tree-supporting willow and riparian forest alliances expected to change little if at all because increased dry-season flows are likely to simply flow through the shallow stream channel gravels. Most of this subreach already contains tree-supporting alliances.	**Woody Riparian Vegetation.** Tree-supporting willow and riparian forest alliances expected to change little if at all compared to with-CDRP and existing. Increased dry-season flows with-CDRP are likely to simply flow through the shallow stream channel gravels. With-project dry-season flows are nearly the same as existing. Most of this subreach already contains tree-supporting alliances.

NOTES: See Appendix HYD1-R for details and further explanation of surface water conditions, and see Appendix HYD2-R for details and further explanation of subsurface and ground water conditions.
1 Future scenarios assume that water management changes made by ODS in 2012 will continue in the future.

SOURCE: ESA, LSCE, and Orion, 2019

annual discharge contained in the revised analysis (6,620 acre-feet and 6,739 acre-feet, respectively). However, differences in the inter- and intra-annual patterns of quarry NPDES discharge between the two documents result in the changes in flow patterns described above. The rationale and methodology for the revisions to quarry NDPES discharge estimates are described above under *ASDHM Post-Processing Refinements* and in detail within Appendix HYD1-R, Section 4.3.2, *Gains from Quarry NPDES Discharges to Alameda Creek*.

15.3.1.2 Impacts and Mitigation Measures, Terrestrial Biological Resources

(This section updates the analyses presented in Impact BI-5 and Impact BI-6.)

Operational Impacts on Special-status Wildlife Species

Impact BI-5: Project operations would not have a substantial adverse effect on special-status species. (Less than Significant)

Impact BI-5 (see EIR Section 5.14.4.4, pp. 5.14-92 to 5.14-97) addresses operational impacts on special-status wildlife species, including impacts on species in Pit F2 and along Alameda Creek in the subreaches downstream of the project site.

Under the revised project operations, water elevations in Pit F2 would be maintained between elevations 180 and 240 feet, compared to the wider range of fluctuation previously proposed for project operations described in the June 2017 EIR (i.e., normally 150 to 240 feet, but with the potential to be as low as 100 feet). However, this change in project operations would not affect the analysis or impact conclusions regarding vegetation or habitat conditions around the perimeter of Pit F2 as discussed in Impact BI-5. The revised operations would reduce the elevation range of vegetation to be more similar to existing conditions. As described in Impact BI-6, if water levels in Pit F2 are higher than the current elevation of vegetation, then the species composition of willow thickets and mixed scrub within Pit F2 could shift to flood-tolerant sandbar willow. This shift in vegetation type would not result in the loss of habitat for California red-legged frog (CRLF) or western pond turtle because it would provide similar quality non-breeding refugia habitat to the existing conditions, and the impacts on these wildlife species due to changes in water level elevations associated with the proposed project would be *less than significant*.

In addition, under the revised recapture operations pumping would generally be limited to July 1 to November 30, during which time, water collected in Pit F2 would be pumped to the SFPUC water system. As a result, there would be less water for the quarry operators to manage during this period and a different pattern of quarry NPDES discharges would be expected compared to what was described in the June 2017 EIR for the previously proposed operations. During these otherwise dry months, the quarry NPDES discharges are generally the only source of surface flow in Alameda Creek in the subreaches of Alameda Creek downstream from the discharge point. The anticipated change in quarry NPDES discharges (see Appendix HYD1-R, Section 6), would in turn affect streamflow, subsurface water, and the pools in Alameda Creek along these subreaches during this period, with associated effects on wildlife and riparian habitat along this stretch of the creek.

However, it is unlikely that the reduction in quarry NPDES discharges would make a substantial impact on pool habitat over the course of a water year. Since quarry NPDES discharge would be larger from December to June under the with-project condition, relative to the existing condition, there should be a corresponding increase in the size of the pool habitat at the end of June under the with-project condition. Pools may dry at a faster rate under the with-project, relative to the existing condition, but would still be supplemented with quarry NPDES discharges. Thus, the variation in pool size and persistence over the course of a hydrologic year, between the existing and with-project condition, should be minimal. The resultant impacts on special-status wildlife species associated with a reduction in quarry NPDES discharges during the dry season would remain essentially the same as described under Impact BI-5 in the June 2017 EIR.

Therefore, as described in the June 2017 EIR, any reduction in quarry NPDES discharge due to the project's pumping operations from Pit F2 would not adversely affect CRLF habitat downstream of the project site, and this impact would be less than significant. Similarly, the habitat quality for other special-status wildlife species, including Alameda whipsnake, foothill yellow-legged frog, and western pond turtle, would be not adversely affected by a reduction in quarry NPDES discharge during the project's pumping operations from Pit F2, and this impact would be *less than significant*.

Operational Impacts on Riparian Habitat

Impact BI-6: Project operations could have a substantial adverse effect on riparian habitat or other sensitive natural community, including wetland habitats. (Less than Significant with Mitigation)

Impact BI-6 (see EIR Section 5.14.4.4, pp. 5.14-97 to 5.14-103) addresses operational impacts on riparian habitat, including impacts on vegetation in Pit F2, woody riparian vegetation and habitats, and instream wetlands.

As described above, the reduction in the magnitude of water level elevation fluctuations in Pit F2 under the revised project operations would not affect the analysis or impact conclusions regarding vegetation conditions around the perimeter of Pit F2 as discussed in Impact BI-6 in the June 2017 EIR. The revised operations would cause the elevation range of vegetation to be more similar to existing conditions. As described in Impact BI-6, if water levels in Pit F2 are higher than the current elevation of vegetation, then the species composition of willow thickets and mixed scrub within Pit F2 could shift to flood-tolerant sandbar willow. However, the willow thickets and mixed scrub would remain in the same location and occupy about the same extent as at present because the valley-wide annual pattern of rise and fall of subsurface water elevations would remain about the same. Willow thickets within a quarry pit are not sensitive natural communities under CEQA because they are not associated with riparian habitat and are not considered jurisdictional by CDFW. Potential minor changes on woody vegetation within Pit F2 would therefore be *less than significant.*

As described above, the revised recapture operations would be expected to result in a greater reduction in quarry NPDES discharges during the dry season than was analyzed in the June 2017 EIR. This change could affect the analysis of impacts on woody riparian vegetation and habitats. In the June 2017 EIR, it was predicted that with the ACRP in operation streamflows in Alameda Creek downstream of the project site would decrease by about 30 percent during the dry season (July-September) compared to existing condition due to reduced quarry NPDES discharges. Under the revised ACRP operations, it is predicted that the decrease in dry-season streamflow would be by about 90 percent (see Appendix HYD1-R, Section 7 for details of this analysis).

However, as described in Impact BI-6, under the existing condition, the riparian vegetation along this reach of Alameda Creek currently exists in a hydrologically variable system. Tree-dominated riparian vegetation experiences episodic dieback or mortality events, including one episode that occurred during the modeled ASDHM baseline period. Impact BI-6 defines a substantial impact on the riparian habitat based on a no net loss threshold, which for this system is defined as a persistent reduction in the extent of tree-supporting vegetation alliances. The predicted increase in change in dry season surface flows in the subreaches of Alameda Creek downstream of the project site due to the indirect effects of the revised project operations on quarry NPDES discharges would likely result in a reduction in the extent of tree-supporting riparian vegetation to a greater magnitude than previously analyzed in the June 2017 EIR. However, even though the revised project operations could increase the severity of the potential impact on the riparian vegetation during the dry season, implementation of **Mitigation Measures M-BI-6a through M-BI-6c, Riparian Habitat Monitoring and Enhancement Mitigation,** the same as identified in the June 2017 EIR, would reduce this impact to less than significant. This mitigation measure would require baseline mapping, annual monitoring/reporting, and habitat enhancement. Regardless of the potential severity of the impact, the measure is designed such that its implementation would ensure that appropriate compensation would be conducted commensurate with the actual magnitude and nature of the impact as determined in the field. The robust mitigation measure was developed to accommodate a range of potential effects in light of the variability of the riparian system and the uncertainties associated with future quarry management practices. Therefore, the impact conclusion for Impact BI-6 remains unchanged from the June 2017 EIR and would be *less than significant with mitigation*.

The proposed operational changes would not alter the analysis or conclusions on the effects of seasonal instream wetlands. As described in Impact BI-6, impacts on seasonal wetlands would be influenced by the total quantity and annual pattern of flows in Alameda Creek. Under the revised project operations, the total annual flow volumes in Alameda Creek downstream of the project site (ASDHM Node 6) would be about the same as the volumes previously analyzed in the June 2017 EIR. The extent of instream wetlands around the margins of permanent pools and other perennial reaches of the creek could increase from December to June under the with-project condition, compared with the with-CDRP and existing conditions. This increased would be driven by increased quarry NPDES discharge during this period under the with-project condition, relative to the with-CDRP and existing conditions. During the dry season instream perennial wetlands around the margins of permanent pools may dry at a faster rate compared with with-CDRP and existing conditions due to decreases in quarry NPDES discharge under the with-project condition during late-summer months. However, the extent of isolated seasonal pools and the seasonal wetlands they support would not change substantially from with-CDRP or existing conditions. This impact would remain *less than significant*.

15.3.2 Hydrology and Water Quality

15.3.2.1 Environmental Setting

(This section updates relevant portions of Chapter 5, Section 5.16, Hydrology and Water Quality, —and specifically sections 5.16.1 and 5.16.2—of the June 2017 EIR to address the revised project description presented in Chapter 14 and revisions contained in Appendices HYD1-R and HYD2-R.)

Changes to Underlying Streamflow Data

Subsequent to the publishing of the June 2017 EIR, refinements were made to project operations and to the post-processing methodology of the ASDHM output. These refinements have caused changes in the reported daily, monthly, and annual streamflow values for the four scenarios included within this analysis. The assumptions and rationale governing these changes are summarized briefly below and are documented in detail in Appendices HYD1-R and HYD2-R.

After the planning department published the June 2017 EIR and the appeal response memoranda in August 2017, ESA found a minor calculation error in some of the streamflow estimates for Alameda Creek that were presented in the June 2017 EIR. The error occurred when ESA adjusted the original ASDHM output to include the quarry discharge at Node 6° and up to 7.5 cfs loss of surface water to the subsurface between Node 6° (just downstream of the San Antonio Creek confluence) and Node 7 (just upstream of the Arroyo de la Laguna confluence). The calculation error only affects the streamflow estimates made for Node 8 (just downstream of the Arroyo de la Laguna confluence) and Node 9 (at the USGS gage at Niles). The error more often underestimated rather than overestimated flows downstream; the nature of the error affected the four scenarios analyzed to variable degrees. This error was addressed in the following document: Davis, J., Leidy, G, and Hsiao, J., 2017. Memo to Chris Kern, San Francisco Planning Department regarding Alameda Creek Recapture Project (ACRP) EIR Modeling Corrections, November 30, 2017. However, subsequent to that memo, the post-processing data for all scenarios have been further revised and updated as described within Appendix HYD1-R, Section 4, *Analytical Methods*.

Refinements to project operations under the with-project condition reduce the proposed pumping period from nine to five months, thereby reducing recapture volumes from an 18-year average of 7,178 acre-feet per year to 6,045 acre-feet per year. This reduction in recapture volume resulted in an increase in predicted quarry NPDES discharges under the with-project scenario of approximately 1,200 acre-feet per year. The revised project operations are described in Chapter 14.3, *Revised Project Operations*.

Quarry NPDES discharge post-processing under the with-CDRP and with-project conditions was updated subsequent to the June 2017 EIR to facilitate a daily comparison of streamflow values downstream of the quarry discharge point. This refinement to post-processing methodology only occurred under the with-CDRP and with-project condition; quarry NDPES discharge under the existing and pre-2001 conditions remained unchanged from the June 2017 EIR. For a description of quarry NDPES discharge assumptions and calculation methodology see Appendix HYD1-R, Section 4.3.2, *Gains from Quarry NPDES Discharges to Alameda Creek*.

Lastly, modifications were made to the calculation methodology used to convert daily data to annual volumes. While the underlying post-processed daily streamflow data for the existing and pre-2001 conditions remains unchanged from the June 2017 EIR, the annual volumes shown for the existing and pre-2001 conditions are slightly different than contained within the June 2017 EIR. This calculation modification also applies to the with-CDRP and with-project conditions, however, as described above the underlying data for these two scenarios has been updated in additional ways as well in the revised analysis.

Section 5.16.2, *Environmental Setting*, describes two baseline conditions used in the impact analysis for hydrology and water quality: existing conditions and with-CDRP conditions. As described above and in Appendix HYD1-R, this recirculated EIR presents updated assumptions for characterizing streamflow under the with-CDRP scenario analyzed in the June 2017 EIR. Thus, as described below, certain portions of EIR Section 5.16.2, are replaced with the information presented below.

Table 5.16-1 (pp. 5.16-2 to 5.16-3), Attributes of Four Scenarios Analyzed, is replaced with **Table 5.16-1 (revised)**, which is the same as Table HYD-1 (revised) in Appendix HYD1-R.

Figure 5.16-3 (page 5.16-13), Flow Duration Curves for Node 4 (Alameda Creek below Welch Creek) for Existing and with-CDRP Conditions, is replaced with **Figure 5.16-3 (revised)**, which is the same as Figure HYD5-1 (revised) in Appendix HYD1-R (see Appendix HYD1-R). The associated text on page 5.16-12 is unchanged.

Figure 5.16-4 (page 5.16-15), Flow Duration Curves for Node 5 (Alameda Creek above San Antonio Creek) for Existing and with-CDRP Conditions, is replaced with **Figure 5.16-4 (revised)**, which is the same as Figure HYD5-2 (revised) in Appendix HYD1-R. The updated average annual flow volumes at this location are 35,002 acre-feet (instead of 34,999) and 27,640 acre-feet (instead of 27,637) for existing and with-CDRP conditions, respectively (see page 5.16-14).[98]

Figure 5.16-5 (page 5.16-16), Flow Duration Curves for Node 7 (Alameda Creek above Arroyo de la Laguna) for Existing and with-CDRP Conditions, is replaced with **Figure 5.16-5 (revised)**, which is the same as Figure HYD5-3 (revised) in Appendix HYD1-R. The updated flow duration curves indicate that changes to the with-CDRP conditions, for which flow exceeds 1 cfs for about 78 percent (instead of 65) of the days and flow exceeds 10 cfs about 26 percent (instead of 35) of the days. The updated average annual flow volumes at this location are 38,277 acre-feet (instead of 38,274) and 32,509 acre-feet (instead of 32,752) for existing and with-CDRP conditions, respectively (see page 5.16-14).

On page 5.16-14, the assumptions for the annual volume of water discharged by the quarries are updated for the with-CDRP conditions to be 6,739 acre-feet (instead of 6,620).

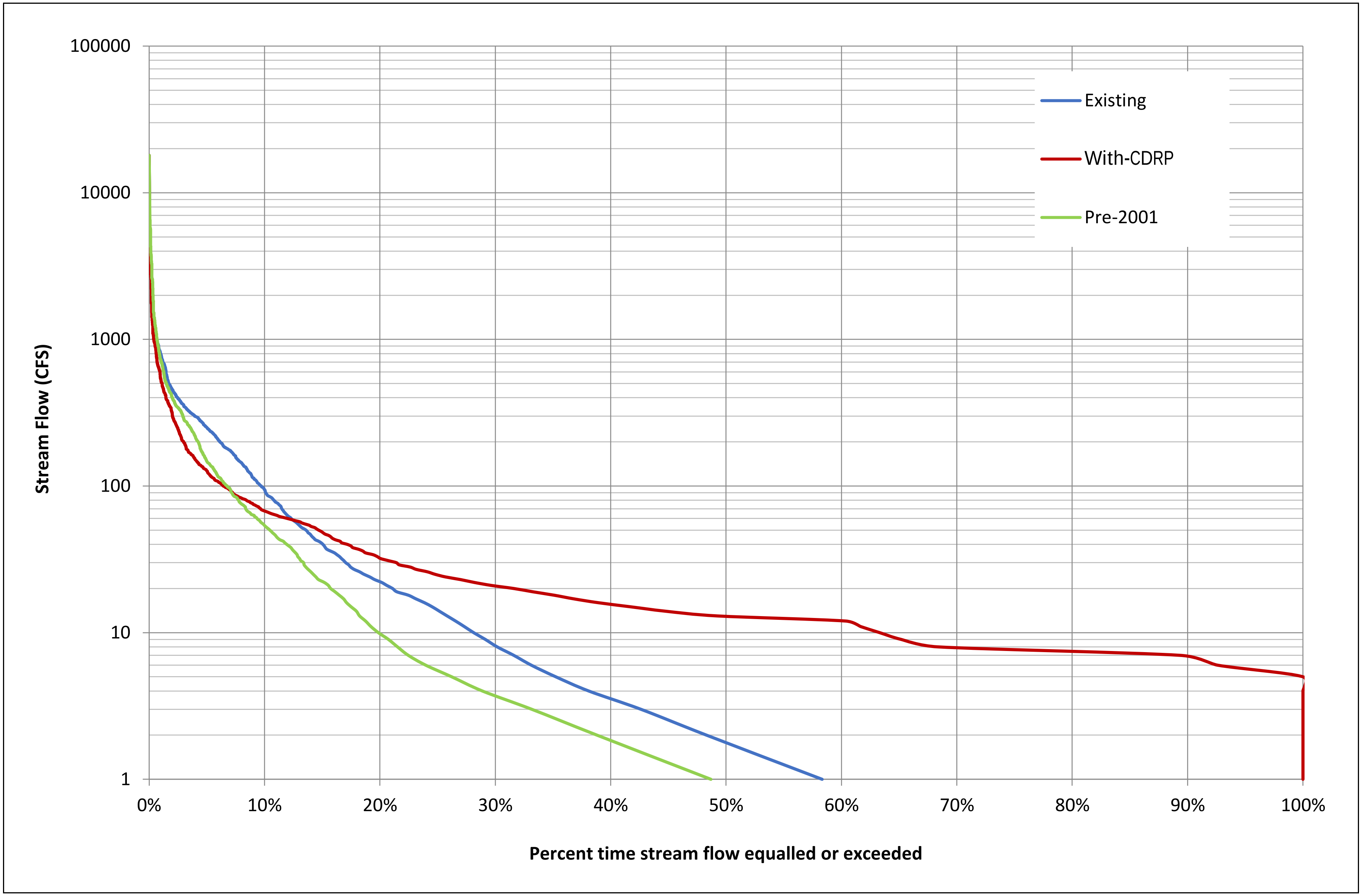
[98] The underlying post-processed daily streamflow data for the existing and pre-2001 conditions remains unchanged from the June 2017 EIR. However, modifications were made to the calculation methodology used to convert daily data to annual volumes. In summarizing the daily streamflow data as annual volumes, the June 2017 EIR methodology did not account for the additional days during leap years. As such, the annual volumes shown for the existing and pre-2001 conditions are slightly different than in the June 2017 EIR.

TABLE 5.16-1 (REVISED)
ATTRIBUTES OF FOUR SCENARIOS ANALYZED

Parameter	Pre-2001 Conditions	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Representative year	2000	2015	2019 to 2020 (following completion of the CDRP and the Calaveras Reservoir refill period)	
Hydrologic period used in analysis	WY 1996 to WY 2013			
Calaveras Reservoir and Dam	– Historical capacity of Calaveras Reservoir = 96,850 acre-feet – Maximum pool elevation = 756 feet	– New dam under construction downstream of existing dam – Storage in Calaveras Reservoir restricted to one-third capacity with usable storage at 13% or 12,400 acre-feet by DSOD – Maximum pool elevation = 705 feet – Minimum pool elevation = 690 feet	– New dam completed – Historical capacity of Calaveras Reservoir restored to nominal capacity = 96,850 acre-feet – Maximum pool elevation = 756 feet	
Instream flow releases/spills from Calaveras Reservoir below Calaveras Dam	None, other than spill from Calaveras Reservoir.	Frequent releases from low-flow valve or cone valve to manage water levels in the reservoir and from low flow valve for experimental purposes. Represented in ASDHM by observed flow at the USGS gage located downstream of Calaveras Reservoir	Implementation of instream flow schedule: – Dry year releases: May –Oct: 7 cfs; Nov - Dec: 5 cfs; Jan –April: 10 cfs, annual average. – Wet/normal year releases: May – Sept: 12 cfs, Oct: 7 cfs; Nov –Dec: 5 cfs, Jan – April: 12 cfs	
Alameda Creek Diversion Dam (ACDD)	– No fish ladder or bypass tunnel – Maximum diversion of Alameda Creek water to Calaveras Reservoir = 650 cfs		– Fish ladder and bypass structure operational – Minimum and Maximum diversion rates of Alameda Creek water to Calaveras Reservoir = 30 cfs to 370 cfs	
ACDD bypass flows	– When the gates on the diversion tunnel are open, only stream discharge greater than 650 cfs passes over the ACDD (Note: Operations at the ACDD between WY 2002 and WY 2010 were influenced by limitations on storage at Calaveras Reservoir. As a result, the gates on the diversion tunnel were closed more frequently than they had been previously). – Under Existing Condition, the ACDD tunnel has been closed since 5/23/2012. Prior to 2012 during the DSOD-restricted period, SFPUC operated ACDD very infrequently. For example, they were not operated at all between 10/24/2004 to 3/7/2007. When the gates on the diversion tunnel are closed, all flow in Alameda Creek passes over the ACDD		– Gate on diversion tunnel closed from April 1 to Nov 30, and all flow in Alameda Creek passes over ACDD. – Diversion of up to 370 cfs from December 1 to March 31. – Minimum bypass flow of 30 cfs whenever there is 30 cfs or more; if less than 30 cfs is present, entire flow passes over the ACDD	

TABLE 5.16-1 (REVISED) (Continued)
ATTRIBUTES OF FOUR SCENARIOS ANALYZED

Parameter	Pre-2001 Conditions	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Quarry pit operations Hanson Aggregates: – SMP-24 (Pits F2, F3-East, F3-West) – SMP-32 – SMP-33 Oliver de Silvia – SMP-30 (Pits F4, F5, F6)	– SMP-24 in active use for aggregate extraction until 2006 – SMP-32 not yet in operation – SMP-30 Pit F6 in active use – Excess water discharged under NPDES permit to Alameda Creek at an average annual rate of 2,796 acre-feet per year	– SMP-24 pits used only to store and manage water to support active mining on SMP-32 and aggregate processing, with excess water discharged under NPDES permit to Alameda Creek at an average annual rate of 3,436 acre-feet per year in 2015, this volume of regulated discharge was 1,206 acre-feet. – SMP-30 Pit F6 in active use for aggregate extraction, with infrequent discharges from SMP-30 to Alameda Creek	It is assumed more water infiltrates to the quarries compared to existing conditions, and consequently, more water is available to the quarry operators for water management and subsequent NPDES discharges. The modeled average amount of water available for quarry NPDES discharges is an annual average of 6,739 acre-feet per year.	It is assumed more water infiltrates to the quarries compared to existing conditions, and more water is available for recapture operations and/or to the quarry operators for water managements and possible NPDES discharges. The average amount of water available to the quarry operators for NPDES discharge decreases compared to the with-CDRP conditions to an annual average of 3,879 acre-feet per year.
Loss of surface flow in Alameda Creek to subsurface between Welch Creek and Arroyo de la Laguna confluences	0 to 17 cfs (maximum) between Welch Creek and San Antonio Creek confluences, and 0 to 7.5 cfs (maximum) between San Antonio Creek and Arroyo de la Laguna confluences, depending on streamflow			
Alameda Creek Recapture Project	Not in operation			Pumping of water from Pit F2 by SFPUC and transfer to SVWTP or San Antonio Reservoir for municipal water supply



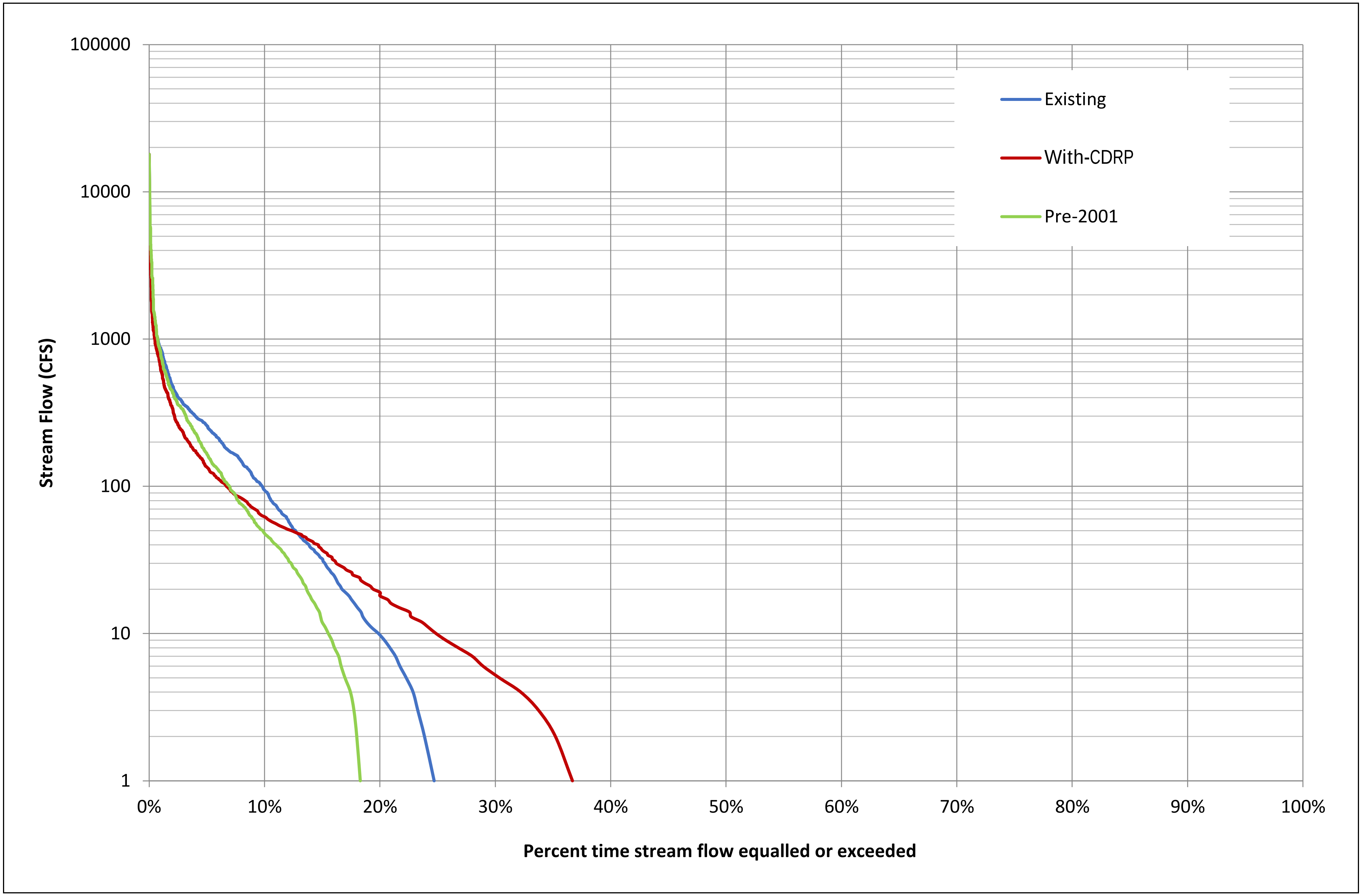
SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

SFPUC Alameda Creek Recapture Project

Figure 5.16-3 (Revised)

Flow Duration Curves for Node 4 (Alameda Creek below Welch Creek) For Existing, With-CDRP, and Pre-2001 Conditions



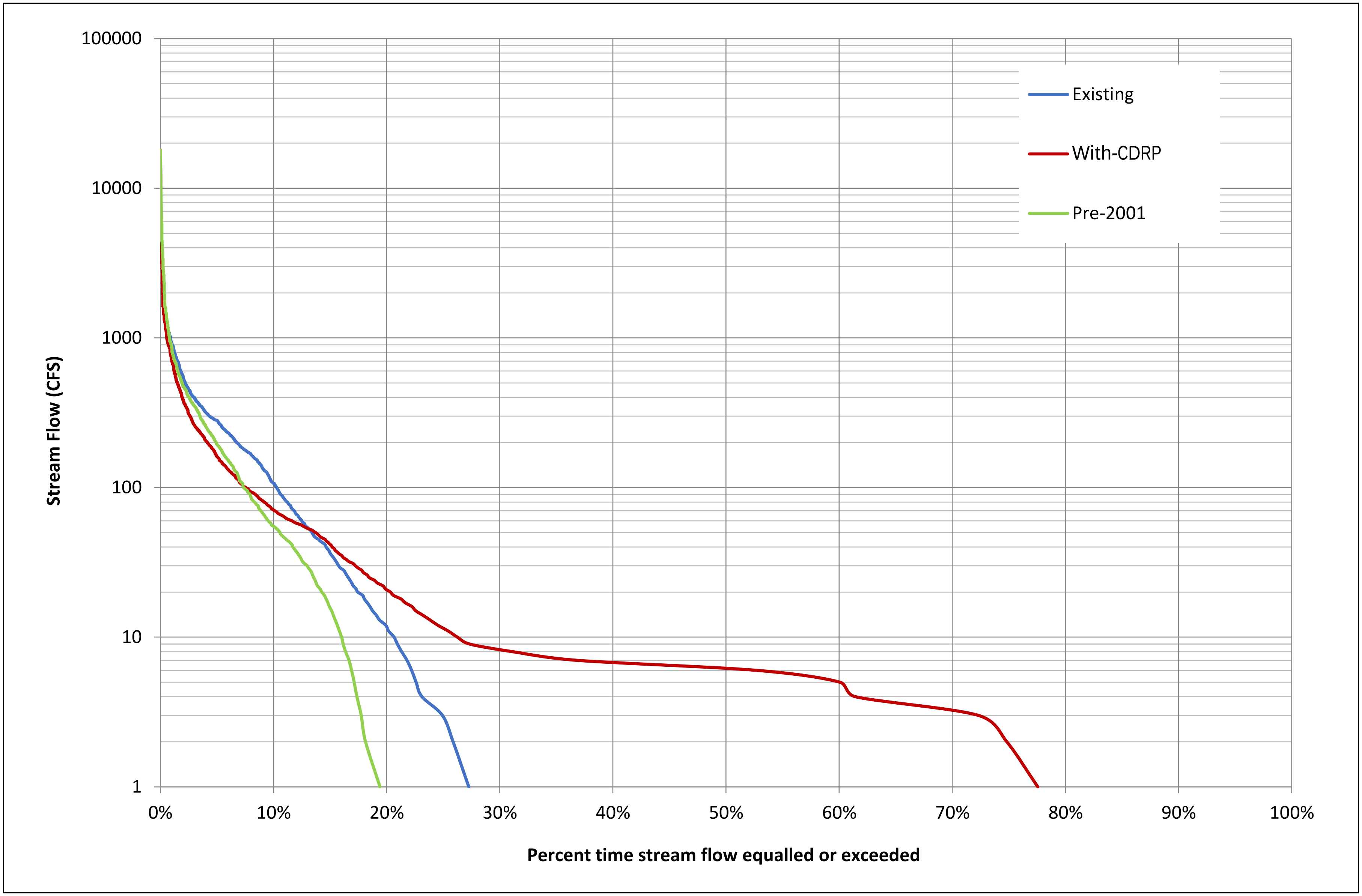
SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

SFPUC Alameda Creek Recapture Project

Figure 5.16-4 (Revised)

Flow Duration Curves for Node 5 (Alameda Creek above San Antonio Creek) For Existing, With-CDRP, and Pre-2001 Conditions



SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

SFPUC Alameda Creek Recapture Project

Figure 5.16-5 (Revised)

Flow Duration Curves for Node 7 (Alameda Creek above Arroyo de la Laguna) For Existing, With-CDRP, and Pre-2001 Conditions

Table 5.16-3 (page 5.16-17), Estimated Average Monthly Flow at Three Locations on Alameda Creek for Existing and With-CDRP Conditions for WY 1996 to WY 2013, is replaced with the following table below. The associated text on page 5.16-17 is updated to indicate that just upstream of the San Antonio Creek confluence, average monthly flow under with-CDRP conditions is greater than, or the same as, under existing conditions in four (instead of five) months. Also, the text is updated to indicated that there is *very little or* no flow in Alameda Creek under either existing conditions or with-CDRP conditions in July, August, September, and October.

**TABLE 5.16-3 (REVISED)
ESTIMATED AVERAGE MONTHLY FLOW AT THREE LOCATIONS ON ALAMEDA CREEK FOR EXISTING AND WITH-CDRP CONDITIONS FOR WY 1996 TO WY 2013 (CFS)**

Node	Scenario	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
4	Existing Conditions	1.4	1.8	40.3	125.4	182.0	120.5	86.8	33.5	11.3	1.2	0.4	0.3
	With-CDRP Conditions	7.3	8.4	33.0	99.9	184.4	87.1	71.9	21.8	13.7	11.0	10.2	10.0
	Difference in flow between with CDRP and existing conditions (With- CDRP Conditions minus Existing Conditions)	5.9	6.6	-7.2	-25.6	2.4	-33.3	-14.9	-11.7	2.4	9.8	9.8	9.7
5	Existing Conditions	0.5	1.1	40.5	127.9	186.8	117.9	80.6	26.1	7.1	0	0	0
	With-CDRP Conditions	0	2.6	28.6	97.5	186.3	81.6	60.8	9.1	1.4	0.1	0	0
	Difference in flow between with CDRP and existing conditions (With-CDRP Conditions minus Existing Conditions	-0.5	1.5	-11.9	-30.4	-0.5	-36.3	- 19.9	-16.9	-5.7	0.1	0	0
7	Existing Conditions	0.6	1.2	43.6	138.4	202.1	130.8	92.2	27.0	7.3	0.1	0	0.1
	With-CDRP Conditions	4.5	7.3	32.9	109.1	203.1	93.5	67.7	10.8	2.3	6.1	6.0	5.9
	Difference in flow between with CDRP and existing conditions (With-CDRP Conditions minus Existing Conditions	3.9	6.1	-10.6	-29.3	1.0	-37.3	-24.5	-16.2	-5.0	6.0	5.9	5.8

SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted by ESA/Orion to include NPDES quarry discharges at Node 6* and losses between Node 6* and 7.

On page 5.16-18, the estimated average annual flow at Niles is updated to be 102,373 acre-feet per year (instead of 101,846) under with-CDRP conditions, and 106,404 acre-feet per year (instead of 103,632) under with project conditions. The average annual flow under with-project conditions is 3.8 percent (instead of 1.8) greater than under with-CDRP conditions.

Under the Section 5.16.2.4, subsection *Quarry Pits*, the text on page 5.16-24 regarding Alameda Creek under with-CDRP conditions is updated as follows. The loss of Alameda Creek surface water to the groundwater between the Welch Creek and San Antonio Creek confluences under existing conditions (Water Year 1996-Water Year 2013) averages 4,530 acre-feet per year (instead of 4,526); the corresponding value for the with-CDRP conditions will be 9,040 acre-feet per year (instead of 9,033), or 4,510 acre-feet per year (instead of 4,507) greater. In addition, the estimated average annual quarry NPDES discharges under with-CDRP conditions will be 6,739 acre-feet (instead of 6,620). (see Appendix HYD1-R for information on how future quarry NPDES discharge volumes were estimated, including assumptions used and limitations of those assumptions).

Updates to Subsurface Water Setting

The revised Appendix HYD2-R provides a substantially more detailed and quantitative characterization of the groundwater and surface water hydrology in the Sunol Valley than was included in Appendix HYD2 in the June 2017 EIR (see Appendix HYD2-R). The changes below are provided to be consistent with the clarifications in Appendix HYD2-R.

In Section 5.16.2.5, *Subsurface Water*, the first sentence in the first paragraph on page 5.16-28 is replaced with the following text to clarify the characteristics of the Livermore Gravels, consistent with the clarifications in Appendix HYD2-R:

> While the lower elevations of Sunol Valley are overlain by a thin layer of alluvial deposits with apparent high transmitting capacity, practically all known supply wells in the project vicinity are completed in uplands areas extending below the shallow alluvium (see compiled data for supply wells from Zone 7 in **Table 5.16-5**) and tapping the Livermore Gravels formation. The Livermore Gravels is an older, water-bearing sedimentary deposit.

In Section 5.16.2.5, *Subsurface Water*, the first paragraph on page 5.16-29 is replaced with the following text to clarify the characteristics of the Livermore Gravels, consistent with the clarifications in Appendix HYD2-R:

> The numerous supply wells used for small-scale domestic and irrigation purposes are low yielding due to the nature of the Livermore Gravels formation in which they are completed. This formation, which is exposed in the uplands portions of the Sunol Valley Groundwater Basin, and which may be up to 500 feet in thickness, consists of weakly compacted, thick, cobble to pebble gravel beds interlayered with sand and mudstone beds. The gravel and sand beds have variable quantities of clay matrix that reduce their porosity and permeability resulting in low yield to water wells completed in the unit. Groundwater recharge is apparently limited as the low permeability of the formation impedes deep percolation.

In Section 5.16.2.5, *Subsurface Water*, the third paragraph on page 5.16-29 is replaced with the following text (although the footnote remains the same) to clarify the characteristics of the Livermore Gravels, consistent with the clarifications in Appendix HYD2-R:

> Consistent with its Very Low CASGEM ranking, there appears to be little potential for increased groundwater development and use in the Sunol Valley Groundwater Basin. This is due to the characteristics of the Livermore Gravels formation that is the primary source for local supply. The state has not previously monitored local groundwater conditions nor is it currently monitoring wells in the basin (DWR Water Data Library). By contrast and as discussed in the following sections, the ACRP project taps water from Pit F2 which is connected to subsurface flow within shallower alluvial deposits at lower elevations of the valley floor along the Alameda Creek alignment. While having favorable porosity and permeability, these materials are too thin to provide a reliable source of supply to wells in the area. Both SFPUC and local aggregate companies have conducted detailed geotechnical and water resources investigations focusing on the shallow alluvial materials and underlying aggregate resources in the project vicinity. SFPUC has continuously monitored groundwater conditions in the shallow alluvial materials for over 10 years while more limited monitoring has been performed by local quarry operators.

In Section 5.16.2.5, *Subsurface Water*, the first full paragraph on page 5.16-30 is replaced with the following text (although the footnote remains the same) to clarify the characteristics of the Livermore Gravels, consistent with the clarifications in Appendix HYD2-R:

> The alluvium has been mapped in the Sunol Valley based on topographic expression, relative elevations, soil development, and interpretation of relative age relationships. The most common mapping subdivisions of younger geologic units include Stream Channel Gravels (Qg); Younger Alluvium (Qa); Older Alluvium (Qoa); Terrace Deposits (Qt); and Livermore Gravels (QTl).

In Section 5.16.2.5, *Subsurface Water*, the first full paragraph on page 5.16-32 is replaced with the following text to clarify the characteristics of the Livermore Gravels, consistent with the clarifications in Appendix HYD2-R:

> **Livermore Gravels Subunit (QTl)**
>
> Underlying the alluvium is the older Livermore Gravels (QTl) formation. This water-bearing subunit is dominated by weakly compacted, thick, cobble to pebble gravel beds interlayered with sand and mudstone beds. The gravel and sand beds have variable quantities of clay matrix that reduce their porosity and permeability. The Livermore Gravels are exposed to the east of the Calaveras Fault north of San Antonio Creek in upland areas and extensively around the Livermore Valley. West of the Calaveras Fault, outcrop exposures are more limited. On the Sunol Valley floor, the Livermore Gravels subunit underlies the Stream Channel Gravels and Younger Alluvium and may extend to depths greater than 500 feet. The Livermore gravels formation is the primary target of aggregate mining in the valley.

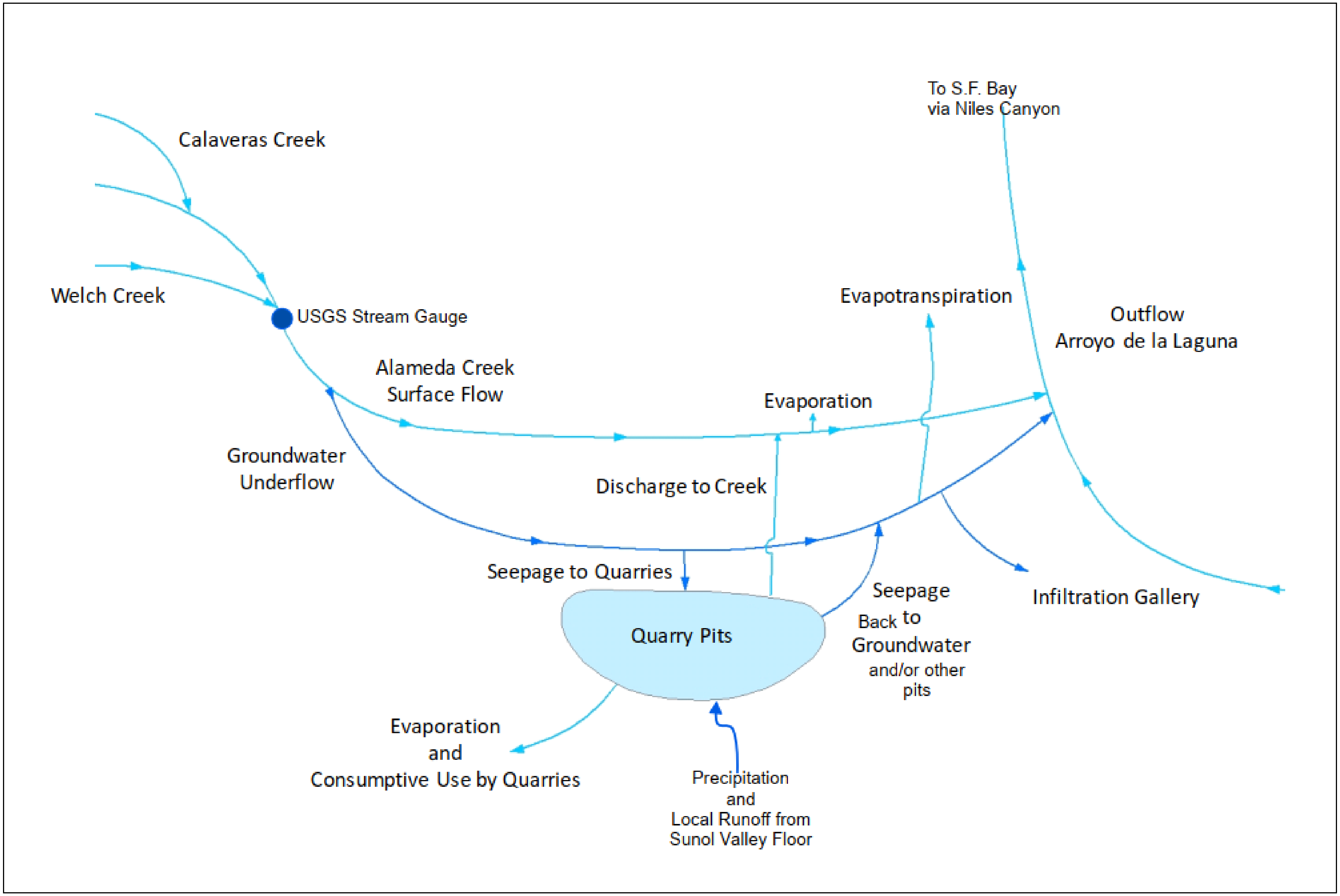
In Section 5.16.2.5, *Subsurface Water*, the last paragraph on page 5.16-34, the term "older bedrock formations" is replaced with " Livermore Gravels," consistent with the clarifications in Appendix HYD2-R.

In Section 5.16.2.5, *Subsurface Water*, Figure 5.16-19 is replaced with **Figure 5.16-19 (revised)** to clarify the flow pathways of groundwater-surface water in the project area, consistent with the clarifications in Appendix HYD2-R. This is the same as Figure 8-1 in Appendix HYD2-R.

Updates to Approach to Analysis

In Section 5.16.4.2, *Approach to Analysis*, the first full paragraph on page 5.16-64, is replaced with the following text to be consistent with the augmented analysis in Appendix HYD2-R:

> ***Groundwater.*** Characterization of groundwater conditions is based on an extensive hydrological dataset from stream gages, quarry pit instrumentation, and a monitoring well network in the project area. Surface water and groundwater interactions are described and quantified using empirical, analytical, and numerical tools. Impacts arising from surface water and groundwater interactions associated with project operations were analyzed with respect to the potential for the project to substantially deplete groundwater supplies or to interfere substantially with groundwater recharge. This analysis was done by determining the effect that recapture activities from project operations would have on groundwater wells in the Sunol Valley Groundwater Basin.



SOURCE: Luhdorff & Scalmanini (2019)

SFPUC Alameda Creek Recapture Project
Figure 5.16-19 (Revised)
Groundwater-Surface Water Pathways in the Project Area

15.3.2.2 Impacts and Mitigation Measures

Operational Impacts on Subsurface Water and Groundwater Recharge

(This section provides revisions and clarifications to Impact HY-2 and related portions of Impact C-HY to address the revised project description and updated analysis in Appendix HYD2-R.)

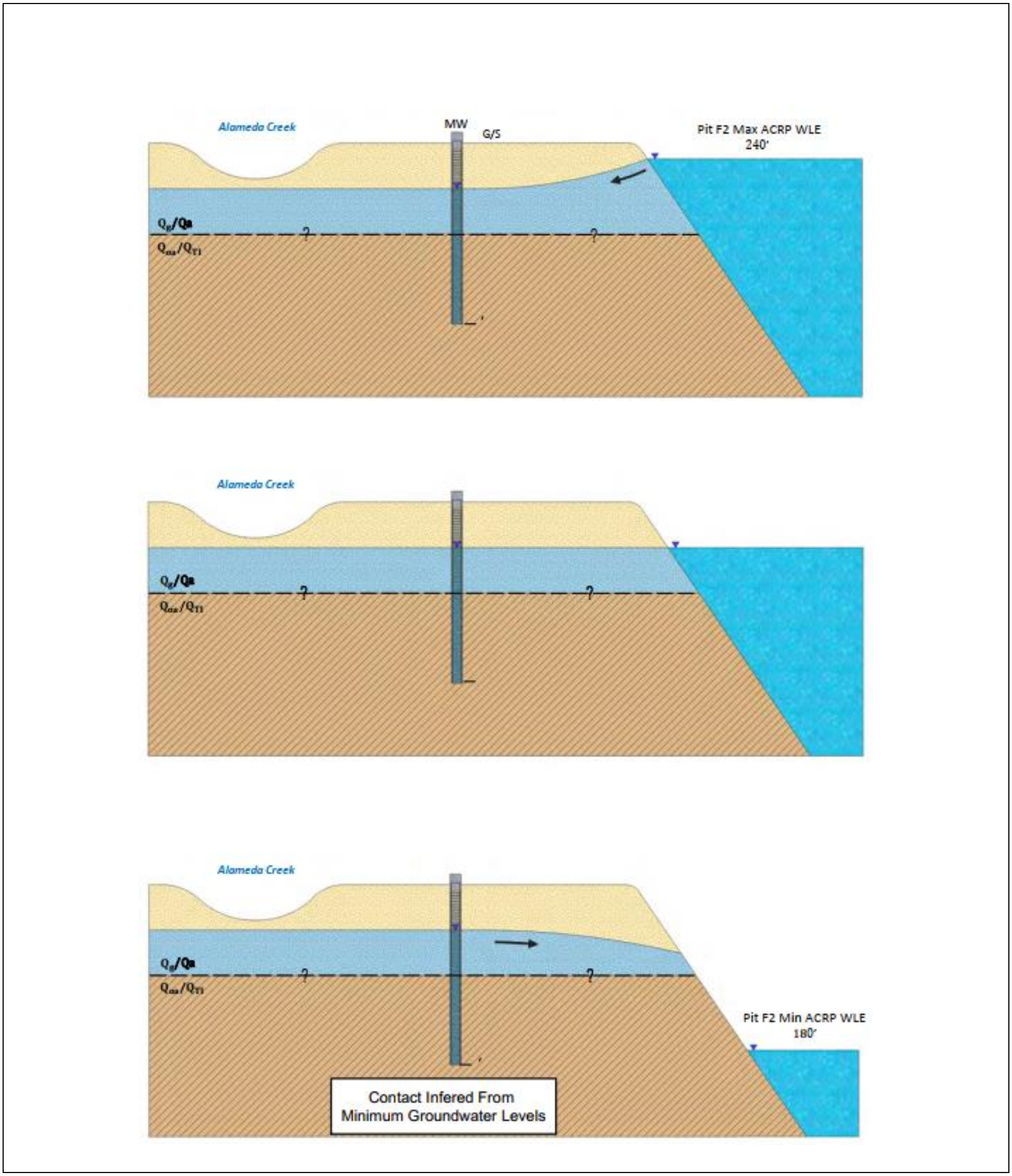
Impact HY-2: Operation of the ACRP would not substantially alter the movement of subsurface water or substantially affect groundwater recharge in the Sunol Valley such that it would affect the production rate of pre-existing nearby wells. (Less than Significant)

Impact C-HY: The project, in combination with past, present, and probable future projects, would not substantially affect hydrology and water quality. (Less than Significant)

Impact HY-2 (pp. 5.16-69 to 5.16-71) addresses the effects of proposed project operations on the movement of subsurface water or groundwater recharge in the Sunol Valley such that it would affect the production rate of pre-existing nearby wells; Impact C-HY (pp. 5.16-77 to 5.16-79) addresses the cumulative impacts of the project as it could affect subsurface water or groundwater recharge. In the first paragraph under Impact HY-2 on page 5.16-69, the description of the project operations is updated to indicate that with the revised project operations (see Chapter 14, Revisions to Project Description), the water elevation in Pit F2 would decline to a minimum elevation of 180 feet under all circumstances, rather than what was described in the June 2017 EIR (150 feet under typical operations and 100 feet in extreme droughts). **Figure 5.16-22 (revised)** reflects this change in minimum operating elevation in Pit F2.

This analysis indicates that the project operation relies on movement of water solely through the shallow aquifer system that is isolated from deeper low-permeability formations that serve as sources of supply elsewhere in the Sunol Valley Groundwater Basin. The narrow and shallow extent of this aquifer, its limited storage capability, and its drainage pattern to Arroyo de la Laguna make the shallow groundwater system an infeasible source of supply for any beneficial use. Local residential and other small-scale supply wells in the Sunol Valley Groundwater Basin are completed in deep low-yielding formations located in upland areas that are recharged from other sources, and therefore the project has no potential to affect movement and recharge in any area. This clarification also applies to Impact C-HY.

This revision to the project description and clarification of the existing supply wells in the Sunol Valley Groundwater Basin do not change the impact conclusions for either Impact HY-2 or Impact C-HY. At both a project-specific and cumulative basis, the operation of the ACRP would have a *less-than-significant* impact on subsurface water flow in the Sunol Valley and would not substantially affect groundwater recharge in the Sunol Valley.



SOURCE: Luhdorff and Scalmanini (2019)

SFPUC Alameda Creek Recapture Project

Figure 5.16-22 (Revised)

Conceptual Cross Section showing ACRP Operating Stages

Operational Impacts on Downstream Water Users

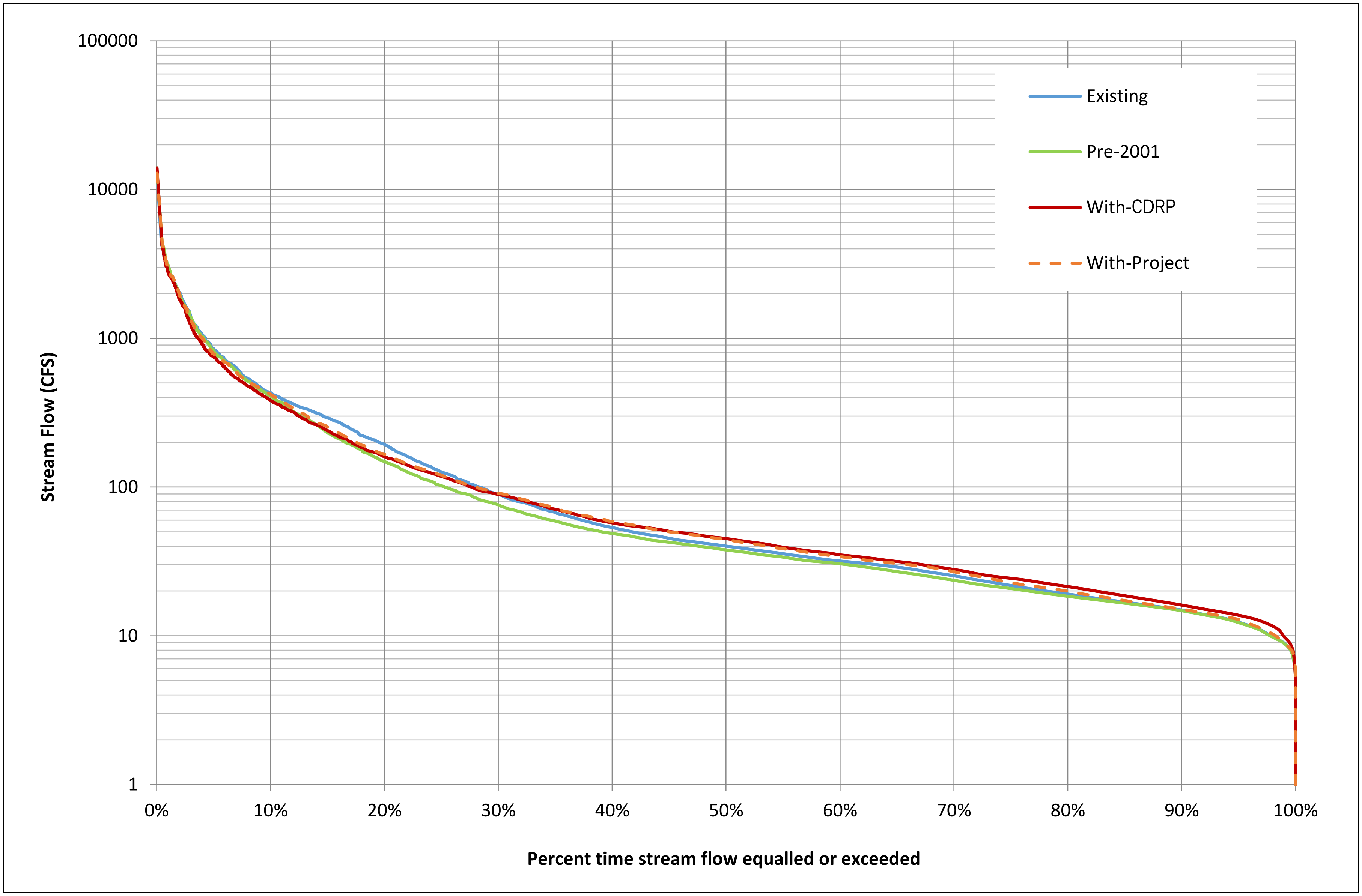
(This section updates Impact HY-5 of the June 2017 EIR to address the revised project description and updated hydrological analysis. Impact HY-5 is comprised of the impact analysis in the November 2016 Draft EIR (pp. 5.16-73 to 5.16-77) as supplemented by the analysis in Response HY-4 in the Responses to Comments document dated June 7, 2017 (pp. 11.5-13 to 11.5-21)).

Impact HY-5: Operation of the ACRP would not cause downstream water users, as a result of project-induced flow changes, to alter their operations in a way that would result in significant adverse environmental impacts. (Less than Significant)

Impact HY-5 analyzes the effects of proposed project operation on other water users with respect to the potential for the project to cause downstream water users, as a result of proposed project-induced flow changes, to alter their operations in a way that would result in significant environmental impacts. Alameda County Water District (ACWD) is the only downstream user of Alameda Creek water that could potentially be affected by the proposed project. ACWD diverts water from Alameda Creek near the downstream end of Niles Canyon about 4 miles downstream of the proposed ACRP using inflatable dams. ACWD is permitted to divert water from Alameda Creek downstream of the Niles gage between October 1 to May 31, a period of 243 days each year. ACWD's current operations reflect the historical and existing conditions, namely pre-2001 and existing conditions.

As was done in the June 2017 EIR, this analysis assesses whether the project would cause ACWD to alter its operations or the way it uses its sources of water in a manner that would result in significant adverse environmental effects by comparing information on four scenarios—pre-2001 conditions, existing conditions, with-CDRP conditions, and with-project conditions. ACWD's current operations reflect the historical and existing conditions, namely pre-2001 and existing conditions. Project conditions similar to those conditions would not be expected to cause ACWD to need to change its operations, or the way it uses sources of water in a manner that would result in significant adverse environmental effects.

An updated comparison of flow duration curves for the four scenarios at Alameda Creek at Niles for the period October 1 to May 31, the permitted period during which ACWD can divert flows from Alameda Creek, is shown in **Figure 5.16-23 (revised)** (same as Figure HYD7-1 (revised) in Appendix HYD1-R); this figure replaces Figure 5.16-23 in Impact HY-5. These curves are based on daily flow estimates derived from the ASDHM model output, with CEQA post-processing as described in Appendix HYD1-R. The following replaces the text associated with this figure (page 5.16-74): Flow at Niles, under pre-2001 and existing conditions, is estimated to exceed 25 cfs on about 68 to 70 (instead of 63 to 65) percent of the days. Under with-CDRP and with-project conditions, flow at Niles is estimated to exceed 25 cfs on about 74 and 72 (instead of 75 and 65) percent of the days, respectively. Flow would exceed 700 cfs on about 6 percent of the days and 5 percent under the with-CDRP conditions, and would exceed 1,200 cfs on about 3 percent of the days under all four conditions. The revised data indicate that for all scenarios except the with-CDRP conditions, the percentage of time that flows exceed 25 cfs would be greater than indicated in the June 2017 EIR.



SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

SFPUC Alameda Creek Recapture Project

Figure 5.16-23 (Revised)
Flow Duration Curves for Node 9 (Alameda Creek at Niles)
For ACWD Diversion Period (October 1 – May 31)
For Existing, Pre-2001, With-CDRP, and With-Project Conditions

Average flow volumes in Alameda Creek at Niles for the period when ACWD can divert water from Alameda Creek, October 1 through May 31, for pre-2001, existing, and with-CDRP and with-project conditions were updated as follows: pre-2001 condition is 97,439 acre-feet (instead of 96,264); existing condition is 100,837 acre-feet (instead of 100,005); with-CDRP conditions is 94,290 acre-feet (instead of 94,575); and with-project condition is 99,300 acre-feet (instead of 97,797). The revised data indicate that for the pre-2001, existing, and with-project conditions, average flow volumes would be higher than previously indicated in the June 2017 EIR; for the with-CDRP conditions, the average flow volume would be slightly lower than previously indicated. The increase in flow volume under the with-project condition is due to revised project operations which add an average of approximately 1,200 acre-feet of water to the creek as quarry NPDES discharge.

Average monthly flow volumes in Alameda Creek at Niles are updated, and the update is explained, in Appendix HYD1-R, Section 8. Similar to the results presented in the June 2017 EIR, these revised flow volumes indicate that operation of the proposed ACRP is not expected to have an adverse effect on the overall amount of water available to ACWD from Alameda Creek at Niles, with the revised flow volumes under with-project conditions indicating slightly greater volumes than previously shown. It is expected that an average of about 5,000 acre-feet more water (instead of 3,000 acre-feet) would arrive at ACWD's diversion point between October and May under with-project conditions than it will under with-CDRP conditions. About an average of 1,500 acre-feet less water (instead of 2,200 acre-feet) would arrive at the ACWD's diversion point between October and May under with-project conditions than under existing conditions.

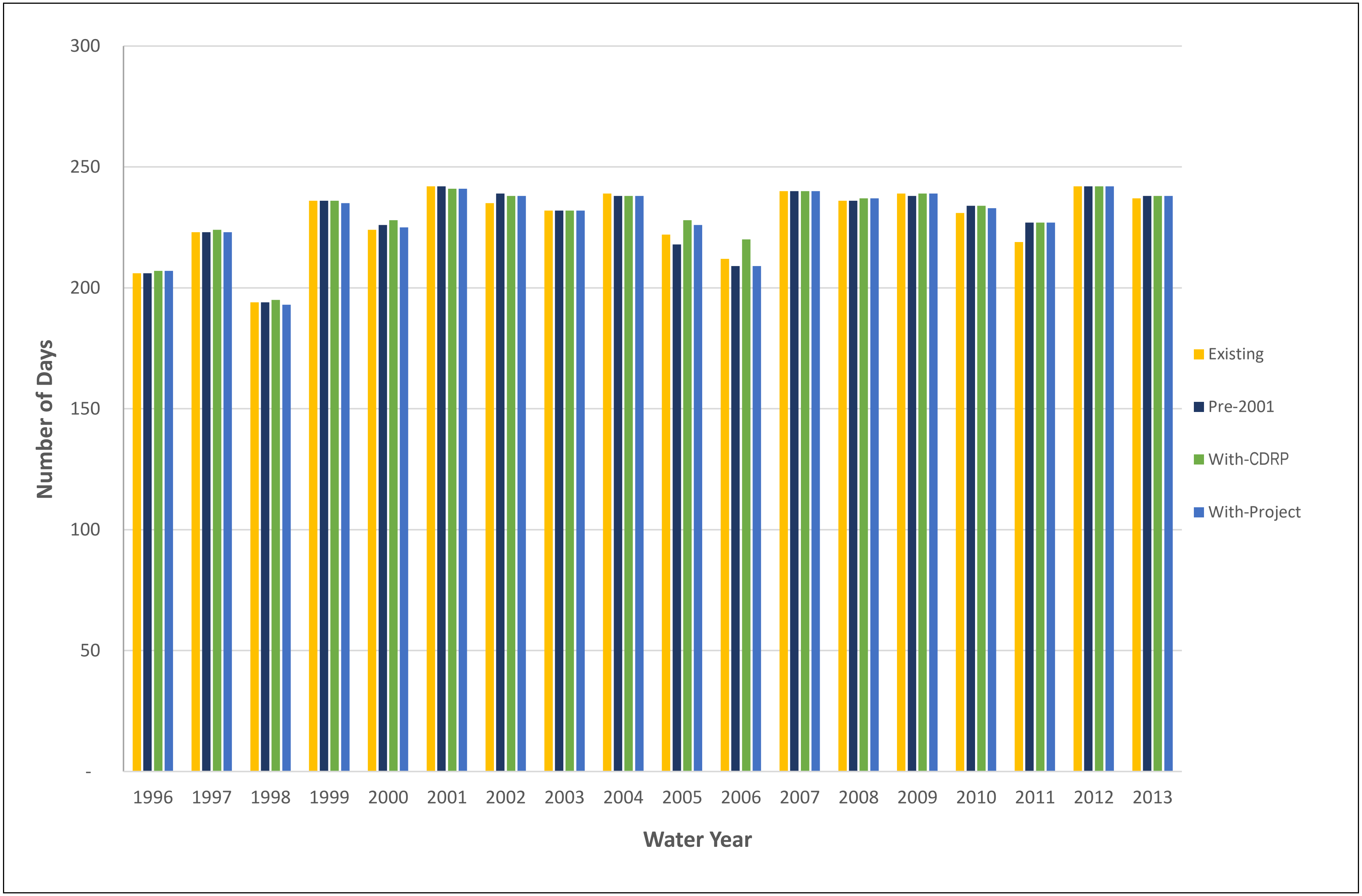
In addition to characterizing future conditions on an average annual and average monthly basis, further information on the four scenarios was developed to ascertain the specific effects of the project on ACWD operations on a daily basis. The analysis provides an updated characterization of potential effects on ACWD operations during high and low flow periods critical to its operation and updates the information that was presented in Response HY-4 to the Responses to Comments document for the June 2017 EIR. **Table 15.3-1** shows the analysis determined the number of days in the 18-year period of record when the ACRP would affect the ability of ACWD to deploy its inflatable dams on Alameda Creek for pre-2001 conditions, existing conditions, with-CDRP conditions, and with-project conditions. The same data are visually depicted in **Figure 15.3-1**. The analysis used the same assumptions as the June 2017 EIR, namely that ACWD takes its inflatable dams down when average daily flows exceed 700 cfs. The results show that the ACWD is or would be able to deploy its inflatable dams on average for 229, 228, 230, and 229 days per year under pre-2001, existing, with-CDRP, and with-project conditions, respectively (see Appendix HYD1-R, Section 8 for details of this analysis). **Table 15.3-2** shows the number days the proposed project would result in increases and decreases in flow at Niles above 700 cfs for the ACWD diversion period over the 18-year period of record. The data indicate on average over all years, only one or two days variation between the with-project and the other three scenarios. Thus, the ACRP would have very little effect on ACWD's ability to deploy its inflatable dams.

TABLE 15.3-1 (REVISED)
NUMBER OF DAYS WITH FLOW AT NODE 9 WHEN ACWD COULD DEPLOY ITS DIVERSION DAMS ON ALAMEDA CREEK FOR WY 1996 TO WY 2013 FOR FOUR SCENARIOS

Water Year Period		Water Year	Existing	Pre-2001	With-CDRP	With-Project
10/01/95	5/31/1996	1996	206	206	207	207
10/01/96	5/31/1997	1997	223	223	224	223
10/01/97	5/31/1998	1998	194	194	195	193
10/01/98	5/31/1999	1999	236	236	236	235
10/01/99	5/31/2000	2000	224	226	228	225
10/01/00	5/31/2001	2001	242	242	241	241
10/01/01	5/31/2002	2002	235	239	238	238
10/01/02	5/31/2003	2003	232	232	232	232
10/01/03	5/31/2004	2004	239	238	238	238
10/01/04	5/31/2005	2005	222	218	228	226
10/01/05	5/31/2006	2006	212	209	220	209
10/01/06	5/31/2007	2007	240	240	240	240
10/01/07	5/31/2008	2008	236	236	237	237
10/01/08	5/31/2009	2009	239	238	239	239
10/01/09	5/31/2010	2010	231	234	234	233
10/01/10	5/31/2011	2011	219	227	227	227
10/01/11	5/31/2012	2012	242	242	242	242
10/01/12	5/31/2013	2013	237	238	238	238
		Average	*228.3*	*228.8*	*230.2*	*229.1*

In a typical diversion season, the ACRP would increase or decrease the amount of time the dams were in place by a day or two relative to pre-2001 conditions, existing conditions, and with-CDRP conditions; that is one or two days in a 243-day diversion season. Compared to pre-2001 and existing conditions, the ACRP would decrease slightly the number of days when the dams could be in place. Compared to with-CDRP conditions, the ACRP would increase slightly the number of days when the dams could be in place. Thus, the ACRP would be expected to have very little effect on ACWD's ability to divert water during high flows.

ACWD is permitted to divert water from Alameda Creek from October 1 to May 31. Under the ACWD's operation rules stipulated by NMFS in the 2017 Biological Opinion on the Joint Lower Alameda Creek Fish Passage Improvements, ACWD must meet certain fish passage bypass amounts depending on measured flow in Alameda Creek at the Niles USGS gage at certain times of the year. For a description of ACWD operational parameters please see Appendix HYD1-R, Section 7, *Implications of ACRP-Caused Surface Water Hydrology Changes for Alameda County Water District Water Supply Operations*.



SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

SFPUC Alameda Creek Recapture Project

Figure 15.3-1 (new)

Number of Days with Flow at Node 9 when ACWD could Deploy Dam For Existing, Pre-2001, With-CDRP, and With-Project Conditions

TABLE 15.3-2
ESTIMATED NUMBER OF DAYS ACRP-CAUSED INCREASES AND DECREASES IN FLOW AT NILES (NODE 9) ABOVE THRESHOLD (700 CFS) FOR THE ACWD DIVERSION PERIOD (OCTOBER 1 TO MAY 31) THAT COULD AFFECT DAM DEPLOYMENT (DAYS)

	Compared to Pre-2001 Conditions		Compared to Existing Conditions		Compared to With-CDRP Conditions	
Water Year	Increase	Decrease	Increase	Decrease	Increase	Decrease
1996	0	1	0	1	0	0
1997	0	0	0	0	1	0
1998	3	2	3	2	2	0
1999	2	1	2	1	1	0
2000	2	1	1	2	3	0
2001	1	-	1	0	0	0
2002	1	0	0	3	0	0
2003	0	0	0	0	0	0
2004	0	0	1	0	0	0
2005	0	8	0	4	2	0
2006	3	3	8	5	12	1
2007	0	0	0	0	0	0
2008	0	1	0	1	0	0
2009	0	1	0	0	0	0
2010	1	0	1	3	1	0
2011	0	0	0	8	1	1
2012	0	0	0	0	0	0
2013	0	0	0	1	0	0
Average	0.7	1.0	0.9	1.7	1.3	0.1

SOURCE: ESA and Orion, 2019.

The ACWD minimum bypass flows are tied temporally to the steelhead in-migration and out-migration seasons. During steelhead in-migration, defined as January 1 through March 31, if flow at Niles is less than 30 cfs, all arriving flow shall be bypassed.[99] **Table 15.3-3** shows a comparison of streamflow conditions at Niles (Node 9) as it relates to steelhead in-migration ACWD bypass operations.

For each scenario, the number of days in which flow at Node 9 is less than 30 cfs, between January 1 and March 31, is shown in Table 15.3-3. In general, under the with-CDRP and with-project conditions there are fewer days in which flow is less than 30 cfs at Node 9, compared to the pre-2001 and existing conditions. This increase in flow (decrease low-flow days) is due to increased quarry NPDES discharge during this late-winter early spring period under the two future conditions. Increased quarry NPDES discharge under the with-CDRP and with-project conditions is ultimately the result of increased seepage into Pit F2, driven by increased releases under the CDRP instream flow schedule (see Appendix HYD1-R, Section 4.3.2, *Gains from Quarry NPDES*

[99] Importantly, no water will be released by ACWD from storage to meet bypass requirements.

Discharges to Alameda Creek). The with-project condition contains the fewest number of days in which flow at Niles is less than 30 cfs, 270 total days during the 18-year period of record, compared with 283 total days under the with-CDRP conditions.

TABLE 15.3-3
DAYS WHEN FLOW AT NILES (NODE 9) IS LESS THAN 30 CFS
ACWD STEELHEAD IN-MIGRATION BYPASS CONDITIONS, JANUARY 1 TO MARCH 31

Water Year Period		Pre-2001 Conditions	Existing Conditions	With-CDRP Conditions	With-project Conditions
01/01/96	3/31/1996	9	9	2	2
01/01/97	3/31/1997	-	-	-	-
01/01/98	3/31/1998	-	-	-	-
01/01/99	3/31/1999	6	6	6	3
01/01/00	3/31/2000	13	13	13	13
01/01/01	3/31/2001	21	21	19	18
01/01/02	3/31/2002	49	22	18	22
01/01/03	3/31/2003	35	34	20	20
01/01/04	3/31/2004	34	31	21	23
01/01/05	3/31/2005	13	6	-	-
01/01/06	3/31/2006	-	-	-	-
01/01/07	3/31/2007	48	47	34	30
01/01/08	3/31/2008	23	20	15	16
01/01/09	3/31/2009	26	25	21	23
01/01/10	3/31/2010	15	15	14	12
01/01/11	3/31/2011	29	15	18	9
01/01/12	3/31/2012	34	34	33	29
01/01/13	3/31/2013	51	40	49	50
	Total	**406**	**338**	**283**	**270**
	Average	**22.6**	**18.8**	**15.7**	**15.0**

SOURCE: SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6˚ and losses between Node 6˚ and 7 by ESA/Orion, 2019

For the steelhead out-migration season, defined as April 1 to May 31, dry years are of particular concern as it relates to ACWD operations. During dry conditions, if flows are less than 25 cfs at Niles, the ACWD will provide 12 cfs plus net SFPUC releases[100] at Niles gage (Node 9) seven consecutive days in April and seven consecutive days in May (days to be specified by NMFS/CDFW). If ACWD diversions are zero and less than 12 cfs arrives at the Alameda Creek Flood Control District drop structure, all of the flow at the drop structure shall be bypassed.[101] **Table 15.3-4** shows a comparison of streamflow conditions during dry years in the 18-year modeled period at Niles (Node 9) as it relates to these steelhead out-migration ACWD bypass operations.

[100] SFPUC fisheries releases are defined in the ACWD Biological Opinion, as flows that are released and/or bypassed by the SFPUC at Calaveras Reservoir and Alameda Creek Diversion Dam.
[101] Importantly, no water will be released by ACWD from storage to meet bypass requirements.

TABLE 15.3-4
DAYS WHEN FLOW AT NILES (NODE 9) IS LESS THAN 25 CFS IN DRY YEARS
ACWD STEELHEAD OUT-MIGRATION BYPASS CONDITIONS, APRIL 1 TO MAY 31

Water Year Period		Pre-2001 Conditions	Existing Conditions	With-CDRP Conditions	With-project Conditions	Year type
04/01/01	5/31/2001	52	51	47	45	Dry
04/01/02	5/31/2002	53	53	42	45	Dry
04/01/03	5/31/2003	25	21	13	13	Dry
04/01/04	5/31/2004	60	55	57	59	Dry
04/01/07	5/31/2007	2	2	2	1	Dry
04/01/08	5/31/2008	57	34	57	57	Dry
04/01/12	5/31/2012	32	32	31	25	Dry
04/01/13	5/31/2013	47	47	47	47	Dry
	Total	**328**	**295**	**296**	**292**	
	Average	**41.0**	**36.9**	**37.0**	**36.5**	

SOURCE: SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6˚ and losses between Node 6˚ and 7 by ESA/Orion, 2019

For each scenario, the number of days in which flow at Node 9 is less than 25 cfs, between April 1 and May 31, for dry years within the 18-year period of record, is shown in Table 15.3-4. In general, under the existing, with-CDRP, and with-project conditions, there is on average a similar number of days in which flow is expected to be less than 25 cfs at Niles during dry years, 36.9, 37.0, and 36.5 respectively. The fewest number of total days, 292, occurs under the with-project condition and can be attributed to increased quarry NPDES discharge during spring months. Overall, low-flow conditions are expected to be relatively consistent between the existing, with-CDRP, and with-project conditions.

Similar to the conclusions in the June 2017 EIR, this updated analysis determined that any effects of the revised ACRP operating protocols on downstream ACWD operations in Alameda Creek would be too minor to cause ACWD to make substantial changes in the way it operates and uses its various sources of water. The explanation for the conclusion reached is consistent with the conclusion reached by ACWD and Alameda County Flood Control and Water Conservation District (ACFCD) in the *Joint Lower Alameda Creek Fish Passage Improvements, Initial Study with Mitigated Negative Declaration/Environmental Assessment with Finding of No Significant Impact.*[102] In this document, ACWD and ACFCD concluded there was no impact from bypass of flow for fish due to ACWD's ability to recoup any lost water in one year by the ability to store water in other years using the Niles Cone aquifer. Likewise, the June 2017 EIR concluded that the environmental impacts that could stem from ACRP-caused changes in ACWD operating practices, if any, would

[102] Hanson Environmental, December 2016, *Alameda County Water District and Alameda County Flood Control and Water Conservation District, Joint Lower Alameda Creek Fish Passage Improvements, Initial Study with Mitigated Negative Declaration/Environmental Assessment with Finding of No Significant Impacts, Final*. Prepared for; Alameda County Water District and Alameda County Flood Control and Water Conservation District.

be too minor to result in changes to ACWD's operations that could result in significant environmental impacts. Therefore, similar to the conclusion in the June 2017 EIR, the proposed project with the revised operating protocols would have a *less than significant* impact on downstream water users.

15.3.3 Other Resource Topics

(This section augments certain impacts in Chapter 5 of the June 2017 EIR to address the revised project description described in Chapter 14.)

15.3.3.1 Construction Impacts

As described in Chapter 14, the revised construction schedule changed the expected construction dates to start and end about three years later than the dates previously anticipated in the June 2017 EIR. In addition, the construction duration changed from 18 to 20 months. These changes have minor implications to the cumulative impact analysis for overlapping construction activities. Chapter 5, Table 5.1-6, Projects Considered in the Cumulative Impact Analysis, identifies in bold face type other projects in the vicinity with the potential for concurrent construction activities with the ACRP. However, despite the two-month extension in construction duration, the three-year delay in the anticipated project construction would result in a reduced potential for concurrent construction to occur with other projects considered in the cumulative impact analyses, since construction of most of the cumulative projects will have been completed prior to the start of the revised ACRP construction schedule. Therefore, under the revised project description, the cumulative construction impacts would be less severe than what is presented in Chapter 5 for cumulative construction impacts related to transportation (Impact C-TR), noise (Impact C-NO), recreation (Impact C-RE), and hazardous materials (Impact C-HZ), and there would be no change to any of the impact conclusions for those impacts.

15.3.3.2 Operational Impacts

As described in Chapter 14, under the revised operational protocols, the water levels in Pit F2 would not be drawn down below an elevation of 180 feet above mean sea level, compared to the an elevation of 150 feet described in the June 2017 EIR. Furthermore, the June 2017 EIR stated that during periods of rare and extreme drought, the water level in Pit F2 could be drawn down as low as 100 feet above mean sea level; this would no longer occur under the revised project operations. EIR Section 5.15, Geology and Soils analyzes the impacts of project operation associated with a geologic unit that could become unstable in Impact GE-4 (page 5.15-26). This impact analyzed Pit F2 water elevations in the range of 240 to 150 feet, with the potential for water elevations to be lowered to 100 feet under extreme drought conditions. With the revised project operations, the water levels would be maintained at a minimum of 180 feet elevation under all conditions, which would reduce the potential for slope instability compared to the conditions analyzed in the June 2017 EIR. Therefore, under the revised project operations, the potential for slope instability identified in Impact GE-4 would be less severe than described in the June 2017 EIR, and the impact would remain *less-than-significant*.

Also described in Chapter 14, under the revised operational protocols, the average number of pumping days would be 101 days per year, as compared to 121 days per year described in the June 2017 EIR. With the reduced number of pumping days, the operational energy consumption would be less than described in the June 2017 EIR. Therefore, operational energy usage identified in Impact ME-4 (pages 5.18-10 to 5.18-12) would be less than the usage described in the June 2017 EIR. Nevertheless, the determination that this impact would be *less than significant with mitigation* remains unchanged and the same mitigation measure identified in the June 2017 EIR applies to the proposed project as revised.

APPENDIX BOS

SF Board of Supervisors Motion Regarding Recirculation

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[Adopting Findings Reversing the Final Environmental Impact Report Certification - Alameda Creek Recapture Project]

Motion adopting findings reversing the Planning Commission's certification of the Final Environmental Impact Report for the San Francisco Public Utilities Commission's proposed Alameda Creek Recapture Project.

WHEREAS, The San Francisco Public Utilities Commission (SFPUC) approved the Alameda Creek Recapture Project (the Project) by Resolution No 17-0146 on June 23, 2017; and

WHEREAS, The proposed Project would recapture water that would be released from Calaveras Reservoir and/or bypassed around the Alameda Creek Diversion Dam (ACDD) when the SFPUC implements the instream flow schedules required as part of the regulatory permits for future operations of Calaveras Reservoir; and

WHEREAS, Released and bypassed water would flow naturally down Alameda Creek through the Sunol Valley and would percolate into and collect in a quarry pit referred to as Pit F2, which is currently leased to Mission Valley Rock Company for water management activities related to aggregate mining activities; and

WHEREAS, The SFPUC would recapture water collected in Pit F2 by pumping it to existing SFPUC water supply facilities in the Sunol Valley for treatment and eventual distribution to its water supply customers in the Bay Area; and

WHEREAS, The Planning Department determined that an Environmental Impact Report (hereinafter "EIR") was required for the proposed Project and provided public notice of that determination by publication in a newspaper of general circulation on June 24, 2015; and

WHEREAS, The Planning Department published a Draft EIR for the proposed Project on November 30, 2016, and circulated to local, state, and federal agencies and to interested organizations and individuals for a 45-day public review period that was later extended for two weeks by the Planning Department, resulting in a 62-day public review period that ended on January 30, 2017; and

WHEREAS, The Planning Commission held a public hearing on the Draft EIR on January 5, 2017; and

WHEREAS, The Planning Department prepared a Responses to Comments document (RTC), responding to all comments received orally at the public hearings and in writing, and published the RTC on June 7, 2017; and

WHEREAS, On June 22, 2017, the Planning Commission, by Motion No. 19952, certified a Final Environmental Impact Report (Final EIR) for the proposed Project under the California Environmental Quality Act (CEQA), Public Resources Code Section 21000 et seq., the CEQA Guidelines, 14 California Code of Regulations, Section 15000 et seq., and San Francisco Administrative Code Chapter 31, finding that the Final EIR reflects the independent judgment and analysis of the City and County of San Francisco, that it is adequate, accurate and objective, and contains no significant revisions to the Draft EIR; and

WHEREAS, By letter to the Clerk of the Board, received by the Clerk's Office on July 24, 2017, Robert Shaver, General Manager, on behalf of the Alameda County Water District, appealed the Final EIR certification (“Appellant”); and

WHEREAS, The Planning Department’s Environmental Review Officer, by memorandum to the Clerk of the Board dated July 26, 2017, determined that the appeal had been timely filed; and

WHEREAS, On September 5, 2017, this Board held a duly noticed public hearing to consider the appeal of the Final EIR certification filed by Appellant and, following the public hearing, conditionally reversed the Final EIR certification, subject to the adoption of these written findings in support of such determination, and requested additional information and analysis be provided; and

WHEREAS, In reviewing the appeal of the Final EIR certification, this Board reviewed and considered the determination, the appeal letters, the responses to the appeal documents that the Planning Department prepared, the other written records before the Board of Supervisors and all of the public testimony made in support of and opposed to the Final EIR appeal; and

WHEREAS, In addition to the appeal letter, the National Marine Fisheries Service ("NMFS") and the Alameda Creek Alliance each submitted a letter in support of the appeal, on July 27, 2017 and August 2, 2017, respectively; and

WHEREAS, In its letter, NMFS stated that it “believes the document does not contain sufficient information to conclude the [Project] will not result in substantial effects on streamflow that support the migration of C[entral] C[alifornia] C[oast] steelhead [fish] in Alameda Creek;” and

WHEREAS, Following the conclusion of the public hearing, the Board of Supervisors conditionally reversed the Final EIR certification, subject to the adoption of written findings of the Board in support of such determination, based on the written record before the Board of Supervisors as well as all of the testimony at the public hearing in support of and opposed to the appeal; and

WHEREAS, The written record and oral testimony in support of and opposed to the appeal and deliberation of the oral and written testimony at the public hearing before the Board of Supervisors by all parties and the public in support of and opposed to the appeal of the Final EIR certification is in the Clerk of the Board of Supervisors File No. 170893 and is incorporated in this motion as though set forth in its entirety;

WHEREAS, The Board finds that the letter from NMFS's raised important questions regarding how the project would affect low flow levels in Alameda Creek, and information in the NMFS letter constitutes significant new information that NMFS had not previously identified that affects the CEQA evaluation of operational impacts of the project on threatened steelhead fish; and

WHEREAS, In light of this new information, the Planning Department proposed to undertake further analysis of the potential operational impacts of the project on threatened steelhead fish related to changes caused by the project on streamflow in Alameda Creek, and proposed to recirculate a portion of the Draft EIR to address this single issue; and

WHEREAS, This Board considered these issues, heard testimony, and shared concerns that further information and analysis was required regarding whether the proposed project would result in operational impacts on steelhead in the lower watershed as a result of project-induced effects on streamflow in Alameda Creek; now therefore be it

MOVED, That this Board of Supervisors directs the Planning Department to provide additional information and analysis regarding whether the proposed project would result operational impacts on steelhead fish in the lower watershed as a result of project-induced effects on streamflow in Alameda Creek; and be it

FURTHER MOVED, In conducting any such additional environmental analysis the Planning Department shall enlist an independent third party review of the groundwater/surface water model to determine if the current model adequately and accurately analyzes the fisheries issues as required by CEQA, and to present the results of such review to the Alameda Creek Fisheries Restoration Workgroup; and be it

FURTHER MOVED, As to all other issues, the Board finds the Final EIR adequate, accurate, and objective, and no further analysis is required.

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APPENDIX APC

Appeal Process Comments Related to Steelhead Impacts

Summary of Comments Related to Steelhead Impacts Received during the Appeal Process

Table APC-1 lists the names, agencies, and organizations that during the appeal process, submitted comments related to operational impacts on Central California Coast steelhead due to project-induced changes in streamflow. **Table APC-2** summarizes those comments and indicates where in the recirculated portions of the EIR those comments are addressed. The San Francisco Planning Department previously responded to comments on other topics that were submitted during the appeal process in the appeal response memoranda[1], and those persons, agencies, and organization and those comments are not listed in these tables.

1 San Francisco Planning Department, Appeal of Final Environmental Impact Report, SFPUC Alameda Creek Recapture Project. Planning Case No. 2015-004827ENV, Board of Supervisors File No. 170893, August 28, 2017, and Appeal of Final Environmental Impact Report Supplemental Responses, September 5, 2017.

**TABLE APC-1
LIST OF AGENCIES, ORGANIZATIONS, AND INDIVIDUALS
SUBMITTING COMMENTS DURING THE APPEAL PROCESS
RELEVANT TO THE RECIRCULATED PORTIONS OF THE ACRP EIR**

Agency / Organization	Name and Title of Person Submitting Comments	Comment Date
Federal and State Agencies		
National Marine Fisheries Service (NMFS)	Gary Stern, San Francisco Branch Supervisor, North-Central Coast Office	7/27/2017
Regional and Local Agencies		
Alameda County Water District (ACWD)	Robert Shaver, General Manager	7/24/2017
Alameda County Water District (ACWD)	Robert Shaver, General Manager	8/25/2017
Alameda County Water District (ACWD)	Robert Shaver, General Manager	9/1/2017
Non-Governmental Organizations		
Alameda Creek Alliance	Jeff Miller, Director	8/2/2017
California Trout	Patrick Samuel, Bay Area Conservation Program Manager	8/18/2017
Individuals		
--	Virginia Cummins	8/8/2017
--	Ron Goldman	8/7/2017
--	Mary Ann Hannon	8/9/2017
--	Leslie Jackson	8/9/2017
--	Sarah Kupferberg	8/17/2017
--	Dave [no last name]	8/8/2017
--	Jim and Diana Prola	8/13/2017
--	Judy Schriebman	8/8/2017
--	M. Starr	8/10/2017
--	Scott Taylor	8/8/2017
--	Lawrence Thompson	8/17/2017
--	Anne Veraldi	8/7/2017
--	Joan Weber	8/8/2017
--	Kristin Womack	8/7/2017

TABLE APC-2
SUMMARY OF WRITTEN COMMENTS SUBMITTED DURING THE APPEAL PROCESS RELEVANT TO THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Federal and State Agencies		
NMFS (7/27/2017)	NMFS believes the document does not contain sufficient information to conclude the ACRP will not result in substantial effects on streamflows that support the migration of CCC steelhead in Alameda Creek. Streamflow simulations results predict hydrologic conditions at a daily time-step, but it is unclear if this plot represents a comparison of "with project" to "without project" conditions.	Section 15.2, Fisheries Resources, Approach to Analysis, Hydrologic Analysis of Alameda Creek Streamflows Appendix HYD1-R
NMFS (7/27/2017), cont'd	Appendix HYD1 offers some information regarding predicted changes in streamflows and indicates May flows will be reduced by approximately 30 percent with ACRP operations. The conclusion regarding potential impacts to steelhead migration presented in the EIR is based on an analysis of the "long term" operation of the ACRP which doesn't fully take into account short-term impacts (i.e., dry water years) and as a result, the analysis presented in the EIR could significantly underestimate potential impacts to steelhead and migratory habitat.	Section 15.2, Fisheries Resources, Approach to Analysis, Hydrologic Analysis of Alameda Creek Streamflows Appendix HYD1-R
NMFS (7/27/2017), cont'd	The EIR asserts that steelhead migration will not be impacted by the ACRP because, for both with and without project scenarios, and that precipitation-generated streamflows in Alameda Creek are predicted to exceed several hundred cubic feet per second during the December through June migration period. This reasoning fails to consider that steelhead do not migrate only during peak flow events, but may migrate anytime within the migration period when instream flows exceed identified minimum flow levels (i.e., 25 cfs for adults, 12 cfs for juvenile/smolts in lower Alameda Creek). A more appropriate impact analysis would instead focus on changes in the amount of time flows exceed these minimum migration thresholds. NMFS reviewed the daily modeling data provided to the Alameda County Water District on June 12, 2017, and found that ACRP operations will diminish migration opportunities for federally-threatened Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) especially out migrating steelhead smolts, in some years. For instance, analysis of the daily streamflow data for May 2008 suggests ACRP operations could result in streamflows in lower Alameda Creek (as measured at the Niles Gage) dropping below the smolt passage threshold of 12 cfs for an additional 15 days when compared to the without ACRP condition.	Section 15.2, Fisheries Resources, Approach to Analysis, and revised Impact BI-11. Note that the issue identified in the June 2017 EIR for streamflow data for May 2008 was due to a calculation error, which has since been corrected. See Appendix HYD1-R for the corrected and updated streamflow data.
NMFS (7/27/2017), cont'd	Based on currently available information, NMFS does not concur with the Final EIR's conclusion that ACRP operations would not substantially interfere with the movement or migration of special-status fish species, including CCC steelhead (Impact BI-11in the DEIR and Impact BI-16 in FEIR). NMFS recommends that the San Francisco Planning Commission and the San Francisco Public Utilities Commission undertake additional analysis to examine the relationship between groundwater and surface water in the Sunol Valley for the purpose of determining the project's potential impacts on a daily time-step to streamflows in Alameda Creek downstream of the project site.	Section 15.2, Fisheries Resources, Approach to Analysis, and revised Impact BI-11. Appendix HYD1-R Appendix HYD2-R Note: There is no Impact BI-16 in the EIR, but presumably the commenter is referring to Response BI-16 in the Response to Comments document.

TABLE APC-2 (Continued)
SUMMARY OF WRITTEN COMMENTS SUBMITTED DURING THE APPEAL PROCESS RELEVANT TO THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Regional and Local Agencies		
ACWD (7/24/2017)	Analysis of this data indicates the operation of the Project will result in severe impacts and potential "take" of the Central California Coast steelhead. These impacts were not included in the Final EIR.	Section 15.2, Fisheries Resources, revised Impact BI-11
ACWD (7/24/2017), cont'd	ASDHM Niles Gauge data show significant impacts to steelhead when analyzed on a daily time step. According to the modeled daily Niles Gauge streamflow data, the Project would result in a substantial, adverse impact to Central California Coast steelhead, a federally-listed threatened distinct population segment of steelhead. Specifically, the data indicates that flows in Alameda Creek would drop below the critical 25 cubic feet per second (cfs) on a substantially greater number of days during the December to April adult emigration migration period and the January to June post-spawn adult emigration period. These thresholds were identified by the National Marine Fisheries Service (NMFS) and California Department of Fish and Wildlife (CDFW) as being minimum passage thresholds for adult and juvenile steelhead downstream of the Project location in the Alameda Creek Flood Control Channel and were integrated into the ASDHM analysis used to conclude CEQA impacts in the Final EIR (Table 14, Dhakal et al, 2012; cited in EIR Appendix HYD-1, page 48; Section 4, Note 1). This is a significant impact under CEQA and is neither disclosed nor mitigated in the Draft EIR or Final EIR. Instead, in both the Draft EIR and Final EIR, the impacts of the Project to steelhead are dismissed as less than significant. Consequently, no mitigation is proposed to offset this significant impact. Comparing with the modeled daily streamflow at Niles gage, the Project results in a 60% increase (138 additional days) in the number of non-passable days for threatened steelhead downstream of the proposed Project location during wet year migration seasons included in the study period. Similarly, a 34% increase in non-passable days (102 additional days) downstream of the Project area during migration season in dry years also is observed. These comparisons were made between the conditions that will exist when the Calaveras Dam Replacement Project (CDRP) has been completed and in operation (with-CDRP conditions) scenario and the conditions that would exist when both the CDRP and the Alameda Creek Recapture Project are completed and are in operation (with-Project conditions) scenario. These significant impacts to steelhead were neither disclosed nor sufficiently analyzed in either the Draft EIR or Final EIR and renders unsupported the conclusions of no impact.	Section 15.2, Fisheries Resources, Approach to Analysis, revised Impact BI-11. Appendix HYD1-R Note that with the revised project operations (see Chapter 14), modeled streamflow data for the with-project and with-CDRP conditions have all been updated, so that the commenter's calculation of passable and non-passable days is no longer applicable.
ACWD, (8/25/2017, Exhibit A)	ACWD is concerned about the reduction of water flows … for the endangered steelhead. ACWD expressed concerns about the methodology the Planning Department proposed for the evaluation of project impacts, and that the project will have a regional influence over groundwater elevations and surface flow in Alameda Creek. ACWD also advised SFPUC that the impacts to this project need to be considered by looking at flows *each day* instead of on a monthly basis.	Section 15.2, Fisheries Resources, Approach to Analysis, and revised Impact BI-11. Appendix HYD1-R Appendix HYD2-R(regional geology)
ACWD (8/25/2017, Exhibit A), cont'd	The data show that the average monthly flow rates appear to meet the requirements for fish passage in Alameda Creek. However, this monthly average obscures the fact that on many drier days within the month water flow is insufficient for fish passage.	Section 15.2, Fisheries Resources, Approach to Analysis, and revised Impact BI-11. Appendix HYD1-R

TABLE APC-2 (Continued)
SUMMARY OF WRITTEN COMMENTS SUBMITTED DURING THE APPEAL PROCESS RELEVANT TO THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Regional and Local Agencies (cont.)		
ACWD (8/25/2017, Exhibit A), cont'd	ACWD provides a graphic showing an example of the days when water flow is too low for fish passage (January 2007), indicating that the operation of project will result in nine days per month that the fish have adequate passage.	Note that with the revised project operations (see Chapter 14), modeled streamflow data for the with-project and with-CDRP conditions have all been updated, so that the commenter's calculation of passable and non-passable days is no longer applicable.
ACWD (8/25/2017, Exhibit C), cont'd	The data show that operation of the ACRP would result in a drop below the critical 25 cfs on a substantially greater number of days during the December to April adult emigration/ migration period and the January to June post-spawn adult emigration period compared with post-CDRP conditions. Based on Horizon's review of these data, compared with post-CDRP conditions, the modeled daily streamflow at Niles gauge with the ACRP would result in a 19 percent decrease (50 days) in the average annual number of passable days for steelhead downstream of the ACRP location during the Draft EIR study period. When the analysis focuses solely on the December to April steelhead migration period, the average number of passable days decreases by 11 percent. The impact of the ACRP to steelhead is worse during dry years. Using SFPUC's designation of "dry" years (i.e., 2000, 2001, 2002, 2003, 2004, 2007, 2008, 2009, 2010, 2012, and 2013) the average number of passable days during the December to April period decreases by 18 percent. Using ACWD's designation of dry years (i.e., 2001, 2004, 2007, 2008, 2009, 2012, and 2013), the average number of passable days during the December to April period decreases by 22 percent. To be clear these comparisons were made between the conditions that will exist when the CDRP has been completed and the conditions that would exist when both the CDRP and the ACRP are both operational. These significant impacts to steelhead by the ACRP were neither sufficiently analyzed nor disclosed in the Draft EIR and Final EIR.	Section 15.2, Fisheries Resources, Approach to Analysis, and revised Impact BI-11.
ACWD (8/25/2017, Exhibit D), cont'd	The methodology used to determine impacts to steelhead failed to properly analyze the surface water-groundwater interaction in the project area and failed to account for the impacts based on steelhead daily flow requirements. The analysis of the daily flow data shows impact to steelhead trout that were not properly analyzed or disclosed in the EIR. While the ASDHM contains the word "daily," the results presented in the EIR were compiled from the daily data and analyzed at a monthly time step. The EIR incorrectly states that the flows resulting from the project would continue to provide suitable conditions for adult upstream migration and smolt downstream migration consistent with the NMFS Biological Opinion for the Calaveras Dam Replacement Project. This is incorrect, and the daily flow data indicate that the Biological Opinion's required migration flows would be negatively impacted. Specifically, pages 48-52 of the Biological Opinion indicate that bypass flows are intended to provide suitable migration conditions from Alameda Creek below the Alameda Creek Diversion Dam and out to the bay. The daily data indicate that the operation of ACRP will conflict with this requirement.	Section 15.2, Fisheries Resources, Approach to Analysis, and revised Impact BI-11. Appendix HYD1-R Appendix HYD2-R (seepage analysis)

TABLE APC-2 (Continued)
SUMMARY OF WRITTEN COMMENTS SUBMITTED DURING THE APPEAL PROCESS RELEVANT TO THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Regional and Local Agencies (cont.)		
ACWD (8/25/2017, Exhibit E), cont'd	Data presented in the EIR for this project shows that the current proposal for operating the project will reduce the number of days available for access, and this reduction will impact the recovery of this federally protected species. The EIR mask the impacts that the operation of the ACRP will have by using monthly average changes in surface water flow as proof that steelhead will not be harmed. Using a monthly average is misleading since the impact to the environment happen during changes in day-to-day operations.	Section 15.2, Fisheries Resources, Approach to Analysis, and revised Impact BI-11.
ACWD (9/1/2017, Attachment from R. Valle)	The Alameda County Flood Control and Water Conservation District is concerned that the operation of the ACRP will negatively impact downstream flows and substantially interfere with the movement or migration of Central California Coast Steelhead by significantly limiting migration opportunities to enter and navigate through the Alameda Creek Flood Control Channel downstream of the proposed ACRP site.	Section 15.2, Fisheries Resources, Approach to Analysis, and revised Impact BI-11.
ACWD (9/1/2017, Attachment from H. Ackerman)	The Alameda County Flood Control and Water Conservation District is concerned that the EIR did not adequately address the project's impacts on groundwater elevations and surface flows in Alameda Creek. Any reductions in flows below the minimum approved by the NMFS will have negative impacts on steelhead migration in lower Alameda Creek.	Section 15.2, Fisheries Resources, Approach to Analysis Appendix HYD1-R Appendix HYD2-R (seepage analysis)
Non-Governmental Organizations		
Alameda Creek Alliance (8/2/2017)	The Alameda Creek Alliance has concerns about the SFPUC Alameda Creek Recapture Project and impacts that its operations could have on recovering threatened steelhead trout within the Alameda Creek watershed.	Section 15.2, Fisheries Resources, revised Impact BI-11
Alameda Creek Alliance (8/2/2017), cont'd	NMFS commented that the final EIR does not contain sufficient information to conclude that the project will not result in substantial effects on streamflows intended to support migration of steelhead trout, and in fact found that project operations will diminish migration opportunities for steelhead, especially outmigrating smolts, in some years. CDFW commented that the modeling analysis used for the EIR may be inadequate for the determination that the project will have "less than a significant impact" on fisheries resources of Alameda Creek.	Section 15.2, Fisheries Resources, revised Impact BI-11 Appendix HYD1-R
Alameda Creek Alliance (8/2/2017), cont'd	An ACWD analysis of daily modeling data provided by the SFPUC after the close of the EIR comment period shows that project operations could result in increased numbers of days where streamflows in lower Alameda Creek fall below the threshold for fish passage, as determined by NMFS. ACWD commented that the hydrologic model relied on in the EIR's impact analyses is insufficient to analyze the surface water groundwater interaction necessary to fully evaluate project impacts. CDFW shared this concern that the modeling used in the EIR did not adequately address ground and surface water interaction in the stream reach of the proposed project and that the EIR analyses do no adequately quantify the stream reach percolation losses of the SFPUC releases.	Section 15.2, Fisheries Resources, Approach to Analysis Appendix HYD1-R Appendix HYD2-R (seepage analysis)
Alameda Creek Alliance (8/2/2017), cont'd	The Alameda Creek Alliance is concerned about the potential reduction in the number of days that steelhead could have access to spawning and rearing habitat upstream of the project. Data presented in the EIR show that the current proposal for project operations will reduce the number of days where adequate streamflow is available for steelhead migration. The EIR uses monthly average changes in surface water flow to conclude that steelhead will not be harmed, whereas analysis of daily flows is needed to	Section 15.2, Fisheries Resources, revised Impact BI-11. Appendix HYD1-R

TABLE APC-2 (Continued)
SUMMARY OF WRITTEN COMMENTS SUBMITTED DURING THE APPEAL PROCESS RELEVANT TO THE RECIRCULATED PORTIONS OF THE ACRP EIR

Commenter	Summary of Comment	EIR Section where Comments is Addressed
Non-Governmental Organizations (cont.)		
	assess the effects of suitable streamflows for steelhead. The Alliance believes there is not adequate information in the EIR to make a determination about streamflows and impacts to steelhead.	Chapter 14, Revisions to the Project Description (revised operations)
California Trout (8/18/2017)	Operation of the project as proposed will have the potential to significantly alter the availability and timing of sufficient flows to allow upstream passage of spawning adult and downstream passage of juvenile steelhead during critical migration windows below established thresholds (25 cfs for adults, 12 cfs for juveniles), causing potential "take" of steelhead in violation of the Endangered Species Act. These impacts were not sufficiently described nor analyzed in the Final EIR and should have been examined more closely.	Section 15.2, Fisheries Resources, revised Impact BI-11 Chapter 14, Revisions to the Project Description (revised operations)
Individuals		
V. Cummins (8/8/2017)	Please make sure that any decisions you make with regard to Alameda Creek be beneficial to the Steelhead Trout population. Too many agencies and so many hours of cooperation have brought us to the level of protection to the Steelhead Trout have as of today. Don't jeopardize the progress that has been made.	Section 15.2, Fisheries Resources, revised Impact BI-11
R. Goldman (8/7/2017) M. Hannon (8/9/2017) L. Jackson (8/9/2017) S. Kupferberg (8/17/2017) J. and D. Prola (8/13/2017) J. Schriebman (8/8/2017) M. Starr (8/10/2017) L. Thompson (8/14/2017) A. Veraldi (8/7/2017) K. Womack (8/7/2017)	These individuals request additional analysis of the relationship between ground water and surface water in the Sunol Valley to determine whether the project has impacts on stream flows in Alameda Creek downstream of the project which could impede steelhead migration and that SFPUC and SF Planning work with all watershed stakeholders.	Section 15.2, Fisheries Resources, revised Impact BI-11 Section 13.3.2, Consultation Concerning Recirculated Portions of the EIR Appendix HYD2-R
Dave [no last name] (8/8/2017)	Opposes any reduction in the needed water flow in Alameda Creek for steelhead.	Section 15.2, Fisheries Resources, revised Impact BI-11
S. Taylor (8/8/2017)	Recommends further study of the project and the issue of water flow during drought years to ensure passage of steelhead during those times.	Section 15.2, Fisheries Resources, revised Impact BI-11
J. Weber (8/8/2017)	Expresses concern that steelhead trout return and migration are protected in all of Alameda Creek and that the proposed project could have an adverse impact on steelhead trout further down in Alameda Creek.	Section 15.2, Fisheries Resources, revised Impact BI-11

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APPENDIX NOP2

Notice of Preparation for Recirculated EIR, Scoping Comments Received, and Transcript of Scoping Meeting

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Notice of Preparation
of a Recirculated Portion of an Environmental Impact Report

Date:	October 18, 2017
Case No.:	**2015-004827ENV**
Project Title:	**Alameda Creek Recapture Project**
Location:	The Sunol Valley in unincorporated Alameda County, west of Calaveras Road and south of Interstate 680. The proposed facilities would be constructed within and adjacent to an existing quarry pit on lands owned by the City and County of San Francisco.
BPA Nos.:	N/A
Zoning:	Water Management
Block/Lot:	N/A
Project Sponsor	San Francisco Public Utilities Commission Antonia Sivyer – (415) 554-2474
Lead Agency:	San Francisco Planning Department
Staff Contact:	Chris Kern – (415) 575-9037 Chris.Kern@sfgov.org

The San Francisco Planning Department is hereby issuing this notice of preparation (NOP) of a recirculated portion of the environmental impact report (EIR) on the project listed above. The purpose of the recirculated portion of the EIR is to address significant new information identified subsequent to the certification of the Final EIR on this project. The San Francisco Planning Department is issuing this NOP to inform the public and responsible and interested agencies about the proposed project, the significant new information, and the intent to prepare a recirculated portion of the EIR. This NOP is also available online at the following website: http://sf-planning.org/sfpuc-negative-declarations-eirs%20.

BACKGROUND

The Planning Department published a Final EIR (or June 2017 EIR) on the San Francisco Public Utilities Commission (SFPUC) Alameda Creek Recapture Project (ACRP or proposed project) on June 7, 2017. Two weeks later, on June 22, 2017, the San Francisco Planning Commission found the Final EIR to be adequate, accurate, and objective and certified the Final EIR in compliance with the California Environmental Quality Act (CEQA), CEQA Guidelines, and Chapter 31 of the San Francisco Administrative Code. Subsequent to that certification, the Alameda County Water District (ACWD) filed an appeal to the San Francisco Board of Supervisors (Board) requesting that the Board overturn the certification of the Final EIR. On July 27, 2017, the National Marine Fisheries Service (NMFS) filed a letter in support of the appeal that contained comments the Planning Department considers to be "significant new information" under CEQA Guidelines section 15088.5. In its letter, NMFS states that it "believes the document does not contain sufficient information to conclude the ACRP will not result in substantial effects on streamflow that support the migration of CCC steelhead in Alameda Creek." The letter provides important clarification of NMFS's questions regarding how the project would affect low flow levels in Alameda Creek; the information in the NMFS letter constitutes significant new information that NMFS had not previously identified. This new information from NMFS affects the CEQA evaluation of operational impacts of the project on Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) distinct population segment (DPS), a species listed as threatened under the federal Endangered Species Act.

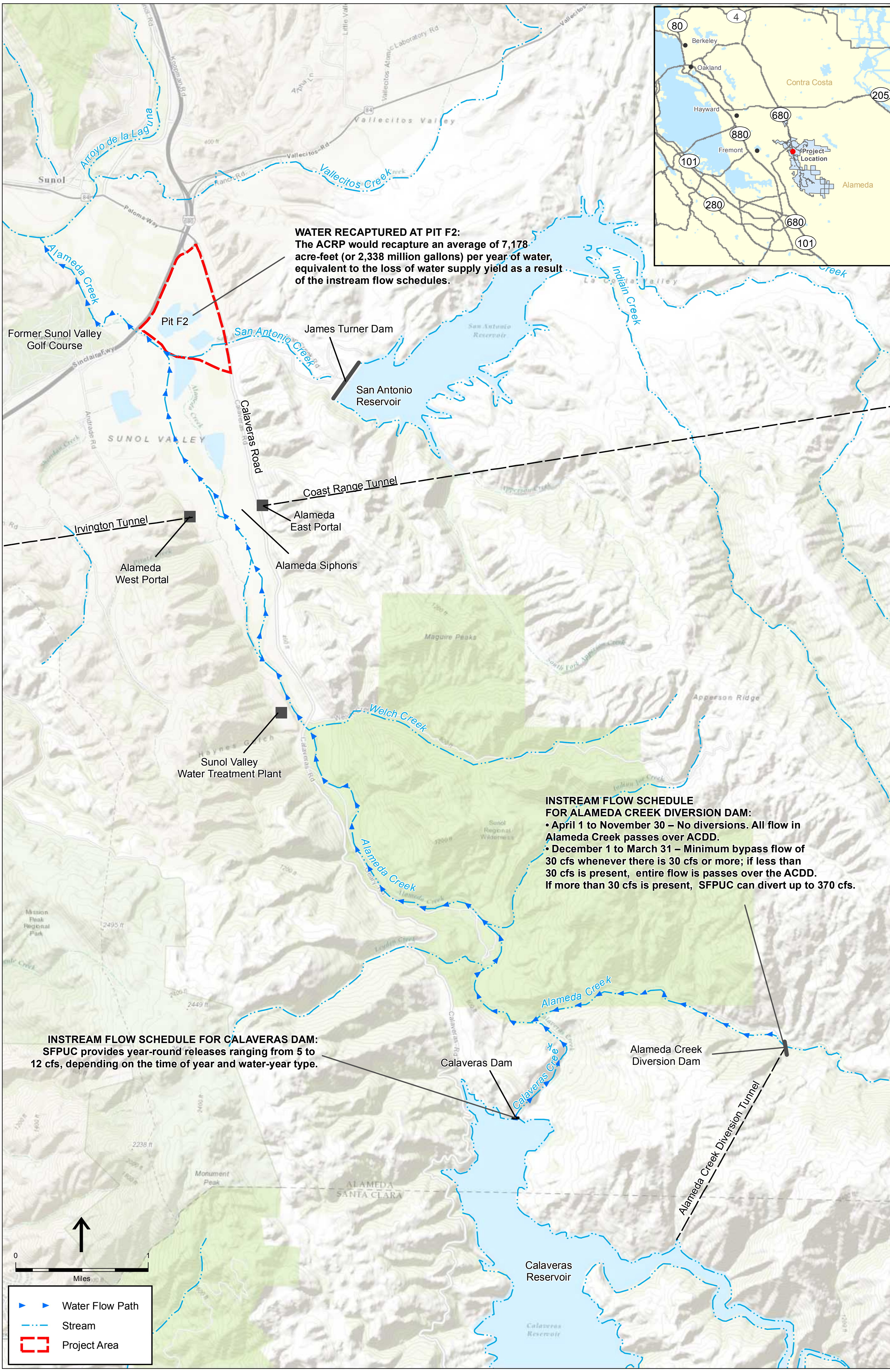
On September 19, 2017, the San Francisco Board of Supervisors adopted findings reversing the Final EIR certification and directed the Planning Department to provide additional information and analysis regarding whether the proposed project would result in operational impacts on steelhead fish in the lower watershed as a result of project-induced effects on streamflow in Alameda Creek.[1] The Board also directed that in conducting such additional environmental analysis, the Planning Department enlist an independent third party to review the groundwater/surface water analysis used in the EIR to determine if the analysis adequately and accurately supports the fisheries impact analysis as required by CEQA. The Board determined that with respect to all other issues, the June 2017 EIR is adequate, accurate, and objective, and no further analysis is required. Therefore, consistent with this direction from the Board, the Planning Department will revise and recirculate a limited portion of the June 2017 EIR that will provide additional information and analysis on operational impacts on steelhead fish in the lower watershed as a result of project-induced effects on streamflow in Alameda Creek.

PROJECT DESCRIPTION

Overview

The SFPUC is proposing the ACRP as part of improvements to its regional water system as one component of the SFPUC's Water System Improvement Program (WSIP). The ACRP is a water supply project located in the Sunol Valley in Alameda County on lands within the SFPUC's Alameda Watershed. The project would be implemented following completion of the Calaveras Dam Replacement Project, which is currently under construction, and in conjunction with future operation of the restored Calaveras Reservoir. To comply with federal and state permit requirements for the future operations of Calaveras Dam and Reservoir, the SFPUC is required to make releases from Calaveras Dam and to bypass creek flow around the Alameda Creek Diversion Dam in accordance with instream flow schedules set forth by the NMFS in a March 5, 2011 biological opinion for the Calaveras Dam Replacement Project. The releases and bypasses are designed to improve conditions for native aquatic species including threatened CCC steelhead in Upper Alameda Creek downstream of Calaveras Dam and the Alameda Creek Diversion Dam. The SFPUC proposes the ACRP to “recapture” some of the water that it is required to release and bypass in order to also use this water in its regional water system. **Figure NOP-1** shows the project location, including the downstream location of the ACRP project area relative to the Calaveras Dam and Reservoir and the Alameda Creek Diversion Dam.

1 San Francisco Board of Supervisors, File No. 171000, Motion No. M17-148, September 19, 2017



SOURCE: ESA, 2015

SFPUC Alameda Creek Recapture Project

Figure NOP-1

Overview of In-Stream Flow Schedules and Downstream Recapture

Under the project, the SFPUC would construct facilities to withdraw water from Pit F2, an existing quarry pit formerly used by quarry operators located adjacent to Alameda Creek about six miles downstream of Calaveras Reservoir. The SFPUC would convey the recovered water to existing SFPUC facilities for treatment and distribution to its water supply customers in the Bay Area. Pit F2 passively collects water originating upstream from Alameda Creek through natural subsurface percolation and seepage, so the SFPUC would not construct any facilities within the Alameda Creek stream channel or actively divert water from the creek. By withdrawing water from Pit F2, SFPUC would recover only water that passively percolates or seeps into the pit. In addition, under the ACRP, the amount of water the SFPUC would pump or "recapture" from Pit F2 would be limited to the portion of the bypassed and released water that the SFPUC otherwise would have stored in Calaveras Reservoir but for implementation of the instream flow schedules established for the Calaveras Dam Replacement Project (described below under *Project Background*). The SFPUC has estimated that the amount of water to be released and bypassed to Alameda Creek as part of the future Calaveras Reservoir operations on average will be about 14,695 acre-feet per year. Under the ACRP, the SFPUC estimates that on average, the amount of water that would be recaptured and conveyed to the regional water system would be about 7,178 acre-feet per year.[2]

By recapturing water out of Pit F2, the SFPUC would maintain its historical withdrawal of water from the Alameda Watershed to the SFPUC regional water system, in accordance with the City and County of San Francisco's (CCSF) existing water rights. The SFPUC included the recaptured water project in the WSIP, and the Planning Department included the project in the environmental analysis of the WSIP Program EIR for the regional water system (described below under *Project Background*).

Project Background

SFPUC Water System Improvement Program. In October 2008, the SFPUC adopted the WSIP (SFPUC Resolution 08-200). The WSIP is a comprehensive program designed to improve the SFPUC's regional water system that serves drinking water to 2.6 million people in San Francisco, San Mateo, Santa Clara, Alameda, and Tuolumne Counties. The adopted WSIP will improve the reliability of the regional water system with respect to water quality, seismic response, water delivery, and water supply. The WSIP consists of a water supply strategy and modifications to system operations as well as construction of a series of facility improvement projects in seven counties—Tuolumne, Stanislaus, San Joaquin, Alameda, Santa Clara, San Mateo, and San Francisco. One of the identified water supply and facility improvement projects of the WSIP is a water recapture project in the Sunol Valley region, now referred to as the ACRP.

The ACRP would support the SFPUC in achieving the established WSIP level of service goals and objectives related to water supply during both nondrought and drought periods by increasing operational flexibility and avoiding the loss of yield to the regional system from the SFPUC Alameda watershed system that would otherwise result from future operations of Calaveras Reservoir.

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[2] An acre-foot of water is the volume of water that would cover one acre of land to a depth of one foot, which is equivalent to about 325,850 gallons. The average recapture volume of 7,178 acre-feet per year is enough water to serve approximately 128,000 residents in San Francisco for one year.

The Planning Department prepared a Program Environmental Impact Report (PEIR) to address the potential environmental impacts of the WSIP.[3] The San Francisco Planning Commission certified the WSIP PEIR on October 30, 2008. The environmental analysis in the WSIP PEIR consisted of two main parts: (1) evaluation of the water supply and system operation impacts of the WSIP at a project-level, including the water recapture project in the Sunol Valley, and (2) evaluation of the WSIP facility improvement projects, including the proposed project, at a programmatic level, based on the information available at that time. Subsequent to certification of the WSIP PEIR in October 2008, the SFPUC approved the WSIP and adopted findings pursuant to CEQA, a Mitigation and Monitoring Reporting Program, and a statement of overriding considerations for the WSIP.[4]

Calaveras Dam Replacement Project. The Calaveras Dam Replacement Project (CDRP) is located upstream from the ACRP in the SFPUC's Alameda Watershed, and ACRP operations are dependent on full operation of the CDRP. The CDRP is a key regional facility improvement project of the WSIP that will construct a replacement Calaveras Dam and restore the storage capacity of Calaveras Reservoir to its historical levels prior to the restrictions imposed by the Department of Water Resources, Division of Safety of Dams in 2001. The Planning Department prepared an EIR on the CDRP to address its potential environmental impacts at a project-level, and the CDRP EIR was tiered from the WSIP PEIR in accordance with CEQA Guidelines Section 15168(c), which provides for environmental review of subsequent activities under the same program. The San Francisco Planning Commission certified the CDRP EIR on January 27, 2011,[5] and the SFPUC adopted the CEQA Findings and approved the CDRP on the same date.[6]

On March 5, 2011, the NMFS issued a Biological Opinion on behalf of the U.S. Army Corps of Engineers, which issued a permit to the SFPUC for the construction and operation of the CDRP as required by the Clean Water Act.[7] In the Biological Opinion, NMFS concluded that the construction and future operation of the CDRP is not likely to jeopardize the continued existence of threatened CCC steelhead based on the SFPUC's commitment to implement suitable instream flow conditions below Calaveras Dam and the Alameda Creek Diversion Dam, as specified in the Biological Opinion. Under this commitment, the SFPUC will make specified year-round releases from Calaveras Dam and will allow specified bypasses around the Alameda Creek Diversion Dam to improve streamflow in Alameda Creek. The required in-stream flow schedules will result in a corresponding reduction in the amount of water that the SFPUC historically maintained in Calaveras Reservoir and historically diverted from Alameda Creek into Calaveras Reservoir.

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3 San Francisco Planning Department, 2008. *San Francisco Public Utilities Commission's Water System Improvement Program, Final Program Environmental Impact Report*, File No. 2005.0159E, State Clearinghouse No. 2005092026, Certified October 30, 2008. Available online at http://sf-planning.org/sfpuc-negative-declarations-eirs.

4 San Francisco Public Utilities Commission (SFPUC), SFPUC Resolution 08-200, Water System Improvement Program California Environmental Quality Act Findings: Findings of Fact, Evaluation of Mitigation Measures and Alternatives, and Statement of Overriding Considerations. October 2008.

5 San Francisco Planning Department, 2011. *San Francisco Public Utilities Commission Calaveras Dam Replacement Project, Final Environmental Impact Report*. San Francisco Planning Department File No. 2005.0161E, State Clearinghouse No. 2005102102. Certified January 27, 2011.

6 San Francisco Public Utilities Commission (SFPUC), SFPUC Resolution 11-0015, Calaveras Dam Replacement Project, Project No. CUW37401, CEQA Findings, Statement of Overriding Considerations, and Mitigation Monitoring and Reporting Program. January 2011.

7 National Marine Fisheries Service, 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.

The CDRP is currently under construction, and completion is scheduled for spring 2019. Operation of the ACRP would not commence until construction of the CDRP is completed, since recapture of flows cannot occur until after the implementation of the instream flow schedules required under the NMFS Biological Opinion.

Project Construction

The ACRP would construct the following key facilities within the project area shown in Figure NOP-1:

- Four 400-horsepower vertical turbine pumps on floating barges centrally located in Pit F2, approximately 400 feet from the shore, with a mooring system to secure the floating barges
- Four 700-foot-long, 16-inch-diameter high density polyethylene (HDPE) flexible discharge pipelines extending from each vertical turbine pump to a new pipe manifold located on shore
- A 100-foot-long, 36-inch-diameter welded steel pipeline connection between the new pipe manifold and the existing Sunol Pump Station Pipeline
- Throttling valves and a flow meter
- An electrical control building
- An electrical transformer, and up to fifteen power and fiber optic line poles, and 1,800 feet of overhead power lines extending from the Hetch Hetchy Water and Power (HHWP) Calaveras Electrical Substation to the new electrical control building.[8] In addition, approximately 2,800 feet of overhead fiber optic communication lines would extend from the HHWP Calaveras Electrical Substation to the new electrical control building below the overhead power lines along the new and existing power poles

No construction would occur within the Alameda Creek bed, bank, or stream channel. The SFPUC conducted water quality monitoring in Pit F2 from June 2014 to July 2016, and has determined at this time that no pretreatment would be required prior to conveying the water to existing SFPUC water facilities (i.e., the Sunol Valley Water Treatment Plant or San Antonio Reservoir). However, the State Water Resources Control Board, Division of Drinking Water would make the final determination regarding the need for additional treatment requirements.

Construction is expected to require approximately 18 months to complete. Construction activities would include staging/laydown, site clearing, demolition, drilling, earth work, structural placement and backfilling, concrete and paving work, dewatering, excavation, and trenching in the project area. The SFPUC would ensure that the ACRP construction contract specifications include uniform minimum provisions to incorporate its Standard Construction Measures to avoid impacts to existing resources to the extent feasible. The SFPUC would also implement protection measures pertaining to seismic and geotechnical issues, hazardous materials, and traffic during project planning, construction, and operation.

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[8] Alternatively, as described in Section 3.3.7, if the HHWP Calaveras Electrical Substation cannot meet the power needs of the ACRP, power would come from the PG&E Sunol Electrical Substation. Under this alternative power option, overhead power lines would extend from existing power poles along Calaveras Road west to the new electrical control building.

Proposed Operations

Recapture operations under the ACRP would occur after implementation of the instream flow schedules required as part of the regulatory permits for future operations of Calaveras Reservoir and the Alameda Creek Diversion Dam. The proposed project would recapture the bypasses and releases as needed and as available at the existing quarry Pit F2 in the Sunol Valley. The project would utilize the natural infiltration of water into the ground in the vicinity of Pit F2 and its detention in the pit as the means by which the water would be recaptured. Using the proposed ACRP facilities described above, the SFPUC would then pump water from Pit F2, and the recaptured water would be transferred to the regional water system for municipal use. The recapture operation of the ACRP would be conducted within the CCSF's existing pre-1914 appropriative water rights. The volume of recaptured water would be tracked daily to ensure the operation is conducted within these water rights.

The volume of water bypassed and released, and subsequently available for recapture, would vary from year to year based on precipitation and the specific requirements of the instream flow schedules. Based on historical data, the SFPUC estimates that the average annual volume of bypasses and releases will be 14,695 acre-feet per year and the average annual recapture volumes would be 7,178 acre-feet per year.

Pumping from Pit F2 would generally take place between April and December, and on average, the ACRP would operate for approximately 121 days a year. Recaptured water would be pumped directly to the Sunol Valley Water Treatment Plant (SVWTP) or San Antonio Reservoir. It is anticipated that, in most cases, the water withdrawn from Pit F2 would be conveyed to the SVWTP and thereby reduce the volume of water conveyed from Calaveras Reservoir to SVWTP, enabling the SFPUC to conserve water in Calaveras Reservoir and maintain the historical annual transfers from the Alameda Watershed system to the regional water system. If the recaptured water is conveyed to San Antonio Reservoir, the water would be used to fill the available storage at that reservoir and subsequently would be treated at the SVWTP for delivery to the SFPUC service area.

ENVIRONMENTAL REVIEW PROCESS

As described above under *Background*, the San Francisco Planning Department prepared a Final EIR in June 2017 that fully evaluated the environmental effects of the proposed project on the environment. With the exception of one issue, the Board of Supervisors found the June 2017 EIR to be in compliance with CEQA (California Public Resources Code, sections 21000 *et seq.*), the *CEQA Guidelines*, and Chapter 31 of the San Francisco Administrative Code. Therefore, the recirculated portion of the EIR on the ACRP will address only one issue: the project-specific operational impact on threatened CCC steelhead due to project-induced changes in Alameda Creek streamflow. The recirculated portion of the EIR will include a hydrologic analysis of changes in Alameda Creek streamflow over a range of conditions needed to support the impact analysis. It will also contain the results of an independent third party review of the sufficiency of the groundwater/surface water analysis used in the EIR to provide adequate and accurate information related to groundwater characteristics, including groundwater and surface water interactions, to support the analysis of project impacts on streamflow in Alameda Creek that could affect fisheries resources. All other issues—including all construction-related impacts, all other operational impacts, cumulative impacts, and evaluation of alternatives—were addressed in the June 2017 EIR, and the Board determined that no further analysis is required for these issues. Therefore, these issues will not be covered in the recirculated portion of the EIR.

The recirculated portion of the EIR will augment the June 2017 EIR for use as an informational document by governmental agencies and the public to aid in the planning and decision-making process. Together, the recirculated portion of the EIR and the June 2017 EIR will disclose any physical environmental effects of the project and identify possible ways of reducing or avoiding its potentially significant impacts.

FINDING

This project may have a significant effect on the environment related to operational impacts on CCC steelhead, and a portion of the Environmental Impact Report is required to be revised and recirculated for this single issue. This determination is based upon the criteria of the State CEQA Guidelines, sections 15064 (Determining Significant Effect) and 15065 (Mandatory Findings of Significance), and for the reasons described above. Documents related to the June 2017 EIR and the prior appeal process are also available upon request by contacting Chris Kern, San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, CA 94103, or by phone at (415) 575-9037, or by email at Chris.Kern@sfgov.org.

PUBLIC SCOPING PROCESS

Pursuant to CEQA Guidelines section 15082, this notice of preparation provides sufficient information describing the proposed project with respect to its potential environmental effects on CCC steelhead from project operations to enable responsible and trustee agencies to make a meaningful response on the limited portion of the EIR to be recirculated. The San Francisco Planning Department will accept written comments from agencies and the public for a 30-day period commencing from the date of this Notice. Written comments will be accepted **until 5:00 p.m. on November 17, 2017**. Written comments should be sent to Chris Kern, San Francisco Planning Department, 1650 Mission Street, Suite 400, San Francisco, CA 94103; by fax to 415-558-6409 (Attn: Chris Kern); or by email to Chris.Kern@sfgov.org.

If you work for a responsible State agency, we need to know the views of your agency regarding the scope and content of the environmental information that is germane to your agency's statutory responsibilities in connection with the proposed project and the limited portion of the EIR to be recirculated. Your agency may need to use the EIR when considering a permit or other approval for this project. Please include the name of a contact person in your agency.

Members of the public are not required to provide personal identifying information when they communicate with the Commission or the Department. All written or oral communications, including submitted personal contact information, may be made available to the public for inspection and copying upon request and may appear on the Department's website or in other public documents.

10/12/17
Date

Lisa Gibson
Lisa Gibson
Environmental Review Officer

San Francisco Public Utilities Commission's

Alameda Creek Recapture Project EIR

Scoping Comments Received in Response to

Notice of Preparation of a Recirculated Portion of an EIR

State of California – The Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Bay Delta Region
7329 Silverado Trail
Napa, CA 94558
(707) 944-5500
www.wildlife.ca.gov

EDMUND G. BROWN JR., Governor
CHARLTON H. BONHAM, Director

November 14, 2017

Mr. Chris Kern
San Francisco Planning Department
1650 Mission Street, Suite 400
San Francisco, CA 94103

Dear Mr. Kern:

Subject: Alameda Creek Recapture Project, Notice of Preparation for Recirculated Environmental Impact Report, SCH #2015062072, Alameda County

The California Department of Fish and Wildlife (CDFW) is issuing this letter to comment on San Francisco Planning Department's Notice of Preparation (NOP) for the recirculated Environmental Impact Report (EIR) for San Francisco Public Utilities Commission's (SFPUC) Alameda Creek Recapture Project (ACRP). CDFW received the NOP for the ACRP pursuant to the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.; hereafter CEQA; Cal. Code Regs., § 15000 et seq.), hereafter CEQA Guidelines.

CDFW is providing comments and recommendations regarding those activities involved in the ACRP that are within CDFW's area of expertise and relevant to its statutory responsibilities (Fish and Game Code, § 1802), and/or which are required to be approved by CDFW (CEQA Guidelines, §§ 15086, 15096 and 15204). CDFW is a Trustee Agency with responsibility pursuant to CEQA for commenting on projects that could directly or indirectly impact biological resources. CDFW has jurisdiction over the conservation, protection, and management of fish, wildlife, native plants, and habitat necessary for biologically sustainable populations of those species (i.e., biological resources). As a Trustee Agency, CDFW is responsible for providing, as available, biological expertise to review and comment upon environmental documents and impacts arising from project activities (CEQA Guidelines, § 15386; Fish and Game Code, § 1802).

CDFW is also considered a Responsible Agency under CEQA §15381 if a project requires discretionary approval, such as under the Lake and Streambed Alteration Agreement (LSAA), California Endangered Species Act (CESA), Native Plant Protection Act, or other provisions of the Fish and Game Code that afford protection to the State's fish and wildlife trust resources.

Alameda County Water District (ACWD) and the National Marine Fisheries Service (NMFS) filed letters of petition in July that the original Final EIR's hydrologic analysis did not adequately demonstrate there would be no significant effect on federally threatened Central California Coast (CCC) steelhead. In response, the San Francisco Board of Supervisors voted to reverse the certification, and instructed the Planning Department to recirculate the EIR's hydrologic analysis.

Since reversal of the certification, the Planning Department and SFPUC have engaged with CDFW and NMFS in discussions on how to improve the hydrologic analysis. We are appreciative of this approach. At this time, we have several recommendations for the Planning Department:

1. The hydrologic analysis in the original EIR used the Alameda System Daily Hydrologic Model (ASDHM) to assess with and without ACRP effects on stream flow. The ASDHM predicts flows at a daily time-step at multiple locations in the Alameda Creek watershed. The original EIR did not summarize results of this model on a daily basis. It is important the revamped analysis summarizes and depicts modeled daily patterns of flow across all water year types used in the analysis to determine if project stream flow patterns are appreciably different without project conditions (Calaveras Dam Replacement scenario), and whether it reduces stream flows at locations or during time periods that might negatively impact steelhead.

2. CDFW recognizes the proposed ACRP project is in an ephemeral stream reach that is a migratory corridor, and not year-round rearing habitat for juvenile steelhead. Our primary concern is whether the ACRP will restrict adult steelhead from being able to migrate upstream and access spawning areas above the project, and if it will restrict steelhead smolts from being able to out-migrate through the affected stream area to San Francisco Bay. To assess this the EIR should compare modeled with and without ACRP stream flows to estimate passage flows in the area downstream of the project for steelhead adults and smolts. There are already sources available to estimate minimum passage flow conditions including channel cross-section stage discharge relationships incorporated in the ASDHM (229 total through entire watershed), and fish passage studies done in the Sunol Valley area of Alameda Creek and in the flood control channel. Comparisons should be made and summarized across each hydrologic year in the analysis, but need not extend outside the migration time period considered relevant for each life stage.

3. Water that the SFPUC proposes to recapture is described as stream flow that percolates to a shallow aquifer that resurfaces in the Sunol quarry pits. We presume that not all the streamflow that percolates to this shallow aquifer is recaptured in the quarries. We would ideally like the ASDHM to be further refined to account for total volume of water in the shallow Sunol aquifer, and volume of water recaptured by quarry operations. Generating these estimates, would help ensure that recapture operations are balanced and do not result in overdraft. CDFW recommends that the EIR provide a feasible method to measure total volume of water recaptured compared to total volume of water available in the aquifer.

4. Please be advised that proposing the recapture of creek underflow that resurfaces in quarries will require an LSAA since there is a direct connection to water being pumped from quarries and streamflow in Alameda Creek. Notification is required for any activity that will substantially divert or obstruct the natural flow; change or use material from the bed, channel, or bank including associated riparian or wetland resources; or deposit or dispose of material where it may pass into a river, lake or stream (Fish and Game Code, §§ 1600 – 1616). Work within watercourses with a subsurface flow are subject to notification requirements. CDFW, as a Responsible Agency under CEQA, will consider the EIR for the project. CDFW may not execute the final LSAA until it has complied with CEQA (Public Resources Code § 21000 et seq.) as the responsible agency.

5. The original draft EIR proposed to curtail water recapture from December through March, when water surface levels in quarry Pit F2 would generally be between 200 and 240 feet above mean sea level. Recapture would primarily occur outside of this time period and water surface levels could be pumped below 100 feet above mean sea level. CDFW recommends recapture be further restricted to June through November. Pumping in April and May overlaps with the smolt outmigration time period and could reduce surface flow in Alameda Creek and prevent smolts from being able to outmigrate to the bay.

6. Restrictions in SFPUC recapture from quarry Pit F2 during select time periods does not restrict the quarry operators from being able to pump and discharge water to Alameda Creek during these times with use of their National Pollutant Discharge Elimination System (NPDES) permit. The original EIR states that volumes and timing of discharges are currently variable and would continue to be variable in the future under the proposed project. The recapture of water from Pit F2 under the proposed project would result in reduced volumes of water that the quarry operators would have to manage thereby reducing the potential for quarry NPDES discharges to Alameda Creek, with associated reductions in Alameda Creek stream flow downstream of the quarries. CDFW recommends that the SFPUC explore mechanisms to gain assurance that the quarry operators will curtail pumping during critical time periods for steelhead, namely, January through May which corresponds to time periods where adult steelhead migrate into the Alameda Creek for spawning and smolts migrate downstream to San Francisco Bay. Removal of water from Pit F2 by SFPUC or the quarry operators during this time period could result in increased streambed percolation upstream of the quarries and a reduction in flows for migrating steelhead, even when accounting for the additional discharge provided to the stream by the quarry operations. The EIR should therefore include conditions that curtail pumping from Pit F2 during this time period.

7. The original Draft EIR in Table 3-5 indicates that in dry years proposed recapture volumes will be greater than SFPUC bypass flows that infiltrate pond F2. Additionally, the Draft EIR also indicates the SFPUC would reserve the right to roll over unutilized recapture from previous years to years where there is additional storage available in supply reservoirs for recapture. CDFW is concerned such practices will create an imbalance and could create further reductions in streamflow during dry and critically dry drought years. We recommend proposed recapture be reduced during dry years to levels less than average infiltration of bypass flows to pit F2, and that the roll over recapture option is removed. The EIR should specifically indicate that roll-over recapture will not occur.

Should the Planning Department have any questions regarding this letter, please contact Ms. Marcia Grefsrud, Environmental Scientist, at (707) 644-2812 or marcia.grefsrud@wildlife.ca.gov; or Mr. Sean Cochran, District Fisheries Biologist, at (707) 576-2575 or sean.cochran@wildlife.ca.gov; or Ms. Brenda Blinn, Senior Environmental Scientist (Supervisory), at (707) 944-5541.

Sincerely,

Craig Weightman
Acting Regional Manager
Bay Delta Region

cc: State Clearinghouse
Gary Stern, NMFS, Santa Rosa – gary.stern@noaa.gov
Rick Rogers, NMFS, Santa Rosa – rick.rogers@noaa.gov
Eric Larson, CDFW Bay Delta Region – eric.larson@wildlife.ca.gov
George Neillands, CDFW Bay Delta Region – george.neillands@wildlife.ca.gov
Brenda Blinn, CDFW Bay Delta Region – brenda.blinn@wildlife.ca.gov

California Department of Fish and Wildlife (CDFW) comments on approach to Improved Analyses for Recirculation of the Alameda Creek Recapture Project EIR

Introduction

These comments serve as a follow up from the May 30, 2018 meeting held at the CDFW Region 3 office in Santa Rosa, CA. The San Francisco Planning Department, San Francisco Public Utilities Commission (SFPUC), and consultants from Orion Environmental Associates, Environmental Science Associates (ESA) and Luhdorff and Scalmanini Consulting Engineers presented new developments in the planned analyses for the recirculated Alameda Creek Recapture Project (ACRP) EIR to agency personnel from CDFW and the National Marine Fisheries Service (NMFS). We would like to thank those involved for taking the time to meet with our agencies and brief us on measures added to the analyses to better assess the ACRP's potential impacts on Central California Coast steelhead trout (*Oncorhynchus mykiss*).

Following the meeting we took additional time to digest the material presented, go back through portions of the original project EIR, and to weigh what was presented and consider if it addressed our previous concerns with the project. This document highlights original concerns we had and feel have not been addressed and additional ones that have recently emerged.

Groundwater Analysis

We were pleased to hear that per consultation with an outside subject matter expert SFPUC has chosen to do accounting for total volume of water in the Sunol Valley groundwater basin. However, there are groundwater accounting concerns we raised in our comment letter dated November 14, 2017 (attachment 1) that are not yet addressed. In the following comments we will interchange the terms groundwater, subsurface flow and creek underflow, but in our opinion the correct characterization of water in this shallow confined aquifer is subterranean streamflow.

- At this time there are no plans to estimate the proportion of Calaveras Dam Replacement Project (CDRP) prescribed releases that percolate into the shallow Sunol Valley groundwater basin upstream of Node 6 that is recaptured in quarry Pit F2. In Appendix HYD1 in the original EIR titled *Surface Water Hydrology Report for the SFPUC Alameda Creek Recapture Project* it makes it clear that the hydrologic analysis makes an assumption that all Alameda Creek flow losses between Welch Creek (node 4) and San Antonio Creek (node 6) are assumed to infiltrate to quarry Pit F2. This is a flawed assumption that we fear could result in a mass imbalance between water recapture in Pit F2 and replenishing inputs from the Sunol Valley aquifer. This will be discussed further in this document.
- To us it seems logical only a portion of underflow in the Sunol Valley upstream of San Antonio Creek would reach Pit F2, and that some of this water would traverse the whole basin and remerge as streamflow in Alameda Creek at the top of Niles Canyon. In the most recent ACRP meeting Tom Elson of Luhdorff and Scalmanini Consulting Engineers presented data that directly confirmed this showing that at groundwater monitoring wells 9 and 10 Alameda Creek is a gaining stream, with groundwater inputs from Sunol Valley underflow. We highly recommend incorporating both the above factors into a more detailed groundwater and surface water hydrology model.

<u>Operational Considerations</u>

- This is similar to comment 5 in our November 2017 letter regarding recapture timeframe and Pit F2 water levels. Based on the description of the ACRP in the original project EIR, SFPUC would recapture water from Pit F2 between April and December, and no water recapture would occur from January through March. During the water recapture period water surface levels in Pit F2 could be drawn as low as 100 feet above mean sea level (msl), but would usually be maintained above 150 feet above msl. Water levels during months where water recapture would not occur would rise and be maintained between 200 and 240 feet above msl. With no true estimate of groundwater replenishment rates to Pit F2, it is in our opinion an unknown whether recapturing an average annual amount of 7,178 acre-feet is sustainable. CDFW is concerned that this project could result in extended periods of water drawdown in quarry Pit F2. This could potentially have significant negative effects on streamflow. A misconception of this project has been characterization of the connection between streamflow, underflow, and water in quarry Pit F2. The ACRP project team acknowledges a connection between streamflow and water in Pit F2 when water surface levels in the quarry rise above the Livermore geologic deposits. When water is below these deposits the project team has portrayed them as isolated systems, with continued seepage of aquifer underflow to Pit F2, but no direct effect of one on the other. We however would characterize this as a more complex relationship. Continued drawdown of Pit F2 below the Livermore deposits affects the time it takes aquifer seepage to replenish the pit and establish a direct connection to the aquifer. Sustainable operation of this system should take this into account and would make withdrawals from Pit F2 during only the summer and fall, when streamflow is ephemeral, and water levels in the aquifer decrease. The recapture amount should be such that when winter rains begin, there would be a high likelihood that input from the aquifer would refill the pit and establish a direct connection with the Sunol aquifer for at least a portion of the adult migration and smolt outmigration period. This operational strategy would better mimic natural patterns in streamflow and groundwater, and reduce streamflow losses during a critical period for steelhead.
- This comment is similar to the previous, but in our November 2017 letter we raised concerns that the project EIR stated SFPUC planned to roll over unutilized recapture across years. This comment still remains unaddressed, but fits in with our concerns that there is not detailed enough groundwater modeling to look at groundwater inflows to Pit F2 and create a mass balance water model.

<u>Smolt Outmigration</u>

- In the May 30, 2018 ACRP meeting Tim Ramirez of SFPUC presented several project protections we presume were measures to protect streamflow for outmigrating steelhead smolts including halting recapture operations when water in Pit F2 was above the Livermore gravels (>225 feet above msl) and when streamflow at the Siphon bridge was >10 cfs. Chris Fitzer of ESA also presented a series graphs with hydrologic modeling output for the CDRP scenario for the spring of 2008 (dry water year) with separate breakouts of streamflow at node 5 (upstream of pit F2), natural accretion between nodes 5 and 7, and the net streamflow gain from quarry discharge from pit F2 (factoring in downstream percolation loss). The objective of this was to make a point that streamflow losses upstream of Pit F2 may make smolt outmigration not feasible from upstream areas, despite quarry discharge gains downstream. Both Chris and Tim cited previous steelhead migration studies in Sunol indicated that a 10 cfs flow was needed to aid steelhead smolts in passage over critical riffles. While we appreciate the detailed examination of hydrologic model output and consideration of measures to protect steelhead smolts, we think the most effective method to prevent project impacts to steelhead smolts is to start water recapture operations annually in June after the smolt outmigration season has ended as we previously suggested in our November 2017 comment letter. Even as flows at node 5 decrease to levels that might be considered marginal for migration of steelhead smolts from upstream, there will be steelhead smolts actively migrating below this site. Any reduction in streamflow within the ACRP project reach or below is an impact that will affect the likelihood these fish will successfully make it to San Francisco Bay. The ACRP, as proposed, would affect streamflow in two ways by reducing quarry NPDES discharge to Alameda Creek, but more importantly by potentially drawing down the Sunol aquifer and increasing percolation losses from the stream channel upstream of the project.

- If the project goes forward with the current proposal to recapture water from Pit F2 from April through December, we would like to see detailed summaries of streamflow model results to determine project effects not just across all years in the analysis, but a detailed breakdown within respective years, with particular emphasis on dry years. What will be most critical is assessing effects to outmigrating smolts in April and May (see comment 2 in our November 2017 letter). We would like this summary to take into account passage flows required for steelhead smolts in the stream from node 9 upstream through the project reach, and to summarize the results in a way where one can discern for respective years whether the project results in any reductions in migration opportunity. Exceedance curves alone while informative do not provide this level of detail. Alameda County Water District (ACWD) is required to provide minimum bypass flows which are inclusive of CDRP contributions below their facilities at Niles Cone in April and May for smolt outmigration based on measured flow at node 9, which is the location of the Alameda Creek Niles USGS gage. These bypasses are required under a NMFS biological opinion (SWR-2013-9696). Any reduction in ACWD's ability to meet these minimum bypass flows due to a reduction in streamflow at node 9 from this project will be an impact.
- A general comment to take into consideration. A lot of presumptions regarding this project rely on estimating the quantity, timing and water quality of quarry discharges, both under existing and future conditions. Frankly there are a lot of unknowns surrounding the effects of the quarry discharge on the stream environment. The project team has raised valid questions about water quality of quarry discharge including temperature suitability and discharges not being estimated on an hourly basis. In light of not having specific measurements to assess true negative/positive effects of quarry discharge on steelhead, we think it is best to view increases in streamflow due to quarry discharge during the smolt outmigration timeframe as an improvement in conditions versus any with project conditions that result in appreciable loss in streamflow from reduced discharge by the quarry operators.

<u>Lake and Streambed Alteration Agreement</u>

Although the focus of the meeting was to brief us on measures added to the analyses to better assess the ACRP's potential impacts on Central California Coast steelhead trout we also expressed need to apply for a Lake and Streambed Alteration Agreement due to the recapture of streamflow from Alameda Creek. The presentation on groundwater interaction lent further support to the characterization of the water in Pit F2 as being subterranean streamflow. Furthermore, analysis presented in the EIR discloses the potential for significant effects which should be addressed in a Lake and Streambed Alteration Agreement pursuant to Fish & Game Code section 1600 et seq.

Moving Forward

We request that the City Planning and SFPUC address all our comments from this document and comments from our November 14, 2017 letter (attachment 1). We are flexible as far as response format, which could range from presenting information at another ACRP meeting, or a response in the form of a technical document, or modeling output in an excel file. We request that you also hold at least one more ACRP meeting with CDFW and NMFS staff to present information that responds to our previous comments, new results and get additional feedback. In our opinion this analysis currently is not refined enough recirculate the EIR. Again thanks for continuing to work with our agency. Should the Planning Department have any questions regarding this letter please contact Marcia Grefsrud, Environmental Scientist at 707-644-2812 or by email at marcia.grefsrud@wildlife.ca.gov, or Sean Cochran, District Fisheries Biologist at 707-576-2575 or by e-mail at sean.cochran@wildlife.ca.gov.

Literature Cited

National Marine Fisheries Service. 2017. Endangered Species Act Section 7 (a) (2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Joint Lower Alameda Creek Fish Passage Improvements Project in Fremont, California (Corps No. (2013-00083S). NMFS PCTS # SWR-2013-9696.

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Making Conservation
a California Way of Life

November 20, 2017

SH# 2015062072
GTS # 04-ALA-2016-00204
GTS I.D. 2410
ALA- VAR - VAR

Chris Kern
Planning Department
City and County of San Francisco
1650 Mission Street, Suite 400
San Francisco, CA 94103-2479

San Francisco Public Utilities Commission Alameda Creek Recapture Project – Notice of Preparation for a Recirculated Portion of an Environmental Impact Report

Dear Chris Kern:

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the above referenced project. In tandem with the Metropolitan Transportation Commission's (MTC) Sustainable Communities Strategy (SCS), Caltrans' mission signals a modernization of our approach to evaluate and mitigate impacts to the State Transportation Network (STN). Caltrans' *Strategic Management Plan 2015-2020* aims to reduce Vehicle Miles Traveled (VMT) by tripling bicycle and doubling both pedestrian and transit travel by 2020. Our comments are based on the Notice of Preparation (NOP).

Project Understanding
San Francisco Public Utilities Commission (SFPUC) proposes to implement the Alameda Creek Recapture Project (ACRP) to recapture water that the SFPUC will release from the Calaveras Reservoir and bypass around the Alameda Creek Diversion Dam when the SFPUC implements the instream flow schedule required as part of the regulatory permits for future operations of Calaveras Reservoir. The project is located in Alameda County, within the Sunol Valley on watershed lands owned by the city and county of San Francisco and managed by the SFPUC. The ACRP is one component of the SFPUCs water system improvement program, which has the overall objective of improving the reliability of the regional water system that serves drinking water to 2.6 million people in the bay area. The project site is adjacent to Interstate (I)-680, just south of the I-680/State Route (SR) 84 junction.

The Planning Department published a Final Environmental Impact Report (FEIR) on the SFPUC Alameda Creek Recapture Project on June 7, 2017. On September 19, 2017, the San Francisco Board of Supervisors adopted findings reversing the FEIR certification and directed the

Planning Department to provide additional information and analysis regarding whether the proposed project would result in operational impacts on steelhead fish in the lower watershed as a result of project-induced effects on streamflow in Alameda Creek. The Board also directed that in conducting such additional environmental analysis, the Planning Department enlist an independent third party to review the groundwater/surface water analysis used in the DEIR to determine if the analysis adequately and accurately supports the fisheries impact analysis as required by the California Environmental Quality Act. The Board determined that with respect to all other issues, the June 2017 DEIR is adequate, accurate, and objective, and no further analysis is required. Therefore, consistent with this direction from the Board, the Planning Department has revised and recirculated a limited portion of the June 2017 DEIR that will provide additional information and analysis on operational impacts on steelhead fish in the lower watershed as a result of project-induced effects on streamflow in Alameda Creek.

Lead Agency
As the Lead Agency, SFPUC is responsible for all project mitigation, including any needed improvements to the STN. The project's fair share contribution, financing, scheduling, implementation responsibilities and lead agency monitoring should be fully discussed for all proposed mitigation measures.

Encroachment Permit
Please be advised that any work or traffic control that encroaches onto the State right-of-way (ROW) requires an Encroachment Permit that is issued by Caltrans. Traffic-related mitigation measures should be incorporated into the construction plans prior to the encroachment permit process. To apply, a completed Encroachment Permit application, the adopted environmental document, and five (5) sets of plans clearly indicating State ROW must be submitted to: Office of Permits, California DOT, District 4, P.O. Box 23660, Oakland, CA 94623-0660. Traffic-related mitigation measures should be incorporated into the construction plans prior to the encroachment permit process. See the website link below for more information.

http://www.dot.ca.gov/hq/traffops/developserv/permits/

Thank you again for including Caltrans in the environmental review process. Should you have any questions regarding this letter, please contact Jannette Ramirez at (510) 286-5535 or jannette.ramirez@dot.ca.gov.

Sincerely,

PATRICIA MAURICE
District Branch Chief
Local Development - Intergovernmental Review

c: State Clearinghouse

ALAMEDA COUNTY WATER DISTRICT

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November 16, 2017

Chris Kern
San Francisco Planning Department
1650 Mission Street, Suite 400
San Francisco, CA 94103-2479

Dear Mr. Kern:

Subject: Comments on the Notice of Preparation of a Recirculated Environmental Impact Report for the Alameda Creek Recapture Project

Thank you for the opportunity to provide comments on the Notice of Preparation (NOP) for the recirculated portion of Alameda Creek Recapture Project (ACRP) Environmental Impact Report (EIR). The Alameda County Water District (ACWD) acknowledges the significant accomplishments of San Francisco Planning Department (Planning) and the San Francisco Public Utilities Commission (SFPUC) to date in the implementation of the Water Supply Improvement Program (WSIP) since ACWD is a customer and, therefore, a beneficiary of the water supply reliability improvements that the SFPUC is achieving through its implementation.

ACWD recognizes that only a portion of the EIR is being recirculated pursuant to the San Francisco Board of Supervisors' September 19, 2017 Motion M17-148, reversing the Planning Commission's Certification of the Final EIR for the SFPUC ACRP. The Board of Supervisors action was based on the written record and oral testimony submitted in connection with the appeal of the final EIR certification that is included in the Clerk of the Board of Supervisors' File No. 170893. Portions of the written record are specifically referred to in these comments to the NOP because they relate to the portion of the EIR being recirculated.

ACWD has a strong interest in protecting and preserving water quality and water supply in Alameda Creek and the Alameda Creek Watershed. ACWD is particularly concerned with potential impacts that the ACRP may have on ongoing fisheries restoration in Alameda Creek. With a service area located downstream of the proposed project location, ACWD uses water from the Alameda Creek Watershed for drinking water supply to over 351,000 people in the cities of Fremont, Newark, and Union City. ACWD relies on adequate flow in Alameda Creek for groundwater recharge and its subsequent use as a potable drinking water supply. Moreover, ACWD, together with the SFPUC and other watershed stakeholders, is actively involved in the ongoing efforts to restore the steelhead run in the Alameda Creek Watershed. On October 5, 2017, the National Marine Fisheries Service (NMFS) issued a Biological Opinion for the

ACWD/Alameda County Flood Control and Water Conservation District's (ACFC's) Joint Lower Alameda Creek Fish Passage Improvements Project. For convenience, the Biological Opinion for the Joint Lower Alameda Creek Fish Passage Improvements Project is enclosed.

As described in the NOP, the ACRP is intended to recapture flows released from Calaveras Reservoir and bypassed through the Alameda Creek Diversion Dam as part of the future operations plan described in the Calaveras Dam Replacement Project Biological Opinion. The ACRP will rely on the slow and steady percolation of surface water from Alameda Creek into the Sunol Valley Groundwater Basin, and into Pit F2, from where it will be pumped to surface water storage or treatment. Pit F2 will effectively act as a depression in southern Sunol Valley, and the dewatering of Pit F2 could facilitate recapture by increasing the percolation from Alameda Creek into Pit F2.

The NOP states that an estimated average of 14,695 AF/year would be released from Calaveras Dam or bypassed at the Alameda Creek Diversion Dam, and the ACRP would recapture approximately half of this amount, an estimated average of 7,178 AF/year. However, with the ACRP, the daily rates of releases and bypass flows would be significantly different from the daily recapture rates. Specifically, these releases and bypasses often would be in the range of ten to several thousand cubic feet per second (cfs), while the recapture rates likely would be in the range of one to ten or twenty cfs. Thus, when releases or bypasses are high, substantial amounts of these releases and bypasses would flow through the Sunol Valley and would not percolate into the ground. Conversely, when releases or bypasses are low, the ACRP would capture Alameda Creek flows that would not be derived from either releases or bypasses. As noted in ACWD's comments below, the disparity between bypass and release rates and recapture rates with implementation of the ACRP may have significant impacts to a variety of types of resources and, therefore, should be analyzed in sufficient detail so that potential impacts can be understood and mitigated as necessary.

Since most of the water associated with releases from Calaveras Dam and bypasses through the Alameda Creek Diversion Dam will flow through the Sunol Valley and will not percolate into the Sunol Valley groundwater basin, the ACRP, under currently contemplated operations, would pump additional water that would not be derived from either releases or bypasses. Some release or bypass water would be recaptured; however, additional water originating from sources other than Calaveras Reservoir and the Alameda Creek Diversion Dam, such as local groundwater and surface water drainages, also might be captured, pumped, and delivered to storage or treatment as a result of the ACRP. Due to this proposed mechanism of operations, it is incorrect to define the ACRP strictly as a "recapture" facility. Rather, the ACRP would act as an alternative water supply or management system to compensate for lost yield from Calaveras Dam and Alameda Creek Diversion Dam.

ACWD Comments

Pursuant to the Board of Supervisors' Motion M17-148, the recirculated portion of the EIR must provide additional information and analysis to address whether the operation of the proposed Project would result in impacts to steelhead in the lower watershed as a result of Project-induced changes in Alameda Creek streamflows. The motion further directs that, in conducting this additional environmental analysis, Planning shall enlist an independent third party to review the groundwater/surface water model to determine if the current model adequately and accurately analyzes the fisheries issues, as required by the California Environmental Quality Act (CEQA). ACWD requests that, to achieve the requirements of Motion M17-148, the EIR include sufficient detail to address the following areas of concern:

1. Additional Analysis and Modeling Approach

   ACWD fully supports Planning retaining an independent third party specialist to review the modeling methodology used for the EIR. Surface water and groundwater interactions are complex and dynamic physical processes. The Alameda System Daily Hydrologic Model (ASDHM) used in the EIR analysis is an empirically derived surface water model developed to analyze surface water flow rates under existing and future conditions. As noted in previous comments, to properly analyze the operational impacts on steelhead in the lower watershed as a result of Project-induced effects on Alameda Creek streamflows, as required by CEQA, the EIR must use a more robust, process-based hydrologic model capable of estimating the impacts on surface water flows rates, groundwater storage, and varying streamflow loss rates to Pit F-2 as a result of the proposed operations of the ACRP throughout the project area, in Niles Canyon, and out to the San Francisco Bay. In addition, as is often the case with surface water and groundwater interactions, controlled physical tests should be conducted and would likely be more conclusive in analyzing these interactions and how they might impact Alameda Creek streamflows and associated fish passage.

   ACWD requests that the independent third party reviewer be provided the record in Board of Supervisors File No. 170839 related to the methodology used in the EIR, and that this information be incorporated into the analysis of operational effects on Alameda Creek streamflows and associated impacts on steelhead. Specifically, the third party reviewer should evaluate the portion of the August 23, 2017 memorandum from Horizon Water and Environment regarding the hydrologic methodologies in the ACRP EIR (section IV), that was included as Exhibit C to ACWD's August 25, 2017 letter to the Board of Supervisors. For convenience, Horizon Water and Environment's memorandum is enclosed.

   Likewise, the July 27, 2017 NMFS comment letter to the Board of Supervisors should be addressed in the recirculated EIR. NMFS stated, "Based on our review of the Final EIR, NMFS believes the document does not contain sufficient information to conclude the ACRP will not result in substantial effects on streamflows that support the migration of [Central California Coast] steelhead in Alameda Creek." In the same letter NMFS went on to say:

   > We recommend the San Francisco Planning Commission and the San Francisco Public Utilities Commission undertake additional analysis to examine the relationship between groundwater and surface water in the Sunol Valley for the purpose of determining the project's potential impacts on a daily time-step to streamflows in Alameda Creek downstream of the project site.

   ACWD requests that Planning work with NMFS, ACWD, and other watershed stakeholders, as well as the independent third party consultant, to develop a model that is robust enough to analyze the dynamic surface water to groundwater processes in the Sunol Valley under the proposed future operations of the ACRP. Specifically, because ACRP is a project of statewide, regional, and area wide significance due, in part, to substantial impacts to steelhead habitat and restoration of steelhead habitat, ACWD requests that Planning conduct a scoping meeting pursuant to CEQA Guidelines section 15082(c) so that ACWD and other interested parties can provide input on: 1) the additional information and analysis of the operational impacts on steelhead as a result of Project-induced changes in Alameda Creek streamflows, and 2) the independent third party review of the groundwater/surface water model to determine its adequacy and accuracy to analyze Alameda Creek streamflows and related fisheries issues.

The modeling approach used in the recirculated EIR to analyze impacts of ACRP should provide sufficient detail to analyze impacts associated with the differing rates of Project releases, bypasses, and recaptures on Alameda Creek streamflows and the following related resources:

- Anadromous fish passage in the Alameda Creek Flood Control Channel, Niles Canyon, and Sunol Valley.

- Aquatic and riparian habitat in Niles Canyon and Sunol Valley.

To achieve this, and to be consistent with past and ongoing work performed by members of the Fisheries' Workgroup, ACWD requests the following components be included in both: 1) the independent third party review of the surface water/groundwater analysis; and 2) the additional information and analysis on operational impacts on steelhead in the lower watershed as a result of Project-induced effects on Alameda Creek streamflows:

a) Calculation of daily groundwater seepage rates and surface water recharge from Alameda Creek and San Antonio Creek into Pit F2.

b) Quantification of the daily changes in groundwater storage as well as the amounts of release and bypass water that will actually percolate into the Sunol Valley Groundwater Basin (DWR Basin No. 2-11).

c) Quantification of the daily amounts of water that originate from sources besides Calaveras Dam releases and Alameda Creek Diversion Dam bypasses and that will be pumped out of Pit F2 at the various times of operation.

Because the proposed ACRP will operate differently in different hydrologic years, because groundwater levels will influence ACRP recapture rates, and because dry year ACRP pumping will exceed bypass, release, and recharge rates during dry years, the analysis needs to evaluate the impacts of the ACRP on surface water flows in Alameda Creek during dry, average, and wet years. Specifically, the hydrologic model needs to be able to provide a detailed accounting of daily inputs and withdrawals into and out of the Sunol Valley Groundwater Basin using the carryover accounting methodology described in the EIR, and to apply this methodology to extended cycles of floods and droughts. While the model has a limited hydrologic timeframe, it should at a minimum extend through 2016, thus capturing the recent drought and post-drought recovery. Ideally the analysis would also include an extended, multiple year droughts like the 1987-1992 drought.

All analyses of the ACRP should be performed under future buildout levels of demands to analyze Project impacts under conditions with the highest stress to the surface water and groundwater resources.

2. Additional Information and Analysis - Cumulative Impacts and Past, Present, and Future Work on Fisheries Projects

   The NOP states that the recirculated EIR will evaluate potential cumulative impacts resulting from implementation of the ACRP in combination with other projects in the vicinity. This cumulative impacts analysis should include projects that are being pursued by the Alameda Creek Fisheries Workgroup including the ACWD/ACFC's Joint Lower Alameda Creek Fish Passage Improvements Project, ACFC's projects in the Lower Alameda Creek, SFPUC's projects in Niles Canyon, and PG&E's plans to address fish passage in Sunol Valley. Additionally, the recirculated portions of the EIR should evaluate the impacts to fish passage in Lower Alameda Creek by considering the October 5, 2017 Biological Opinion from NMFS for the Joint Lower Alameda Creek Fish Passage Improvements Project as part of the physical environmental conditions or CEQA baseline. Section 2.6 of the Lower Alameda Creek Fish Passage Improvements Biological Opinion indicates that it is the goal of the SFPUC "to avoid all impacts to steelhead migration associated with the future operation of the ACRP." ACWD believes that, to be assured that the current proposal for operations of the ACRP will avoid all impacts to steelhead migration, more detailed analyses must be carried out (as described in other portions of this letter).

3. Additional Information and Analysis - Continued Monitoring

   ACWD requests the scope of the recirculated EIR contain a description of an adaptive monitoring plan, which will provide additional information and analysis regarding the operational impacts to steelhead, as required by Motion M17-148, and which will help to ensure that the ongoing operation of the ACRP does not have a negative impact on the recovery of steelhead in the Alameda Creek Watershed. At a minimum, this adaptive monitoring plan should include the installation of a United States Geological Survey gage in the vicinity of the confluence of Alameda Creek and Arroyo de la Laguna so the impacts of the operation of ACRP on surface water flow through the Sunol Valley can be identified to facilitate adjustments to ACRP operations to minimize these impacts.

4. Additional Information and Analysis - Sources of Water to be Recaptured

   To fully evaluate the Project's operational impacts on steelhead as required by Motion M17-148, the recirculated EIR should identify the water supplies that would be captured as a result of ACRP operations and include an analysis of the impacts to both surface water and groundwater in the affected area. This analysis should include the impacts of adding an additional point of diversion to SFPUC's Calaveras Reservoir water rights, to determine if this additional and proposed Project operations would change downstream Alameda Creek streamflows in any way that would impact other legal users of Alameda Creek water, including both steelhead and ACWD. This evaluation should clearly evaluate the changes in surface water flows in Alameda Creek and groundwater conditions in the Sunol Valley with the ACRP in operation, when compared to the future conditions scenario in NMFS's Biological Opinion for Calaveras Reservoir. The projected future operations of Calaveras Reservoir without the ACRP were permitted by NMFS with the assumption that all of the water stored in and conveyed from Calaveras Reservoir would be diverted only at the reservoir or the Alameda Creek Diversion Dam. The ACRP would add an additional point of diversion downstream from the existing points of diversion, and would divert water from sources besides Alameda Creek Diversion Dam bypasses and Calaveras Reservoir releases, and proposed operations with these changes were not evaluated or authorized by NMFS's Biological Opinion for Calaveras Reservoir.

Thank you again for the opportunity to comment during the project scoping phase. ACWD wishes to work together collaboratively with and to provide consultation to Planning and SFPUC staff as they consider revising and recirculating this EIR as directed by the Board of Supervisors in Motion M17-148. ACWD would like to meet with Planning staff and other concerned parties as part of this scoping process. Should you have any questions about these comments or about ACWD's Alameda Creek water supply and downstream operations, please feel free to contact Steven Inn, Manager of Water Resources, at (510) 668-4441. We look forward to coordinating and collaborating further with you on this project.

Sincerely,

RBShaver

Robert Shaver
General Manager

la/tf
Attachments
cc: Steve Ritchie, San Francisco Public Utilities Commission
Ellen Levin, San Francisco Public Utilities Commission
Daniel Woldesenbet, Alameda County Public Works
Hank Ackerman, Alameda County Public Works

ALAMEDA COUNTY WATER DISTRICT

DIRECTORS
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JONATHAN WUNDERLICH
Finance

December 6, 2017

Chris Kern
San Francisco Planning Department
1650 Mission Street, Suite 400
San Francisco, CA 94103-2479

Dear Mr. Kern:

Subject: Comments on the Scoping Meeting at the San Francisco Planning Department for the Recirculated Environmental Impact Report for the Alameda Creek Recapture Project

Thank you for the opportunity to attend, seek clarification, and provide comments at the December 6, 2017, Scoping Meeting for the recirculated portion of Alameda Creek Recapture Project (ACRP, Project) Environmental Impact Report (EIR).

The Alameda County Water District (ACWD) is submitting this letter concurrently with the December 6 Scoping Meeting to the San Francisco Planning Department (Planning) and the San Francisco Public Utilities Commission (SFPUC) for your consideration in the preparation of the recirculated portions of the EIR. This letter also supplements ACWD staff's questions and comments that may arise at the Scoping Meeting.

ACWD Comments on the Scoping Meeting

Pursuant to the Board of Supervisors' Motion M17-148, the recirculated portion of the EIR must provide additional information and analysis to address whether the operation of the proposed Project would result in impacts to steelhead in the lower watershed as a result of Project-induced changes in Alameda Creek flows. The motion further directs that, in conducting this additional environmental analysis, Planning shall enlist an independent third party to review the groundwater/surface water model to determine if the current model adequately and accurately analyzes the fisheries issues, as required by the California Environmental Quality Act (CEQA). To achieve the requirements of Motion M17-148, the EIR should include sufficient detail to address the following areas of concern:

1. Scope of Review by Independent Third Party Specialist

   ACWD fully supports Planning retaining a third party specialist to conduct an independent review of the modeling methodology used for the EIR. Surface water and groundwater interactions are complex and dynamic physical processes. Upon request by ACWD, Planning has provided ACWD with a scope of work for the third party specialist. The memo, "Scope of Work for Third Party Independent Review of ACRP EIR Conceptual Groundwater Model," dated October 11, 2017, (Scope of Work) is attached and sets forth a review process that does not appear to be truly independent, as requested in Motion M17-148. The Scope of Work indicates that Planning provides the reviewer with specific, and limited, documents and establishes the key questions of the review; moreover, the Scope of Work describes the report preparation process whereby the peer reviewer shall incorporate Planning's comments and revisions into the peer reviewer's draft and final reports.

A. QUESTION
Will Planning provide the independent third party reviewer with the full record in Board of Supervisors File No. 170839, including the information submitted by National Marine Fisheries Service (NMFS) and ACWD during the appeal process, in order to evaluate the concerns regarding the existing methodology?

B. REQUEST
ACWD requests that the third party reviewer be provided the record in Board of Supervisors File No. 170839 related to the methodology used in the EIR, including the information submitted by NMFS and ACWD during the appeal process, and that this information be incorporated into the analysis of operational effects on Alameda Creek flows and associated impacts on steelhead. Additionally, ACWD requests the peer reviewer be given freedom, after adequate time to review of the entire record, to establish their own questions and to prepare a truly independent report of their review.

2. <u>Additional Information and Analysis</u>

On November 30, 2017, ACWD received a memorandum, dated the same day, from ESA to Planning which describes a calculation error that impacts the modeling results for Alameda Creek flow estimates presented in the Project EIR. The correction of these errors changes the resulting analysis of the Project impacts to Alameda Creek flows, and the significance of these changes is an indication of the sensitivities of the model to input variables such as quarry discharges.

A. QUESTION
Will Planning provide complete documentation of the original basis for the quarry discharge inputs previously used in the modeling for the EIR, as well as complete documentation for the new information that formed the basis for correcting the error in the modelling?

B. REQUEST
ACWD requests that Planning provide complete documentation of the original basis for the quarry discharge inputs previously used in the modeling for the EIR, as well as complete documentation for the new information that formed the basis for discovering the error in the model that Planning corrected.

3. <u>Modeling Approach</u>

In previous comments, ACWD and others have asserted that the EIR must use a more robust, process-based hydrologic model capable of estimating the impacts on surface water flows rates, groundwater storage, and varying streamflow loss rates to Pit F-2 as a result of the proposed operations of the ACRP throughout the project area, in Niles Canyon, and out to the San Francisco Bay. The July 27, 2017, NMFS comment letter to the Board of Supervisors stated:

> We recommend the San Francisco Planning Commission and the San Francisco Public Utilities Commission undertake additional analysis to examine the relationship between groundwater and surface water in the Sunol Valley for the purpose of determining the project's potential impacts on a daily time-step to streamflows in Alameda Creek downstream of the project site.

The November 30, 2017, ESA memorandum seems to underscore previously identified deficiencies in the model. The model does not provide consistent, understandable results when subjected to minor changes to input variables, which indicates the model is not robust enough to confidently analyze such a complex system. For example, in the memo, the act of increasing quarry discharges to Alameda Creek at times exhibits decreased net streamflow. Finally, the Notice of Preparation for the recirculation of the EIR does not include a description of this revision to the modeling, even though ACWD and NMFS have requested that Planning revise the modeling approach to address these identified concerns.

A. QUESTION
Will Planning commit to working with NMFS, ACWD, and other watershed stakeholders, as well as the independent third party consultant, to develop a model that is robust enough to analyze the dynamic surface water to groundwater processes in the Sunol Valley under the proposed future operations of the ACRP?

B. REQUEST
ACWD requests that Planning commit to working with NMFS, CDFW, ACWD, and other watershed stakeholders, as well as the independent third party consultant, to develop a model that is robust enough to analyze the dynamic surface water to groundwater processes in the Sunol Valley under the proposed future operations of the ACRP.

Thank you for the additional opportunity to comment during the Project scoping phase. ACWD wishes to work together collaboratively with and to provide consultation to Planning and SFPUC staff as they consider revising and recirculating this EIR as directed by the Board of Supervisors in Motion M17-148. Should you have any questions about these comments, please feel free to contact Steven Inn, Manager of Water Resources, at (510) 668-4441. We look forward to coordinating and collaborating further with you on this project.

Sincerely,

Robert Shaver
General Manager

la/tf
Attachment
Hand delivered
cc: Steve Ritchie, San Francisco Public Utilities Commission
Ellen Levin, San Francisco Public Utilities Commission

ALAMEDA COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT, ZONE 7
100 NORTH CANYONS PARKWAY, LIVERMORE, CA 94551-9486 • PHONE (925) 454-5000

October 31, 2017

Chris Kern
San Francisco Planning Department
1650 Mission Street, Suite 400
San Francisco, CA 94103

Sent by email: Chris.Kern@sfgov.org

Re: Notice of Preparation - Alameda Creek Recapture Project (Recirculation)

Zone 7 Water Agency (Zone 7, or Zone 7 of the Alameda County Flood Control and Water Conservation District) has reviewed the referenced Notice of Preparation in the context of Zone 7's mission to provide water supply, flood protection, and groundwater and stream management within the Zone 7 Service Area. Zone 7 has also been a long-time member of the Alameda Creek Fisheries Restoration Workgroup.

We have a few comments for your consideration:

1. The project should not result in operational changes to upstream (Zone 7) or downstream (ACWD and ACPWA) water supply or flood protection agencies.

2. The analysis should address any potential flooding impacts. Of particular concern in this region is the Sunol Glen Elementary School.

3. Zone 7 has nearly completed a major update to the Stream Management Master Plan, including extensive floodplain modeling. Please contact Jeff Tang, 925-454-5075 or jtang@zone7water.com, for more information.

4. The EIR should include adequate analysis on any potential impacts on groundwater resources and management.

5. Attached for your reference are (1) Zone 7's 2015 comment letter on the Notice of Preparation, and Zone 7's 2017 comment letter on the appeal of certification of the EIR.

Thank you for the opportunity to comment on this project. If you have any questions on this letter, please feel free to contact me at (925) 454-5005 or via email at erank@zone7water.com .

Sincerely,

Elke Rank

Elke Rank

cc: Carol Mahoney, Amparo Flores, file

Alameda Creek Alliance

P.O. Box 2626 • Niles, CA • 94536
Phone: (510) 499-9185
E-mail: alamedacreek@hotmail.com
Web: www.alamedacreek.org

November 15, 2017

Chris Kern
San Francisco Planning Department
1650 Mission Street, Suite 400
San Francisco, CA 94103

Re: Recirculated EIR for Alameda Creek Recapture Project

Dear Chris Kern:

Thank you for the opportunity to comment on the Notice of Preparation for the recirculated portion of Alameda Creek Recapture Project (ACRP) Environmental Impact Report (EIR).

The Alameda Creek Alliance has a long history of working to restore steelhead trout in the Alameda Creek watershed, and has worked with the SFPUC since 1999 to improve habitat conditions to support the recovery of steelhead. We share regulatory agency concerns about the potential impacts that the ACRP may have on fisheries restoration in Alameda Creek.

The recirculated portion of the EIR is intended to provide additional information and analysis to evaluate whether operation of the ACRP would result in impacts to steelhead trout in the lower watershed as a result of project-induced effects on streamflow in Alameda Creek. The Planning Department has been directed to recruit an independent third party to review the groundwater/surface water model used for analysis, to determine if the current model adequately and accurately analyzes the fisheries issues and impacts as required by CEQA. The Planning Department has also been directed to work with regulatory agencies, ACWD and other watershed stakeholders, and the independent third party consultant to develop a suitable model to analyze surface water/groundwater processes in the Sunol Valley under the proposed future operations of the ACRP.

We request that the Planning Department, SFPUC and the independent third party consultant meet with the Alameda Creek Fisheries Restoration Workgroup as part of the scoping process, to initiate this analysis and evaluation of the model. The Fisheries Workgroup is the longstanding stakeholder forum for Alameda Creek fisheries issues, and benefits from participation and expertise from regulatory agencies, water management agencies, consultants and advocacy groups.

Sincerely,

Jeff Miller
Director
Alameda Creek Alliance

San Francisco Public Utilities Commission's

Alameda Creek Recapture Project EIR

Scoping Meeting

Notice of Public Scoping Meeting on a Recirculated Portion of an Environmental Impact Report

1650 Mission St.
Suite 400
San Francisco,
CA 94103-2479

Reception:
415.558.6378

Fax:
415.558.6409

Planning
Information:
415.558.6377

Date:	November 21, 2017
Case No.:	**2015-004827ENV**
Project Title:	**Alameda Creek Recapture Project**
Location:	The Sunol Valley in unincorporated Alameda County, west of Calaveras Road and south of Interstate 680. The proposed facilities would be constructed within and adjacent to an existing quarry pit on lands owned by the City and County of San Francisco.
BPA Nos.:	N/A
Zoning:	Water Management
Block/Lot:	N/A
Project Sponsor	San Francisco Public Utilities Commission Antonia Sivyer – (415) 554-2474
Lead Agency:	San Francisco Planning Department
Staff Contact:	Chris Kern – (415) 575-9037 Chris.Kern@sfgov.org

The San Francisco Planning Department is hereby issuing this notice of a public scoping meeting on a recirculated portion of the environmental impact report (EIR) for the project listed above. The purpose of the scoping meeting is to receive oral comments on the scope of the recirculated portion of the EIR, which will address significant new information that was identified subsequent to the certification of the Final EIR for this project in June 2017. The San Francisco Planning Department issued a notice of preparation (NOP) of the recirculated portion of the EIR on October 18, 2017 to inform the public and responsible and interested agencies about the intent to prepare a recirculated portion of the EIR. This NOP is available online at the following website: http://sf-planning.org/sfpuc-negative-declarations-eirs.

BACKGROUND AND PROJECT DESCRIPTION

On June 22, 2017, the San Francisco Planning Commission certified the Final EIR (or June 2017 EIR) for the San Francisco Public Utilities Commission's (SFPUC) Alameda Creek Recapture Project (ACRP or proposed project). On September 19, 2017, following an appeal by the Alameda County Water District of the certification of the EIR, the San Francisco Board of Supervisors (Board) adopted findings reversing the Final EIR certification and directed the Planning Department to provide additional information and analysis on one aspect of the project: operational impacts on steelhead fish in the lower watershed as a result of project-induced effects on streamflow in Alameda Creek. The Board determined that with respect to all other issues, the June 2017 EIR is adequate, accurate, and objective, and no further analysis is required. This decision was based on "significant new information" under CEQA Guidelines section 15088.5 that was submitted by the National Marine Fisheries Service (NMFS) on Central California Coast (CCC) steelhead (*Oncorhynchus mykiss*) distinct population segment (DPS), a species listed as threatened under the federal Endangered Species Act. Therefore, consistent with this direction from the Board, the Planning Department will recirculate a limited portion of the June 2017 EIR that will provide additional information and analysis on operational impacts on steelhead fish in the lower watershed as a result of project-induced effects on streamflow in Alameda Creek.

The SFPUC is proposing the ACRP, a water supply project located within the SFPUC Alameda Watershed in Alameda County, as a part of improvements to its regional water system. Under the ACRP, the SFPUC would recapture some of the water that will be released from Calaveras Reservoir and/or bypassed around the Alameda Creek Diversion Dam when the SFPUC implements the instream flow schedules required as part of the regulatory permits for future operations of Calaveras Reservoir to improve conditions in Upper Alameda Creek for native aquatic species including steelhead fish. The recaptured water would maintain the historical contribution from the Alameda Watershed to the SFPUC regional water system, in accordance with the City and County of San Francisco's existing water rights. The proposed project would involve constructing facilities to withdraw water from Pit F2, an existing quarry pit formerly used by quarry operators located adjacent to Alameda Creek about six miles downstream of Calaveras Reservoir. The SFPUC would convey the recovered water to existing SFPUC facilities for treatment and distribution to its water supply customers in the Bay Area. Pit F2 passively collects water originating upstream from Alameda Creek through natural subsurface percolation and seepage, so the SFPUC would not construct any facilities within the Alameda Creek stream channel or actively divert water from the creek.

FINDING

The Planning Department has determined that a portion of the EIR prepared for the proposed project must be revised and recirculated prior to any final decision regarding whether to approve the project.

PUBLIC SCOPING PROCESS

Pursuant to CEQA section 21083.9(a)(2) and CEQA Guidelines section 15082(c)(1), a public scoping meeting will be held to receive oral comments concerning the scope of the recirculated portion of the EIR. The meeting will be held on **December 6, 2017 at 2 p.m.** at the **San Francisco Planning Department, 1650 Mission Street, Room 431, San Francisco, California**. To request a language interpreter or to accommodate persons with disabilities at the scoping meeting, please contact the staff contact listed above at least 72 hours in advance of the meeting. Written comments will also be accepted at this meeting. As indicated in the NOP for this project, written comments were accepted from October 18, 2017 and until 5:00 p.m. on November 17. 2017. If you have questions concerning environmental review of the proposed project, please contact **Chris Kern at (415) 575-9037**.

Members of the public are not required to provide personal identifying information when they communicate with the Commission or the Department. All written or oral communications, including submitted personal contact information, may be made available to the public for inspection and copying upon request and may appear on the Department’s website or in other public documents.

SAN FRANCISCO
PLANNING DEPARTMENT

Recirculated Portions of EIR Public Scoping Meeting Sign-In Sheet
SFPUC Alameda Creek Recapture Project
December 6, 2017

PRINT NAME	ORGANIZATION/AFFILIATION	ADDRESS	TELEPHONE	EMAIL
1. Leonard Ash	ACWD	43885 S. Grimmer Blvd. Fremont CA 94538	510-668-4209	leonard.ash@acwd.com
2. Evan Buckland	ACWD	"	510-668-6539	evan.buckland@acwd.com
3. Thomas Niesar	ACWD	"	510-668-6549	Thomas.Niesar@ACWD.com
4. Tom Francis	BAWSCA	155 Bovet Road, Suite 650 San Mateo, CA 94402	650-349-3000	tfrancis@bawsca.org
5. Sean Cochran	CDFW	3633 Westwind Blvd Santa Rosa, CA 95403	707 576-2575	Sean.cochran@wildlife.ca.gov
6. Betty Rhodes	SFPUC	525 Golden Gate #12 SF 94102	415-554-3240	BLaupp@sfwater.org
7. Bryan Dessaure	SFPUC	525 Golden Gate Ave 9th Fl SF, CA 94103	415-551-4619	bdessaure@sfwater.org
8. Antonia Sivyer	SFPUC	525 Golden Gate	415 554-2474	asivyer@sfwater.org
9. IRINA TORREY	SFPUC	525 GOLDEN GATE	415 554-3232	ITORREY@SFWATER.ORG
10. Josh Milstein	SF City Atty	1390 Market St. 418	415 554-4211	

***Privacy Notice: All information provided on this form will become part of the public record.**

11. Joyce Hsiao Orion 550 Kearny, #800A, SF 415-951-9503 joyce@orionenvironment.com

SAN FRANCISCO PLANNING DEPARTMENT

---o0o---

PUBLIC SCOPING MEETING ON THE

SFPUC ALAMEDA CREEK RECAPTURE PROJECT

RECIRCULATED PORTION OF THE

DRAFT ENVIRONMENTAL IMPACT REPORT

---o0o---

Wednesday, December 6, 2017

1650 Mission Street, Room 431

San Francisco, California

Reported By: Deborah Fuqua, CSR #12948

APPEARANCES:

<u>San Francisco Planning Department</u>

CHRIS KERN, Senior Environmental Review Coordinator

<u>San Francisco Public Utilities Commission</u>

TIM RAMIREZ, Natural Resources Division

NANCY RHODES, Communications, Public Outreach

ELLEN LEVIN, Deputy Manager, Water Enterprise

BRYAN DESSAURE, Bryan Dessaure, Project Management

ANTONIA SINGER, Antonia Singer, Environmental Project Management

IRINA TORREY, Manager, Bureau of Environmental Management

<u>City Attorney of San Francisco</u>

JOSH MILSTEIN, Deputy City Attorney

<u>Orion + ESA</u>

JOYCE HSIAO, Project Manager

<u>Alameda County Water District</u>

THOMAS NIESER

LEONARD ASH

EVAN BUCKLAND

STEVEN INN (appearing telephonically)

PATRICK MIYAKI, general Counsel (appearing telephonically)

APPEARANCES (continued):

Bay Area Water Supply and Conservancy Agency

TOM FRANCIS

California Department of Fish and Wildlife

SEAN COCHRAN

MARCIA GREFSRUD (appearing telephonically)

Zone 7 Water Agency

ELKE RANK (appearing telephonically)

Alameda Creek Alliance

JEFF MILLER

Horizon Water and Environment

TOM ENGELS

Wednesday, December 6, 2017 2:05 p.m.

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P R O C E E D I N G S

CHRIS KERN: Okay. I think we're going to get started. This is Chris Kern with the Planning Department, and I'll be running this meeting.

We'll just go around the table here first.

TOM FRANCIS: I'm Tom Francis. I'm with the Bay Area Water Supply and Conservation Agency, BAWSCA.

THOMAS NIESER: Thomas Nieser, with Alameda County Water District or ACWD.

LEONARD ASH: I'm Leonard Ash with ACWD.

EVAN BUCKLAND: My name is Evan Buckland, also with ACWD.

SEAN COCHRAN: Sean Cochran with California Department of Fish and Wildlife.

TIM RAMIREZ: Tim Ramirez with the PUC, Natural Resources Division.

NANCY RHODES: Nancy Rhodes, SFPUC, Communications, Public Outreach.

ELLEN LEVIN: Ellen Levin, Deputy Manager for the Water Enterprise at the SFPUC.

BRYAN DESSAURE: Bryan Dessaure, Project Management for SFPUC.

ANTONIA SINGER: Antonia Singer, Environmental

Project Manager for the SFPUC.

IRINA TORREY: Irina Torrey, Manager of the Bureau of Environmental Management, SFPUC.

JOSH MILSTEIN: Josh Milstein, City Attorney's Office.

JOYCE HSIAO: Joyce Hsiao, with Orien, EIR Project Manager.

CHRIS KERN: And then on the phone, can you please state your name, spell your name and the agency that you are representing.

STEVEN INN: This is Steven Inn, Alameda County Water District. Name's spelled S-T-E-V-E-N, last name spelled I-N-N.

ELKE RANK: This is Elke Rank with Zone 7 Water Agency. It's E-L-K-E, R-A-N-K.

PATRICK MIYAKI: Patrick Miyaki, M-I-Y-A-K-I. I'm general counsel for the Alameda County Water District.

JEFF MILLER: Jeff Miller, Alameda Creek Alliance. That's J-E-F-F, M-I-L-L-E-R.

MARCIA GREFSRUD: Marcia Grefsrud, Department of Fish and Wildlife. M-A-R-C-I-A, G-R-E-F-, as in Frank, S, as in Sam, -R-U-D as in David.

TOM ENGELS: This Is Tom Engels, E-N-G-E-L-S, with Horizon Water and Environment.

CHRIS KERN: Okay. Is there anyone else on the phone?

(No response)

CHRIS KERN: Okay. Great. So I wanted to just briefly go over the purpose of this meeting and the format, and then we'll -- well, let's start with that.

So the purpose of the meeting is to provide an opportunity for responsible agencies and stakeholders to provide any additional comments they may have on the scope of the recirculated portion of the Draft EIR for the Recapture Project.

I think all of the folks on phone, I believe, have received copies of the Notice Of Preparation and are familiar with the project. But if there's a need to provide an overview of the project, we can do that. Otherwise, we'll probably skip that portion, unless somebody would like an overview of the project description.

And then the format of this meeting really -- this is an EIR scoping meeting. So the way that the Planning Department runs these scoping meetings is we receive comments about the scope and content of a Draft EIR or, in this case, about the recirculated portion of the EIR that's focusing on the effects of the project on steelhead. But we do not responded to substantive comments in the context of these meetings. We instead will take the feedback that we get or the comments that we get, consider that, and address that in the Draft EIR that we'll be circulating. There will then of course be opportunity to review and comment on the Draft EIR. And, again, we'll respond in writing to any comments we receive on the draft.

We will, on the other hand, be happy to respond to questions or provide clarifications about the process going forward. And I would also, you know, just out of respect for all of our time and the cost to the public of holding this meeting, ask that, if you have comments that you've already submitted in writing, there's no need to repeat or reiterate those comments. They are already part of the CEQA record and will be considered in a draft -- in a Draft Recirculated EIR. So there's really nothing to be gained by, you know, repeating comments that we already have in our record.

And that's -- it's simple as that. So I guess I would ask if there's anybody that would like an overview of the project or if we can just move forward to the comment portion.

THOMAS NIESER: Maybe there's one element. We received a memo update. We do have some questions about it. We received a memo about a week ago about some revised modeling from the core CEQA. So I don't think it's anything fundamental to the project that's changed, but would it make sense to explain that at this time?

CHRIS KERN: No, I don't think we want to explain that. We're hoping what the memo is straightforward and self-explanatory. I guess if you have specific questions about the content of that memo, it'd be best, really, if you could provide those in writing. You know, send us an e-mail, and then we can provide a response. We don't really have at this meeting the, you know, the preparers of that memo, the modelers. We wouldn't be prepared to get into the technical details of that memo.

Okay?

JOYCE HSIAO: Anyone on the phone have any questions or would like to hear anything about the project?

(No response)

CHRIS KERN: So I think we'll just go around the table to my right and see if folks have comments that they'd like to make on the record.

TOM FRANCIS: No comments for BAWSCA.

THOMAS NIESER: So probably not a surprise.

I've got a few comments, possible questions. And from your introduction, Chris, maybe we can discuss them as questions or maybe they'll be noted as comments. I'll leave it to you to decide.

CHRIS KERN: Okay.

THOMAS NIESER: So maybe first just start by thanking you guys for having the scoping meeting. I know it was largely at our request. I know -- understand it's also a CEQA process but...

We did have some questions that were slightly addressed by comments that we've submitted already in writing on the NOP but, at the same time, still a little outstanding confusion on our part. So I'll just summarize them.

I think first and foremost is that most of the issues that our agency had as well as some of the other commenters were related to our concerns about the sufficiency of the modeling analysis that was done, not the work per se but the model itself, the technique, the methodology. And what we noticed in the NOP for this Recirculated EIR is that there's no real description of any significant revision to that modeling or that process, even though we feel that it would address most of the comments that were -- really kind of brought us to here, where we are today.

So in its absence, I'll just have to ask. Is the Planning Department committed to working with NMFS and ACWD and other agencies in the watershed as well as -- I know there's an independent third party expert -- to develop a more robust model to more thoroughly analyze the dynamic surface water and groundwater situation in Sunol Valley that's a result of -- or that will be affected by the proposed ACRP project?

CHRIS KERN: Yeah, and that's not a question that I'm going to respond to in the context of this meeting. But it certainly will be addressed in the Recirculated Draft.

THOMAS NIESER: Okay. I think, then, to put it in the form of a comment, is that is a major area of concern. We feel it's fundamental to addressing the outstanding comments and really what we're all here about.

So another comment is, when we reviewed the -- we were provided with the scope of work that was given for the third party expert. Thank you very much.

We had a look at that. We are very familiar with the selected expert, Dr. Moran. ACWD's with worked with her in the past, and we respect her very much. But looking at the scope of work, it seems to step away from a true third party independent review, and it's somewhat scripted. It's got a lot of specifics. It appears to sort of prescribe the record of information that's supposed to be included in that review as well as a lot of coordination, working with the planning group on the process. So it almost seems more like a collaborator in the study rather than an independent review.

So, frankly, a comment is that it didn't appear to be, outwardly, an independent review on our part. But obviously that could be just how we're reading it.

We do have questions about the work specifically in the list of information that will be provided for the third party specialist, independent third party specialist. Will she be provided with the full record of the Board of Supervisors File No. 170839, including the information submitted by NMFS and ACWD during the appeal process?

CHRIS KERN: And I'll take that to be really a more procedural question. And, yes, she has been.

THOMAS NIESER: Full record?

CHRIS KERN: I believe so.

JOYCE HSIAO: She re- -- we sent her electronic files of the appeal response memo that includes as attachments all of those letters.

THOMAS NIESER: Okay. As well -- this kind of gets back to the modeling. If the third party specialist -- again, reading into the scope a bit perhaps, but if the third party specialist sort of comes to a similar conclusion that we made during the initial CEQA and finds that the fundamental methodology for the analysis, the modeling, is not sufficient to provide adequate detail for parties such as ours to figure whether or not we're being impacted, is the Planning Department up to revising the modeling as a result of that recommendation?

CHRIS KERN: I think we'll cross that bridge if and when we come to it.

THOMAS NIESER: Okay. Anything else that you can provide for the role? It seems -- in terms of how input from the specialist would be handled by the planning group?

CHRIS KERN: Our intent is, you know, per the direction from the Board of Supervisors, to present the results of peer review to the fisheries work group and then to consider the results of her analysis and conclusions in the recirculated portion of the Draft EIR.

THOMAS NIESER: Okay. And my last questions are surrounding that memo that was received. And I realize there's not a lot of information that people hear, but there are some questions. And they can be converted into a comment if you prefer.

We received the data. Appreciated that. There wasn't a tremendous amount of detail in it. It's clear that the change was made but not necessarily what the basis or the assumptions -- basis for the assumptions of the change that resulted in some changed stream flow data. We did notice it appears to significantly address a number of the concerns that we had raised in the preliminary CEQA, which is an interesting outcome.

So we're assuming that there will being more supporting documentation for both the basis of the original assumptions for the quarry discharges as well as the modified data that we received, why -- it's a pretty significant change, sort of a doubling of the amount of water that's being discharged in Alameda Creek. So we're hoping we'll get full information as to what the assumptions were for the original data set and then the revised data set.

CHRIS KERN: Yeah. We'll consider that a question.

THOMAS NIESER: A request? Okay.

CHRIS KERN: Consult with the appropriate technical experts.

THOMAS NIESER: Okay. Another question is -- so we understand that ESA's model is a post processing of -- I'll use the term "Water Department." Is that okay, Ellen? San Francisco Water Department, your group?

So the San Francisco Water Department did a system modeling, and then ESA did a post processing for change in downstream operations as a result of this future operation. And the question is, when you've got these quarry discharges pulling water out of Sunol basin and discharging it so that they can continue to do their gravel operations, was that extraction of water from Sunol factored back into the Planning Department's modeling? And -- which would affect sort of the re-operation of how maybe Calaveras Reservoir or deliveries of that reservoir would work, resulting storage levels.

And if you think about it, it's -- I think it's roughly 120,000 acre feet over the whole period that gets taken out of Sunol. And I'm just questioning if that was sufficiently reflected by going back into the initial modeling and then fed back into the ESA model. So we've got one model feeding another. Was the process done to take the changed output back to the head works of the original model and get them to sort of converge to a consistent result?

And I'm assuming we don't have an answer to that in the room.

CHRIS KERN: Right.

THOMAS NIESER: But we would like to get some more knowledge as to how that was exactly modeled.

And maybe just one final comment back to the modeling element is that, with that component, you know, presumably it's going to affect the sort of carryover accounting and the sort of accounting system that's documented in the planned operation of the ACRP. So it's sort of basically the same question. How does that carryover accounting factor in the quarry operations for the ESA analysis?

And that's -- those are my comments at this point.

CHRIS KERN: Okay.

LEONARD ASH: Just to add to what Thomas said, we have a letter, Chris, that I'll leave with you, just sort of summarizing the comments we've had and providing a little bit more background to what we're asking. We do appreciate everybody's time. We look forward to working collaboratively as we approach the recirculation of the EIR.

CHRIS KERN: Thanks.

SEAN COCHRAN: Sean Cochran, Department of Fish and Wildlife.

I'm not going to get too much into additional comments beyond what we already provided in our comment letter regarding the -- for the Notice Of Preparation for the Recirculated EIR. The one thing I just want to stress, and I think it's kind of highlighted in our letter, is the key thing that we would like to get at with this analysis that the previous EIR really didn't thoroughly document, that we at least see, is the recapture operation's effect on kind of how it affects stream flow at specific times, not necessarily volumes of flow, you know, across a particular time period.

So really what we want to address, really what we can kind of see as the major shortcoming in the previous EIR's analysis is it didn't look into how the timing of the stream flow with the ACRP would affect steelhead. And that's what we're -- kind of really would like to get from the recirculated modeling analysis. So I'll just put that on the record. And that's really all I kind of wanted to stress.

CHRIS KERN: Thanks. So I think that's it for comments of folks in the room, unless I'm mistaken.

On the phone? Why don't we start with -- let's see. Steven Inn, do you have any additional comments for the Water District?

STEVEN INN: No, that was already covered by Thomas. Thank you.

CHRIS KERN: Elke, I think you had mentioned that -- well, I'm not sure. Were you planning to provide additional comments?

ELKE RANK: You know, I just wanted to very quickly say a thank you for hosting this meeting. I think this is really useful. And I know that you've received our comment letter on October 30th or 31st. And there were some attachments to that, so we just wanted to reiterate that same concerns that are already in our letter. So I don't need to go through those again. And with that, I'll close out.

CHRIS KERN: Okay. Thanks.

Jeff?

JEFF MILLER: I just want to say also thanks for making this available on the phone. Did I hear you say you are going to present the results of the analysis to the Alameda Creek Fisheries Restoration Work Group; is that correct?

CHRIS KERN: Of the third party review of the groundwater model.

JEFF MILLER: Okay.

CHRIS KERN: And we would expect to do that, we think, in April.

JEFF MILLER: Okay. Great. That's it. Thank you.

CHRIS KERN: Patrick?

PATRICK MIYAKI: I also just want to say thanks for allowing us to participate by phone. And I do not have any additional comments.

CHRIS KERN: Okay.

Marcia?

MARCIA GREFSRUD: I don't have anything else to add either. Thank you.

CHRIS KERN: Okay. And then lastly, Tom Engels?

TOM ENGELS: I do not have anything to add. Thank you.

CHRIS KERN: Okay. Is there anybody else that I've missed?

(No response)

CHRIS KERN: Okay, great. So then let me just briefly go over what we see is the process going forward. As I mentioned -- I'm not sure if I mentioned, but our plan is to schedule a meeting with CDFW and NMFS at the end of January to continue our discussions about our analysis and methodologies, to present the results of the peer review to the Fisheries Work Group, we believe, in April.

And then we anticipate publishing the draft of the recirculated portion of the EIR in May. It will be out at the standard 45-day public comment period, and during that comment period, we will hold a hearing at the San Francisco Planning Commission also to receive comments. We anticipate that we'll publish the response to comments in the fall and that certification of the final recirculated portion of the EIR will also go to the Commission sometime this fall. And as we get closer to those dates, we'll try to nail down, of course, a more specific schedule.

Okay. Well, thank you all for coming and participating. And we look forward to working with you through the remainder of this process.

Thank you.

JOYCE HSIAO: So we'll end this conference call. Thank you all on the phone.

(Whereupon, the proceedings concluded at 2:26 p.m.)

STATE OF CALIFORNIA)
) ss.
COUNTY OF MARIN)

I, DEBORAH FUQUA, a Certified Shorthand Reporter of the State of California, do hereby certify that the foregoing proceedings were reported by me, a disinterested person, and thereafter transcribed under my direction into typewriting and which typewriting is a true and correct transcription of said proceedings.

I further certify that I am not of counsel or attorney for either or any of the parties in the foregoing proceeding and caption named, nor in any way interested in the outcome of the cause named in said caption.

Dated the 29th day of December, 2017.

DEBORAH FUQUA

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MEMORANDUM

DATE	October 28, 2019
TO	Sean Cochran, Marcia Grefsrud, Craig Weightman—California Department of Fish and Wildlife
CC	Rick Rogers, Andres Ticlavilca—National Marine Fisheries Service Ellen Levin, Tim Ramirez, Antonia Sivyer—San Francisco Public Utilities Commission
FROM	Chris Kern—San Francisco Planning Department Joyce Hsiao, Chris Fitzer, Garrett Leidy, Tom Elson—ESA+Orion JV team
SUBJECT	Recirculation of Portions of the Alameda Creek Recapture Project EIR, Planning Department Case No. 2015-004827ENV Responses to Scoping Letters from California Department of Fish and Wildlife

INTRODUCTION AND BACKGROUND

The San Francisco Planning Department issued a notice of preparation (NOP) on October 18, 2017 to inform the public and responsible and interested agencies about the intent to revise and recirculate portions of the environmental impact report (EIR) on the San Francisco Public Utilities Commission's (SFPUC) Alameda Creek Recapture Project (ACRP) that was published in June 2017. The recirculated portions of the June 2017 EIR will provide additional information and analysis on the potential operational impacts on steelhead fish in the lower watershed as a result of project-induced effects on streamflow in Alameda Creek. The Planning Department also conducted a scoping meeting before the California Department of Fish and Wildlife (CDFW) and the National Marine Fisheries Service (NMFS) as trustee agencies on October 3, 2017 to solicit oral comments on the scope of the additional analysis. On December 6, 2017, the Planning Department conducted another scoping meeting open to all interested parties.

In response to the NOP, the California Department of Fish and Wildlife (CDFW) submitted a comment letter dated November 14, 2017 to the Planning Department listing seven issues and recommendations to the Planning Department. In turn, in response to concerns expressed by the CDFW and NMFS, the Planning Department conducted a follow-up consultation meeting with CDFW and NMFS on May 30, 2018 to discuss the additional analysis. On June 22, 2018, CDFW submitted additional comments to the Planning Department by email on the approach to the additional analysis for the portions of the ACRP EIR to be recirculated. In response to those comments, the SFPUC met with CDFW and NMFS on November 1, 2018 to present revised ACRP operating protocols that were designed to avoid effects on Alameda Creek streamflow during the steelhead migration season. At that meeting, the SFPUC discussed how the revised operations would respond to the agencies' comments.

PURPOSE OF THIS MEMORANDUM

The purpose of this memorandum is to provide written responses to the CDFW scoping comments raised in both the November 14, 2017 letter and the June 22, 2018 email. Each comment is reproduced below verbatim, followed by a written response. In order to provide context for many of the responses, the revised ACRP operating protocols are included in this memo. The recirculated portions of the EIR will describe the revised project operations and will address the agencies' scoping comments in detail.

REVISED ACRP OPERATING PROTOCOLS

In response to comments from CDFW, the SFPUC revised the operating protocols for the ACRP in order to avoid effects on Alameda Creek streamflow during the steelhead migration season. The SFPUC would maintain the elevation in Pit F2 between 180 feet and 240 feet (NAVD88). Nearly all pumping for the recapture operations would occur between July 1 and November 30 of each year, outside of the migration period for steelhead in Alameda Creek. From December 1 to April 30 of each year, no pumping from Pit F2 for recapture operations would occur, with one exception. The exception during this period would be for safety purposes, which could occur if the water levels in Pit F2 reach an elevation of 240 feet above mean sea level and there is a danger of the pit spilling and flooding; in this event, the SFPUC would pump the water from Pit F2 until the water level is brought down to an elevation of 230 feet.

No pumping from Pit F2 would occur from May 1 to June 30 under either of the following conditions: (1) streamflow in Alameda Creek just above its confluence with San Antonio Creek is greater than zero,[1] <u>or</u> (2) the water elevation in Pit F2 is less than 225 feet elevation, even if the flow at Alameda Creek above San Antonio Creek is zero.[2] In other words, pumping could occur in May and June only when there is no streamflow in Alameda Creek above the confluence with San Antonio Creek <u>and</u> the water elevation in the pit is greater than 225 feet. At no time of the year would the SFPUC draw down the water levels in Pit F2 below an elevation of 180 feet. These operational controls are intended to protect against potential impacts from project operation on surface water and groundwater conditions in the creek, thereby avoiding both direct and indirect effects of project operations on steelhead migration. **Figure 1** schematically depicts the revised ACRP operational protocols for each month of the year compared to the monthly operations previously proposed in the June 2017 EIR. Under the revised operations, the average annual recapture volume would be reduced by about 1,200 acre-feet, from 7,178 to 6,045 acre-feet per year. Chapter 14 in the recirculated Draft EIR will provide a detailed description of the revised ACRP operations.

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1 When there is no streamflow in Alameda Creek above its confluence with San Antonia Creek (i.e., streamflow is zero), there is no connectivity in Alameda Creek between the Sunol Valley and upper or lower Alameda Creek, and under these conditions, the creek is not an active migration corridor for steelhead.

2 A Pit F2 water surface elevation of 225 feet is used as the threshold for pumping in May and June because this elevation represents the approximate contact point between the permeable stream channel gravels and the older, impermeable alluvium and Livermore Gravels. When water levels in the pit are above 225 feet, there is limited potential for the pit to accept seepage from the adjacent aquifer. Therefore, there is limited potential for the pit to drawdown water levels from the adjacent aquifer, which could indirectly affect streamflow within the creek. See Appendix HYD2-R in the recirculated Draft EIR for a discussion of the hydrogeologic properties of these two geologic units.

MONTH	REVISED OPERATIONS	JUNE 2017 EIR OPERATIONS	REMARKS
Oct	Pumping permitted if pit water levels greater than 180 ft	Pumping permitted if pit water levels greater than 150 ft	Pumping period reduced from 9 months to 5 months, with additional pumping in May and June only under specified conditions
Nov			
Dec	No Pumping*		
Jan		No Pumping	No pumping period extended from December to June compared to January to March
Feb			
Mar			
Apr		Pumping permitted if pit water levels greater than 150 ft	
May	No pumping if pit water levels less than 225 ft or if flow at San Antonio Creek is greater than zero		Pit Level will not be drawn down below 180 ft compared to 150 feet
Jun			
Jul	Pumping permitted if pit water levels greater than 180 ft		Recapture volume reduces from an average of about 7,200 acre-feet/yr to about 6,000 acre-feet/yr
Aug			
Sep			

No Pumping   Revised Operations   Pumping Permitted up to Specified Limit

*The only exception during this period would be for safety purposes, in which case pumping could occur if the water levels in Pit F2 reach an elevation of 240 feet and there is a danger of the pit spilling and flooding. In this case, pumping water from Pit F2 would be conducted until the water level is brought down to an elevation of 230 feet.

SOURCE: SFPUC, 2019

Figure 1
Revised ACRP Operations

LETTER FROM CRAIG WEIGHTMAN, ACTING REGIONAL MANAGER, BAY DELTA REGION, CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE, NOVEMBER 14, 2017

Comment 1: Daily Patterns of Streamflow across All Water Year Types

1. The hydrologic analysis in the original EIR used the Alameda System Daily Hydrologic Model (ASDHM) to assess with and without ACRP effects on stream flow. The ASDHM predicts flows at a daily time-step at multiple locations in the Alameda Creek watershed. The original EIR did not summarize results of this model on a daily basis. It is important the revamped analysis summarizes and depicts modeled daily patterns of flow across all water year types used in the analysis to determine if project stream flow patterns are appreciably different without project conditions (Calaveras Dam Replacement scenario), and whether it reduces stream flows at locations or during time periods that might negatively impact steelhead.

Response 1

We have revised the steelhead impact analysis for the recirculated EIR to be at a daily time step. As indicated above, with the revised project operations, the SFPUC has provided revised ASDHM output for the 18-year period covering Water Years 1996 to 2013. For this same period, the planning department's CEQA consultants have revised the post-processing assumptions for the two future scenarios (with-project and with-CDRP conditions) to allow for quarry NPDES discharges, losses to the subsurface, and streamflows to be estimated on a daily time step, and to incorporate changes to the revised project operational criteria. The revised post processing also incorporates estimates of seepage from Alameda Creek into Pit F2, at a daily time step, to refine estimated water levels in the pit. See Appendix HYD1-R in the recirculated Draft EIR for a description of the analytical methods used for the revised analysis.

As described in Chapter 15 in the recirculated Draft EIR, the revised steelhead analysis compares with-project conditions to adjusted existing conditions (i.e., with-CDRP conditions plus assumed removal of barriers to steelhead migration) at two locations downstream of the project site: primary study area (as represented by Node 7) and extended study area (as represented by Node 9). The analysis determines migration opportunity days based on migration opportunity thresholds for the primary and extended study areas, including a breakdown of thresholds for adult steelhead (for the period December through April) and for juvenile steelhead (March through June). These threshold conditions are derived from the National Marine Fisheries Service (NMFS) Calaveras Dam Replacement Project (CDRP) Biological Opinion, in which it was identified that adult upstream passage and juvenile downstream passage would be provided in the Sunol Valley (Node 7) with flows of approximately 20 cfs and 10 cfs, respectively. At Node 9, threshold conditions are derived from the comment letter from NMFS regarding the June 2017 EIR for the ACRP, in which minimum flow levels for adults and juvenile/smolts in lower Alameda Creek, are identified at 25 cfs and 12 cfs, respectively. See Response 2 below for more detail.

Chapter 15 of the recirculated Draft EIR will present the post-processing analytical results in terms of the changes in migration opportunity days for each water year in the study period for the adult migration period from December through April and for the juvenile migration period from March through June at both Nodes 7 and 9. On each of the individual days where the analysis shows a change in migration opportunity under project conditions compared to the adjusted existing conditions, the analysis also examines the magnitude of increase or decrease in flow relative to the threshold condition to understand and explain the underlying cause of the differences.

Comment 2: Comparison of Downstream Passage flows for Steelhead Adults and Smolts

> 2. CDFW recognizes the proposed ACRP project is in an ephemeral stream reach that is a migratory corridor, and not year-round rearing habitat for juvenile steelhead. Our primary concern is whether the ACRP will restrict adult steelhead from being able to migrate upstream and access spawning areas above the project, and if it will restrict steelhead smolts from being able to out-migrate through the affected stream area to San Francisco Bay. To assess this the EIR should compare modeled with and without ACRP stream flows to estimate passage flows in the area downstream of the project for steelhead adults and smolts. There are already sources available to estimate minimum passage flow conditions including channel cross-section stage discharge relationships incorporated in the ASDHM (229 total through entire watershed), and fish passage studies done in the Sunol Valley area of Alameda Creek and in the flood control channel. Comparisons should be made and summarized across each hydrologic year in the analysis, but need not extend outside the migration time period considered relevant for each life stage.

Response 2

As described in Response 1, above, the revised steelhead analysis in the recirculated Draft EIR compares with-project conditions to adjusted existing conditions at a daily time step at two locations downstream of the project site, Node 7 and Node 9, during the migration period for adults (December through April) and for juveniles (March through June). Migration opportunity threshold conditions used in the analysis were based on information provided by NMFS. For the primary study area, the threshold conditions in the Sunol Valley is based on flows identified in the CDRP Biological Opinion.[3] In the extended study area (Niles Canyon and Lower Alameda Creek Channel), flow requirements for adult upstream passage and juvenile downstream passage have not been directly identified; however, NMFS has commented that steelhead may migrate anytime within the migration period when instream flows exceed identified minimum flow levels of 25 cfs for adults and 12 cfs for juveniles/smolts in the Lower Alameda Creek channel.[4] The threshold conditions used in the revised steelhead analysis are as follows:

- Primary Study Area (Sunol Valley, Node 7)
  - 20 cfs Dec – Apr (adults), 10 cfs Mar – Jun (juveniles)
- Extended Study Area (Niles Canyon, Node 9)
  - 25 cfs Dec – Apr (adults), 12 cfs Mar – Jun (juveniles)

Comment 3: Volume of Water in the Shallow Aquifer and Volume of Water Recaptured

> 3. Water that the SFPUC proposes to recapture is described as stream flow that percolates to a shallow aquifer that resurfaces in the Sunol quarry pits. We presume that not all the streamflow that percolates to this shallow aquifer is recaptured in the quarries. We would ideally like the ASDHM to be further refined to account for total volume of water in the shallow Sunol aquifer, and volume of water recaptured by quarry operations. Generating these estimates, would help ensure that recapture operations are balanced and do not result in overdraft. CDFW recommends that the EIR provide a feasible method to measure total volume of water recaptured compared to total volume of water available in the aquifer.

Response 3

As described above, since publication of the EIR in June 2017, the SFPUC has revised the ACRP operating protocol, and consequently, the SFPUC revised the ASDHM model outputs to reflect the revised ACRP operations. The revised analyses in the recirculated Draft EIR rely on the revised ASDHM model outputs. Rather than making further refinements to the ASDHM, the recirculated Draft EIR will include additional quantitative analysis and post-processing of the updated ASDHM model outputs to account for the effects of the project on water in the shallow aquifer and water used by quarry operations.

The recirculated Draft EIR will include a revised and expanded version of Appendix HYD2 (referred to as Appendix HYD2-R), a technical report that discusses groundwater and surface water conditions and

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3 National Marine Fisheries Service (NMFS), 2011. Biological Opinion for Calaveras Dam Replacement Project in Alameda and Santa Clara Counties. Tracking No. 2005/07436. March 5, 2011

4 National Marine Fisheries Service (NMFS), 2017. *Letter to the City and County of San Francisco regarding June 22, 2017 Planning Commission Decision Regarding the Final EIR for the ACRP*. Santa Rosa, CA.

interactions in the ACRP EIR study area. As requested by CDFW, the revised Appendix HYD2-R will provide a substantially more detailed and quantitative characterization of the shallow aquifer, and groundwater–surface water interactions in the Sunol Valley for use in the EIR impact analysis. Appendix HYD2-R discusses groundwater–surface water interactions that are relevant to the proposed ACRP operation based on empirical data, including groundwater levels, surface water elevations, Alameda Creek streamflow; observations from other field studies; and analytical and numerical methods to quantify groundwater movement. In addition, numerical modeling is employed to quantify the transient nature of leakage and seepage from Alameda Creek into Pit F2 as a function of streamflow, storage in the aquifer, and surface water storage in Pit F2.

In addition, the recirculated EIR will include a revised version of Appendix HYD1 (referred to as Appendix HYD1-R), a technical report that discusses effects of the ACRP on surface water hydrology. Appendix HYD1-R will include revised estimates of quarry NPDES discharges under different scenarios as part of the post-processing of the updated ASDHM output in order to examine more closely the potential effects of ACRP operations on surface flows downstream of the project site. The surface flow analysis incorporates groundwater–surface water interactions to estimate creek to Pit F2 infiltration.

Chapter 15 of the recirculated Draft EIR will provide a detailed analysis of the potential physical effects of the project on the environment, including impacts on steelhead fish and groundwater resources, based on the best available information and using the quantitative analysis of groundwater-surface water interactions and hydrological conditions as appropriate.

Comment 4: Lake and Streambed Alteration Agreement

> 4. Please be advised that proposing the recapture of creek underflow that resurfaces in quarries will require an LSAA since there is a direct connection to water being pumped from quarries and streamflow in Alameda Creek. Notification is required for any activity that will substantially divert or obstruct the natural flow; change or use material from the bed, channel, or bank including associated riparian or wetland resources; or deposit or dispose of material where it may pass into a river, lake or stream (Fish and Game Code, §§ 1600- 1616). Work within watercourses with a subsurface flow are subject to notification requirements. CDFW, as a Responsible Agency under CEQA, will consider the EIR for the project. CDFW may not execute the final LSAA until it has complied with CEQA (Public Resources Code § 21000 et seq.) as the responsible agency.

Response 4

The SFPUC intends to submit an application to the CDFW for a Lake and Streambed Alteration Agreement for the ACRP following completion of the CEQA process. The recirculated portions of the EIR indicate this as part of the relevant permits and approvals for the ACRP in the chapter describing the revised project description.

Comment 5: Restriction on Recapture Operations

> 5. The original draft EIR proposed to curtail water recapture from December through March, when water surface levels in quarry Pit F2 would generally be between 200 and 240 feet above mean sea level.

> Recapture would primarily occur outside of this time period and water surface levels could be pumped below 100 feet above mean sea level. CDFW recommends recapture be further restricted to June through November. Pumping in April and May overlaps with the smolt outmigration time period and could reduce surface flow in Alameda Creek and prevent smolts from being able to outmigrate to the bay.

Response 5

See description under *Revised ACRP Operating Protocols*, above. The SFPUC has revised the proposed ACRP operations to expand the no pumping period from December to June and to limit drawdown in Pit F2 to a minimum water level of 180 feet (NAVD88) to avoid effects on Alameda Creek streamflow during the steelhead migration season.

Comment 6: Quarry NPDES Discharges

> 6. Restrictions in SFPUC recapture from quarry Pit F2 during select time periods does not restrict the quarry operators from being able to pump and discharge water to Alameda Creek during these times with use of their National Pollutant Discharge Elimination System (NPDES) permit. The original EIR states that volumes and timing of discharges are currently variable and would continue to be variable in the future under the proposed project. The recapture of water from Pit F2 under the proposed project would result in reduced volumes of water that the quarry operators would have to manage thereby reducing the potential for quarry NPDES discharges to Alameda Creek, with associated reductions in Alameda Creek stream flow downstream of the quarries. CDFW recommends that the SFPUC explore mechanisms to gain assurance that the quarry operators will curtail pumping during critical time periods for steelhead, namely, January through May which corresponds to time periods where adult steelhead migrate into the Alameda Creek for spawning and smolts migrate downstream to San Francisco Bay. Removal of water from Pit F2 by SFPUC or the quarry operators during this time period could result in increased streambed percolation upstream of the quarries and a reduction in flows for migrating steelhead, even when accounting for the additional discharge provided to the stream by the quarry operations. The EIR should therefore include conditions that curtail pumping from Pit F2 during this time period.

Response 6

As described above, the SFPUC has revised the proposed ACRP operating protocols to avoid pumping from Pit F2 during the steelhead migration period and when water levels in Pit F2 are below 180 feet. Under the proposed project, Pit F2 water levels would be higher from December to June because the SFPUC would not be pumping, and the project, thereby, would not affect upstream percolation. The recirculated Draft EIR will include a substantially more detailed and quantitative characterization of the groundwater and surface water hydrology in the Sunol Valley, including the effects of pumping water from Pit F2 on seepage rates and Alameda Creek streamflow.

The EIR analysis takes into account the extent to which the project operations would affect quarry NPDES discharges. In the absence of information on future quarry management practices, the EIR uses the historical record of NPDES discharges to make certain assumptions about the timing of future discharges (see Appendix HYD1-R in the recirculated Draft EIR for details). Importantly, the revised steelhead analysis in Chapter 15 in the recirculated Draft EIR, as described in Responses 1 and 2 above, examines changes in streamflow conditions at Nodes 7 and 9 under with-project conditions compared to the adjusted existing conditions, and this streamflow analysis incorporates estimates for quarry NPDES discharges.

The Planning Department acknowledges CDFW's recommendation that the SFPUC explore mechanisms to assure that the quarry operators curtail pumping during critical time periods for steelhead and shared this recommendation with the SFPUC. As noted above, the SFPUC has revised project operations in order to avoid effects on Alameda Creek streamflow during the steelhead migration season. Please note that the effects of the quarry operations independent of the project are not within the scope of the project EIR.

Comment 7: Carryover Recapture Operations

> 7. The original Draft EIR in Table 3-5 indicates that in dry years proposed recapture volumes will be greater than SFPUC bypass flows that infiltrate pond F2. Additionally, the Draft EIR also indicates the SFPUC would reserve the right to roll over unutilized recapture from previous years to years where there is additional storage available in supply reservoirs for recapture. CDFW is concerned such practices will create an imbalance and could create further reductions in streamflow during dry and critically dry drought years. We recommend proposed recapture be reduced during dry years to levels less than average infiltration of bypass flows to pit F2, and that the roll over recapture option is removed. The EIR should specifically indicate that roll-over recapture will not occur.

Response 7

As described above, the SFPUC has revised the ACRP operating protocols since publication of the June 2017 EIR. Under the revised operating protocol under all hydrologic conditions, the SFPUC would limit the drawdown of Pit F2 to a minimum elevation of 180 feet. No pumping would occur if the water level in Pit F2 is at or below 180 feet. In addition, with the extended period of no pumping, the annual average volume of recaptured water would be about 1,200 acre-feet less than previously estimated. Specifically, under the revised operation, in dry years, when the average annual inflow to Pit F2 from the CDRP bypasses and releases is estimated to be 7,536 acre-feet per year, the SFPUC would recapture *less* than this amount, an estimated 6,856 acre-feet per year, or 1,606 acre-feet per year on average less in dry years than previously proposed.

With the restrictions under the revised operating protocols and the reduced average annual recapture volume, recapturing water stored from previous years (i.e., carryover operations) would rarely be expected to occur. For example, based on 18 years of modeling, the volume of pumping from Pit F2 is only greater than Pit F2 inflow from bypasses and releases in hydrologic year 2012 (by 330 acre feet) (although total Pit F2 inflow in hydrologic year 2012 is greater than the recaptured volume). In all other hydrologic years of the study period, the amount of water the SFPUC would recapture from Pit F2 would be less than the portion of Pit F2 inflow from bypassed and released water in that hydrologic year. The SFPUC would have stored the entire volume of bypassed and released water in Calaveras Reservoir but for the implementation of the instream flow schedules established in the CDRP Biological Opinion. As part of the proposed project, the SFPUC would maintain an accounting of water credits and withdrawals, and the potential for carryover (or roll over) could occur only when there is credit available from previous years. However, existence of credit alone is insufficient to permit pumping, since recapture operations must comply with specified operating protocols for time of year and pit water levels, as described above.

The revised steelhead analysis in Chapter 15 of the recirculated Draft EIR will include discussion of the impacts of project operations on steelhead migration during dry years, including potential carryover operations.

EMAIL FROM SEAN COCHRAN, DISTRICT FISHERIES BIOLOGIST, BAY DELTA REGION, CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE, JUNE 22, 2018

Comment 8: Groundwater Analysis in Sunol Valley

> We were pleased to hear that per consultation with an outside subject matter expert SFPUC has chosen to do accounting for total volume of water in the Sunol Valley groundwater basin. However, there are groundwater accounting concerns we raised in our comment letter dated November 14, 2017 (attachment 1) that are not yet addressed. In the following comments we will interchange the terms groundwater, subsurface flow and creek underflow, but in our opinion the correct characterization of water in this shallow confined aquifer is subterranean streamflow.
>
> - At this time there are no plans to estimate the proportion of Calaveras Dam Replacement Project (CDRP) prescribed releases that percolate into the shallow Sunol Valley groundwater basin upstream of Node 6 that is recaptured in quarry Pit F2. In Appendix HYD1 in the original EIR titled Surface Water Hydrology Report for the SFPUC Alameda Creek Recapture Project it makes it clear that the hydrologic analysis makes an assumption that all Alameda Creek flow losses between Welch Creek (node 4) and San Antonio Creek (node 6) are assumed to infiltrate to quarry Pit F2. This is a flawed assumption that we fear could result in a mass imbalance between water recapture in Pit F2 and replenishing inputs from the Sunol Valley aquifer. This will be discussed further in this document.
> - To us it seems logical only a portion of underflow in the Sunol Valley upstream of San Antonio Creek would reach Pit F2, and that some of this water would traverse the whole basin and remerge as streamflow in Alameda Creek at the top of Niles Canyon. In the most recent ACRP meeting Tom Elson of Luhdorff and Scalmanini Consulting Engineers presented data that directly confirmed this showing that at groundwater monitoring wells 9 and 10 Alameda Creek is a gaining stream, with groundwater inputs from Sunol Valley underflow. We highly recommend incorporating both the above factors into a more detailed groundwater and surface water hydrology model.

Response 8

The recirculated Draft EIR will include a revised and expanded version of Appendix HYD2 (referred to as Appendix HYD2-R), a technical report that discusses groundwater and surface water conditions and interactions in the ACRP EIR study area. As requested by CDFW, the revised Appendix HYD2-R provides a substantially more detailed and quantitative characterization of the groundwater and surface water hydrology in the Sunol Valley for use in the EIR impact analysis, including groundwater-surface water interactions that are relevant to the proposed ACRP operation based on empirical data including groundwater levels, surface water elevations, Alameda Creek streamflow; observations from other field studies; and analytical and numerical methods to quantify groundwater movement. In addition, numerical modeling is employed to quantify the transient nature of leakage and seepage from Alameda Creek into Pit F2 as a function of streamflow, storage in the aquifer, and surface water storage in Pit F2.

The commenter indicates that the correct characterization of water in this shallow confined aquifer is "subterranean streamflow." The implication of this term is that there is a subterranean stream present, but the criteria for this classification are not satisfied. As stated in Appendix HYD2-R, subsurface flow in the Sunol Valley is classified as both "groundwater" and "stream underflow."

As noted in the comment, Appendix HYD1 in the June 2017 EIR assumed that all of the Alameda Creek streamflow loss to the subsurface that occurs between Welch Creek and San Antonio Creek (up to 17 cfs) accumulates in Pit F2. This assumption was primarily used to estimate future quarry NPDES discharges. The recirculated Draft EIR will include a revised Appendix HYD1 (referred to as Appendix HYD1-R) to provide updated technical information on surface water hydrology to support the EIR analysis of the revised project operations. Similar to the previous version, Appendix HYD1-R uses this same assumption as part of the updated hydrological analysis and post-processing of the ASDHM output to estimate the comparative volume of the quarry NPDES discharges under the various scenarios.

In addition to the 17 cfs loss between Welch Creek and San Antonio Creek, the EIR impact analysis also incorporates an additional observed loss in streamflow to the subsurface (up to 7.5 cfs) between San Antonio Creek and Arroyo de la Laguna.[5] This is consistent with studies that have shown up to a total of 24.5 cfs loss to the subsurface occurs in the Sunol Valley between Welch Creek and Arroyo de la Laguna. When characterizing losses in streamflow within the Sunol Valley, the revised analysis in the recirculated Draft EIR considers these two losses as part of one, 24.5 cfs loss in streamflow from Welch Creek to the Arroyo de la Laguna, rather than two discrete loss events. Thus, when viewed in this context, it is reasonable to assume that only a portion of streamflow losses to the subsurface within the Sunol Valley end up in Pit F2. CDFW is correct to note that a portion of that loss does resurface near the top of Niles Canyon as return flow, however, the EIR analysis does not incorporate this return flow into streamflow estimates downstream of the Arroyo de la Laguna confluence. No information is available on the quantity of return flow that might reenter the surface stream and so no allowance is made for it in the ASDHM or post-processing results. As a result, it is possible that the estimates of flows in Alameda Creek at Niles are understated in the EIR analysis, and the impact conclusions are conservative.

Appendix HYD2-R provides an updated analysis of flow between Welch Creek and Pit F2 using analytical and numerical methods. In the reach upstream of the quarries, where no losses to mining pits occur, analyses show that the shallow aquifer has a finite capacity to transmit underflow due to its thin nature. The maximum groundwater flow rate was determined to be less than 1 cfs despite the fact that streamflow reached as much 2,500 cfs in the study period. Additionally, groundwater level data indicate that the primary source of water to the shallow aquifer is stream recharge. Within the quarry reach and adjacent to

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[5] The 7.5 cfs loss to the subsurface between San Antonio Creek and Arroyo de la Laguna was not explicitly accounted for in the CDRP Biological Opinion, because it was assumed that in general the gain from the quarry NPDES discharges in this same reach balances out this loss. However, the analysis in the ACRP EIR includes post-processing of the ASDHM output to account for both the 7.5 cfs loss and the gains from the quarry NPDES discharges to provide a more refined analysis of the potential impacts of pumping water from Pit F2 at a daily time step. See Appendix HYD1-R for details.

Pit F2, similar results were found reflecting consistent aquifer cross-sectional areas between the quarry reach and upstream to Welch Creek. This consistency was also shown through a quantification of aquifer storage volume from Welch Creek to Arroyo de la Laguna.

A mass balance is also presented in Appendix HYD2-R which quantified total seepage into Pit F2. The mass balance method used continuous surface elevation data to determine total seepage into the pit after accounting for precipitation, evaporation, runoff, and quarry discharges. Disaggregation of seepage from the creek and from groundwater using numerical and analytical methods showed close agreement. Application of the numerical model which reflected transient filling and drainage of the shallow aquifer, and then seepage into Pit F2, indicated a maximum seepage rate of about 1 cfs under both the with-ACRP and with-CDRP scenarios. However, it was also found that the with-ACRP scenario had fewer days at the maximum seepage rate than the with-CDRP scenario due to the with-ACRP having water stored at higher elevations in Pit F2. When water is stored at the higher elevations, particularly for longer periods under the revised ACRP operating parameters, the gradient for seepage into the pit from the creek is reduced to a significant degree as shown in the appendix.

With regard to groundwater conditions below the quarry reach to Arroyo de la Laguna, and specifically at wells MW9 and MW10, physical data from borings and groundwater level data indicate that the thinning aquifer downstream of the quarry reach results in less available storage space for stream recharge to occur. However, the data indicate similar fluctuations as upstream reaches and reflects the same seasonal recharge and drainage of aquifer storage volume. In very wet periods, the MW10 location may be inundated by high flows in Arroyo de la Laguna. Because of its thin nature, pools may also be evident in dry months which reflects the presence of underlying groundwater.

The groundwater and surface water analysis in Appendix HYD2-R focuses on and quantifies the seepage and leakage processes that occur through the shallow aquifer and how they are affected by operation of Pit F2 under the ACRP. These processes are also compared to the with-CDRP scenario as required for the CEQA impact analysis. As discussed above, the updated analyses are intended to quantify the transient relationships between groundwater and surface water interactions via the shallow aquifer system as well as seepage into Pit F2 under the CEQA scenarios. A detailed groundwater and surface water hydrology model for the entire Sunol Valley was not relevant to the scope and scale of potential impacts by the project.

Comment 9: Relationship between Streamflow and Drawdown in Pit F2

- This is similar to comment 5 in our November 2017 letter regarding recapture timeframe and Pit F2 water levels. Based on the description of the ACRP in the original project EIR, SFPUC would recapture water from Pit F2 between April and December, and no water recapture would occur from January through March. During the water recapture period water surface levels in Pit F2 could be drawn as low as 100 feet above mean sea level (msl), but would usually be maintained above 150 feet above msl. Water levels during months where water recapture would not occur would rise and be maintained between 200 and 240 feet above msl. With no true estimate of groundwater replenishment rates to Pit F2, it is in our opinion an unknown whether recapturing an average annual amount of 7,178 acre-feet is sustainable. CDFW is concerned that this project could result in extended periods of water drawdown in quarry Pit F2. This could potentially have significant negative effects on streamflow. A misconception of this project has been characterization of the connection between streamflow, underflow, and water in quarry Pit F2. The ACRP project team acknowledges a connection between streamflow and water in Pit F2 when water surface levels in the quarry rise above the Livermore geologic deposits. When water is below these deposits the project team has portrayed them as isolated systems, with continued seepage of aquifer underflow to Pit F2, but no direct effect of one on the other. We however would characterize this as a more complex relationship. Continued drawdown of Pit F2 below the Livermore deposits affects the time it takes aquifer seepage to replenish the pit and establish a direct connection to the aquifer. Sustainable operation of this system should take this into account and would make withdrawals from Pit F2 during only the summer and fall, when streamflow is ephemeral, and water levels in the aquifer decrease. The recapture amount should be such that when winter rains begin, there would be a high likelihood that input from the aquifer would refill the pit and establish a direct connection with the Sunol aquifer for at least a portion of the adult migration and smolt outmigration period. This operational strategy would better mimic natural patterns in streamflow and groundwater, and reduce streamflow losses during a critical period for steelhead.

Response 9

As described above, under *Revised ACRP Operating Protocols*, the SFPUC has revised the proposed project operations to limit the draw down level in Pit F2 to 180 feet and to restrict recapture pumping operations to summer and fall months. Under the revised operations, the average annual recapture volume would be reduced from 7,178 acre-feet per year to 6,045 acre-feet per year compared to the previous operations described in the June 2017 EIR. The recapture pumping period has been limited to occur only during the summer and fall (outside of the steelhead migration period), from July to November. The recirculated Draft EIR will contain a revised Appendix HYD2-R that provides a substantially more detailed and quantitative characterization of the shallow aquifer and the groundwater-surface water interactions in the Sunol Valley; it includes estimates of the rates of seepage of aquifer underflow to Pit F2 in the range from 0 cfs to about 1 cfs. As suggested by CDFW, the revised recapture operations would occur in the summer and fall when streamflow is ephemeral, water levels in the shallow aquifer are minimal, and seepage rates are lowest. See also Response 8, above.

Comment 10: Carryover of Water Stored in Pit F2 and Groundwater Analysis

- This comment is similar to the previous, but in our November 2017 letter we raised concerns that the project EIR stated SFPUC planned to roll over unutilized recapture across years. This comment still remains unaddressed, but fits in with our concerns that there is not detailed enough groundwater modeling to look at groundwater inflows to Pit F2 and create a mass balance water model.

Response 10

Please refer to Response 7 above regarding carryover recapture operations, and to Responses 3 and 8 above regarding additional groundwater modeling and quantification of groundwater movement. The additional quantitative groundwater analysis conducted in Appendix HYD2-R includes analytical and numerical tools to quantify the rate of stream leakage and seepage into Pit F2. Modeling parameters were verified through a mass balance analysis of inputs and outputs affecting the storage volume in Pit F2. The modeling analysis in Appendix HYD2-R integrates ASDHM flows and daily time steps to provide sufficient means to assess the effects of variable pit levels on seepage from Alameda Creek into Pit F2 and to determine the associated effects on streamflow in Alameda Creek.

Comment 11: Smolt Outmigration

- In the May 30, 2018 ACRP meeting Tim Ramirez of SFPUC presented several project protections we presume were measures to protect streamflow for outmigrating steelhead smolts including halting recapture operations when water in Pit F2 was above the Livermore gravels (>225 feet above msl) and when streamflow at the Siphon bridge was >10 cfs. Chris Fitzer of ESA also presented a series graphs with hydrologic modeling output for the CDRP scenario for the spring of 2008 (dry water year) with separate breakouts of streamflow at node 5 (upstream of pit F2), natural accretion between nodes 5 and 7, and the net streamflow gain from quarry discharge from pit F2 (factoring in downstream percolation loss). The objective of this was to make a point that streamflow losses upstream of Pit F2 may make smolt outmigration not feasible from upstream areas, despite quarry discharge gains downstream. Both Chris and Tim cited previous steelhead migration studies in Sunol indicated that a 10 cfs flow was needed to aid steelhead smolts in passage over critical riffles. While we appreciate the detailed examination of hydrologic model output and consideration of measures to protect steelhead smolts, we think the most effective method to prevent project impacts to steelhead smolts is to start water recapture operations annually in June after the smolt outmigration season has ended as we previously suggested in our November 2017 comment letter. Even as flows at node 5 decrease to levels that might be considered marginal for migration of steelhead smolts from upstream, there will be steelhead smolts actively migrating below this site. Any reduction in streamflow within the ACRP project reach or below is an impact that will affect the likelihood these fish will successfully make it to San Francisco Bay. The ACRP, as proposed, would affect streamflow in two ways by reducing quarry NPDES discharge to Alameda Creek, but more importantly by potentially drawing down the Sunol aquifer and increasing percolation losses from the stream channel upstream of the project.

Response 11

Please refer to *Revised ACRP Operating Protocols*, above. The SFPUC has revised the proposed ACRP operations to expand the no pumping period from December to June. No pumping would occur from Pit F2 in May and June when flow at Node 5 (upstream of the project site at the confluence of Alameda and San Antonio Creeks) is greater than zero. Pumping would also not occur in May and June when the water level in Pit F2 is less than elevation 225 feet, even if flow at Node 5 is zero.

Appendix HYD2-R in the recirculated Draft EIR will contain more detailed analysis and quantification of seepage and leakage in the vicinity of Pit F2, as summarized in Response 8, above.

Comment 12: Detailed Summaries of Streamflow Model Results and Passage Flows

- If the project goes forward with the current proposal to recapture water from Pit F2 from April through December, we would like to see detailed summaries of streamflow model results to determine project effects not just across all years in the analysis, but a detailed breakdown within respective years, with particular emphasis on dry years. What will be most critical is assessing effects to outmigrating smolts in April and May (see comment 2 in our November 2017 letter). We would like this summary to take into account passage flows required for steelhead smolts in the stream from node 9 upstream through the project reach, and to summarize the results in a way where one can discern for respective years whether the project results in any reductions in migration opportunity. Exceedance curves alone while informative do not provide this level of detail. Alameda County Water District (ACWD) is required to provide minimum bypass flows which are inclusive of CDRP contributions below their facilities at Niles Cone in April and May for smolt outmigration based on measured flow at node 9, which is the location of the Alameda Creek Niles USGS gage. These bypasses are required under a NMFS biological opinion (SWR-2013-9696). Any reduction in ACWD's ability to meet these minimum bypass flows due to a reduction in streamflow at node 9 from this project will be an impact.

Response 12

Please refer to the *Revised ACRP Operating Protocols*, above. The SFPUC revised the proposed ACRP operations to conduct pumping only from July 1 to November 30, with limited pumping in May and June. No pumping would occur from Pit F2 from December to April, and also in May and June when there is flow present at Node 5. Pumping would also not occur in May and June when the water level in Pit F2 is less than elevation 225 feet, even if flow at Node 5 is zero.

The revised steelhead analysis in Chapter 15 in the recirculated Draft EIR will include a detailed breakdown of streamflow conditions affecting juvenile outmigration during March to June at both Node 7 and Node 9, as described in Response 2, above. This revised and augmented analysis provides streamflow information at a daily time step, expanding upon the information depicted in the flow duration exceedance curves (see discussions of Migration Opportunity Threshold Conditions under Responses 1 and 2). The analysis of migration conditions will focus specifically on potential changes in passable days, at multiple, locations, with the implementation of project operations. Analysis at the level of a daily time-step will provide greater context on steelhead migration in all hydrologic years (wet and dry) by analyzing streamflow conditions for each day within the 18-year study period.

The revised steelhead analysis also updates the relevant regulatory framework, including a description of the Biological Opinion issued by NMFS for the Joint Alameda Creek Fish Passage Improvements Project.[6]

The recirculated Draft EIR will also include an updated analysis of the potential for the project to affect streamflow in Alameda Creek that could substantially affect ACWD's water supply operations that would in turn cause significant environmental impacts. However, the ability of ACWD to meet its minimum bypass flows is not considered in this EIR.

Comment 13: Water Quality of Quarry NPDES Discharges

- A general comment to take into consideration. A lot of presumptions regarding this project rely on estimating the quantity, timing and water quality of quarry discharges, both under existing and future conditions. Frankly there are a lot of unknowns surrounding the effects of the quarry discharge on the stream environment. The project team has raised valid questions about water quality of quarry discharge including temperature suitability and discharges not being estimated on an hourly basis. In light of not having specific measurements to assess true negative/positive effects of quarry discharge on steelhead, we think it is best to view increases in streamflow due to quarry discharge during the

[6] National Marine Fisheries Service, 2017. Endangered Species Act Section 7(a)(2) biological Opinion and Magnuson-Steven Fishery Conservation and Management Act Essential Fish habitat Response for the Joint Alameda Creek Fish Passage Improvements Project in Fremont, California (Corps File No. 2013-00083S). October 5, 2017.

> smolt outmigration timeframe as an improvement in conditions versus any with project conditions that result in appreciable loss in streamflow from reduced discharge by the quarry operators.

Response 13

The revised hydrologic analysis conducted for the recirculated portions of the ACRP EIR considers the changes to the volumes of quarry NPDES discharges under the various scenarios (see Response 6, above) as part of the post processing of ASDHM results to determine their effects on Alameda Creek streamflow at a daily time step and associated effects on steelhead (see Response 1, above). This approach is consistent with this comment, in that other parameters, such as water quality or diurnal timing of the quarry discharges are not considered in this conservative approach to analysis. However, the EIR analysts acknowledge that the quarry NPDES discharges have exhibited high turbidity and high temperatures, neither of which is conducive to steelhead habitat. The post-processing conducted for the EIR analysis also recognizes that the gain from quarry NPDES discharges occurs about 550 feet downstream from Node 6, and that connectivity of streamflow in Alameda Creek for steelhead migration upstream of the discharge point must also consider whether or not there is flow present at Node 5.

The revised project operations would result in a reduction in the average annual volume of water recaptured from Pit F2 by the SFPUC compared to the volume described in the June 2017 EIR. Commensurate with this reduction in recapture, is a modeled increase in quarry NPDES discharges under the with-project condition. That is, as less water is recaptured from Pit F2, more water is available within the pit for discharge back into Alameda Creek by the quarry operators. Additionally, revised project operations are designed, in part, so that increases in quarry NPDES discharges occur during the steelhead migration season (i.e., from December to June, when the project is not in operation).

Comment 14: Lake and Streambed Alteration Agreement

> Although the focus of the meeting was to brief us on measures added to the analyses to better assess the ACRP's potential impacts on Central California Coast steelhead trout we also expressed need to apply for a Lake and Streambed Alteration Agreement due to the recapture of streamflow from Alameda Creek. The presentation on groundwater interaction lent further support to the characterization of the water in Pit F2 as being subterranean streamflow. Furthermore, analysis presented in the EIR discloses the potential for significant effects which should be addressed in a Lake and Streambed Alteration Agreement pursuant to Fish & Game Code section 1600 et seq.

Response 14

Please refer to Response 4 above.

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APPENDIX TRP

Third Party Review of the Groundwater/ Surface Water Model

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Independent Review of the Groundwater Analysis Used in the SFPUC Alameda Creek Recapture Project EIR

Jean Moran, PhD

Initial report January 18, 2018, revised Feb 26, 2018

revised and re-written based on updated HYD2 June 10, 2019, finalized July 30, 2019

I. Introduction

The purpose of this report is to provide an independent review of the analyses and model of groundwater and surface water interactions used in the ACRP EIR, Appendix HYD2. The overall goal is to report on whether the groundwater-surface water analysis prepared for the updated EIR (including Chapter 14, Revisions to the Project Description) is adequate for the purpose of analyzing impacts on streamflow in Alameda Creek that could affect fisheries resources, as required by CEQA. The analysis presented in the EIR is based on conceptual and numerical surface water-groundwater models that use output from a surface water model (Alameda System Daily Hydrologic Model or ASDHM) to predict streamflow in Alameda Creek. This report focuses on the reach of Alameda Creek discussed in HYD2, between the Welch Creek gauge and the confluence with Arroyo de la Laguna.

The report provides an assessment of the data, analytical methods, assumptions, and interpretations presented in HYD2, then addresses four key questions regarding the adequacy of the characterization of surface water-groundwater exchange. The four key questions are:

Q#1: Does the EIR groundwater analysis adequately evaluate the surface and groundwater interaction within the Alameda Creek watershed, including Project's operational effects of lowering of Pit F2 elevations through pumping?

Q#2: Does the EIR groundwater analysis adequately describe the extent to which the ACRP will affect the loss rate of surface water from Alameda Creek, lower local groundwater levels, and affect downstream streamflow rates?

Q#3: Does the EIR groundwater analysis adequately characterize the hydraulic properties of the lower alluvium/Livermore gravels in the ACRP project area?

Q#4: Does the EIR groundwater analysis accurately characterize the relationship between groundwater and surface water in the Sunol Valley so that its conclusions can be used to accurately determine the ACRP's potential impacts to streamflows in Alameda Creek downstream of the project site?

My understanding of the project is that SFPUC will release water to Alameda Creek daily (from Calaveras Reservoir and bypasses at the ACDD) and will recover a portion (modeled range: 4045-8031 acre-ft, average of 6045 acre-ft annually) of the released water by pumping it out of Pit F2 (between July 1 and Nov 30) to storage or treatment and eventually into its distribution system. Pit F2 water elevation will be maintained between 240 ft and 180 ft amsl. In the conceptual model, water enters Pit F2 by seepage of groundwater when groundwater levels are higher in elevation than Pit F2 water levels and higher than the base of the permeable Qa/Qg sediments. Some of this seepage water may have resided for some time in pits upstream. Other contributions to Pit F2 include watershed runoff and direct rainfall. Water leaves Pit F2 by evaporation, consumptive use by quarry operations, NPDES quarry discharges to

Alameda Creek, and by seepage to groundwater when water elevations in Pit F2 are higher than groundwater elevations in the adjacent aquifer and higher than the base of the Qa/Qg sediments. Under project operations, reduced discharges related to quarry operations are expected, which will be approximately balanced by discharge via pumping from the pit during the dry season. In-stream releases and bypasses are expected to offset project pumping relative to the existing streamflow scenario presented in the ACRP EIR.

II. Assessment of Data and Analytical Methods

The data analyzed in HYD2 are time series of groundwater levels from monitoring wells installed within the study area, time series of surface water elevations in quarry pits, and a record of Alameda Creek streamflow at the gage below Welch Creek. Additional information comes from well lithologic logs, geologic maps showing the extent of the aquifer formations, pit slurry wall 'as builts', communication regarding quarry operation, a local precipitation record, and previous studies carried out by LSCE and others. The variety of data examined and the spatial and temporal data coverage are adequate for addressing the central question of assessment of impacts on stream flow in Alameda Creek due to the Project.

Several methods of analysis are applied to describe and quantify surface water-groundwater interaction. Groundwater flow (or flux) is predicted using analytical (Dupuit) and numerical (MODFLOW) approximations of groundwater flow. Groundwater storage in the shallow aquifer is quantified using geologic and GIS data. A water budget for Pit F2, developed using data from multiple sources, helps calibrate and verify the quantitative methods. Recharge-porous media flow-discharge processes, and the lack of significant interaction between formations deeper than Qa/Qg (older alluvium and Livermore gravels) and Qa/Qg or the stream are presented in the conceptual model and applied in the analysis and numerical model. These methods rely on the data mentioned above and involve some underlying assumptions and approximations, which are evaluated herein.

Section 6.3.2 provides an estimate of the shallow aquifer extent and volume, based on the mapped extent of the Qa and Qg formations and on extrapolated thicknesses from previously existing cross sections. Mined material volumes are subtracted and saturated water volumes are determined from groundwater levels and specific yield values from previous investigations of hydraulic properties. The methods employed are sound and based on the best available data, and the relatively small total volume of water held in Qa/Qg alluvium is an important factor for predicting the possible effects of the Pit F2 pumping project on streamflow and on groundwater levels.

Section 9.2 describes an analytical method for quantifying the flux between the stream and the shallow alluvium in the upstream portion of the study area, where Qg sediments predominate and surface water-groundwater interaction is not affected by seepage to quarry pits. The method employed (Dupuit equation) applies to (homogeneous, isotropic) unconfined aquifers with an impervious base and essentially horizontal flow. The method of analysis, the geometry, and K (hydraulic conductivity) value used in the analysis are all reasonable for the Alameda Creek setting. The discharge (flux) value determined (<1cfs) is important for predicting creek flows and groundwater levels.

Section 9.3 describes the components of the water budget for Pit F2, calculated over a time period when there were no quarry additions in the budget. Use of a one day time step is reasonable. Although there is some uncertainty in each of the water budget components, the values are based on the best available information and are reasonable. The 'closed' water balance allows determination of the subsurface seepage rate into Pit F2. Two seepage pathways are quantified – one through the gap in the slurry wall at the South Bay Aqueduct (SBA) and the other via groundwater along the south wall adjacent to Pit F3.

A numerical model in which the creek is a point source of water and Pit F2 is a point sink, is used to simulate seepage from the creek to the pit. The key parameters for accuracy of this type of model are the boundary conditions, the hydraulic conductivity value(s) assigned to the porous medium, and the availability of head values, which in this case come from ASDHM Node 5 stream flow, combined with Mannings Equation. Although the determination of the value used for the hydraulic conductivity (K) uses reasoning that is somewhat circular (i.e., the good agreement between the three methods (Dupuit, MODFLOW, and water balance) is related to the fact that K is based on the water balance), there are multiple lines of evidence for a K value in the range used in the model and in the water budget. The comparison of aquifer properties from aquifer tests (e.g., specific capacity) and sediment composition on p. 15-16 is useful in this regard. Moreover, the value of 600 ft/d is within a reasonable range reported elsewhere for coarse, stream-deposited alluvium. The boundary conditions once again rely on an impervious lower boundary and no flow boundaries along the slurry walls. Changing the boundary condition for 'with Project' conditions (p. 39-40) is a reasonable way to examine the difference in flows with and without the Project. The parameters used in the model (Table 9-4), which is applied over a limited geographic extent, are also reasonable.

In general, the results of the analyses show rapid filling of the aquifer when there is significant flow in the creek and only somewhat slower drainage of the aquifer as the creek flows recede. The primary assumptions upon which the analyses are based are largely supported by observations and data, and by the similar results determined using multiple analytical methods. Overall, the analyses provide a reasonably reliable method for predicting creek leakage and seepage (groundwater flow) to and from Pit F2.

III. Limitations and Sources of Uncertainty

HYD2 of the ACRP EIR relies on data and interpretation from many previous studies, some of which had goals unrelated to the goal of the EIR, such as exploring the viability of groundwater extraction within the study area using production wells, or hydrogeologic characterization of the sediments that fill Sunol Valley. As such, the monitoring locations and types of data analyzed are somewhat limited in the extent to which they can be used to directly address the four key questions stated above.

Also of note is that the possible effects of the ACRP will be in combination with the effects of CDRP; however, data and analysis are for past and existing conditions, and data do not yet exist for with-CDRP conditions. The analysis and models presented, however, are based on experimental releases that occurred in the summer of 2008, and the water budget on another period during which quarry additions did not take place. Still, one important condition that has not been observed is a Pit F2 water elevation above the elevation of the base of the permeable Qa/Qc units (224'; Fig 6-5), when water in the pit is expected to recharge the shallow aquifer.

As noted above, the volumes listed on the Table in Appendix 1 are somewhat uncertain, but the uncertainty varies among the different components, e.g., the surface areas of the different units and volume of mined pits can be reported with relatively low uncertainty, the gross volumes have a somewhat higher uncertainty because of likely variation in depth over the areas, and the water volumes have even higher uncertainty because of likely variability in Sy. However, the small total volume occupied by the Qa-Qg aquifer system leads to a relatively small water volume in any case.

Aquifer heterogeneity is discussed on p. 10, 15, 21, and 39, and acknowledged in figures by '?' signs at the contacts. Heterogeneity clearly plays a role in governing flow through porous media within all sections (Qa/Qg, Qoa, Livermore Formation). Flow is likely relatively rapid through connected lenses of coarse-grained material. Large and small lenses of differing permeability are visible in the walls of the pits and boundaries between different units cannot be identified in pit walls or in lithologic logs of monitoring wells. Although use of a single K value in the numerical analyses is common practice, significant dispersion within the shallow aquifer is likely. Dispersive flow affects both stream flow and groundwater levels, leading to tailing flow on hydrographs. Heterogeneity also affects pools that remain in the stream bed after significant stream flow (p. 24 second paragraph of 8.2), which may be fed by groundwater or may be perched and drying out.

Discussions related to the relative impermeability of the Qoa and Livermore Formations are mostly qualitative, except for reports of low specific capacities reported by Farrar (1990), and analysis of a pump test of a quarry supply well screened exclusively in the Livermore Formation that was carried out by LSCE. Although there is almost certainly some flux across the contact between the shallow alluvium and Livermore Formation, there is not likely enough to significantly affect the interaction between the creek and the shallow alluvium over a seasonal or interannual time scale.

There are no CASGEM wells within the Sunol Valley Groundwater Basin, and there is less than 2000 af/y of pumping, so the basin is automatically classified as Very Low priority due to low current and historical production.

IV. Addressing the Four Questions

Q1. Does the EIR groundwater analysis adequately evaluate the surface and groundwater interaction within the Alameda Creek watershed, including the Project's operational effects of lowering of Pit F2 elevations through pumping?

The analysis presented in HYD2 and Figures in Section 9 show estimated seepage rates from the creek to Pit F2 and show hydrograph recessions for the stream and for groundwater. Pumping from Pit F2 is to take place only between July 1 and Nov 30, when streamwater-groundwater interaction is minimal and stream flow is generated by CDRP releases. The lack of significant groundwater flow into or out of the pit when the pit water level is lower than the Qa/Qg contact indicates that pumping from the pit over that time period should not significantly affect groundwater levels in the project area or elsewhere.

Q2. Does the EIR groundwater analysis adequately describe the extent to which the ACRP will affect the loss rate of surface water from Alameda Creek, lower local groundwater levels, and affect downstream streamflow rates?

Sections 11.1-11.3 adequately describe the expected effects of both CDRP and ACRP on streamflow compared to existing conditions. These predictions are based on historical observations of stream flow and consider ASDHM output, predicted seepage rates and locations, and expected operating conditions under CDRP and ACRP. The expected effects on groundwater levels in the alluvial aquifer are also adequately described, and are based on the predicted flux through the shallow alluvial aquifer from the creek and predicted recession as stream flow decreases. The seepage rate from the creek to the alluvial aquifer is determined analytically, and the seepage rate from the creek to Pit F2 is modeled using similar parameters, as described above.

The vast majority of recharge water to the shallow alluvium is from the creek, released at Calaveras dam, though this water may have resided in one or more upstream pits for some time. The close match between creek and monitoring well hydrographs is evidence that recharge to the alluvium is dominated by stream flow. Some precipitation and runoff from intervening watershed areas, accounted for between model nodes in ASDHM, also contribute recharge.

The analysis presented shows that groundwater moves through the shallow alluvium relatively quickly, so there is insignificant carryover in the alluvium from year-to-year, but the modeled flux shows that drainage of stream water into Pit F2 during high flows in the creek is a relatively small volume.

Q3. Does the EIR groundwater analysis adequately characterize the water-bearing properties of the lower alluvium/Livermore gravels in the ACRP project area?

The surface water-groundwater analysis in the EIR does not include interaction between the shallow Qa/Qg sediments and the deeper Qoa/Livermore sediments, and states that the deeper system is hydraulically separated from the shallow alluvium (p.2 Appendix HYD2, e.g.). Flow within the deeper formations and flow between the deeper formations and Qa/Qg sediments is considered to be negligible for the purposes of examining the interaction between Alameda Creek, the quarry pits, and Qa/Qg sediments. The boundaries between all four of the aforementioned units are indistinct, and occur at variable depths, but the maximum thickness of the shallow alluvium is not likely more than about 60 ft., based on lithologic logs. The assumption of an impermeable lower boundary pervades all of the analyses and models (conceptual and numerical).

Data and direct observations (wells screened exclusively in the Livermore Formation or exclusively in the Qoa) are few in Sunol Valley, as all of the wells included in the draft EIR are shallow wells located within the mapped Qg formation. Geologic cross sections and well lithologic logs in LSCE reports reveal some information about the properties of the units below the shallow alluvium, and additional information comes from the Lonestar well pump test (LSCE, 1993), and observations in older publications (Niles, La Costa, USGS Geologic Map, Dibblee 1980; DWR Bulletin 118-2 Livermore and Sunol Valleys, 1966), and from quarry operators.

The Livermore Formation is described in publications variously as heterogeneous, with lenses, gravels with sand and silt and a high clay content that fills pore space and leads to low permeability. Other key lines of evidence regarding its low permeability are the observed low rate of seepage from sediments deeper than about 50’ into the quarry pits, the effectiveness of continuous slurry walls that reach depths of 40 to 60 feet, the high rate of drawdown even with a low pumping rate of 100 gpm and low transmissivity observed during the two-day pump test carried out on the packed-off Lonestar well (T=3,500 gpd/ft), and the deeper static water levels recorded in the few wells screened in the Livermore Formation compared to those recorded in wells screened in the shallow Qa/Qg. Springs in the Sunol Upland, described in Bulletin 118-2 as issuing from the base of the shallow alluvium, provide further evidence for the low permeability of the deeper units.

The Livermore Formation holds a large volume of water in spite of its relatively low porosity because of its larger areal extent and thickness of 400-500 ft. The key characteristic for this study is the much lower average hydraulic conductivity (or permeability) of the Livermore Formation than of the shallow alluvial materials, which leads to much slower groundwater flow.

The Livermore Formation is hydraulically connected to the deep quarry pits as no continuous impermeable unit exists in the sediments, and to Qoa (which may be connected to Qa/Qg). However, the movement of water within the Livermore Formation and between the Livermore Formation and Qa/Qg is much, much slower than flow in the shallow aquifer system. Comparison of estimated conductivities suggests that the rate of groundwater flow is *at least* an order of magnitude lower in the Livermore gravels than in the Qa/Qg. The flux of groundwater between the deeper formations and the shallow aquifer can therefore be considered negligible within an inter-annual time frame. Since the likely vertical direction of transport is downward, some small fraction of the groundwater that enters the Qa/Qg during high flows will be ‘lost’ to the deeper formations on a decadal (or longer) time scale. The volume of water that flows out of the Qa/Qg to the low permeability sediments is likely within the uncertainty of the predicted flows in the creek given the relatively small volume of water held in the Qa/Qg.

Observations presented here, along with information from previous publications, referenced in the draft EIR, support the conclusion that the permeability of the Livermore Formation in the project area is low enough to restrict the flow of groundwater between the Livermore Formation and overlying, permeable sediments relative to inter-annual groundwater flows between the stream and shallow alluvium. The conclusion in HYD2 that ‘the Livermore Gravels subunit is not considered to have a dynamic influence on groundwater conditions that could affect daily to seasonal impacts of ACRP operations (i.e., under with-Project scenario)’ is therefore reasonable.

Q4. Does the EIR groundwater analysis accurately characterize the relationship between groundwater and surface water in the Sunol Valley so that its conclusions can be used to accurately determine the ACRP's potential impacts to streamflows in Alameda Creek downstream of the project site?

A large amount of streamflow, pit water elevation, and groundwater elevation data are presented in the ACRP EIR. These data show convincingly the strong hydraulic connection between the creek and the shallow groundwater in the project area. Pit F3W and Pit 4 water level data likewise show the hydraulic connection between these pits and the shallow groundwater. Groundwater flow is described in sufficient detail in the EIR and analysis supports the notion that a small volume of storage is available in the shallow alluvium and that groundwater flow is relatively rapid in Qa/Qg (where all groundwater interaction takes place in the analysis).

The interaction between water flowing in Alameda Creek, water stored in quarry pit F2, and water that moves through the porous media in Sunol Valley is complex, and the many, major alterations of the system due to engineered infrastructure make predicting water fluxes between these ‘pools’ of water challenging. These alterations include impoundments, infiltration galleries, slurry walls, stream discharge due to pumping from pits, additions to pits by quarry operators, diversions of stream flow, and removal of a significant portion of the shallow aquifer system within the study area. The analysis in HYD2 uses the available data to make predictions of potential impacts to streamflows using justifiable assumptions and reasonable estimations of aquifer properties and relationships between stream flow and flow through porous media.

Data and References

LSCE. 1993. *Ground-Water and Aggregate Resources, Sunol Valley*. Prepared for San Francisco Water Department. December 1993. Prepared by Luhdorff & Scalmanini Consulting Engineers.

LSCE. 2009. *Final Report, Feasibility to Recapture Reservoir Releases, Alameda Creek*. Prepared for San Francisco Public Utilities Commission. April 22, 2009. Prepared by Luhdorff & Scalmanini Consulting Engineers.

San Francisco Planning Department, *SFPUC Alameda Creek Recapture Project Final Environmental Impact Report*, Volumes 1-3. Case No. 2015-004827ENV. June 22, 2017

Niles, La Costa, USGS Geologic Map, Dibblee 1980

DWR Bulletin 118-2 Livermore and Sunol Valleys, 1966

Precipitation record for Calaveras Road station (CAD) and Alameda Creek gauge (ACC) from cdec.ca.gov

Streamflow record for Alameda Creek below Welch Creek from usgs.gov

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EMPLOYMENT

Professor, Department of Earth & Environmental Science
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EDUCATION

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RESEARCH EXPERIENCE

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Best Paper of 2014, International Consortium on Geo-disaster Reduction	2014
Hitchon Award - International Association of Geochemistry	2007
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<u>Publications since 2005 (*peer-reviewed; ± student)</u>

*Jamal Alikhani±, Amanda Deinhart±, Ate Visser, Richard Bibby, Roland Purtschert, Jean Moran, Arash Massoudieh, Brad Esser "Nitrate vulnerability projections from Bayesian inference of multiple groundwater age tracers", *Journal of Hydrology*, DOI: 10.1016/j.jhydrol.2016.04.028, April, 2016.

*Harms, Patrick±; Visser, Ate; Moran, Jean; Esser, Bradley 'Distribution of Tritium in Precipitation and Surface Water in California' *Journal of Hydrology*, DOI: 10.1016/j.jhydrol.2015.12.046, March, 2016.

*Visser, Ate; Moran, Jean; Hillegonds, Darren; Singleton, Michael; Kulongoski, Justin; Belitz, Kenneth; Esser, Bradley 'Geostatistical Analysis of Tritium, Groundwater Age, and Other Noble Gas Derived Parameters in California', *Water Research 91*, DOI: 10.1016/j.watres.2016.01.004, Jan, 2016.

*Ryan G. Lucas±, Francisco Suárez, Martha H. Conklin, Scott W. Tyler, and Jean E. Moran 'Polymictic Pool Behavior in a Montane Meadow, Sierra Nevada, CA', *Hydrological Processes*, DOI: 10.1002/hyp.10834, May, 2016.

Kropp, A., Joyce, J. Moran, J.E. "Source of water key to understanding landslide causation", Proceedings of the 12th International Symposium on Geodisaster Reduction (winner of ICGdR best paper of the year, 2014)

Michael J. Singleton, Jean E. Moran, Ate Visser, Stephanie H. Uróstegui±, Daniel C. Segal±, Elizabeth DeRubeis±, and Bradley K. Esser "Climate Change Impacts to Recharge in a High-Elevation Groundwater Basin" LLNL-TR- 548931-Draft, August, 2013, 55 pp.

Michael J. Singleton, Jean E. Moran, Roald Leif, Bradley K. Esser "Distinguishing Septic System and Agricultural Nitrate Sources with Stable Isotope Compositions and Trace Organic

Compounds: An Investigation of Nitrate Sources in Chico, CA" LLNL-TR-553871, August 2015, 17pp.

Menso DeJong±, Jean E. Moran, Ate Visser, Michael J. Singleton, and Bradley K. Esser, "Identifying Paleowater in California Drinking Water Wells", LLNL-TR-661416, August 2014, 25pp.

Jean E. Moran, Amanda Deinhart±, Ate Visser, Richard K. Bibby, Sarah Roberts, Michael J. Singleton, Gary R. Eppich, and Bradley K. Esser, "Application of Multi-Tracer Methods to Determine Age Distribution in Wells with Increasing Nitrate Concentrations" LLNL-TR-669087, March 2015, 35 pp.

Visser, A., Moran, J.E., Singleton, M.J. and Esser, B.K. "Geostatistical analysis of groundwater age and other noble gas derived parameters in California groundwater" LLNL-TR-654049, report to the State Water Resources Control Board, October 2014, 44pp.

Visser, A., Bibby, R., Moran, J.E., Singleton, M.J., Esser, B. "Development of a Capability for the Analysis of Krypton-85 in Groundwater Samples" LLNL-TR-665865, June 2015, 26pp.

Moran, J.E., Visser, A., Esser, B.K. and Singleton, M.J. "Workshop on Tracers in MAR" LLNL-TR-663257, report to the State Water Resources Control Board, October 2014, 83pp.

*Visser A., Singleton M., Hillegonds D., Velsko C., Moran J. E., and Esser B. K. (2013) A membrane inlet mass spectrometry system for noble gases at natural abundances in gas and water samples, pp. 40. *Rapid Communications in Mass Spectrometry,* Volume 27, Issue 21, 2472–2482 doi: 10.1002/rcm.6704

*±Segal, D.C., Moran, J.E., Visser, A., Singleton, M.J., and Esser, B.K. (2014) "Seasonal Variation of High Elevation Groundwater Recharge as Indicator of Climate Response", *Journal of Hydrology*, v. 519:3129-3141.

*Bensen, A.±, Zane, M., Becker, T.±, Visser, A., Urióstegui, S.±, DeRubeis, E.±, Moran, J. E., Esser, B., K., Clark, J. (2014) "Quantifying Reaeration Rates in Alpine Streams using Deliberate Gas Tracer Experiments", *Water*, 6(4):1013-1027.

Singleton, M.J., Moran, J.E., Visser, A., Uriostegui, S.H.±, Segal, D.C.±, DeRubeis, E.±, Esser, B.K. (2014) Climate Change Impacts to Recharge in a High-Elevation Groundwater Basin. LLNL-TR-548931, 55pp.

*Hu, Q., Moran, J.E., Gan, J. (2012) Sorption, Degradation, and Transport of Methyl Iodide and Other Iodine Species in Geological Media. *Applied Geochemistry*. http://dx.doi.org/10.1016/j.apgeochem.2011.12.022

Visser, A. Moran, J.E., Aql, R., Singleton, M.J., Esser, B.K. (2013) Examination of Water Quality in "Tritium-Dead" Drinking Water Wells. LLNL-TR-558107, 54pp.

Moran, J.E., Esser, B.K., Hillegonds, D. ±Holtz, M., Roberts, S.K., Singleton, M.J., ±Visser, A. (2011) Nitrate fate and transport in the Salinas Valley. LLNL-TR-484186, 38pp.

*O'Leary, D.R., Izbicki, J.A., Moran, J.E., Meeth, T., Nakagawa, B., Metzger, L., Bonds, C., Singleton, M.J. (2011) Movement of Water Infiltrated from a Recharge Basin to Wells. *Ground Water* doi: 10.1111/j.1745-6584.2011.00838.x.

*Singleton, M.J. and Moran, J.E. (2010) Dissolved noble gas and isotopic tracers reveal vulnerability of groundwater in a small, high elevation catchment to predicted climate changes. *Water Resources Research* doi: 10.1029/2009WR008718.

Singleton, M.J., Moran, J.E., Roberts, S.K., Hillegonds, D.J., Esser, B.K. (2010) An isotopic and dissolved gas investigation of nitrate source and transport to a public supply well in California's Central Valley. LLNL-TR-427957, 31 pp.

*Iodine: Radionuclides, by Hu, Q.H., and J.E. Moran. in: Encyclopedia of Inorganic Chemistry. Edited by R.H. Crabtree, 165-178. John Wiley: Chichester, 2010.

Esser, B.K., Singleton, M.J., and Moran, J.E. (2009) Identifying Nitrate Sources and Sinks. Southwest Hydrology, 8 (4), 32-33.

* Cey, B.±, Hudson, G.B., Moran, J.E., and Scanlon, B.R. (2009) Evaluation of Noble Gas Recharge Temperatures in a Shallow Unconfined Aquifer. *Ground Water* 47, 646-659.

*McNab, W.W., Singleton, M.J., Moran, J.E., Esser, B.K. (2009) Ion exchange and trace element surface complexation reactions associated with applied recharge of low-TDS water in the San Joaquin Valley, California. *Applied Geochemistry*, 24, 129-137.

*Geochemical Cycling of Iodine Species in Soils, by Hu, Q., Moran, J.E., and Blackwood, V.± in: Comprehensive Handbook of Iodine. Edited by Preedy, V., Burrow, G.,and Watson, R. Academic Press 2009, 1328 pp.

*Cey, B.±, Hudson, G.B., Moran, J.E., and Scanlon, B.R. (2008) Impact of Artificial Recharge on Dissolved Noble Gases in Groundwater in California, USA. *Environ. Sci. Technol.* 42, 1017-1023.

*Hu, Q., Rose, T.P., Zavarin, M., Smith, D.K., Moran, J.E., Zhao, P.H. (2008) Assessing field-scale migration of radionuclides at the Nevada Test Site: "Mobile" species. *J. Environ. Radioactivity*, 99, 1617-1630.

Moran, J.E., Ruiz, R., Ford, T., Singleton, M.J., Esser, B.K., Soto, G.T., Velsko, C., and Hillegonds, D. (2008) Development of a Field Deployable Gas Extraction Apparatus. UCRL-TR-407175, 24pp.

Tompson, A., Demir, Z., Moran, J.E., Mason, D., Wagoner, J., Kollet, S., Mansoor, K., McKereghan, P. (2008) Groundwater Availability Within the Salton Sea Basin. LLNL-TR-400426, 156pp.

Applied Geochemistry, Volume 22, Issue 3, Pages 491-714 (2007)
Halogens and Their Isotopes in Marine and Terrestrial Systems
Edited by J.E. Moran and G.T. Snyder

Winner of the Hitchon Award for the most significant *Applied Geochemistry* publication of 2006
*Moore K.±, Ekwurzel B. E., Esser B. K., Hudson G. B., and Moran J. E. (2006) Sources of groundwater nitrate revealed using residence time and isotope methods. *Applied Geochemistry* 21(6), 1016-1029.

*Fehn, U., Moran, J.E., Snyder, G.T., and Muramatsu, Y. (2007) The Initial ^{129}I/I Ratio and the Presence of 'Old' Iodine in Continental Margins, *Nucl. Instr. Meth. Phys. Res., B* Volume 259, Issue 1, pp. 496-502

*Carle S. F., Esser B. K., and Moran J. E. (2006) High-resolution simulation of basin scale nitrate transport considering aquifer system heterogeneity. *Geosphere* 2 (4, Special Issue: Modeling Flow and Transport in Physically and Chemically Heterogeneous Media), 195-209.

*McNab W. W., Singleton M. J., Moran J. E., and Esser B. K. (2007) Assessing the Impact of Animal Waste Lagoon Seepage on the Geochemistry of an Underlying Shallow Aquifer. *Environ. Sci. Technol.* 41(3), 753-758.

*Singleton M. J., Esser B. K., Moran J. E., Hudson G. B., McNab W. W., and Harter T. (2007) Saturated Zone Denitrification: Potential for Natural Attenuation of Nitrate Contamination in Shallow Groundwater Under Dairy Operations. *Environ. Sci. Technol.* 41(3), 759-765.

Moran, J.E., Beller, H.R., Leif, R., and Singleton, M.J. (2006) Fate and Transport of Wastewater Indicators: Results from Ambient Groundwater and from Groundwater Directly Influenced by Wastewater, Technical Report, UCRL-TR-222531, 66 pp.

*Hu, Q., Zhao, P., Moran, J.E., and Seaman, J.C. (2005) Sorption and Transport of Iodine Species in Sediments from the Savannah River and Hanford Sites, *Journal of Contaminant Hydrology*. Vol. 78, no. 3, pp. 185-205. Jul 2005.

*Hu, Q. and Moran, J.E. (2005) Simultaneous analyses and applications of multiple fluorobenzoate and halide tracers in hydrologic studies. *Hydrological Processes* Volume 19, Issue 14 , Pages 2671 – 2687. Apr 2005.

*Schwer, K.±, Santschi, P.H., Moran, J.E., and Elmore, D. (2005) Near-conservative behavior of ^{129}Iodine in the Orange County Aquifer System, California, *Applied Geochemistry*. Volume: 20; Journal Issue: 8, Pages 1461-1472. 2005.

APPENDIX ACFRW

Alameda Creek Fisheries Restoration Workgroup Meeting

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SAN FRANCISCO
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AGENDA

PRESENTATION TO THE ALAMEDA CREEK FISHERIES RESTORATION WORKGROUP
on the
Alameda Creek Recapture Project EIR

Thursday, September 12, 2019, 9:30 a.m. to 12:30 p.m.
at Zone 7 Water Agency, 100 North Canyons Parkway in Livermore

9:30 to 9:40	Introductions	Elke Ranke, Zone 7 / Tim Ramirez, SFPUC
9:40 to 9:50	Purpose of Meeting, CEQA process	Chris Kern, SF Planning
9:50 to 10:00	Revised ACRP Operations	Tim Ramirez, SFPUC
10:00 to 11:00	Summary of Updated GW/Surface Water Analysis	Tom Elson, LSCE
11:00 to 11:45	Results of Third Party Review	Jean Moran, Ph.D.
11:45 to 12:15	Summary of Revised CEQA Analysis	Chris Fitzer, ESA
12:15 to 12:30	Next Steps	Chris Kern, SF Planning

San Francisco Planning Department
Environmental Planning

Alameda Creek Recapture Project EIR

Alameda Creek Fisheries Restoration Workgroup Meeting

September 12, 2019

Presentation Overview

- Introductions (Elke Rank / Tim Ramirez)
- Purpose of Meeting (Chris Kern)
- Revised ACRP Operations (Tim Ramirez)
- Summary of Revised Appendix HYD2 (Tom Elson)
- Third Party Review of GW Analysis (Jean Moran)
- Recirculated EIR Contents and Revised Steelhead Analysis (Chris Fitzer)
- Next Steps and Questions / Discussion (Chris Kern)

SFPUC Alameda Creek Recapture Project EIR, Recirculation

Purpose of Meeting

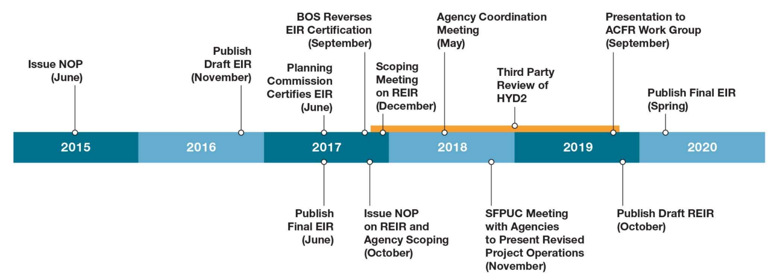
- **To present the results of the independent Third Party Review of the groundwater – surface water analysis used in the ACRP EIR**
- To provide context for the Third Party Review
  - Present revisions to the proposed ACRP operations
  - Present revisions to Appendix HYD2, which presents the groundwater – surface water analysis
- To provide brief overview of the Recirculated ACRP EIR

Third Party Independent Review: Jean Moran, PhD

- Professor, Dept of Earth & Environmental Science, California State University East Bay, where she was awarded outstanding researcher in 2017
  - Ph.D., Geochemistry, University of Rochester
  - M.S., Geophysics, University of Washington
  - B.S., Geology and B.A., Physics, University of Rochester
- Teaches hydrology, hydrogeology, contaminant transport
- Research Scientist, Lawrence Livermore National Laboratory
- Project Leader, Groundwater Ambient Monitoring and Assessment
- Numerous peer-reviewed publications

ACRP CEQA PROCESS

ACRP CEQA Process: Timeline

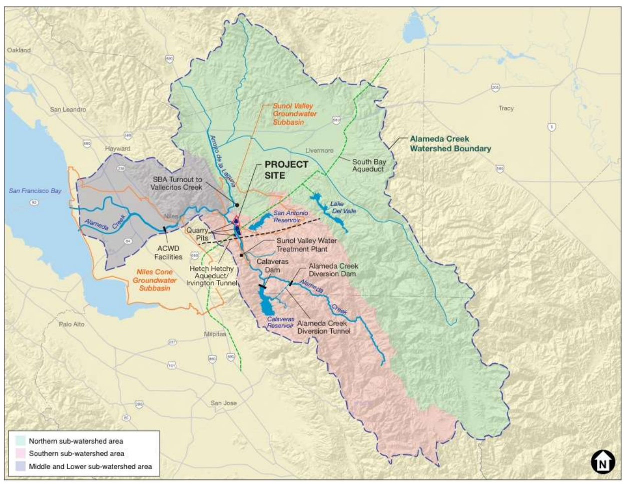


REVISED ACRP OPERATIONS

ACRP Overview

- The Alameda Creek Recapture Project is part of the SFPUC's Water System Improvement Program
- Key Objectives:
  - Recapture a portion of future minimum instream flows from Calaveras Dam and bypasses at Alameda Creek Diversion Dam and maintain the historical annual transfers from the Alameda Watershed
  - Maintain water supply reliability

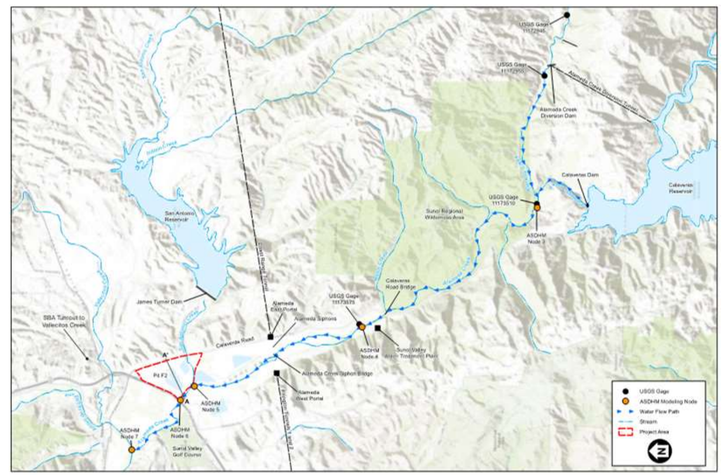
Regional Overview



SFPUC Alameda Creek Recapture Project EIR, Recirculation

ESA+ORION a joint venture

Project Location Map



SFPUC Alameda Creek Recapture Project EIR, Recirculation

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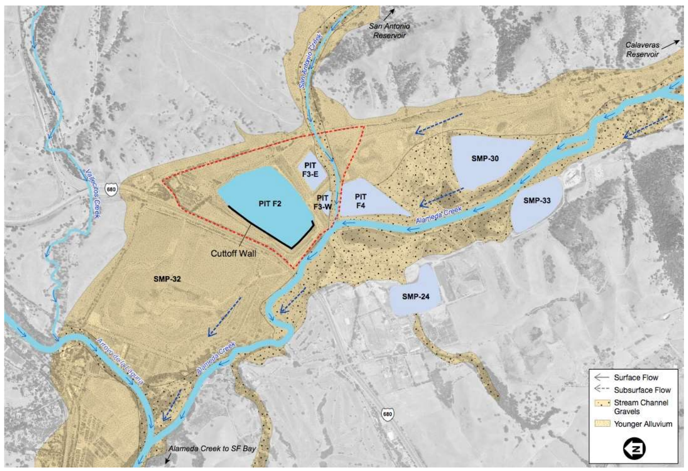
Primary Study Area



Project Description

- Estimated combined Calaveras Dam releases and bypasses at the Alameda Creek Diversion Dam:
  - Average annual = 14,695 acre-ft / year
- Estimated recapture volume:
  - Original operations, average annual = 7,178 acre-ft / year
  - Revised operations, average annual = 6,045 acre-ft / yr
- Pit F2 passively collects water through natural subsurface percolation and seepage
- Recaptured water pumped from Pit F2 during specified periods and transferred to existing SFPUC facilities

Overview of ACRP Project Revisions

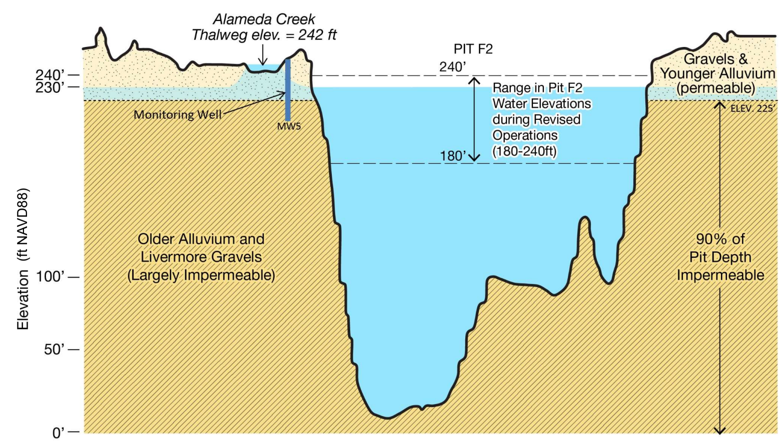
- Operational changes proposed by SFPUC

Months	New	Original	Remarks
October November	Pumping: Pit Elev >= 180'	Pumping: Pit Elev >= 150'	*Pumping period reduces to five months from 9 months*
December January February March April	No Pumping	No pumping (January–March)	*No pumping period extends from December to June compared to January to March*
May June	No pumping if Node 5 flow >0 cfs. No pumping if Pit Elev <225' even if Node 5 flow = 0 cfs.	Pumping: Pit Elev >= 150' (April–September)	*Pit level will not be drawn down below 180' compared to 150'*
July August September	Pumping: Pit Elev >= 180'		*Recapture volume reduces to about 6,000 AF from 7,200 AF and the difference of 1,200 AF would add to streamflow at Node 6*

SFPUC Alameda Creek Recapture Project EIR, Recirculation

ESA+ORION a joint venture

Schematic of Revised ACRP Operating Protocols



SFPUC Alameda Creek Recapture Project EIR, Recirculation

ESA+ORION a joint venture

REVISED APPENDIX HYD2

Appendix HYD2-Revised

Updated groundwater-surface water interactions including numerical and analytical methods to quantify differences between CEQA scenarios

Tom Elson, Mohamed K. Nassar, and Ken Utley

Luhdorff & Scalmanini Consulting Engineers

September 12, 2019

Purpose

- CDFW comments on potential operational impacts
  - Influence of ACRP storage (Pit F2) on stream leakage
  - Apply analysis using daily timesteps
- Peer review
  - Integrate peer review input

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Updated analyses

- Calculation of aquifer storage using borehole and GIS information
- Aquifer flow upstream of Quarry Reach
  - Verification of conceptualization in EIR
  - Magnitude of aquifer flux as a function of stream leakage without influence of quarry pits
  - Time-series analysis of aquifer flow and connection to streamflow
- Seepage into Pit F2
  - Used time series streamflow data
  - Estimated seepage flux via two pathways into Pit F2
    - Seepage from creek to pit (numerical model)
    - Seepage from groundwater (analytical solution)
  - Verification with Pit F2 mass balance

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Results

Used verified solutions for seepage into Pit F2 and applied to ASDHM base period

- Examined stream leakage and seepage to Pit F2 from creek for CEQA scenarios
    - Assume Pit F2 level below contact for with-CDRP scenario
    - Use modeled Pit F2 levels for with-Project (ACRP) scenario
    - Output includes time-series of creek leakage and seepage at Pit F2, plus storage in aquifer

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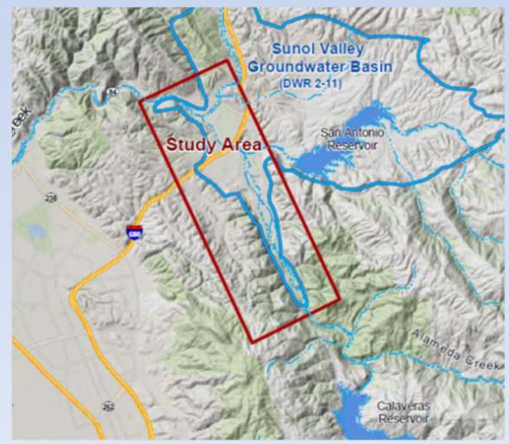
Project Setting



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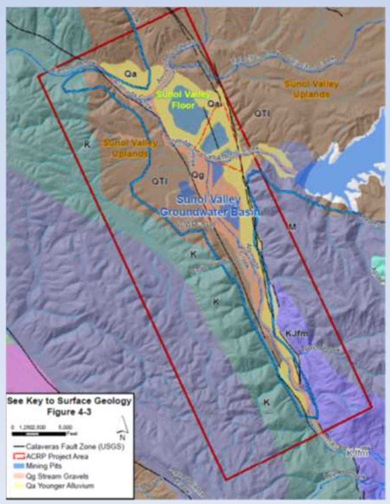
Shallow Aquifer (Qa, Qg)

Geometry

- Sloped
- Thin
- Narrow
- High K

…and, directly connected to Alameda Creek



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Storage volume of shallow aquifer

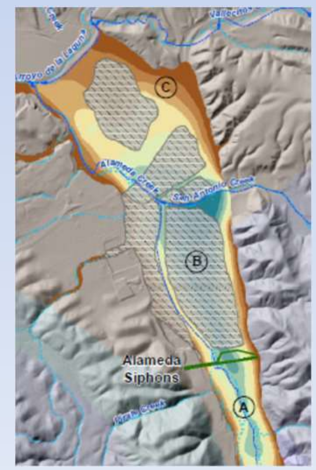
<u>Volume* by reach</u>

A (upper) = 490 af

B (quarry) = 342 af

C (gallery) = 303 af

** Volume of water that fills and drains in response to recharge and flows*



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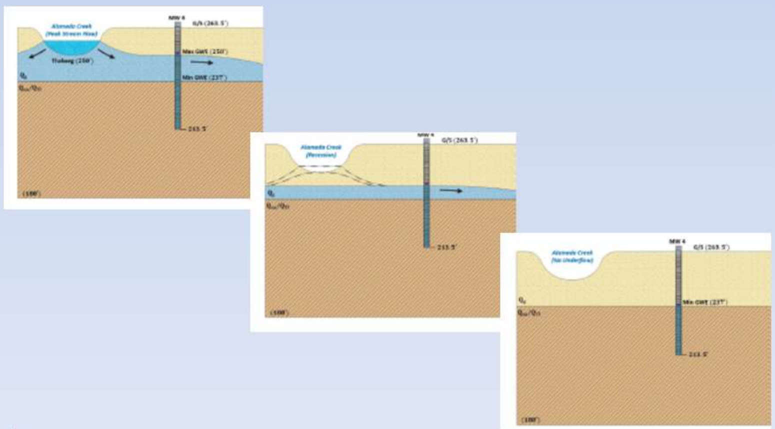
Simulations and EIR conceptualization



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Groundwater flow in upper reach (upstream of quarry reach)

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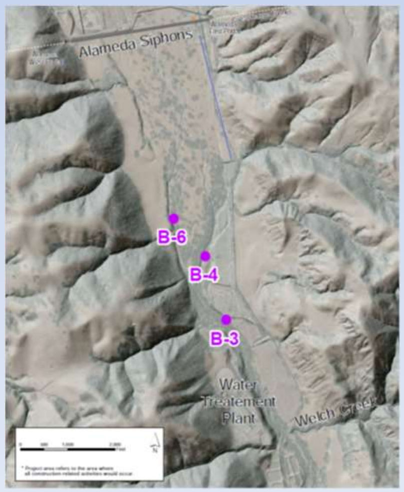
Conceptualization and upstream reach

- Examined area between Welch Creek and Alameda Siphons
  - No losses to pits
  - Same surficial stream channel gravels and younger alluvium
  - Time series data for geotechnical piezometers B3, B4, and B6
  - Stream gaging just upstream below Welch Creek



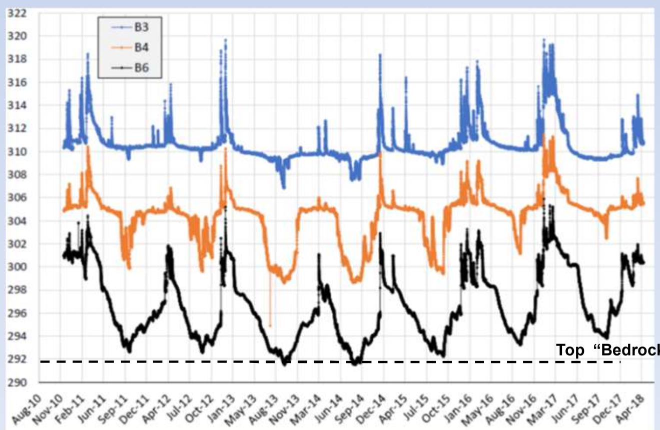
Upper Reach

Shallow aquifer underlain by “bedrock”

26

Conceptualization and upstream reach

Time series heads (ft, NAVD88) at B3, B4, and B6



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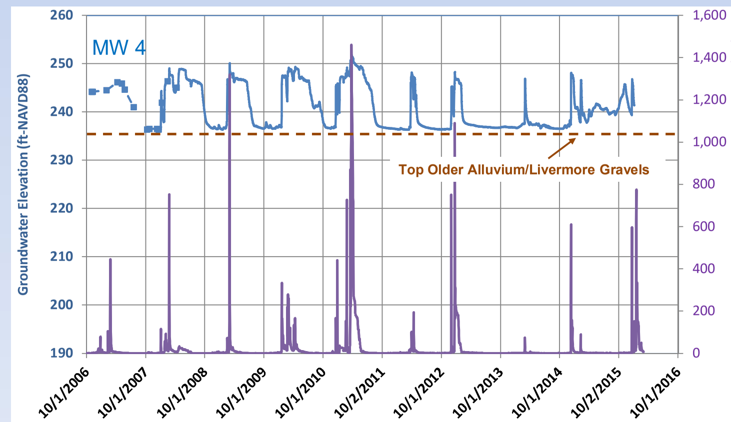
Comparison with quarry reach



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Groundwater flow in upper reach

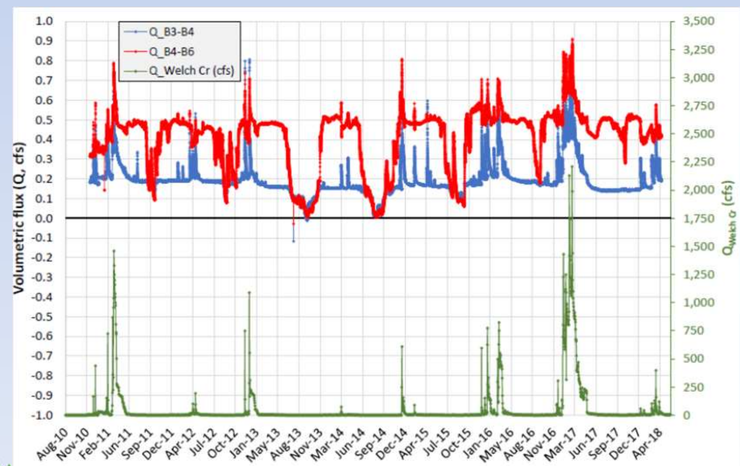
Analytical solution (Dupuit)[1] used to estimate aquifer flux for observed time-series heads B3,B4, and B6

- *Flow is a function of head change between any two locations and specific time, hydraulic conductivity, aquifer cross-sectional area, and distance between piezometers*

1. An analytical solution is an exact solution of the governing equation of a groundwater flow problem under certain simplifying assumptions.

29

Volumetric flux in upstream reach



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Results

- Peak subsurface flow closely corresponds to peaks in Welch Creek flow
- Subsurface flow ranges from 0 to 1 cfs and is seasonal with recharge from the stream
- Flow characteristics consistent with an aquifer of limited extent (cross-section area) and with creek serving as predominant source of recharge

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Groundwater flow in quarry reach

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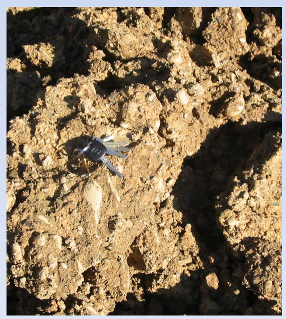
Quarry reach (shallow aquifer underlain by Livermore Gravels)

Livermore Gravels – target for aggregate mining



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Groundwater flow in quarry reach

- Expect similar behavior as upstream, but with significant losses into quarry pits (as observed in multiple streamflow studies and experience by mining operators)
- Groundwater monitoring and quarry operations (i.e., discharges) indicate that subsurface flow is seasonal and influenced primarily by flow in Alameda Creek
- Peak groundwater levels are closely aligned with peaks in Welch Creek gage data

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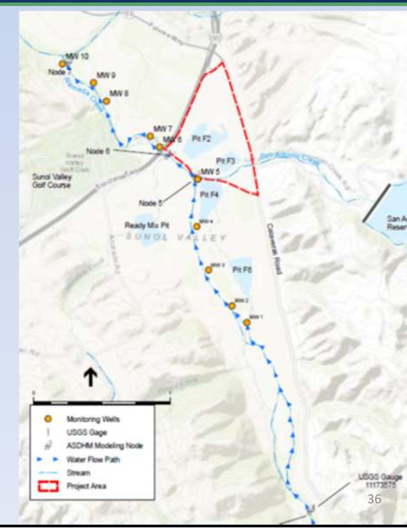
Seepage into Pit F2

1. Created a mass balance for Pit F2 to account for changes in pit volume and quantify seepage into pit
2. Performed separate analyses to account for subsurface seepage into Pit F2:
   a) *Numerical MODFLOW simulation of seepage from Alameda Creek into Pit F2 through slurry wall gap*
   b) *Dupuit analytic solution for groundwater seepage along southern edge (used Pit F3-West as a proxy for groundwater head)*
3. Compared analytic results with mass balance to verify parameter estimates

Data Sources

- Continuous water levels in MWs 1 – 10
- Gaged flow below Welch Creek *and Node 5 (above San Antonio confluence)*
- Quarry Discharges *(daily records)*
- Pit Levels (monitored continuously)
- *Other (precip., evap., and runoff)*



Mass balance

$$Inflow - Outflow = Change\ in\ storage$$

Components

P: Direct precipitation rate into the pit *(meas.)*

R: Watershed runoff rate into the pit *(est.)*

S: Subsurface seepage rate into the pit *(computed)*

Q_{in}: Quarry addition rate, *by operators* *(not reported)*

E: Evaporation rate from pit surface *(algorithm)*

Q_{out}: Quarry discharge rate out of pit, *by operators* *(reported)*

V: Pit water volume *(head meas. by transducer)*

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Mass balance

$$Inflow - Outflow = Change\ in\ storage$$

$$P(t) + R(t) + S(t) + Q_{in}(t) - E(t) - Q_{out}(t) = {(V(t) - V(t-1))}/{dt}$$

Interested in solving for seepage into pit

38

Mass balance

where:
$(V(t) - V(t-1))$ is change in pit volume

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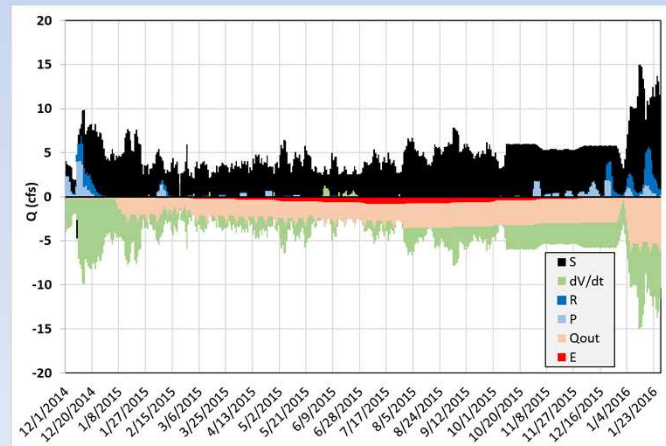
Pit F2 flow mass balance components



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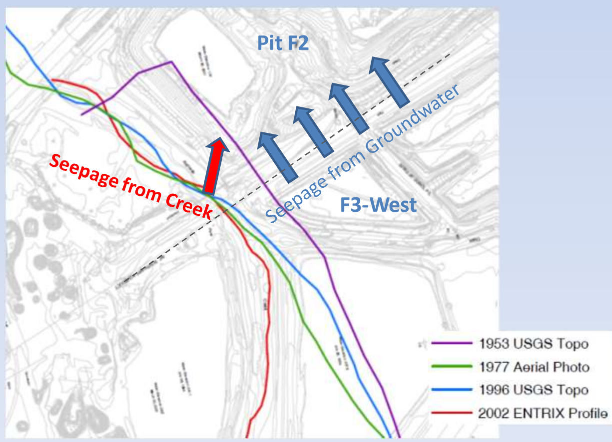
Disaggregation of seepage components



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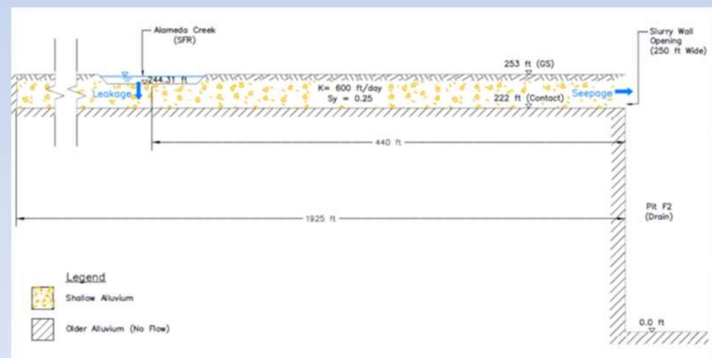
MODFLOW simulation – creek leakage and seepage into pit



Used MODFLOW as numerical flow model platform developed by U.S. Geological Survey; solves groundwater flow equation to simulate the flow of groundwater through porous media.

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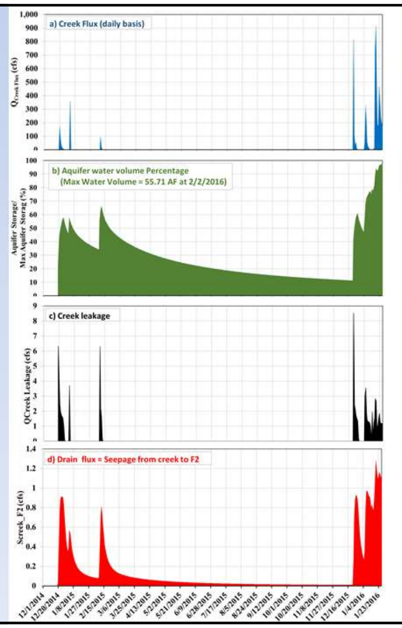
Numerical simulation: creek-to-pit pathway (mass balance time period)



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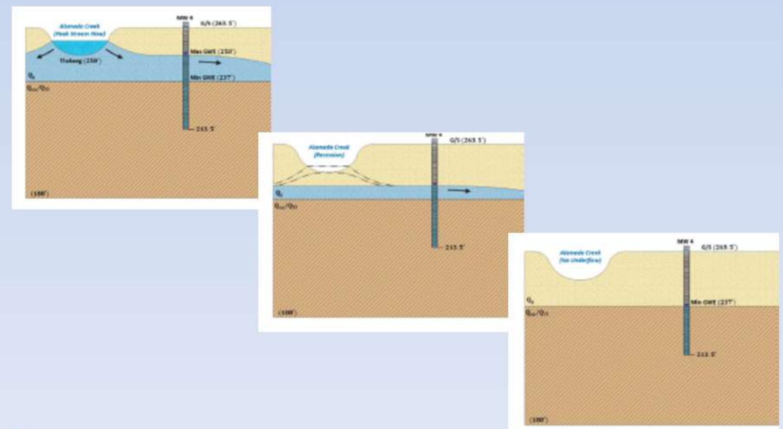
Simulations and EIR conceptualization



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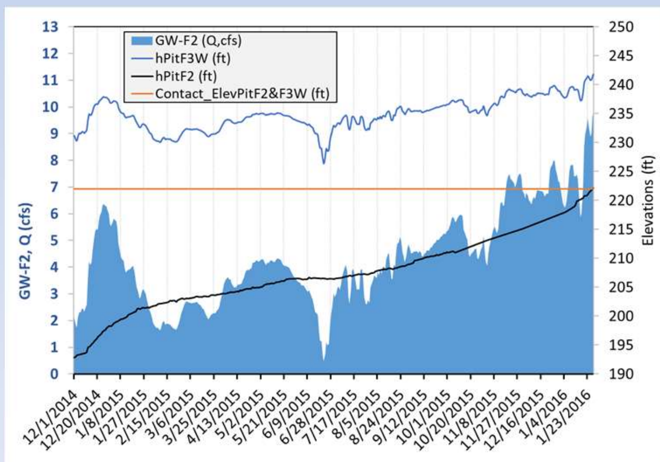
Analytic solution: “groundwater” pathway



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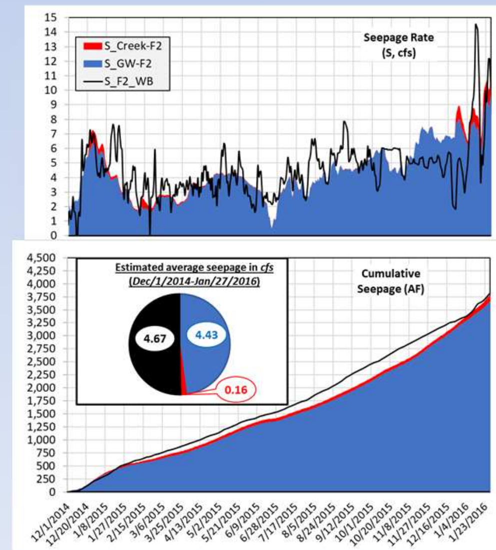
Mass balance verification



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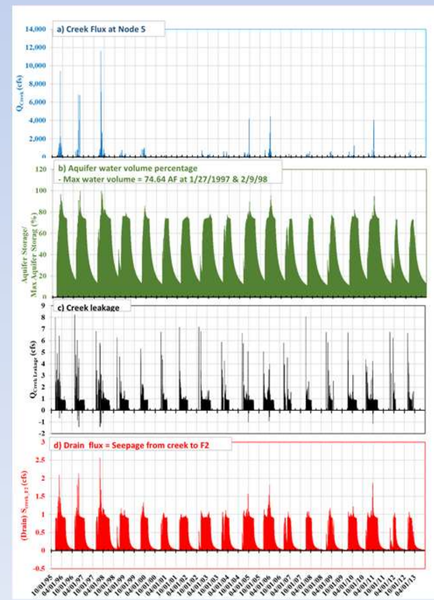
Application for stream-pit interaction during ASDHM base period

Used numerical model (creek-to-pit pathway) to estimate seepage from Alameda Creek as a function of Welch Creek flow during ASDHM base period (1996 WY to 2013 WY)

1. For with-CDRP, assume Pit F2 water level always below contact (based on historical mining practices)
2. For ACRP, Pit F2 level based on projected recapture over base period.
3. Compare number of days that leakage could impact threshold flows during migration and immigration periods

47

Creek flow and simulated seepage for ASDHM base period: with-CDRP



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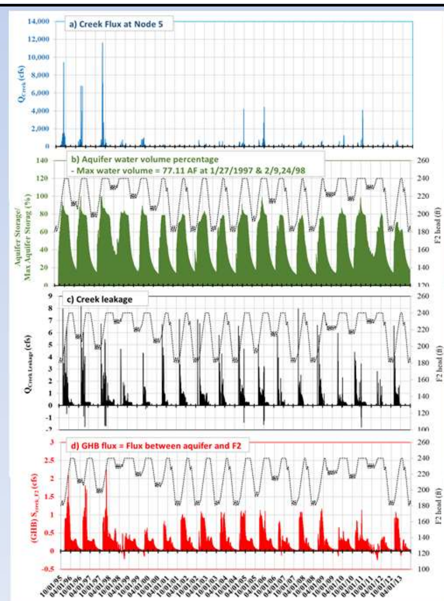
Creek flow and simulated seepage for ASDHM base period: with-ACRP



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Time-series water table profile and creek stage (animation)

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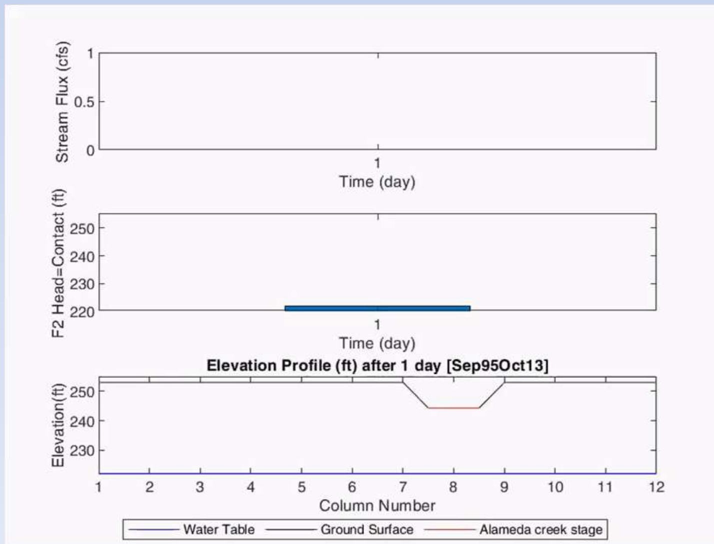
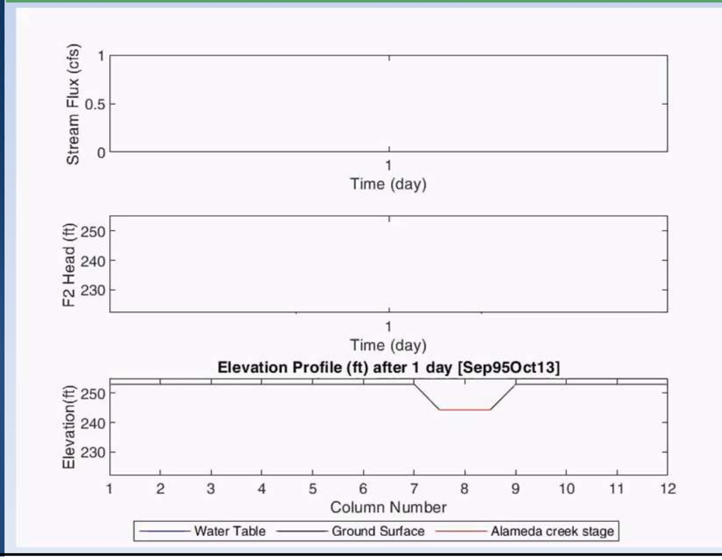
with-CDRP pit level always below contact



ACRP Proposed Operation (11/1/2018)



Comparison of scenarios

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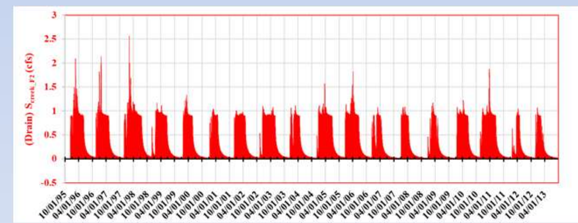
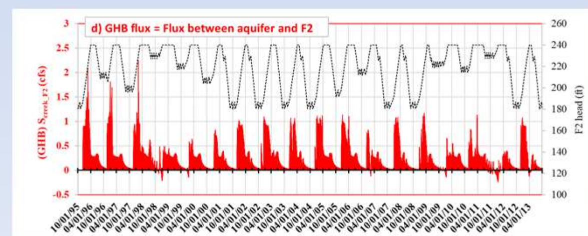
Seepage comparison

with-CDRP



with-ACRP



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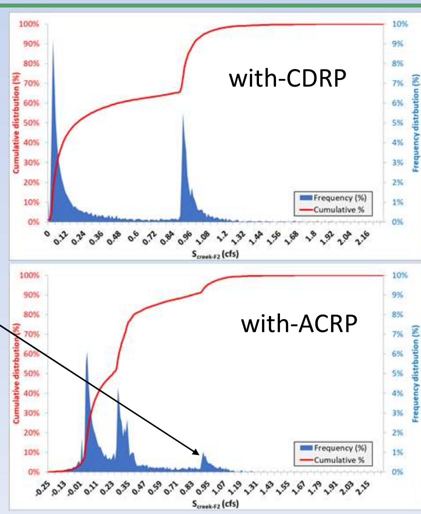
Frequency distribution comparison of seepage rates for ASDHM base period



Fewer days at this peak

Average stream leakage (cfs) using numerical model for ASDHM base period

Month	with-CDRP	with-ACRP
January	0.97	0.87
February	1.02	0.77
March	0.95	0.50
April	0.81	0.27
May	0.47	0.14
June	0.24	0.07
July	0.03	0.02
August	0	0
September	0	0
October	0	0
November	0.12	0.12
December	0.66	0.65
minimum	0	0
maximum	1.02	0.87
Average annual	0.44	0.28

Summary

- Updated analysis consistent/compatible with ASDHM
- Practically all water that accrues Pit F2 is sourced from Alameda Creek (other sources are direct precipitation and runoff)
  - A significant seepage pathway is laterally along southern edge (F3-West) as indicated in mass balance

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Summary, cont.

- Seepage from Alameda Creek into Pit F2 has a finite maximum constrained by stream stage, aquifer thickness and aquifer properties
  - Maximum seepage rate from creek pathway is about 1 cfs
  - Under new proposed ACRP operations, number of days at 1 cfs (max. seepage) is less than with-CDRP scenario due to higher storage in Pit F2 under ACRP

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THIRD PARTY REVIEW OF APPENDIX HYD2

Outline

- My charge
  - Carry out an independent review of the LSCE analysis of surface water-groundwater interaction in the vicinity of the ACRP (as reported in Appendix HYD2)
- Tasks and schedule
- Guiding questions
- Information sources relied upon
- Outcome of initial review
- Outcome of final review
  - Conceptual model and water budget for Pit F2
  - Analysis of groundwater-stream interaction upstream of quarries
  - Numerical flow model that predicts effects of project on stream flow

Tasks and Schedule

- Initial contact (Sept '17)
- Site visit and meeting (Nov '17)
- Draft report of review of v1 of Appendix HYD2 (Jan '18)
- Final report of review of v1 of Appendix HYD2 (Mar '18)

- Revised HYD2 received (May '19)
- Draft report of review of v2 HYD2 (June '19)
- Final report of review of v2 HYD2 (July '19)

Guiding questions

- **Q#1**: Does the EIR groundwater analysis adequately evaluate the surface and groundwater interaction within the Alameda Creek watershed, including Project's operational effects of lowering of Pit F2 elevations through pumping?
- **Q#2**: Does the EIR groundwater analysis adequately describe the extent to which the ACRP will affect the loss rate of surface water from Alameda Creek, lower local groundwater levels, and affect downstream streamflow rates?
- **Q#3**: Does the EIR groundwater analysis adequately characterize the hydraulic properties of the lower alluvium & Livermore gravels in the ACRP project area?
- **Q#4**: Does the EIR groundwater analysis accurately characterize the relationship between groundwater and surface water in the Sunol Valley so that its conclusions can be used to accurately determine the ACRP's potential impacts to streamflows in Alameda Creek downstream of the project site?

Information sources relied upon

- Luhdorff & Scalmanini Consulting Engineers (LSCE), 1993. *Ground-Water and Aggregate Resources, Sunol Valley*.
- LSCE. 2009. *Final Report, Feasibility to Recapture Reservoir Releases, Alameda Creek*.
- McBain & Trush, Inc. Alameda Creek Population Recovery Strategies and Instream Flow Assessment for Steelhead Trout, Final Study Plan. January 2008.
- San Francisco Planning Department, 2016. SFPUC Alameda Creek Recapture Project, Draft Environmental Impact Report. Volumes 1 and 2.
- San Francisco Planning Department, 2017. SFPUC Alameda Creek Recapture Project, Responses to Comments on the Draft Environmental Impact Report.
- SFPUC, ACWD, and McBain & Trush, Inc. 2012. *Draft Technical Memorandum, Overview of Methods, Models, and Results to Develop Unimpaired, Impaired, and Future Flow and Temperature Estimates along Lower Alameda Creek for Hydrogeologic Years 1996-2009*.
- URS Corporation. 2007. *Sunol, California Task 1.3 – Condition Assessment Report Alameda County, California for SFPUC Alameda Creek Fishery Enhancement*.

Information sources relied upon (con't)

- Pit transducer (water level) records
- Monitoring well transducer (water level) records
- Monitoring well lithologic/drilling logs
- Quarry slurry wall as-builts
- USGS gauge record below Welch confluence
- cdec.ca.gov precipitation record
- Bulletin 118 Livermore and Sunol Valleys 1966

Initial Review: Outcome/Findings

– Implicit assumptions were not addressed quantitatively
  - Small volume of groundwater storage in study area
  - Water in stream gravel sediments is predominantly from Alameda Creek
  - Stream gravel sediments fill and drain rapidly

– Analysis of impacts of project on stream flow likely reasonable, but analysis of impacts on groundwater unconvincing due to lack of explicit consideration of groundwater transport (Q2)

– Characterization of the hydraulic properties of the Livermore Formation are based mainly on prior descriptions, and indicate that the shallow, dynamic system can be considered as separate from the slower, deeper system for the purposes of predicting flow in the creek

Review updated HYD2: Outcome/Findings

– Conceptual model
  - Describes flow pathways
  - Is based on water level data and operational observations

– Water budget for Pit F2
  - Uses best available information and reasonable values
  - Allows calculation of the seepage rate into Pit F2

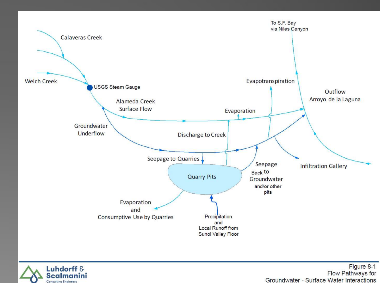
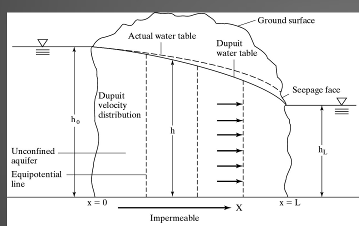


Figure 8-1
Flow Pathways for
Groundwater - Surface Water Interactions

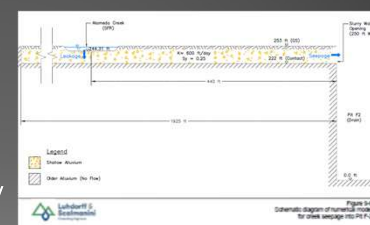
Review updated HYD2: Outcome/Findings

- Analysis to determine flux between stream and groundwater, upstream of quarries
  - Uses the Dupuit formulation, which assumes nearly horizontal flow away from the stream, and applies a high, but reasonable value of hydraulic conductivity for stream gravels



Review of updated HYD2: Outcome/Findings

- Numerical model to determine affect of project on stream flow
  - Uses reasonable boundary conditions, hydraulic properties and stream stage values
  - Simulates flow at gap in slurry wall and along the south wall adjacent to Pit F3
  - Run with different boundary conditions to predict difference in flows with and without the project



Review of updated HYD2: Findings

Q#1: Does the EIR groundwater analysis adequately evaluate the surface and groundwater interaction within the Alameda Creek watershed, including Project's operational effects of lowering of Pit F2 elevations through pumping?

- The analysis presented in HYD2 gives estimated seepage rates from the creek to Pit F2 and describes hydrograph recessions for the stream and for groundwater.
- The lack of significant groundwater flow into or out of the pit when the pit water level is lower than the Qa/Qg contact indicates that pumping from the pit between July 1 and Nov 30 should not significantly affect groundwater levels in the project area

Review of updated HYD2: Findings

- **Q#2**: Does the EIR groundwater analysis adequately describe the extent to which the ACRP will affect the loss rate of surface water from Alameda Creek, lower local groundwater levels, and affect downstream streamflow rates?
- The analysis presented shows that groundwater moves through the shallow alluvium relatively quickly, so there is insignificant carryover in the alluvium from year-to-year, and the modeled flux shows that drainage of stream water into Pit F2 during high flows in the creek is a relatively small volume
- HYD2 adequately describes the expected effects of both CDRP and ACRP on streamflow and groundwater levels in the shallow aquifer compared to existing conditions

Review of updated HYD2: Findings

- **Q#3**: Does the EIR groundwater analysis adequately characterize the hydraulic properties of the lower alluvium & Livermore gravels in the ACRP project area?
- In HYD2, characterization of the hydraulic properties of the Livermore Formation is based mainly on prior descriptions, and the analysis does not include interaction between the Livermore Formation and shallow sediments
- The Livermore Formation is water-bearing, but lacks vigorous flow in the study area. Interaction between it and overlying sediments is minimal relative to inter-annual flows between the stream and the shallow aquifer

Review of updated HYD2: Findings

- **Q#4**: Does the EIR groundwater analysis accurately characterize the relationship between groundwater and surface water in the Sunol Valley so that its conclusions can be used to accurately determine the ACRP's potential impacts to streamflows in Alameda Creek downstream of the project site?
- The interaction between water flowing in Alameda Creek, water stored in quarry pit F2, and water that moves through the porous media in Sunol Valley is complex, and the many, major alterations of the system due to engineered infrastructure make predicting water fluxes between these 'pools' of water challenging.
- The analysis in HYD2 applies the available data to make predictions of potential impacts to streamflows using justifiable assumptions and reasonable estimations of aquifer properties and relationships between stream flow and flow through porous media.

Summary

- The primary assumptions upon which the analyses are based are largely supported by observations and data, and by the similar results determined using multiple analytical methods. Overall, the analyses provide a reasonably reliable method for predicting creek leakage and seepage (groundwater flow) to and from Pit F2.
- Uncertainties
  - Aquifer heterogeneity results in spatial variability in groundwater flow rates
  - Future conditions will be different than those already observed, e.g., Pit F2 elevation above the base of the permeable gravel units
  - Mostly qualitative consideration of interaction between the Livermore Formation and shallow sediments

CONTENTS OF RECIRCULATED EIR

Recirculated Portions of the Draft EIR

- Chapter 13. Introduction
- Chapter 14. Revisions to the Project Description
- Chapter 15. Recirculated Portions of Environmental Setting, Impacts and Mitigation Measures
  - Fisheries Resources
    - Impact BI-11 only
  - Other Resource Topics affected by the revised project description
- Additional Appendices
  - Appendix HYD1-R, Revised Surface Water Report
  - Appendix HYD2-R, Revised Groundwater Report
  - Other appendices to support the CEQA process

Revised Steelhead Impact Analysis

- Based on review of NMFS and CDFW concerns:
  - Requested operations to be more protective of migration season
    - Expand “no pumping” period
  - Requested more information on streamflow impacts during steelhead migration, specifically:
    - Analysis at a daily time-step
    - Timing of adult and juvenile migration
    - Primary and extended study area
    - Dry years
    - Migration outside peak flow periods

Revised Steelhead Impact Analysis

- Revised approach to analysis based on updated streamflow predictions for all scenarios and study locations
  - Used updated ASDHM output due to revised project operations
  - Revised post-processing of ASDHM data
    - Refined groundwater/surface water interactions based on revised Appendix HYD2
    - Quarry NPDES discharge post-processing to allow daily time-step comparison
- Migration Opportunity Days Analysis
- Daily Hydrographs

Steelhead Study Area and Season

- Study Area
  - Primary study area (Sunol Valley)
  - Extended study area (Niles Canyon through lower Alameda Creek Channel)
- Project-related changes in the context of seasonal, life-stage specific habitat requirements of CCC steelhead DPS
  - Adult Migration: December 1 through April 30
  - Juvenile Outmigration: March 1 through June 30
- Considers creek connectivity conditions needed for steelhead migration

Revised Steelhead Impact Analysis

- Migration opportunity threshold conditions
  - Primary Study Area
    - 20 cfs Dec - Apr, 10 cfs Mar - Jun
  - Extended Study Area
    - 25 cfs Dec - Apr, 12 cfs Mar - Jun
- Daily hydrographs during steelhead migration periods
  - Range of water-year types (wet to dry)

Results of Revised Steelhead Analysis

- Migration Opportunity Days and Magnitude Change Analysis
  - CDRP NMFS BO comparison
  - CEQA comparison
- Daily Hydrographs
  - Wet and Dry Years
    - CDRP NMFS BO comparison
    - CEQA comparison
- Impact Conclusions
  - No change from June 2017 EIR
  - Less than significant

Analysis of Other Resource Areas

- Due to delayed construction schedule, revised cumulative analysis
- Due to revised project operations, other topics analyzed
  - Terrestrial Biological Resources
  - Riparian Habitat
  - Groundwater recharge
  - Downstream water users
  - Stability of geologic unit
  - Energy
- No change in any impact conclusions

Next Steps in CEQA Process

- October 2019: Publish recirculated portions of the Draft EIR
- November 2019: Public Hearing before SF Planning Commission on recirculated portions of the Draft EIR
- Early 2020: Prepare Final EIR, including responses to comments on the recirculated portions of the Draft EIR

SAN FRANCISCO
PLANNING DEPARTMENT

SIGN-IN SHEET

PRESENTATION TO THE ALAMEDA CREEK FISHERIES RESTORATION WORKGROUP
on the
Alameda Creek Recapture Project EIR

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Pat Samuel	Caltrout	(by phone)
Elke Rank	Zone 7	

APPENDIX BIO2-R

Alameda Creek Fisheries Habitat Assessment Report, Addendum (updates and replaces portions of Appendix BIO2)

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Introduction

This Appendix BIO2-R updates and replaces certain isolated part of Appendix BIO2, which was included in the environmental impact report (EIR) on the SFPUC Alameda Creek Recapture Project (ACRP) (San Francisco Planning Department, June 2017) in compliance with the California Environmental Quality Act (CEQA). This update has been prepared to support the revised portion of ACRP environmental impact analysis as part of the recirculation process required under CEQA. It updates discussion related to the revised ACRP operations, which is described in EIR Chapter 14 of the recirculated portion of the EIR, as well as updated information that reflects the refined hydrological analysis as presented in Appendix HYD1-R of the EIR. The vast majority of Appendix BIO2 remains unchanged from in the June 2017 EIR, and this appendix serves only to update that appendix.

Updates

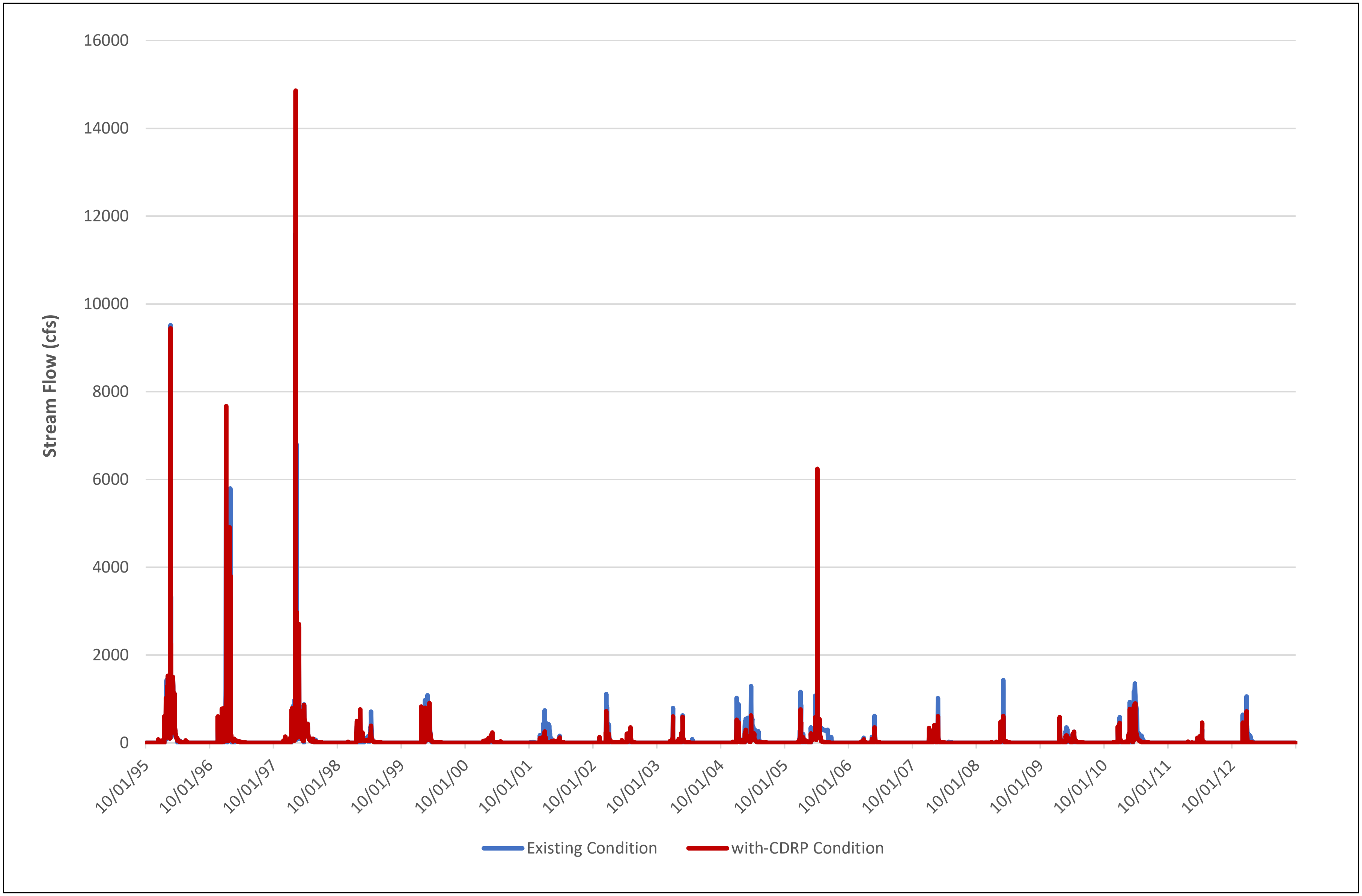
In Section 1.3, Project Summary, the text is updated to indicate that the SFPUC is proposing the ACRP to recapture an annual average of 6,045 acre-feet per year, and not 7,178 acre-feet per year.

In Section 2.2, Existing and with-CDRP Conditions, Table 2-1 is updated to reflect the refined analysis of quarry pit operations under the with-CDRP conditions. The average amount of water available for quarry NPDES discharges in an annual average of 6,739 acre-feet per year instead of 6,620 acre-feet per year.

In Section 2.3.1, Literature Review, the following additional document was reviewed for this study:

- *National Marine Fisheries Service Biological Opinion for the Joint Lower Alameda Creek Fish Passage Improvements Project* (NMFS, 2017).

In Section 3.3, Alameda Creek Habitat Conditions, the description of the with-CDRP condition should be updated to indicated that the Calaveras Dam Replacement Project (CDRP) was completed in the spring of 2019. Also in this section, regarding Alameda Creek streamflow simulations, **Figures 3-6 (revised)** and **3-7 (revised)** are updated hydrographs of estimated flows above San Antonio Creek confluence (Node 5 instead of Node 6) and above the Arroyo de la Laguna confluence (Node 7), respectively. Similarly, **Figures 3-8 (revised)** and **3-9 (revised)** are updated flow duration curves above San Antonio Creek confluence (Node 5 instead of Node 6) and above the Arroyo de la Laguna confluence (Node 7), respectively. **Figures 3-10 (revised)** and **3-11 (revised)** are December through June hydrographs for Very Wet (2006), Wet (2003), Dry (2008), and Very Dry (2007) Water Year Types for Nodes 5 (instead of 6) and 7, respectively. The Figures 3-6 (rev) to 3-11 (rev) replace the respective figures in the June 2017 EIR.



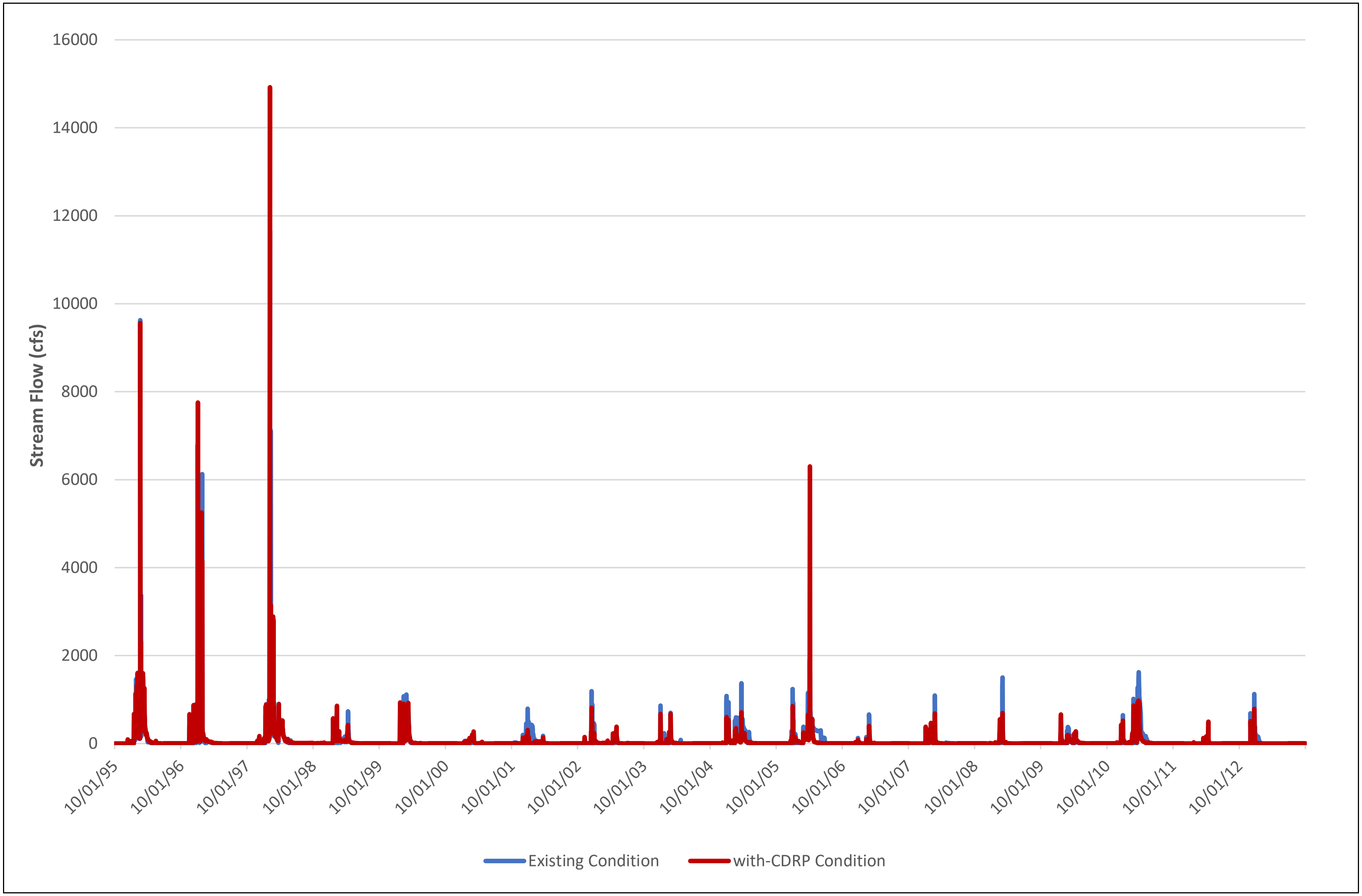
SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

SFPUC Alameda Creek Recapture Project

Figure 3-6 (revised)

Modeled Hydrographs of Alameda Creek Above San Antonio Creek (ASDHM Node 5)



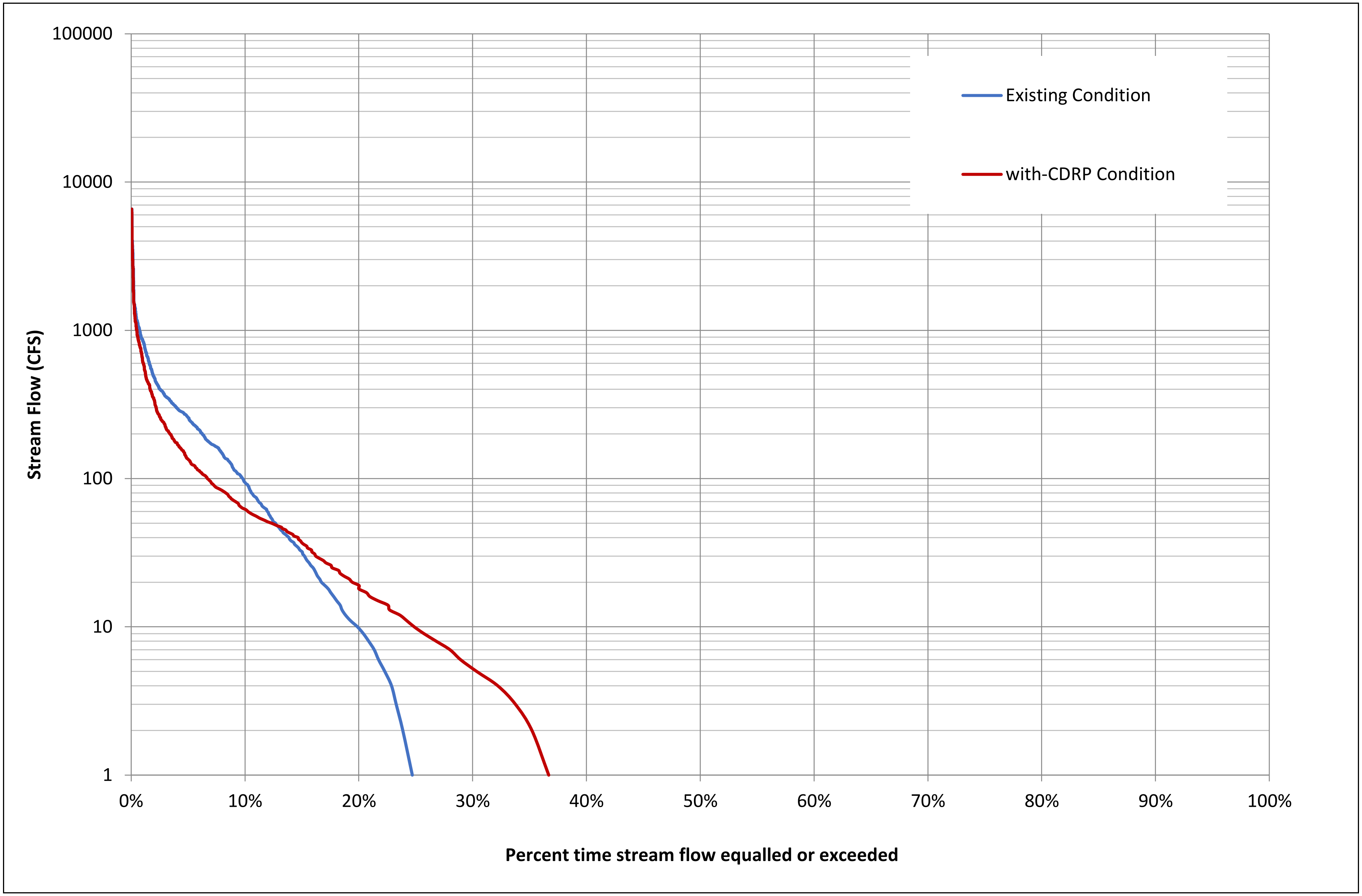
SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES discharges at Node 6 and losses between Node 6 and 7 by ESA/Orion.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

SFPUC Alameda Creek Recapture Project

Figure 3-7 (revised)

Modeled Hydrographs of Alameda Creek Above Arroyo de la Laguna (ASDHM Node 7)



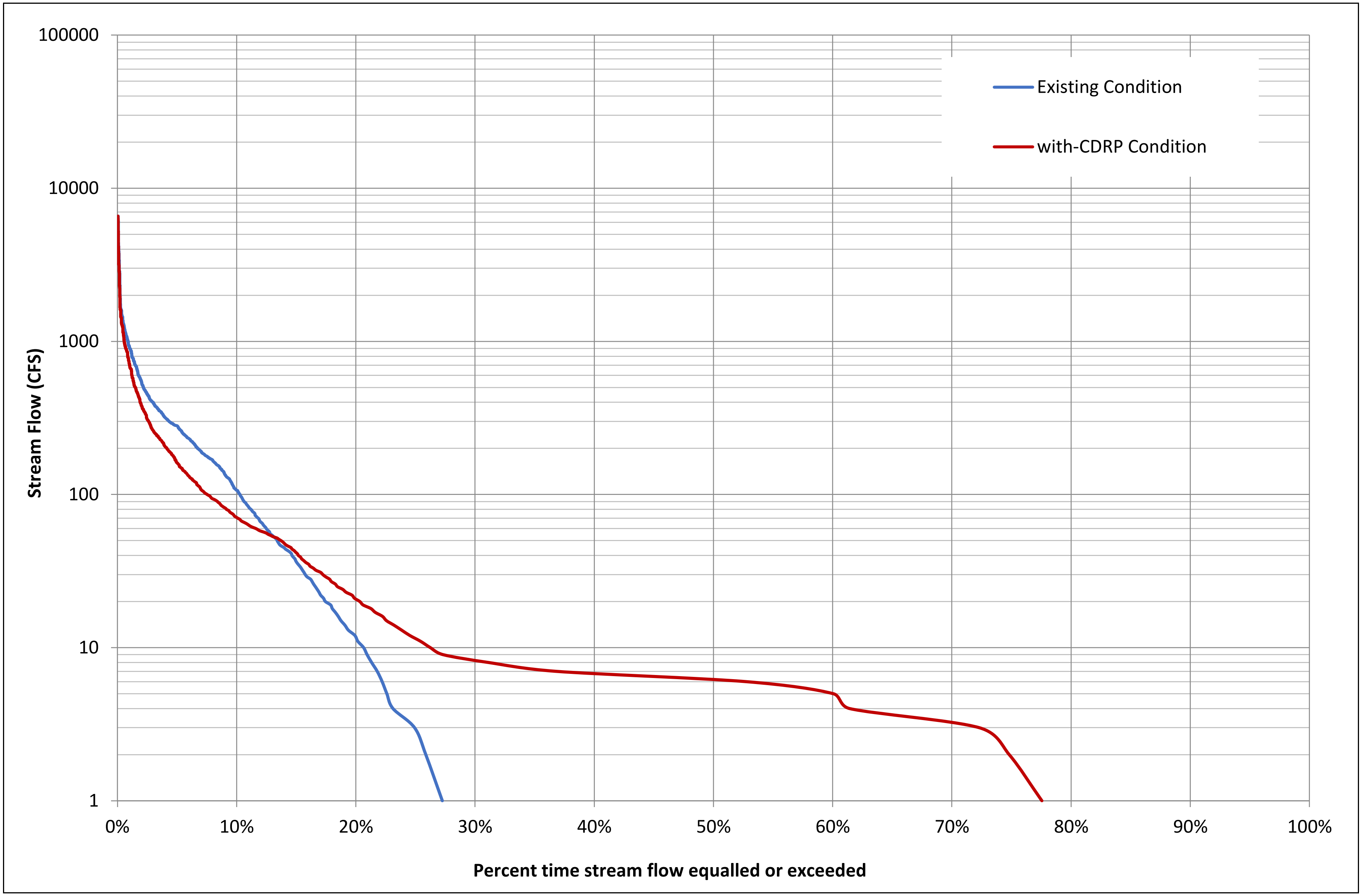
SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

SFPUC Alameda Creek Recapture Project

Figure 3-8 (revised)

Modeled Flow Duration Curves of Alameda Creek Above San Antonio Creek (ASDHM Node 5)



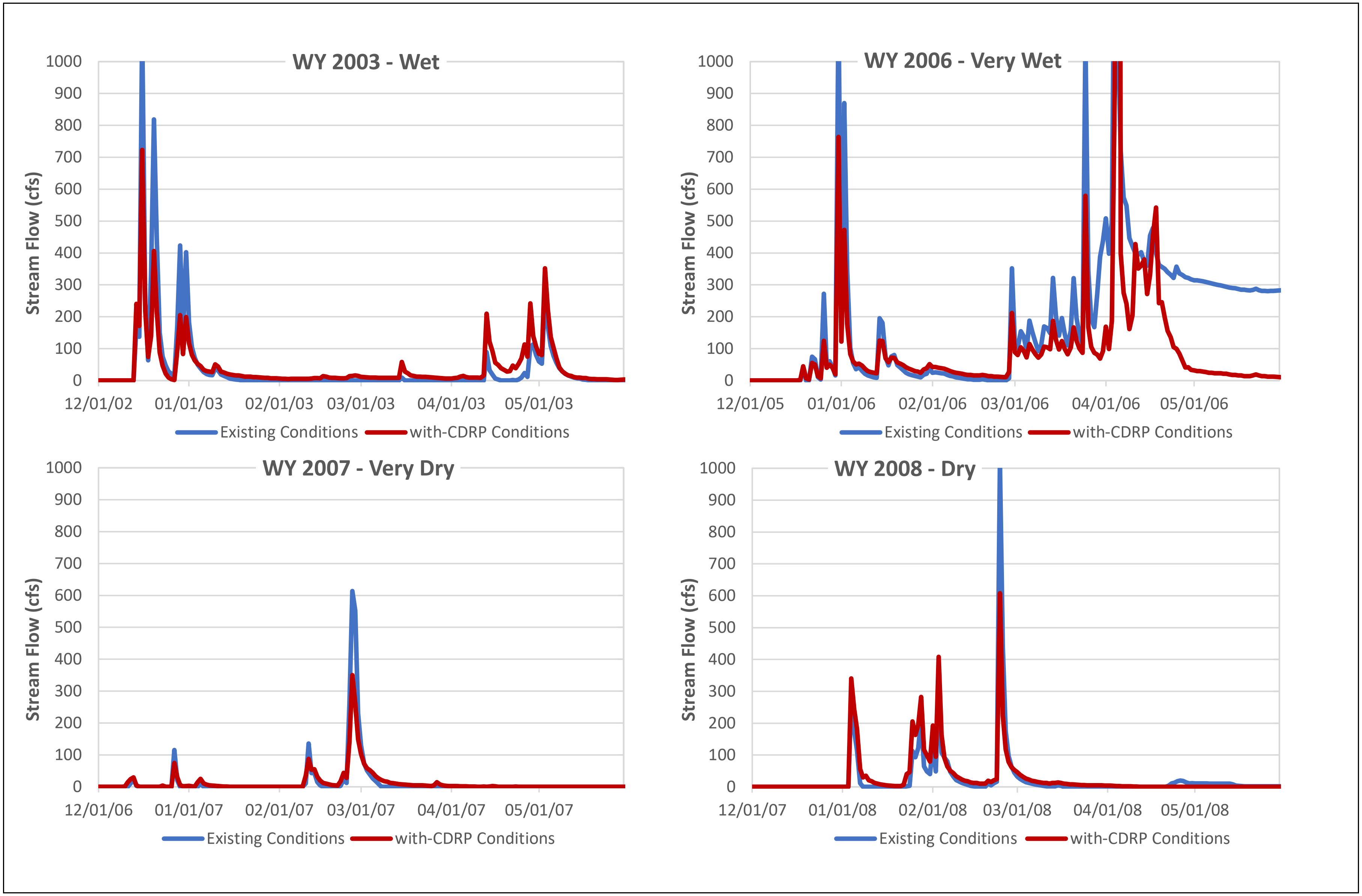
SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6 and losses between Node 6 and 7 by ESA/Orion.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

SFPUC Alameda Creek Recapture Project

Figure 3-9 (revised)

Modeled Flow Duration Curves of Alameda Creek Above Arroyo de la Laguna (ASDHM Node 7)



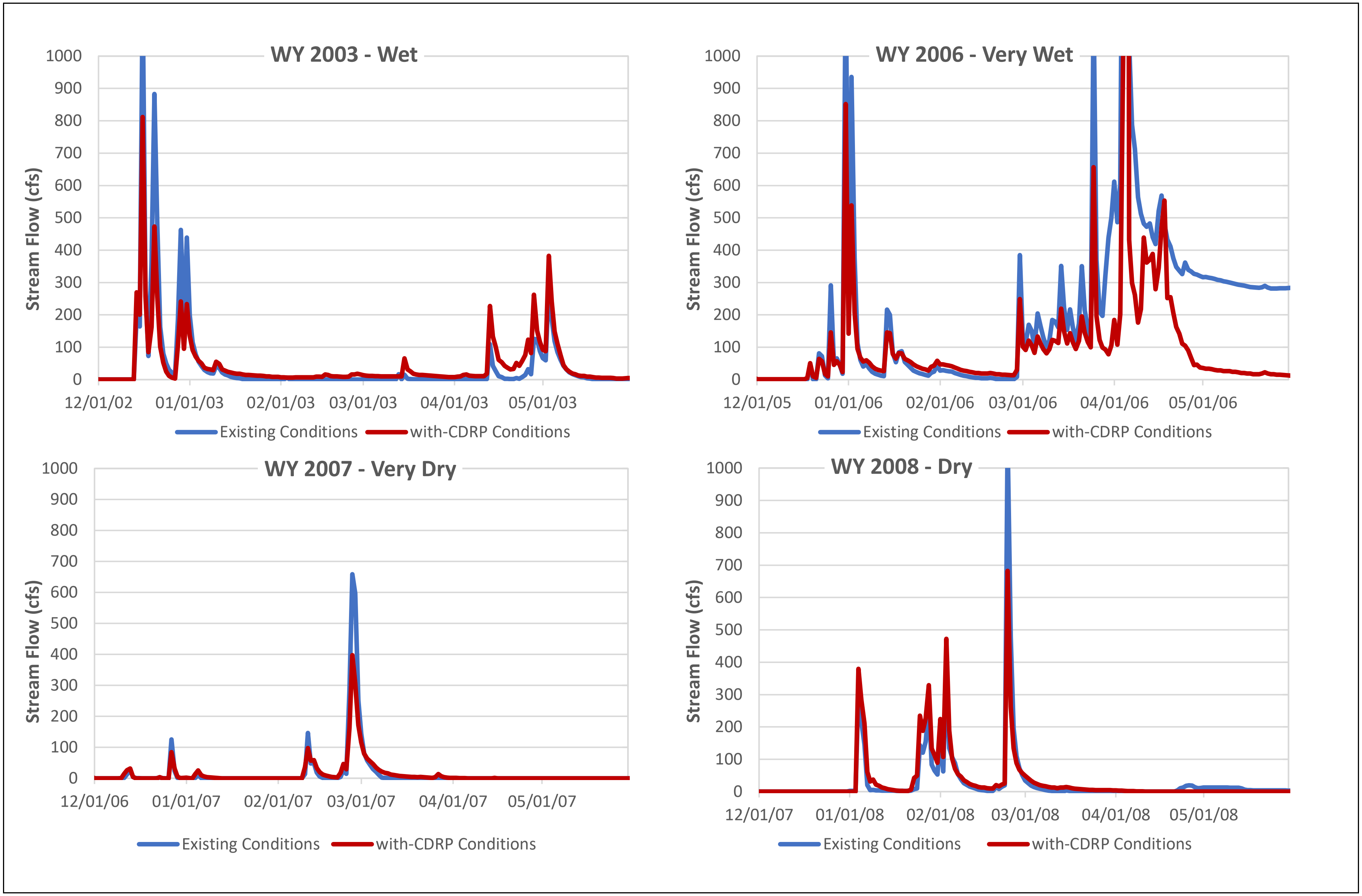
SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

SFPUC Alameda Creek Recapture Project

Figure 3-10 (revised)

Modeled Stream Flow During Typical Migration Period
Alameda Creek Above San Antonio Creek (ASDHM Node 5)



SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6 and losses between Node 6 and 7 by ESA/Orion.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

SFPUC Alameda Creek Recapture Project

Figure 3-11 (revised)

Modeled Stream Flow During Typical Migration Period
Alameda Creek Above Arroyo de la Laguna (ASDHM Node 7)

In Section 3.3.2, Reach-by-Reach Habitat Characterization, the text on the primary study area is clarified to indicated that as part of the SFPUC's commitment under the CDRP regulatory requirements, physical modifications of shallow areas in the Sunol Valley are proposed to create conditions for juvenile downstream passage at flows of approximately 10 cfs, in addition to creating conditions for adult upstream passage at flows of approximately 20 cfs. In addition, the text on the extended study area under with-CDRP conditions is augmented as follows to update the information on the Joint Lower Alameda Creek Fish Passage Improvements sponsored by the Alameda County Water District (ACWD) and Alameda County Flood Control & Water Conservation District.

> Since the publication of the June 2017 EIR, ACWD completed an Initial Study with Mitigated Negative Declaration/Environmental Assessment with Finding of No Significant Impacts[1] and NMFS completed a BO[2] for the Joint Lower Alameda Creek Fish Passage Improvements Project, which proposes to construct fishways at the two inflatable dam drop structures, as well as construct fish screens at ACWD's Shinn Pond intakes (design flow rate of 425 cfs). Construction of the Joint Lower Alameda Creek Fish Passage Improvements Project is scheduled to occur over a four-year period (2019 through 2022). Upon completion of the project, ACWD will modify operation of the water diversion facilities in the Flood Control Channel to provide bypass flows for the protection of steelhead.[3]

All references to either Appendix HYD1 or Appendix HYD2, should be replaced with Appendix HYD1-R or Appendix HYD2-R, respectively.

---

1 Hanson Environmental, 2016. *Alameda County Water District and Alameda County Flood Control & Water Conservation District Joint Lower Alameda Creek Fish Passage Improvements, Draft Initial Study with Mitigated Negative Declaration/Environmental Assessment with Finding of No Significant Impacts*. October 2016.

2 National Marine Fisheries Service (NMFS), 2017. *Biological Opinion for the Joint Lower Alameda Creek Fish Passage Improvements Project*. Santa Rosa, CA.

3 National Marine Fisheries Service (NMFS), 2017. *Biological Opinion for the Joint Lower Alameda Creek Fish Passage Improvements Project*. Santa Rosa, CA.

APPENDIX HYD1-R

Revised Surface Water Hydrology Report (supersedes Appendix HYD1)

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DRAFT

Revised Surface Water Hydrology Report

for the

SFPUC Alameda Creek Recapture Project

Prepared for

San Francisco Planning Department

Prepared by

ESA+Orion Joint Venture

December 2019

Table of Contents

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1. Introduction

This Appendix HYD1-R supersedes and replaces in its entirety Appendix HYD1, which was included in the environmental impact report (EIR) on the SFPUC Alameda Creek Recapture Project (ACRP or project) published by the San Francisco Planning Department in June 2017 (referred to as the "June 2017 EIR"). It has been revised as part of the portions of the EIR that are being recirculated as required under the California Environmental Quality Act (CEQA) Guidelines section 15088.5.

1.1 Background

The purpose of this report is to determine the environmental effects of operation of the San Francisco Public Utilities Commission's (SFPUC) proposed ACRP on surface water hydrology. The ACRP is a water supply project located in the Sunol Valley in Alameda County on lands owned by the City and County of San Francisco (CCSF) as part of its Alameda Watershed. The project would construct pumping and associated facilities to withdraw water from an existing quarry pit, which passively collects subsurface percolation and seepage from water originating upstream in Alameda Creek, and would convey the water to existing SFPUC facilities for treatment and distribution to customers in the Bay Area. The volume of water to be pumped is related to the regulatory requirements for the SFPUC to release and bypass water from its upstream facilities as well as to the CCSF's existing water rights. Additional description of the project is presented in the section 1.2 below, and detailed description of the proposed ACRP is presented in EIR Chapters 3 and 14.

This report describes the regional and local hydrology of the Alameda Creek watershed in the vicinity of the ACRP and related features affecting the hydrology, including water supply facilities and quarry operations within the watershed. It also presents a technical analysis of the potential hydrologic changes that would be a consequence of operation of the proposed ACRP, which serves as supporting information for the CEQA environmental impacts analysis of the project operations on fisheries resources, terrestrial biological resources, and downstream users of water from Alameda Creek. The report, in conjunction with Appendix HYD2-R (which describes groundwater and surface water interactions in the ACRP project area), provides the background information needed to support impact conclusions in the ACRP EIR for resources potentially affected by hydrologic conditions. The EIR is being prepared to satisfy the requirements of CEQA.

This revised and updated report retains all relevant information previously presented in Appendix HYD1 as part of the June 2017 EIR, but it also includes revised and augmented information. As described in more detail in EIR Chapter 13, portions of the EIR have been revised and augmented in response to significant new information that became available subsequent to publication of the June 2017 EIR. Specifically, the technical analysis in this report has been revised and augmented to address information from the National Marine Fisheries Service (NMFS) regarding potential impacts of ACRP operations on steelhead fish habitat in Alameda Creek. It also has been revised to address the revised ACRP operational protocols, which the SFPUC developed in response to concerns raised by NMFS and the California Department of Fish and Wildlife (CDFW).

This report also incorporates more detailed analysis described in Appendix HYD2-R regarding groundwater and surface water interactions. In addition, the analysis in this reports includes minor corrections to calculation errors found in the previous Appendix HYD1.[1] New and revised graphics have been developed to clarify the information presented. This report slightly re-organizes the previous text, with portions of the previous section 5 now included in section 2, and end notes now presented as footnotes. Nonetheless, the text in sections 2 and 3 of this report are almost entirely unchanged from the previous Appendix HYD1. To assist the reader, the unchanged text from the previous Appendix HYD1 is shown in gray tone.

1.2 Alameda Creek Recapture Project

The ACRP is one component of system-wide improvements to the SFPUC's regional water system known as the Water System Improvement Program (WSIP).[2] It is related to and dependent upon another WSIP project, the Calaveras Dam Replacement Project (CDRP). The CDRP consists of construction of a new Calaveras Dam and improvements to the Alameda Creek Diversion Dam (ACDD), which together when completed, will restore Calaveras Reservoir to its historical capacity. As part of the future operations of Calaveras Dam and Reservoir, the SFPUC is required by federal and state permitting agencies to implement instream flow schedules that stipulate year-round releases from Calaveras Dam to Alameda Creek and bypass flows around the Alameda Creek Diversion Dam.[3,4] The releases and bypasses will benefit fish and other aquatic life, including steelhead, in Alameda Creek. The volume of the releases and bypasses would vary from year-to-year depending on hydrologic conditions but are estimated to average 14,695 acre-feet per year.

The SFPUC would operate the ACRP by pumping water from Pit F2, an existing quarry pit formerly used by quarry operators located adjacent to Alameda Creek about six miles downstream of Calaveras Reservoir, and conveying the water to its existing water treatment and distribution facilities. Pit F2 passively collects water originating upstream from Alameda Creek through natural subsurface percolation and seepage, and the SFPUC would recover only water that passively percolates or seeps into Pit F2. The location of the proposed ACRP is shown in **Figure HYD1-1**.

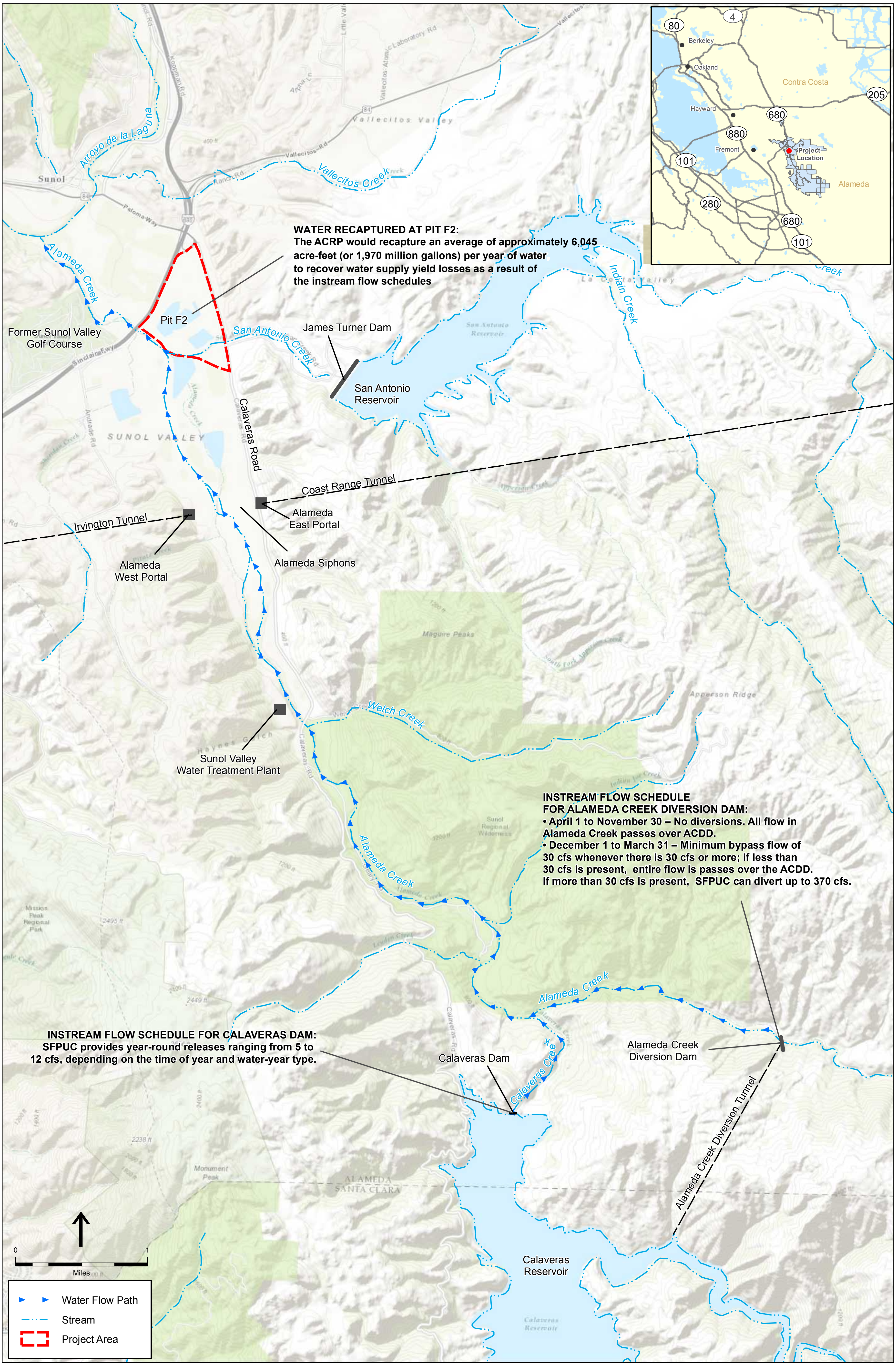
---

1 After the Planning Department published the June 2017 EIR and the Appeal Response memoranda in August 2017, ESA found a minor calculation error in some of the streamflow estimates for Alameda Creek that were presented in the June 2017 EIR. The error occurred when ESA adjusted the original Alameda System Daily Hydrologic Model (ASDHM) output to include the quarry discharge at Node 6 and up to 7.5 cfs loss of surface water to the subsurface between Node 6 (just downstream of the San Antonio Creek confluence) and Node 7 (just upstream of the Arroyo de la Laguna confluence). The calculation error only affects the streamflow estimates made for Node 8 (just downstream of the Arroyo de la Laguna confluence) and Node 9 (at the USGS gage at Niles). The error more often underestimated rather than overestimated flows downstream; the nature of the error affected the four scenarios analyzed to variable degrees. This error was addressed in the following document: Davis, J., Leidy, G, and Hsiao, J., 2017. *Memo to Chris Kern, San Francisco Planning Department regarding Alameda Creek Recapture Project (ACRP) EIR Modeling Corrections*, November 30, 2017. However, subsequent to that memo, the post-processing data for all scenarios have been further revised and updated as described in Section 4 of this report.

2 San Francisco Planning Department, 2008. F*inal Environmental Impact Report for the San Francisco Public Utilities Commission's Water System Improvement Program*. San Francisco Planning Department File No. 2005.0159E, State Clearinghouse No. 2005092026. Certified October 30, 2008.

3 National Marine Fisheries Service (NMFS), 2011. Biological Opinion for Calaveras Dam Replacement Project in Alameda and Santa Clara Counties. Tracking No. 2005/07436. March 5, 2011.

4 California Department of Fish and Game (CDFG), 2011. *Streambed Alteration Agreement for Calaveras Dam Replacement Project*. Notification No. 1600-2010-0322-R3. Jane 28, 2011.



SOURCE: ESA, 2015

SFPUC Alameda Creek Recapture Project

Figure HYD1-1
Project Location and Overview of Alameda Creek Recapture Project

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The amount of water the SFPUC would pump or "recapture" from Pit F2 would be limited to the portion of the bypassed and released water that the SFPUC otherwise would have stored in Calaveras Reservoir but for implementation of the instream flow schedules established for the CDRP. The volume of water that the ACRP would recapture would vary from year-to-year depending on hydrologic conditions; the SFPUC estimates that it would average 6,045 acre-feet per year. See EIR Chapter 14 for a detailed description of the proposed ACRP operations.

1.3 Technical Analysis and Scenarios Analyzed

This report provides a technical analysis of hydrologic conditions and potential hydrologic changes that would occur with operation of the proposed ACRP. The analysis is based on output from the Alameda System Daily Hydrologic Model (ASDHM), which is a model used to simulate surface water flows in Alameda Creek (see Section 4 for further description of the ASDHM). Hydrologic conditions are dynamic and depend on rainfall conditions, and the ASDHM uses 18 years of site-specific hydrologic data, from water years (WY) 1996 to 2013, to predict surface water flows in Alameda Creek under various conditions (or scenarios).

Four scenarios are examined in this report for the CEQA analysis to characterize the effects of the ACRP on surface water hydrology: pre-2001 conditions, existing conditions, with-CDRP conditions, and with-project conditions. The attributes of the four scenarios are shown in **Table HYD1-1**. In general, the attributes of pre-2001 conditions are essentially the same as those of existing conditions, except that Calaveras Reservoir was operated with its full storage of 98,850 acre-feet. The attributes of with-project conditions are the same as those of with-CDRP conditions, except for the addition of the proposed ACRP. The four scenarios are described below.

1.3.1 Pre-2001 Conditions

Pre-2001 conditions are the conditions that existed before storage in Calaveras Reservoir was restricted by order of the California Department of Water Resources, Division of Safety of Dams (DSOD). The DSOD restricted storage in Calaveras Reservoir in 2001 because of concerns about the seismic safety of the dam. The pre-2001 scenario represents Alameda Creek streamflow conditions when the SFPUC was operating Calaveras Reservoir at its full historical capacity. At that time, the SFPUC filled the reservoir close to its spillway crest elevation whenever runoff from the watershed was sufficient. Almost all the water withdrawn from the reservoir was conveyed to San Antonio Reservoir or the Sunol Valley Water Treatment Plant via the Calaveras Pipeline. Although the SFPUC sought to avoid any loss of stored water, unseasonable storms over the watershed would occasionally cause water to spill over Calaveras Dam's spillway crest or necessitate a release of water from the reservoir to Calaveras Creek through the large cone valve at the dam. **Figure HYD1-2** schematically depicts major factors affecting Alameda Creek streamflow conditions in the vicinity of Pit F2 under the pre-2001 scenario that distinguishes it from the other scenarios.

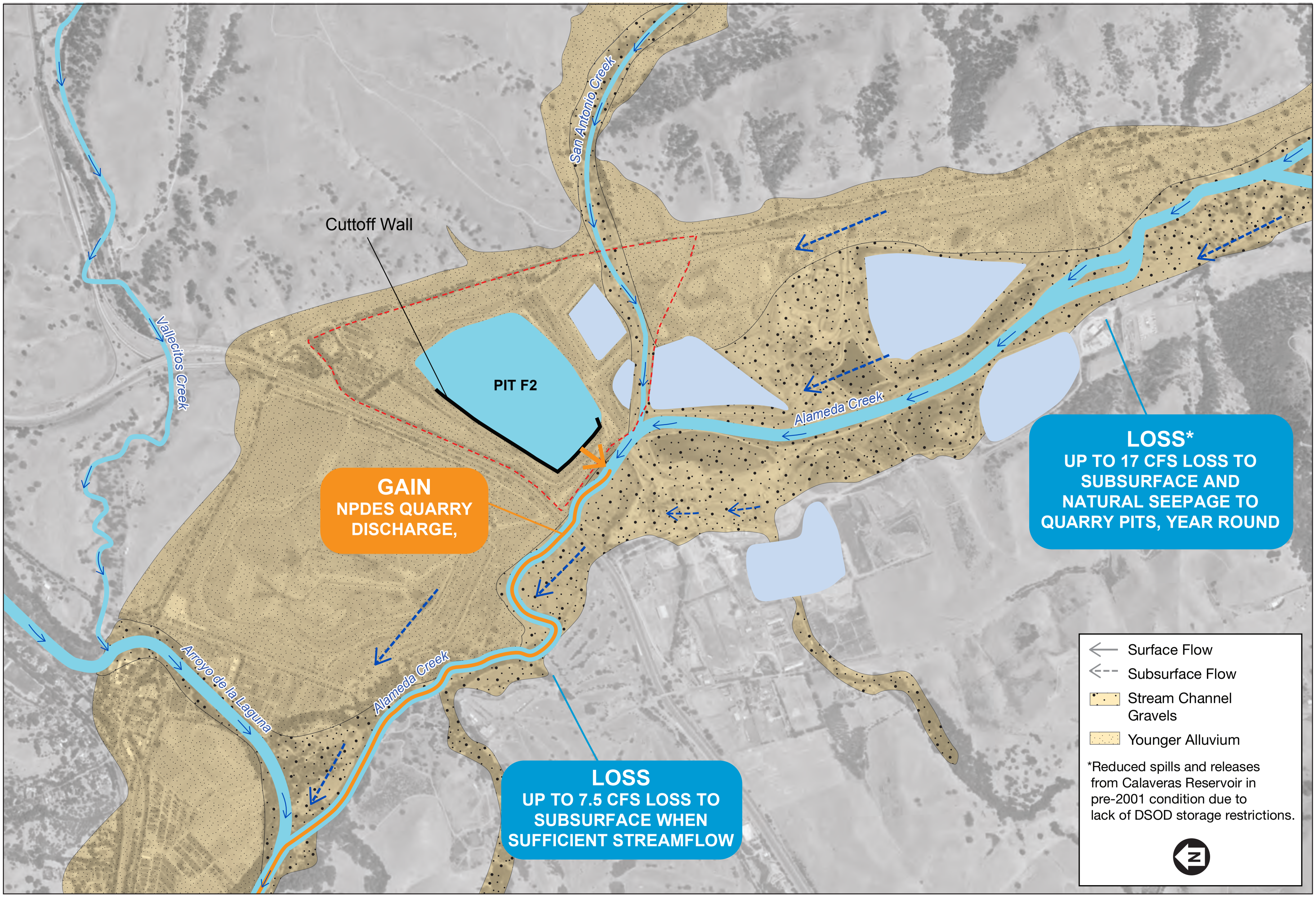
TABLE HYD1-1
ATTRIBUTES OF FOUR SCENARIOS ANALYZED

Parameter	Pre-2001 Conditions	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Representative year	2000	2015	2019 to 2020 (following completion of the CDRP and the reservoir refill period)	
Hydrologic period used in analysis	WY 1996 to WY 2013			
Calaveras Reservoir and Dam	– Historical capacity of Calaveras Reservoir = 96,850 acre-feet – Maximum pool elevation = 756 feet	– New dam under construction downstream of existing dam – Storage in Calaveras Reservoir restricted to one-third capacity with usable storage at 13% or 12,400 acre-feet by DSOD – Maximum pool elevation = 705 feet – Minimum pool elevation = 690 feet	– New dam completed – Historical capacity of Calaveras Reservoir restored to nominal capacity = 96,850 acre-feet – Maximum pool elevation = 756 feet (NGVD 29)[a]	
Instream flow releases/spills from Calaveras Reservoir below Calaveras Dam	None, other than spill from Calaveras Reservoir.	Frequent releases from low-flow valve or cone valve to manage water levels in the reservoir and from low flow valve for experimental purposes. Represented in ASDHM by observed flow at the USGS gage located downstream of Calaveras Reservoir	Implementation of instream flow schedule: – Dry year releases: May –Oct: 7 cfs; Nov - Dec: 5 cfs; Jan –April: 10 cfs, annual average. – Wet/normal year releases: May – Sept: 12 cfs, Oct: 7 cfs; Nov –Dec: 5 cfs, Jan – April: 12 cfs	
Alameda Creek Diversion Dam (ACDD)	– No fish ladder or bypass tunnel – Maximum diversion of Alameda Creek water to Calaveras Reservoir = 650 cfs		– Fish ladder and bypass structure operational – Minimum and Maximum diversion rates of Alameda Creek water to Calaveras Reservoir = 30 cfs to 370 cfs	
ACDD bypass flows	– When the gates on the diversion tunnel are open, only stream discharge greater than 650 cfs passes over the ACDD (Note: Operations at the ACDD between WY 2002 and WY 2010 were influenced by limitations on storage at Calaveras Reservoir. As a result, the gates on the diversion tunnel were closed more frequently than they had been previously). – Under Existing Condition, the ACDD tunnel has been closed since 5/23/2012. Prior to 2012 during the DSOD-restricted period, SFPUC operated ACDD very infrequently. For example, they were not operated at all between 10/24/2004 to 3/7/2007. When the gates on the diversion tunnel are closed, all flow in Alameda Creek passes over the ACDD		– Gate on diversion tunnel closed from April 1 to Nov 30, and all flow in Alameda Creek passes over ACDD. – Diversion of up to 370 cfs from December 1 to March 31. – Minimum bypass flow of 30 cfs whenever there is 30 cfs or more; if less than 30 cfs is present, entire flow passes over the ACDD	

TABLE HYD1-1 (REVISED) (Continued)
ATTRIBUTES OF FOUR SCENARIOS ANALYZED

Parameter	Pre-2001 Conditions	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Quarry pit operations Hanson Aggregates: – SMP-24 (Pits F2, F3-East, F3-West) – SMP-32 – SMP-33 Oliver de Silvia – SMP-30 (Pits F4, F5, F6)	– SMP-24 in active use for aggregate extraction until 2006 – SMP-32 not yet in operation – SMP-30 Pit F6 in active use – Excess water discharged under NPDES permit to Alameda Creek at an average annual rate of 2,796 acre-feet per year	– SMP-24 pits used only to store and manage water to support active mining on SMP-32 and aggregate processing, with excess water discharged under NPDES permit to Alameda Creek at an average annual rate of 3,436 acre-feet per year in 2015, this volume of regulated discharge was 1,206 acre-feet. – SMP-30 Pit F6 in active use for aggregate extraction, with infrequent discharges from SMP-30 to Alameda Creek	It is assumed more water infiltrates to the quarries compared to existing conditions, and consequently, more water is available to the quarry operators for water management and subsequent NPDES discharges. The modeled average amount of water available for quarry NPDES discharges is an annual average of 6,739 acre-feet per year.	It is assumed more water infiltrates to the quarries compared to existing conditions, and more water is available for recapture operations and/or to the quarry operators for water managements and possible NPDES discharges. The average amount of water available to the quarry operators for NPDES discharge decreases compared to the with-CDRP scenario to an annual average of 3,870 acre-feet per year.
Loss of surface flow in Alameda Creek to subsurface between Welch Creek and Arroyo de la Laguna confluences	0 to 17 cfs (maximum) between Welch Creek and San Antonio Creek confluences, and 0 to 7.5 cfs (maximum) between San Antonio Creek and Arroyo de la Laguna confluences, depending on streamflow			
Alameda Creek Recapture Project	Not in operation			Pumping of water from Pit F2 by SFPUC and transfer to SVWTP or San Antonio Reservoir for municipal water supply

[a] Note that the datum for this elevation is NGVD29, but for all other elevations in this report, the datum is NAVD88 unless specified otherwise.



SOURCE: ESA, 2019

SFPUC Alameda Creek Recapture Project

Figure HYD1-2

Primary Study Area - Pre-2001 Conditions

1.3.2 Existing Conditions

Existing conditions are the conditions that existed in 2015, the year in which the Notice of Preparation for the ACRP EIR was published, and represent the typical baseline conditions used for CEQA impact analyses (CEQA Guidelines section 15125). Under the existing conditions, the SFPUC operates its water system in the Alameda Creek watershed with storage in Calaveras Reservoir limited to about 38,100 acre-feet or about one third of its pre-2001 storage capacity, and has been doing so since 2001. However, the usable storage capacity is 13 percent (or 12,400 acre-feet) of pre-2001 capacity due to minimum and maximum storage elevations requirements of 690 feet and 705 feet, respectively. Thus, the water level in the reservoir is maintained far below the spillway crest elevation. As a result, no uncontrolled spills have occurred since 2001. **Figure HYD1-3** schematically depicts major factors affecting Alameda Creek stream flow conditions in the vicinity of Pit F2 under the existing conditions scenario that distinguishes it from the other scenarios.

1.3.3 With-CDRP Conditions

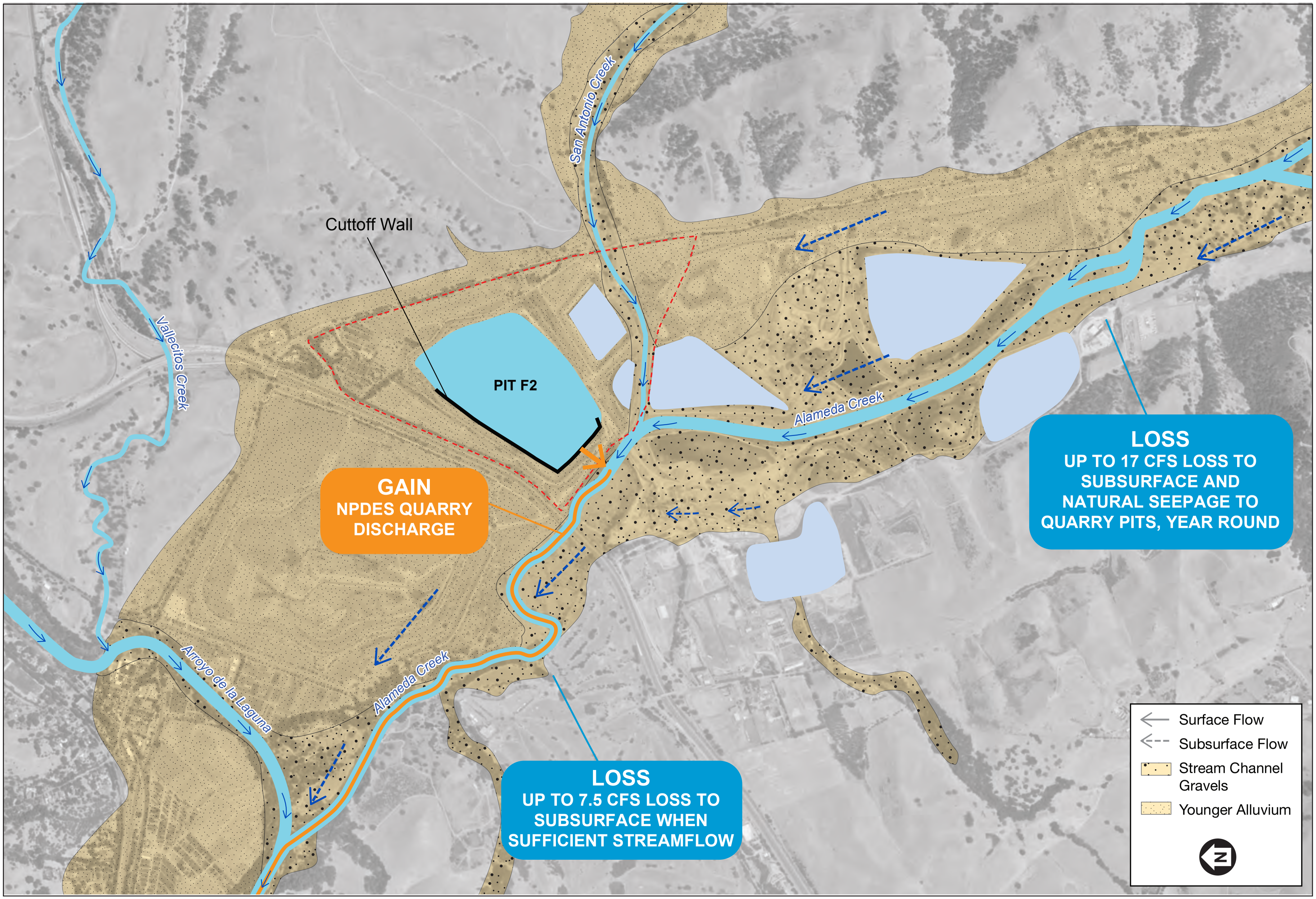
With-CDRP conditions (also referred to as adjusted existing conditions) are the conditions that will exist when the CDRP has been completed and in operation. This condition is a pre-requisite for ACRP operations. Construction of the CDRP is expected to be completed in 2019 and Calaveras Reservoir's nominal capacity of 96,850 acre-feet will be restored. If there is a wet period immediately following project completion, the reservoir could fill in two years; if drier conditions prevail, it will take longer to fill the reservoir.

Once the reservoir is full, the SFPUC will operate it much as it did before the DSOD restrictions were imposed, except that the SFPUC will implement instream flow schedules by making releases from the reservoir and by bypassing water at the Alameda Creek Diversion Dam, as required by state and federal authorizations for the CDRP. The releases will be made in accordance with the instream flow schedule for Calaveras Reservoir shown in **Table HYD1-2**. The releases will be made to Calaveras Creek below Calaveras Dam using permanent low-flow valves that will be installed at the new dam.

TABLE HYD1-2
CDRP INSTREAM FLOW SCHEDULE FOR RELEASES FROM CALAVERAS DAM

		Dry (Schedule B)		Normal/Wet (Schedule A)	
Flow Schedule Decision Date	Flow Schedule Application Period	Cumulative Arroyo Hondo flows for water year classification (MG)	Flow Release (cfs)	Cumulative Arroyo Hondo flows for water year classification (MG)	Flow Release (cfs)
N/A	October	N/A	7	N/A	7[a]
N/A	Nov 1 thru Dec 31	N/A	5	N/A	5
Dec 29	Jan 1 thru Apr 30	≤ 360	10[a]	> 360	12[a]
Apr 30	May 1 thru Sept 30	≤ 7,246	7	> 7,246	12

SOURCE: National Marine Fisheries Service (NMFS), 2011. Southwest Region. Biological Opinion for Calaveras Dam Replacement Project in Alameda and Santa Clara Counties. Tracking No. 2005/07436. March 5, 2011.



SOURCE: ESA, 2019

SFPUC Alameda Creek Recapture Project

Figure HYD1-3

Primary Study Area - Existing Conditions

The release schedule is different for dry and normal/wet years, with the classification of the year based on cumulative inflow from Arroyo Hondo into Calaveras Reservoir. Years are expected to be classified as dry 40 percent of the time. The releases will be made year-round and will be in the range of 5 to 12 cfs, depending on the time of the year and whether the year is classified as dry or normal/wet. The total annual release volume in dry years would be approximately 5,540 acre-feet; in normal or wet years it would be approximately 7,545 acre-feet.

As part of the CDRP, a fish screen will be installed at the Alameda Creek Diversion Dam. The fish screen will prevent fish from entering the tunnel that conveys diverted water to Calaveras Reservoir, but it will also reduce the capacity of the tunnel from 650 cfs to 370 cfs. In addition, a bypass system and a fish ladder will be installed at the diversion dam that will enable fish passage and bypass of water to benefit aquatic life in Alameda Creek below the diversion dam. Operation of the Alameda Creek Diversion Dam under with-CDRP conditions will be in accordance with the following schedule[5]:

- Diversion shall be restricted to the period between December 1 and March 31
- No diversion from April 1 to November 30
- Diversion rates shall not exceed 370 cfs
- Minimum bypass flow of 30 cfs will be provided immediately below the ACDD when water is present in upper Alameda Creek above the Alameda Creek Diversion Dam. Water will be bypassed using the bypass tunnel, fish ladder, and/or across the dam crest.

In accordance with this schedule, a minimum of 30 cfs will be bypassed at the Alameda Creek Diversion Dam whenever there is 30 cfs or more arriving at the diversion dam from the upper watershed. When there is less than 30 cfs arriving from the upper watershed, the entire flow will be bypassed at the diversion dam and will continue downstream in the creek. Average daily flow at the USGS gage on Alameda Creek above the diversion dam typically exceeds or is close to 30 cfs from December through April, so it can be expected that, after completion of the CDRP, there will be substantial flow in the reach of Alameda Creek between the diversion dam and the Calaveras Creek confluence for much of the winter.

The SFPUC calculates that releases from Calaveras Reservoir will total 5,540 acre-feet per year in dry years and 7,533 acre-feet per year in normal and wet years. The releases from Calaveras Reservoir together with the bypasses at the Alameda Creek Diversion Dam are estimated to average 14,695 acre-feet per year. In dry years, the releases and bypasses are estimated to average 10,133 acre-feet per year. In wet years, the releases and bypasses are estimated to average 18,345 acre-feet per year.

5 National Marine Fisheries Service (NMFS), 2011. Biological Opinion for Calaveras Dam Replacement Project in Alameda and Santa Clara Counties. Tracking No. 2005/07436. March 5, 2011.

Figure HYD1-4 schematically depicts major factors affecting Alameda Creek stream flow conditions in the vicinity of Pit F2 under the with-CDRP conditions scenario that distinguishes it from the other scenarios.

1.3.4 With-project Conditions

With-project conditions are the conditions that would exist when both the CDRP and the ACRP are completed and are in operation. It includes the SFPUC's proposed pumping of water from Pit F2 as well as the releases and bypasses of water from the CDRP instream flow schedules. Under with-project conditions, the SFPUC would operate Calaveras Reservoir at its full historical capacity and would also have Pit F2 available as a water supply storage facility. **Figure HYD1-5** schematically depicts major factors affecting Alameda Creek stream flow conditions in the vicinity of Pit F2 under the with-project conditions scenario that distinguishes it from the other scenarios.

1.3.5 Additional Scenario — CDRP BO Conditions

For the revised analysis in the recirculated portions of the EIR, one additional scenario was included to allow comparison with conditions analyzed in the CDRP Biological Opinion (BO)[6], which provides the regulatory baseline established by the National Marine Fisheries Service for steelhead conditions in the Alameda Creek watershed (see EIR Chapter 15, Section 15.2, Fisheries Resources). **Figure HYD1-6** schematically depicts major factors affecting Alameda Creek stream flow conditions in the vicinity of Pit F2 under the CDRP BO conditions scenario that distinguishes it from the other scenarios.

This scenario, referred to as the CDRP BO condition, is similar to the with-CDRP scenario in that it represents the conditions that will exist when the CDRP has been completed and in operation. However, the streamflow simulations for the two scenarios differ: the CDRP BO scenario is based entirely on the ASDHM output, while the with-CDRP conditions include additional post-processing steps to account for quarry NPDES discharges from Pit F2 and a 7.5 cubic foot per second (cfs) loss in Alameda Creek streamflow to the subsurface between the San Antonio Creek confluence and the confluence with Arroyo de la Laguna. The similarities and differences between these two scenarios are described in Section 4, Post-Processing Validation for Fisheries Analysis.

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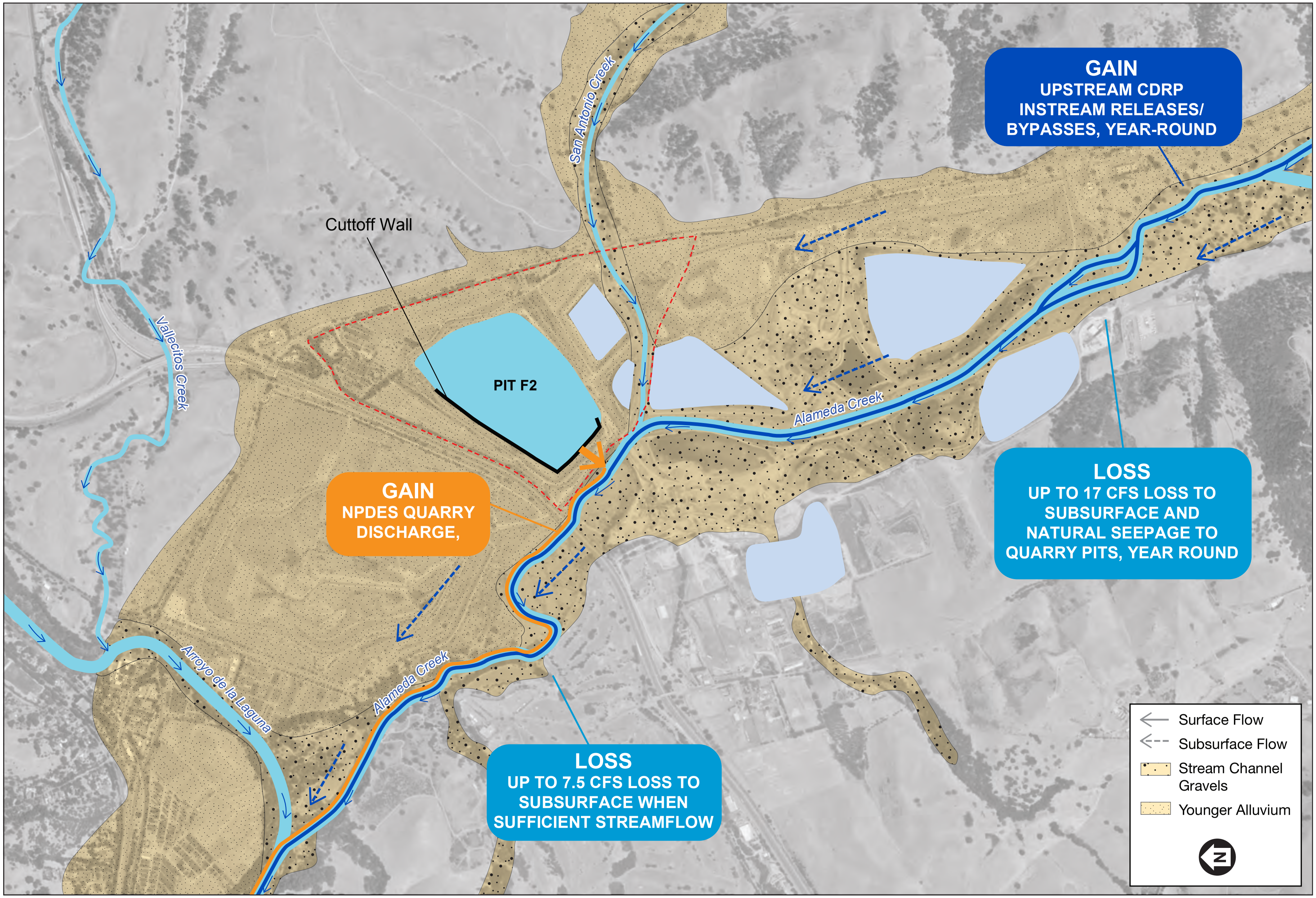
6 National Marine Fisheries Service (NMFS), 2011. Biological Opinion for Calaveras Dam Replacement Project in Alameda and Santa Clara Counties. Tracking No. 2005/07436. March 5, 2011.

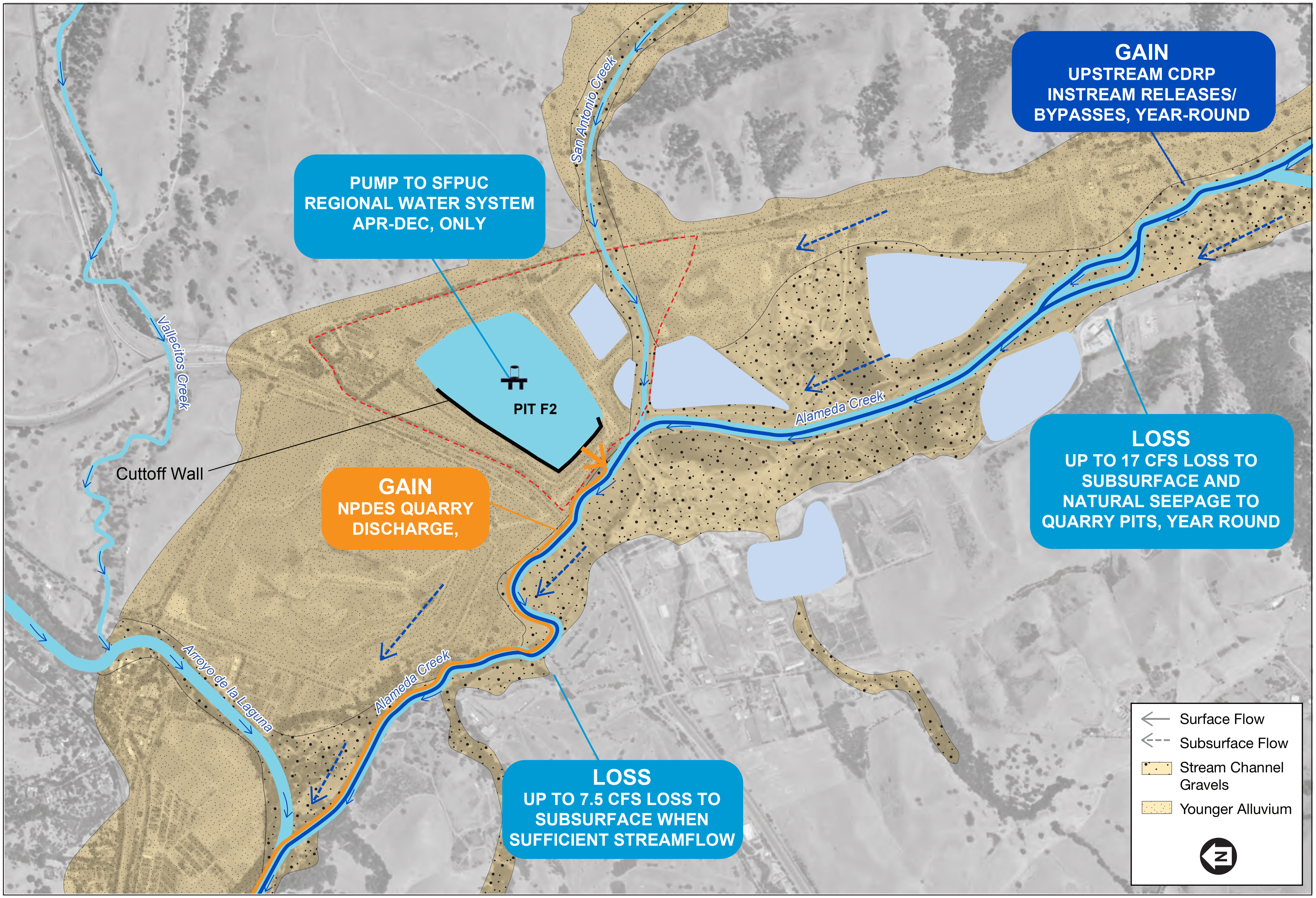


SOURCE: ESA, 2019

SFPUC Alameda Creek Recapture Project

Figure HYD1-4

Primary Study Area - With-CDRP Conditions

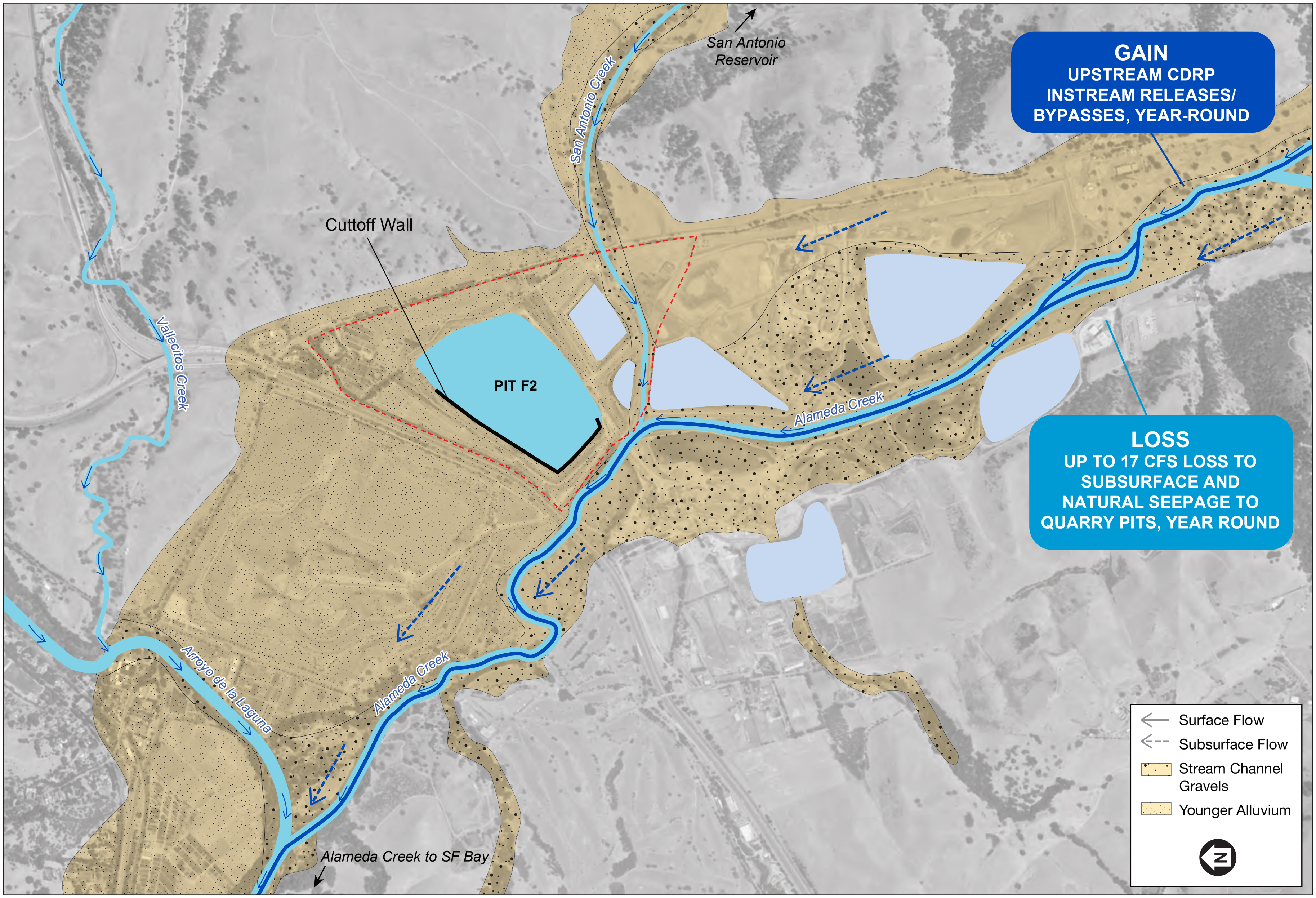


SOURCE: ESA, 2019

SFPUC Alameda Creek Recapture Project

Figure HYD1-5

Primary Study Area - With-Project Conditions



SOURCE: ESA, 2019

SFPUC Alameda Creek Recapture Project

Figure HYD1-6

Primary Study Area - CDRP Biological Opinion

2. Alameda Creek Watershed

2.1 Regional Hydrology

The proposed project area lies within the Alameda Creek watershed. The watershed is shown in **Figure HYD2-1**. The Alameda Creek watershed encompasses an area of approximately 700 square miles, extending from Mount Diablo in the north, Altamont Pass in the east, Mount Hamilton in the south, and San Francisco Bay in the west. Elevations in the watershed range from about 4,000 feet near the headwaters to sea level at the point where the creek flows to San Francisco Bay.[7]

The climate of the Alameda Creek watershed is characterized by warm, dry summers and mild, rainy winters. Average temperatures range from the mid-50s in winter to the high 70s in summer (in degrees Fahrenheit [°F]). Average annual precipitation in the watershed is 20 inches, but it is higher in the headwaters (26 inches).[8]

The Alameda Creek watershed can be divided into four catchments, the larger northern and southern catchments, and the smaller middle and lower catchments. About 65 percent of the Alameda Creek watershed lies within the northern catchment. Most of the northern catchment is occupied by rangeland, cropland, and wildland, but it also contains the cities of Livermore, Pleasanton, Dublin, and San Ramon. The northern catchment drains to Arroyo de la Laguna and its tributaries, Arroyo del Valle, Arroyo las Positas, Arroyo Mocho, and San Ramon and Tassajara Creeks.

The southern catchment consists almost entirely of undeveloped wildland and rangeland. About 25 percent of the Alameda Creek watershed lies within the southern catchment. The catchment includes the Sunol-Ohlone Regional Wilderness, the SFPUC's Alameda watershed lands, and the Sunol Valley. It drains to Arroyo Hondo, upper Alameda Creek, and Alameda Creek's tributaries, including Calaveras Creek, Welch Creek, San Antonio Creek, La Costa Creek, and Indian Creek. The small middle and lower catchments comprise the remaining 10 percent of the Alameda Creek watershed.

The northern and southern catchments meet at the northern end of the Sunol Valley at the confluence of Arroyo de la Laguna and Alameda Creek. The middle catchment consists of the lands that drain to Alameda Creek as it flows through Niles Canyon. Sinbad and Stoneybrook Creeks are tributaries to the reach of Alameda Creek in the middle catchment. The lower catchment consists of the lands that drain to Alameda Creek as the creek flows across the San Francisco Bay Plain. In the lower catchment, much of the creek is confined between levees and receives runoff from urban storm drains.

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7 San Francisco Planning Department, 2011. *Final Environmental Impact Report for the San Francisco Public Utilities Commission Calaveras Dam Replacement Project*. San Francisco Planning Department File No. 2005.0161E, State Clearinghouse No. 2005102102. Certified January 27, 2011.

8 San Francisco Planning Department, 2012. F*inal Environmental Impact Report for the San Francisco Public Utilities Commission San Antonio Backup Pipeline Project*. San Francisco Planning Department File No. 2007.0039E, State Clearinghouse No. 2007102030. Certified September 20, 2012.

SOURCE: ESA, 2019

SFPUC Alameda Creek Recapture Project

Figure HYD2-1

Alameda Creek Watershed and Sub-watershed Areas

Over the last century, the natural hydrology of the Alameda Creek watershed has been altered by water supply system operations, gravel mining, urban development, and flood reduction projects. However, almost all of the urban development and flood reduction projects are located in the northern and lower catchments. The primary anthropogenic factors affecting the natural hydrology of Alameda Creek in the southern catchment are water supply system operations and gravel mining.

The proposed ACRP would lie at the northern end of the southern catchment, about 1.5 miles upstream of Alameda Creek's confluence with Arroyo de la Laguna. The following description of water resources in the vicinity of the ACRP is focused on the southern, middle, and lower catchments because that is where the potential effects of the ACRP would occur. The northern catchment would not be affected by the proposed project.

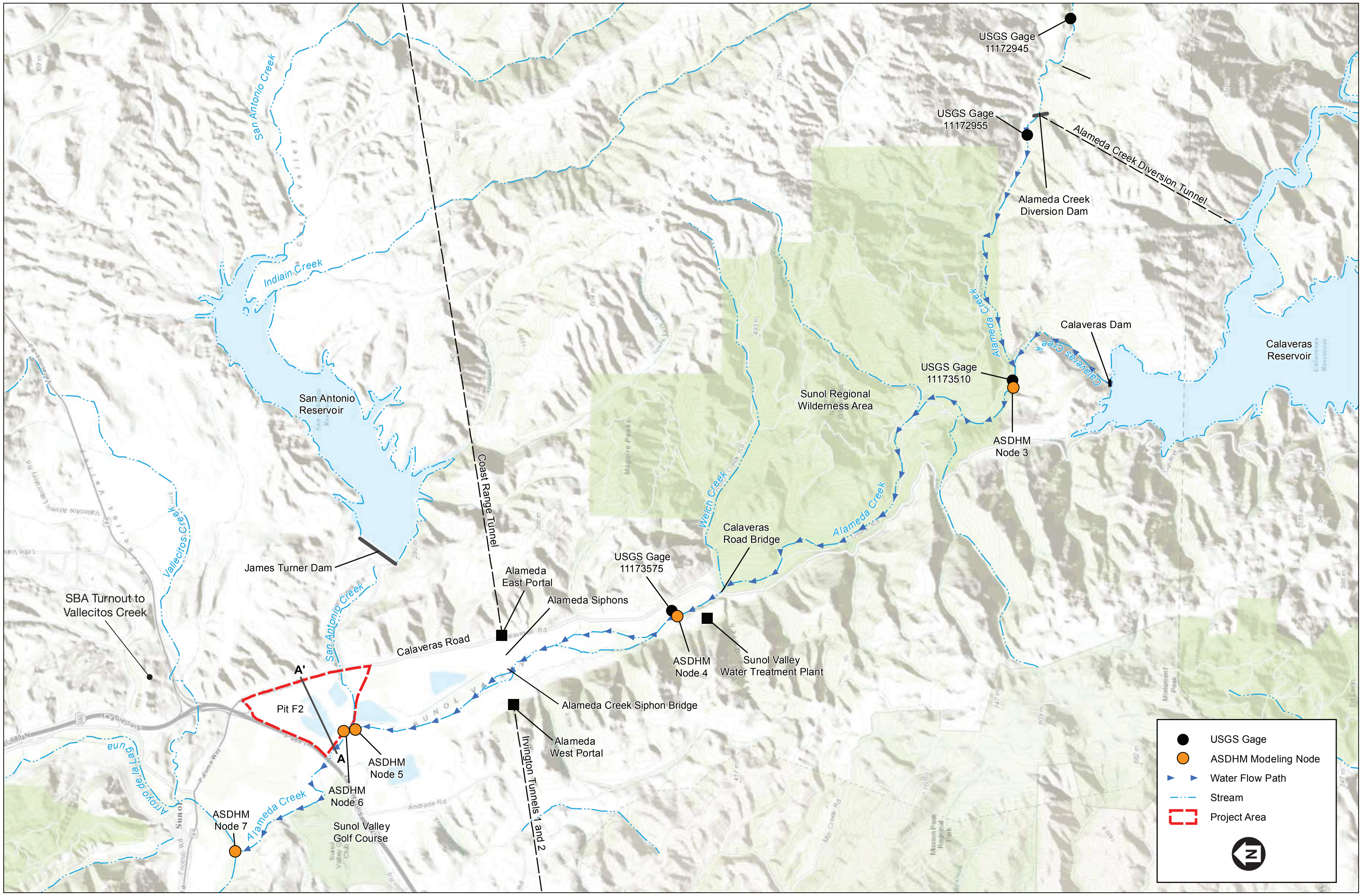
The major surface water bodies in the southern catchment are Calaveras Reservoir, San Antonio Reservoir, Alameda Creek and its tributaries, including San Antonio Creek, and several large water-filled quarry pits in the Sunol Valley. Calaveras Reservoir and San Antonio Reservoir are components of the SFPUC's water supply system. **Figure HYD2-2** shows the water bodies and the reach of Alameda Creek between the Alameda Creek Diversion Dam and the Arroyo de la Laguna.

The major surface water bodies in the middle and southern catchments are Alameda Creek and the Quarry Lakes. The Quarry Lakes are several former quarry pits that the Alameda County Water District uses for water storage and groundwater recharge. They are located on both sides of Alameda Creek, where it emerges from the Niles Canyon and begins to flow across the Bay Plain.

2.2 Calaveras Reservoir

Calaveras Reservoir is formed by Calaveras Dam, which was completed in 1925. The reservoir is located on Calaveras Creek about one mile upstream of the Calaveras Creek/Alameda Creek confluence. It collects water from Calaveras Creek and Arroyo Hondo as well as from local drainages along the western perimeter of the reservoir. Calaveras Reservoir also receives water from the upper reaches of Alameda Creek. Water from Alameda Creek is diverted at the Alameda Creek Diversion Dam and flows through a 1.8-mile-long tunnel to Calaveras Reservoir. The SFPUC draws water from Calaveras Reservoir and conveys it by pipeline to the Sunol Valley Water Treatment Plant for treatment and distribution to customers, or to San Antonio Reservoir for storage.

When it first went into service, Calaveras Reservoir had a storage capacity of 96,850 acre-feet at a pool elevation of 756 feet (NGVD 1929), although the storage capacity has been reduced somewhat as a result of siltation. The SFPUC typically filled the reservoir to its capacity in the wet season, whenever there was sufficient runoff to do so. Storage was drawn down in the drier months to supply water to customers in the SFPUC's service area when demand was at its seasonal peak. For example, in the spring of 2000, the SFPUC filled the reservoir, raising the water surface elevation to 756 feet. In the following summer, fall and winter, the reservoir was drawn down, and the water surface elevation fell



SOURCE: ESA, 2019

SFPUC Alameda Creek Recapture Project

Figure HYD2-2

Surface Water Bodies in the Alameda Creek Watershed between the Alameda Creek Diversion Dam and Arroyo de la Laguna to 727 feet.[9] The reservoir plays an important role in carryover storage for the SFPUC regional water system and as such the SFPUC maintains as much stored water in the reservoir as possible from year-to-year.

In 2001, the DSOD determined that Calaveras Dam was vulnerable to damage in an earthquake and required that the SFPUC not fill the reservoir above elevation 700, except briefly during high flow events. The elevation restriction was later raised to 705 feet. A pool elevation of 705 feet corresponds with a capacity of 38,100 acre-feet.[10] With storage limited to that which can be accommodated between elevations 690 feet and 705 feet, the reservoir's usable storage became 12,400 acre-feet. The SFPUC has been operating Calaveras Reservoir with usable storage limited to 12,400 acre-feet since 2001, approximately 13 percent of the reservoir's storage capacity before the DSOD restriction was imposed.

In 2011, the SFPUC began constructing the CDRP, which consists of replacing the existing Calaveras Dam and modifying the Alameda Creek Diversion Dam. The new dam is being built immediately downstream of the existing dam, and the CDRP is scheduled for completion in 2019. During the construction period, Calaveras Reservoir is being operated with a usable capacity of 12,400 acre-feet, although this may be reduced at times to facilitate construction. The Alameda Creek Diversion Dam tunnel has also been closed since May 2012. Once the CDRP is complete, the nominal capacity of the reservoir will be restored to its original value of 96,850 acre-feet.

2.3 San Antonio Creek and Reservoir

San Antonio Creek is an intermittent stream with its headwaters about nine miles east of Alameda Creek. It joins Alameda Creek about one-third of a mile upstream of the Interstate 680 (I-680) bridge and in the reach of the creek adjacent to a number of quarry pits. San Antonio Reservoir is located on San Antonio Creek about 1.5 miles upstream of the creek's confluence with Alameda Creek. The reservoir has a storage capacity of 50,500 acre-feet and is formed by Turner Dam, which was constructed in 1965. The reservoir collects and stores runoff from the upper San Antonio Creek watershed. In addition to storing local runoff, San Antonio Reservoir can be used to store Calaveras Reservoir water, Hetch Hetchy water (from the Tuolumne River watershed), and subsurface water from Alameda Creek. Water from Calaveras Reservoir is transferred to San Antonio Reservoir as described above, and Hetch Hetchy water and Alameda Creek subsurface water is transferred to San Antonio Reservoir as described below.

The Hetch Hetchy Aqueduct conveys Tuolumne River water from Yosemite National Park to the Bay Area, and passes through the Sunol Valley about 1.5 miles south of the proposed ACRP. Hetch Hetchy water is conveyed beneath Alameda Creek in the Alameda Siphons to the Irvington Tunnels, which

9 San Francisco Planning Department, 2011. *Final Environmental Impact Report for the San Francisco Public Utilities Commission Calaveras Dam Replacement Project*. San Francisco Planning Department File No. 2005.0161E, State Clearinghouse No. 2005102102. Certified January 27, 2011.

10 Ibid.

convey the water west towards the Bay Area to the water supply service area. Hetch Hetchy water can be diverted from the aqueduct to San Antonio Reservoir upstream of the Alameda Siphons.[11] Subsurface water was formerly diverted to San Antonio Reservoir from the Sunol Infiltration Gallery, which in recent years has been used as the irrigation water supply for the Sunol Golf Course. The infiltration gallery is located about one-half mile downstream of the ACRP project area.

2.4 Alameda Creek

Alameda Creek flows from its headwaters near Mount Hamilton northward through the Sunol-Ohlone Regional Wilderness and the Sunol Valley to its confluence with Arroyo de la Laguna. Just downstream of the confluence it turns and flows westward through Niles Canyon and across the Bay Plain to San Francisco Bay. Its total length is 46 miles.

2.4.1 Channel Form

The uppermost reach of Alameda Creek flows through rugged and undeveloped terrain from its headwaters to the Alameda Creek Diversion Dam. The creek channel upstream of the diversion dam slopes steeply, descending in a narrow well-defined channel at an average rate of about 125 feet per mile. Water that passes over the diversion dam continues through a steep channel, including the gorge known as Little Yosemite, to Alameda Creek's confluence with Calaveras Creek at the southern end of the Sunol Valley. The reach of the creek between the diversion dam and the confluence with Calaveras Creek descends at an average rate of about 165 feet per mile.

Downstream (north) of the Calaveras Creek confluence, Alameda Creek's channel slope becomes much flatter, descending at a rate of about 27 feet per mile through the Sunol Valley. From the confluence, Alameda Creek flows for several miles in a well-defined channel contained within the valley bottom to the Calaveras Road bridge. The channel width ranges between 100 and 250 feet in this reach, but widens out to about 500 feet downstream of the bridge. From the Calaveras Road bridge to the Alameda Siphons, the creek flows in a broad sometimes braided channel. Downstream of the Alameda Siphons, levees confine the channel until the creek reaches the I-680 bridge. About 40 years ago, this section of Alameda Creek was relocated westward to facilitate gravel quarrying in the SMP-30 area.

Downstream (north) of I-680, the creek flows along the west side of the Sunol Valley to its confluence with Arroyo de la Laguna. Beyond the confluence, the channel steepens as Alameda Creek flows through Niles Canyon, before flattening again as the creek flows across the Bay Plain. The most downstream reach of Alameda Creek flows through an urbanized area and is confined between levees.

The proposed ACRP lies adjacent to the reach of Alameda Creek between the Alameda Siphons and I-680, commonly referred to as the quarry reach. The elevation of the creek channel's lowest point, or

[11] San Francisco Planning Department, 2008. *Final Environmental Impact Report for the San Francisco Public Utilities Commission's Water System Improvement Program*. San Francisco Planning Department File No. 2005.0159E, State Clearinghouse No. 2005092026. Certified October 30, 2008.

thalweg, varies from about elevation 274 feet at the upstream end of the quarry reach to about elevation 236 feet at the downstream end. The elevation of the thalweg at the confluence of Alameda and San Antonio Creeks, near the proposed ACRP, was between 240 and 242 feet in 2003.[12]

2.4.2 Flow Regime

From its headwaters to the Alameda Creek Diversion Dam, streamflow in Alameda Creek is largely unaffected by human activities; below the diversion dam it is affected by SFPUC's water supply operations. Operations at the diversion dam under existing conditions are different from operations before 2001, when the DSOD imposed restrictions on storage in Calaveras Reservoir. Under pre-2001 conditions, if the gates on the tunnel entrance at the diversion dam were open and streamflow was less than 650 cubic feet per second (cfs), all the water in the creek was diverted through the tunnel to Calaveras Reservoir. Streamflow in excess of 650 cfs passed over the diversion dam and continued down Alameda Creek. If the gates to the diversion tunnel were closed the entire flow passed over the diversion dam and continued down Alameda Creek. After the DSOD imposed restriction on Calaveras Reservoir, the SFPUC reduced diversions to the reservoir and did not operate the diversion dam from about 2004 to 2007, and almost all of the flow in Alameda Creek at the Alameda Creek Diversion Dam, passed over the diversion dam and continued down the creek. Since May 2012, due to the Streambed Alteration Agreement permit requirements for the CDRP (related to ACDD fish passage project construction), the ACDD tunnel has been closed.

Downstream of the diversion dam, Alameda Creek flows to its confluence with Calaveras Creek. Calaveras Creek contributes to flow in Alameda Creek as a result of stormwater runoff to Calaveras Creek below Calaveras Dam, and from seepage, releases, and spills from the dam. Releases and spills from the dam to Calaveras Creek were infrequent before 2001. Releases have increased in frequency since then because of the restrictions on storage in Calaveras Reservoir. No unregulated spills have occurred since 2001 because of the lowered storage level at the reservoir.

Below its confluence with Calaveras Creek, Alameda Creek flows through the Sunol Valley. The creek gains water from tributary streams and loses water to stream channel deposits in the reach between the Welch Creek and San Antonio Creek confluences. The characteristics of the substrate in this reach of Alameda Creek suggest that the losses have always occurred, but were likely increased when quarry pits were excavated alongside the creek. Some of the time, primarily during the night, surface water flow in the creek near the proposed project area is increased when gravel quarry operators pump excess water out of gravel pits and discharge it, under NPDES permit, to the creek.

Arroyo de la Laguna joins Alameda Creek about 1.5 miles downstream of the proposed ACRP. Arroyo de la Laguna drains a much larger area than the upper reaches of Alameda Creek. Flow in Alameda Creek downstream of the Arroyo de la Laguna confluence increases substantially as a result of runoff from the larger, more developed catchment. It is further increased by releases of water from the South

[12] Entrix, Inc, 2003. Assessment of Alameda Creek in the vicinity of Mission Valley Rock Company including the proposed Ivaldi mining site, Sunol Valley reach of Alameda Creek. Letter report to Mr. W.M. Calvert, Mission Valley Rock Company, January 8, 2003.

Bay Aqueduct, a component of the State Water Project, and from Del Valle Reservoir south of the city of Livermore. Water released from the South Bay Aqueduct and Del Valle Reservoir flows down Arroyo de la Laguna to Alameda Creek and on through Niles Canyon. It is recaptured by Alameda County Water District, a state water contractor, as it exits Niles Canyon. Flow in Alameda Creek is flashy; that is, flow increases and decreases rapidly in response to precipitation over its watershed. In the dry season, there is little or no flow in the reach of the creek adjacent to the proposed ACRP.

2.5 Measured Streamflow[13]

2.5.1 Water Years and Water Year Types

Statistical data on precipitation and streamflow are organized by water year; that is, the period from October 1st of one year to September 30th of the next year. For example, Water Year 2002 is the period from October 1, 2001 until September 30, 2002. The SFPUC classifies water year types based on flow measured at a stream gage on Arroyo Hondo, which is a major tributary of Calaveras Creek. Arroyo Hondo flows into Calaveras Reservoir. Years in which the exceedance probability is greater than 60 percent are classified as dry years. All other years are classified as normal/wet years. The classification of the water year types since 1969, when the Arroyo Hondo gage was installed, is shown in **Figure HYD2-3**.

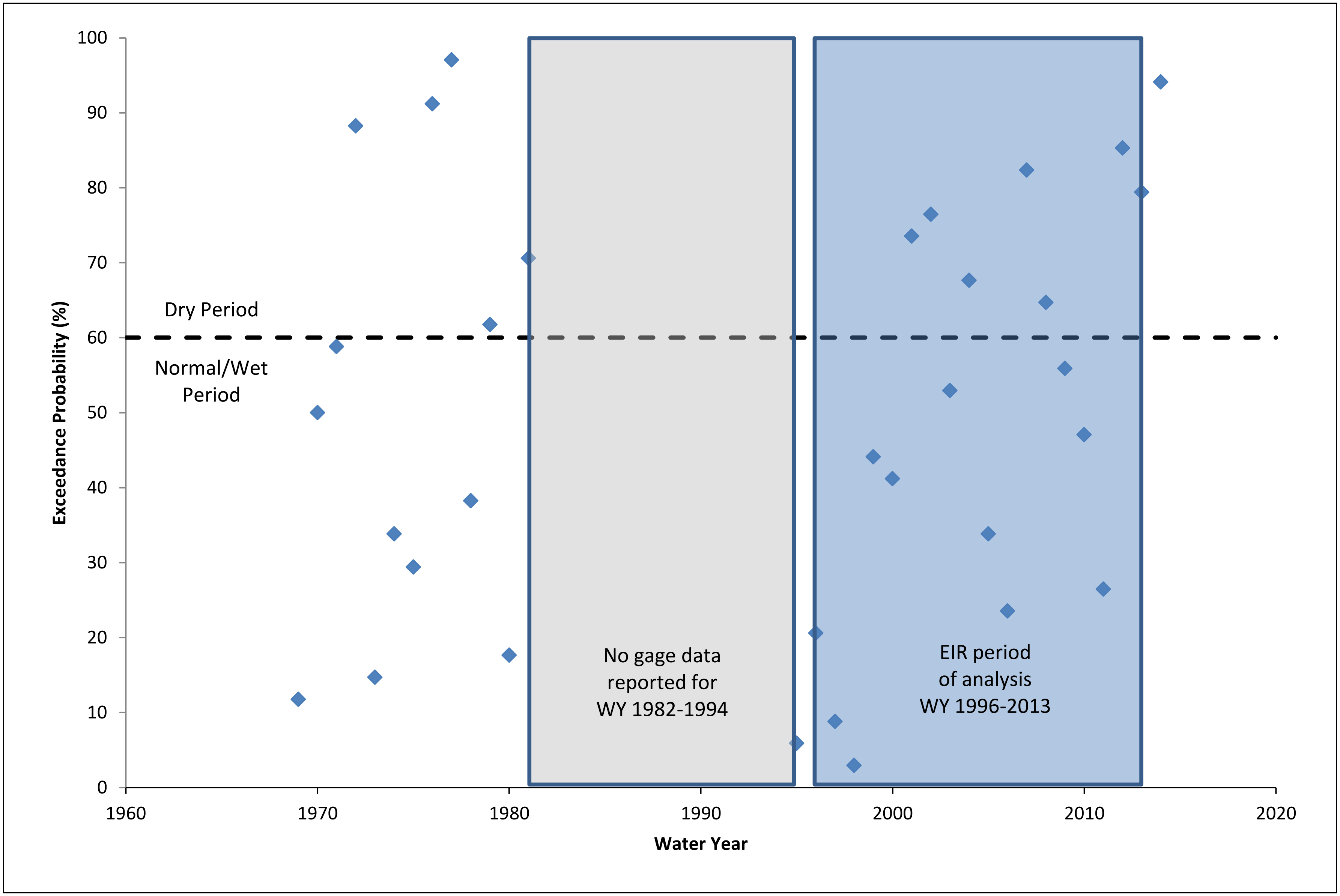
2.5.2 Gaging Stations

The USGS measures streamflow at stream gages located along the mainstem of Alameda Creek, including the following five gages: upstream of the Alameda Creek Diversion Dam; below the Calaveras Creek confluence; below the Welch Creek confluence; at the downstream end of Niles Canyon; and in the section of the creek confined between levees near the Interstate 880 bridge. Gage numbers, catchment areas and periods of record are shown in **Table HYD2-1**. The locations of the gages are shown in Figure HYD2-2. In March 2010, the SFPUC installed two additional gages on the mainstem of Alameda Creek. They are located between the San Antonio Creek and Arroyo de la Laguna confluences.

TABLE HYD2-1
USGS GAGES ON MAINSTEM OF ALAMEDA CREEK

Gage No.	Gage Location	Catchment Area (square miles)	Period of record
11-172945	Upstream of Alameda Creek Diversion Dam	33.3	1995-present
11-173510	Downstream of Calaveras Creek confluence	135	1996-present
11-173575	Downstream of Welch Creek confluence	145	2000-present
11-179000	Near Niles	633	1891-present
11-180700	Flood Control Channel at Union City	639	1959-present

[13] This section was previously Section 5.1 in Appendix HYD1 of the June 2017 EIR.



SOURCE: USGS, 2015. Annual mean discharge values for USGS Gage 11173200, Arroyo Hondo Near San Jose, CA. Text file retrieved from USGS website on August 21, 2015. Normal/wet and dry periods are based on the exceedance probabilities used in Dhakal et. al. 2012.

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Figure HYD2-3

Classification of water year types based on the USGS Gage on Arroyo Hondo

2.5.3 Historical Flow Data

The USGS stream gage just upstream of the Alameda Creek Diversion Dam has been in place since Water Year 1995. The stream gage records unimpaired flow from the upper Alameda Creek watershed. **Figure HYD2-4** is a plot of gaging data from Water Year 1994 until Water Year 2015. It shows that Alameda Creek is a naturally flashy stream. A flashy stream is one where flow can vary greatly from day-to-day and even hour-to-hour in response to rainfall over the stream's watershed. The highest daily flow during the entire period of record was just over 1,200 cfs in Water Year 1995; the highest daily flow in the hydrologic period used in the analysis of the proposed ACRP, Water Year 1996 to Water Year 2013, was about 1,150 cfs in December 1997.

Flow volume in Alameda Creek varies widely from year-to-year. As measured above the Alameda Creek Diversion Dam, the highest annual flow volume within the period of record was 36,054 acre-feet and occurred in Water Year 1998; the lowest annual flow volume was 522 acre-feet and occurred in 2014. **Figure HYD2-5** compares the hydrographs as measured above the Alameda Creek Diversion Dam for a representative wet and dry year: 2006 with an exceedance probability of 24 percent, which was accordingly classified as normal/wet; and 2007 with an exceedance probability of 86 percent, which was classified as dry. Annual flow volumes in 2006 and 2007 were 21,502 acre-feet and 4,771 acre-feet, respectively. In 2006, daily flows exceeded 500 cfs three times; in 2007 daily flows exceeded 200 cfs only once. In 2006, daily flow exceeded 50 cfs for most of March and much of April. In 2007, there was little flow in the creek after mid-March.

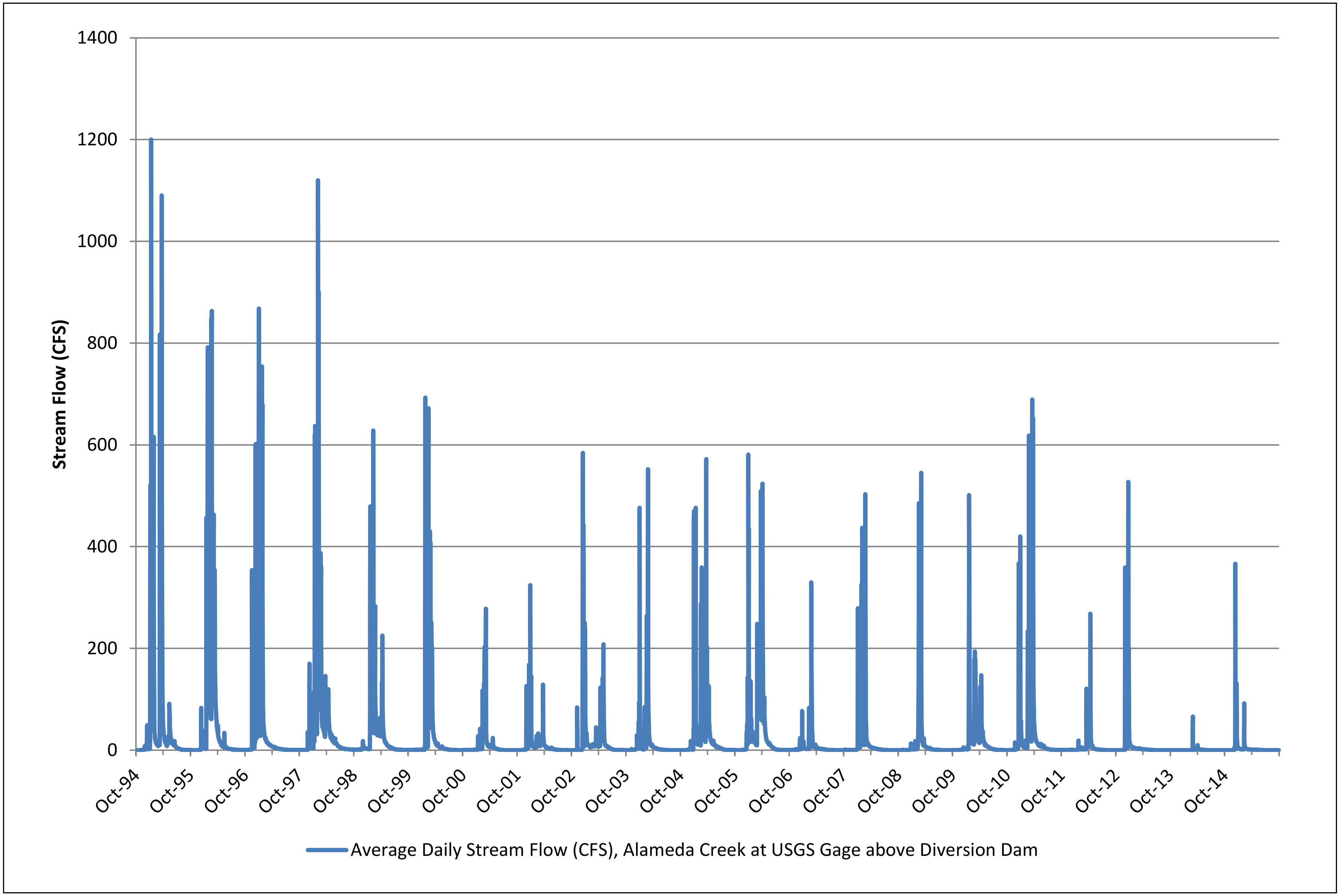
Table HYD2-2 shows average daily flows by month as measured at the USGS gage above the Alameda Creek Diversion Dam from Water Year 1996 through Water Year 2013. The highest average daily flow by month typically occurs in February.[14]

TABLE HYD2-2
ALAMEDA CREEK ABOVE ALAMEDA CREEK DIVERSION DAM –
USGS AVERAGE DAILY FLOW BY MONTH FOR WATER YEARS 1996-2013 (cfs)

Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average Daily	0.2	2.3	26.4	60.1	82.1	50.4	25.2	7.4	2.6	0.8	0.3	0.2
Max Daily Average	1.5	354	602	868	1,120	689	524	208	14.0	5.8	2.6	1.5
Min Daily Average	0.0	0.0	0.0	0.4	1.2	1.5	2.4	0.5	00	0.0	0.0	0.0
% of Av. Annual Flow	0.1	0.9	10.2	23.3	31.8	19.5	9.8	2.9	1.0	0.3	0.1	0.1

SOURCE: USGS, 2016. Mean daily discharge values for USGS Gage 11172945, Alameda Creek Above Diversion Dam Near Sunol, CA. Accessed on July 7, 2016.

[14] Average daily flows by month are calculated by averaging all the daily flow records for a particular month over the period Water Year 2002 to Water Year 2010.



SOURCE: USGS, 2015. Mean daily discharge values for USGS Gage 11172945, Alameda Creek Above Diversion Dam Near Sunol, CA. Text file retrieved from USGS website October 08, 2015.

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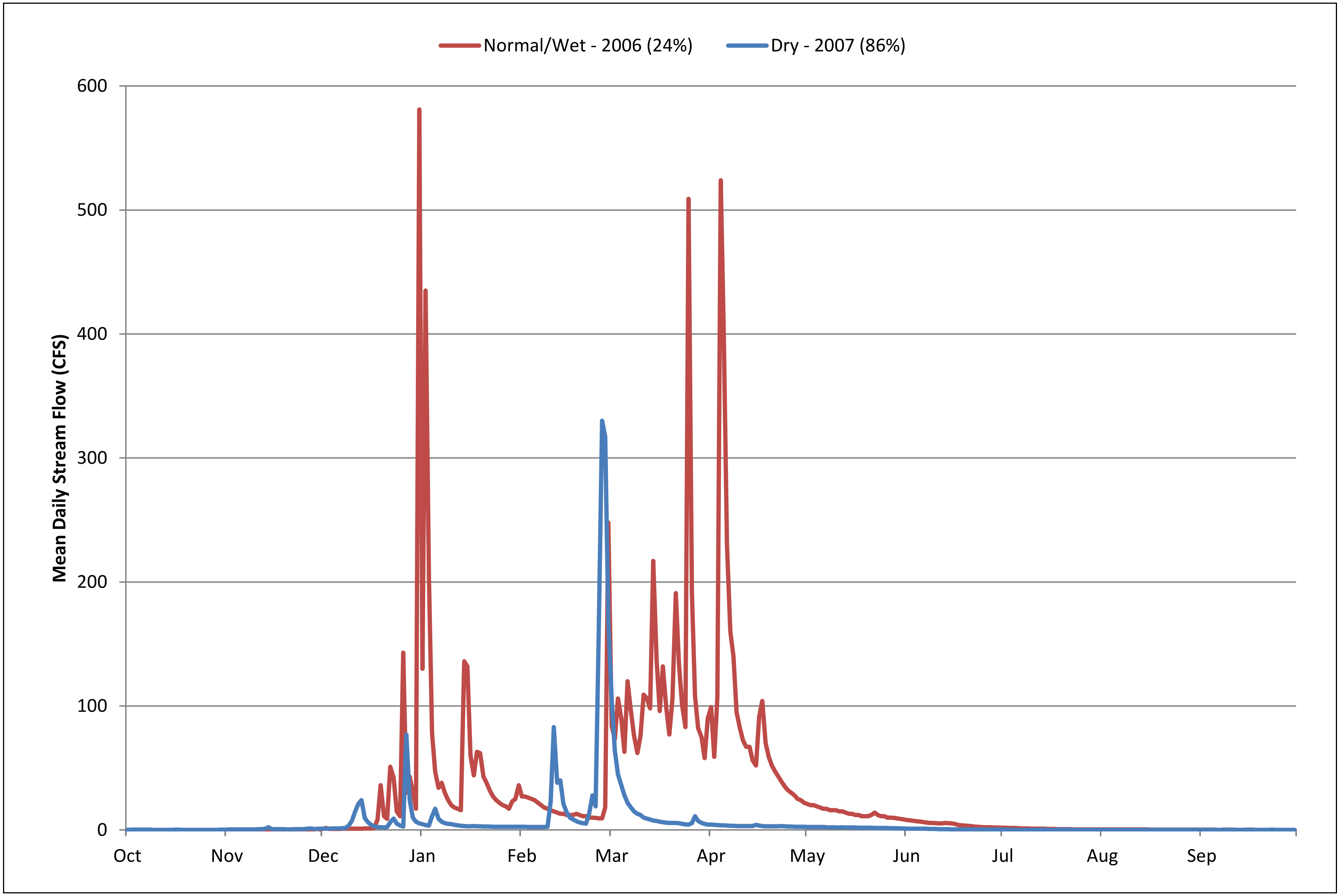
Figure HYD2-4

Historical Alameda Creek flow measured at the USGS Gage above the Alameda Creek Diversion Dam



SOURCE: USGS, 2015a. Mean daily discharge values for USGS Gage 11172945, Alameda Creek Above Diversion Dam Near Sunol, CA. Text file retrieved from USGS website October 08, 2015; USGS, 2015b. Annual mean discharge values for USGS Gage 11173200, Arroyo Hondo Near San Jose, CA. Text file retrieved from USGS website on August 21, 2015.

NOTE: Exceedance probabilities (in parentheses) were calculated using data from the Arroyo Hondo gauge for Water Years 1969-2015 (longest gage record for upper watershed).

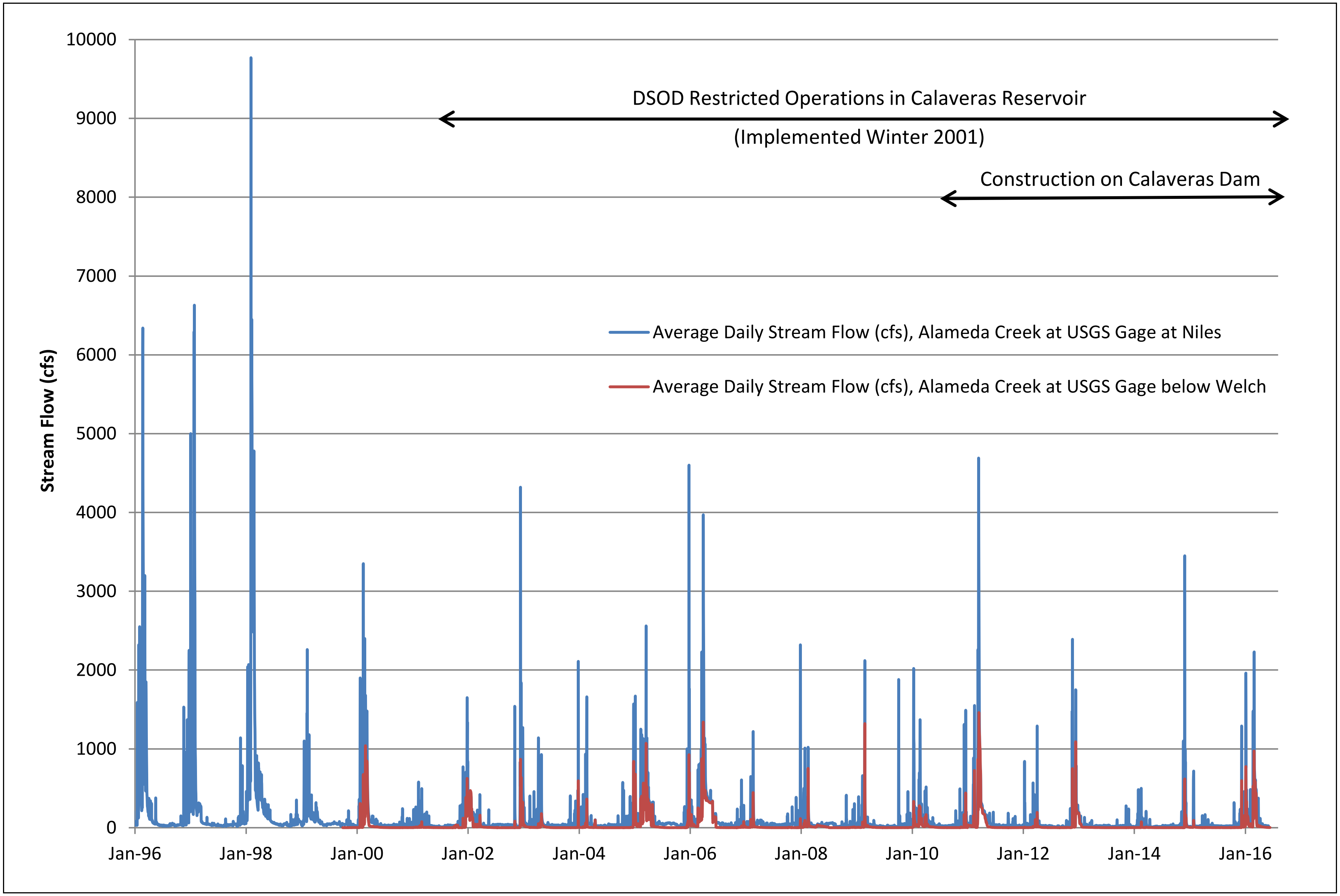
Figure HYD2-5
Flow in Alameda Creek measured at the USGS gage above the Alameda Creek Diversion Dam in example wet (2006) and dry years (2007)

Measured streamflow at the other four USGS gages on Alameda Creek is influenced by the SFPUC's municipal water system operations. The effects of the SFPUC's water system operations on flow in Alameda Creek are different for the periods before and after the DSOD-imposed restrictions on storage in Calaveras Reservoir, and for the period after construction of the CDRP began. Before 2001, the SFPUC operated Calaveras Reservoir in a manner that took advantage of its full storage, except for a limitation that the reservoir could not normally be drawn down below elevation 690 feet to prevent entrainment of fish in the outlet works. Since 2001, when the DSOD restrictions were imposed, the SFPUC has captured less water from the watershed upstream of Calaveras Reservoir and has diverted less water from Alameda Creek to the reservoir than it would have in the absence of the restrictions. Consequently, more water has passed over the Alameda Creek Diversion Dam than before 2001, and releases at Calaveras Dam were more frequent than they were before 2001. In 2010, construction of the CDRP began, which further limited storage in the reservoir. Beginning in Water Year 2011, releases were made from the reservoir to accommodate construction activities.

The ACRP project area lies between the USGS gage just downstream of the Welch Creek confluence and the USGS gage at Niles. The Welch Creek gage is located about three miles upstream of the ACRP project area and the Niles gage is located about four miles downstream of it. **Figure HYD2-6** shows flow in Alameda Creek at the Welch Creek gage for the period from Water Year 2000 to Water Year 2016 and flow in Alameda Creek at the USGS gage at Niles for the period from Water Year 1996 until 2016. The flow rate at the Niles gage is strongly influenced by flows from the large Arroyo de la Laguna watershed, including water released from the State Water Project into the Arroyo de la Laguna watershed, above its confluence with Alameda Creek.

Tables HYD2-3 and **HYD2-4** show, respectively, average daily flows by month as measured at the Welch Creek gage for the period Water Year 2000 through Water Year 2013 and at the Niles gage from Water Year 1996 through Water Year 2013. The highest average daily flow at the Welch Creek gage typically occurs in March; at the Niles gage it occurs in February.

Table HYD2-5 shows the average annual flow and the average annual flow volume at four locations. Three of the four gages are for the period Water Year 1996 to Water Year 2013. Data for the Welch Creek gage are for Water Year 2000 to Water Year 2013 because the gage was only installed in 1999. Flow generally increases in a downstream direction, but the total volume of flow in Alameda Creek below the Calaveras Creek confluence is lower than it is above the Alameda Creek Diversion Dam because the SFPUC diverts some of the water in the creek at the diversion dam to Calaveras Reservoir for municipal use.



SOURCE: USGS, 2016. Mean daily discharge values for USGS Gage 11173575, Alameda Creek Below Welch Creek Near Sunol, CA. Text file retrieved from USGS website on June 26, 2016.

USGS, 2016. Mean daily discharge values for USGS Gage 11179000, Alameda Creek Near Niles, CA. Text file retrieved from USGS website on June 26, 2016.

Figure HYD2-6

Historical Alameda Creek flow measured at the USGS Gage below Welch Creek and at Niles

TABLE HYD2-3
ALAMEDA CREEK BELOW WELCH CREEK –
USGS AVERAGE DAILY FLOW BY MONTH FOR WATER YEARS 2000-2013 (cfs)

Month	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average Daily	1.7	1.3	37.8	53.3	45.2	103.2	85.4	38.3	12.7	1.1	0.5	0.3
Max Daily Average	34.0	83.0	1,090	699	1,040	1,460	1340	345	335	7.3	2.3	1.9
Min Daily Average	0.0	0.0	0.1	0.7	0.8	2.0	1.4	0.6	0.2	0.1	0.0	0.0
% of Av. Annual Flow	0.5	03	9.9	14.0	11.9	27.1	22.4	10.1	3.3	0.3	0.1	0.1

SOURCE: United States Geologic Survey (USGS), 2016. Mean daily discharge values for USGS Gage 11173575, Alameda Creek Below Welch Creek Near Sunol, CA. Accessed on July 7, 2016.

TABLE HYD2-4
ALAMEDA CREEK AT NILES –
USGS AVERAGE DAILY FLOW BY MONTH FOR WATER YEARS 1996-2013 (cfs)

Statistic	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Average Daily	42.5	56.6	166.8	307.7	491.7	287.8	172.8	74.2	42.7	33.0	32.0	31.1
Max Daily Average	1,880	1,540	4,600	6,630	9,770	4,690	3,970	928	340	68.0	112	152
Min Daily Average	7.1	7.6	12.0	12.0	14.0	18.0	12.0	10.0	8.0	7.7	5.9	3.8
% of Av. Annual Flow	2.4	3.3	9.7	17.7	28.3	16.5	9.9	4.3	2.5	1.9	1.8	1.8

SOURCE: USGS, 2016. Mean daily discharge values for USGS Gage 11179000, Alameda Creek Near Niles, CA. Accessed on July 7, 2016.

TABLE HYD2-5
USGS AVERAGE ANNUAL FLOW AT FOUR LOCATIONS ON MAINSTEM OF ALAMEDA CREEK
FOR WATER YEARS 1996-2013

Gauge Location	Average Annual Flow (cfs)	Average Annual Volume (acre-feet)
Alameda Creek above ACDD	21	15,027
Alameda Creek below Calaveras Creek	15	10,494
Alameda Creek below Welch Creek*	32	22,972
Alameda Creek near Niles Canyon	143	103,661

SOURCE: USGS, 2016. *Data for Welch Creek gage is for Water Year 2000 to Water Year 2013.

2.6 Gravel Quarries in Sunol Valley

Several gravel quarries are located at the north end of Sunol Valley, adjacent to and on both sides of Alameda Creek. There is no direct surface water flow into the quarry pits from Alameda Creek. Water enters the pits by percolation from the surrounding ground and as rainfall. Minor amounts of surface runoff and subsurface water may also enter the pits from the eastern watershed. Water levels in the pits vary and are primarily dependent on management action by the quarry operators and the rate of seepage from the surrounding ground (see Section 3, Quarry Operations, for detailed information on the quarries).

2.7 Quarry Lakes

Quarry Lakes are several former gravel quarry pits located in the city of Fremont where Alameda Creek flows out of Niles Canyon. Alameda County Water District diverts water into Quarry Lakes from Alameda Creek during the wetter months of the year using temporary inflatable dams.[15] The water in Quarry Lakes percolates into the ground and recharges the Niles Cone, a groundwater basin that extends under the Bay Plain from the foot of the Diablo Range to San Francisco Bay. Its northern limit is the city of Hayward boundary, and its southern limit is the Alameda/Santa Clara County line.

2.8 Subsurface Water

The following main geological units lie below the Sunol Valley: stream channel deposits, Younger Alluvium, Older Alluvium, and the Livermore Gravels. The Older Alluvium and Livermore Gravels underlie the Sunol Valley and consist of dense clays and gravels that are non-water-bearing. From about the Welch Creek confluence to the mouth of Niles Canyon, stream channel deposits and Younger Alluvium lie above the Older Alluvium and Livermore Gravels. Water can be readily transmitted through the stream channel deposits and Younger Alluvium.

Water enters the stream channel deposits and Younger Alluvium from Alameda Creek, Welch Creek, San Antonio Creek, and as runoff from less-defined minor drainages. For more information on subsurface water, see Appendix HYD2-R.

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[15] ACWD, 2014. Reliability by Design: Integrated Resource Planning at Alameda County Water District.

3. Quarry Operations

3.1 Overview of Quarry Operations

Commercial gravel quarries operated by Hanson Aggregates and Oliver de Silva (ODS) are located at the north end of Sunol Valley, between the Alameda Siphons to the south and the confluence with Arroyo de la Laguna to the north. Quarry pits lie adjacent to and on both sides of Alameda Creek. Some of the pits are active; that is, quarry operators are currently extracting aggregate from the pits under Surface Mining Permits (SMP). Aggregate extraction has been completed in some pits and those inactive pits are now used for water management in support of mining operations. Quarry operations are expected to continue until no additional aggregate can be extracted, which is estimated to occur within the next 20 years.

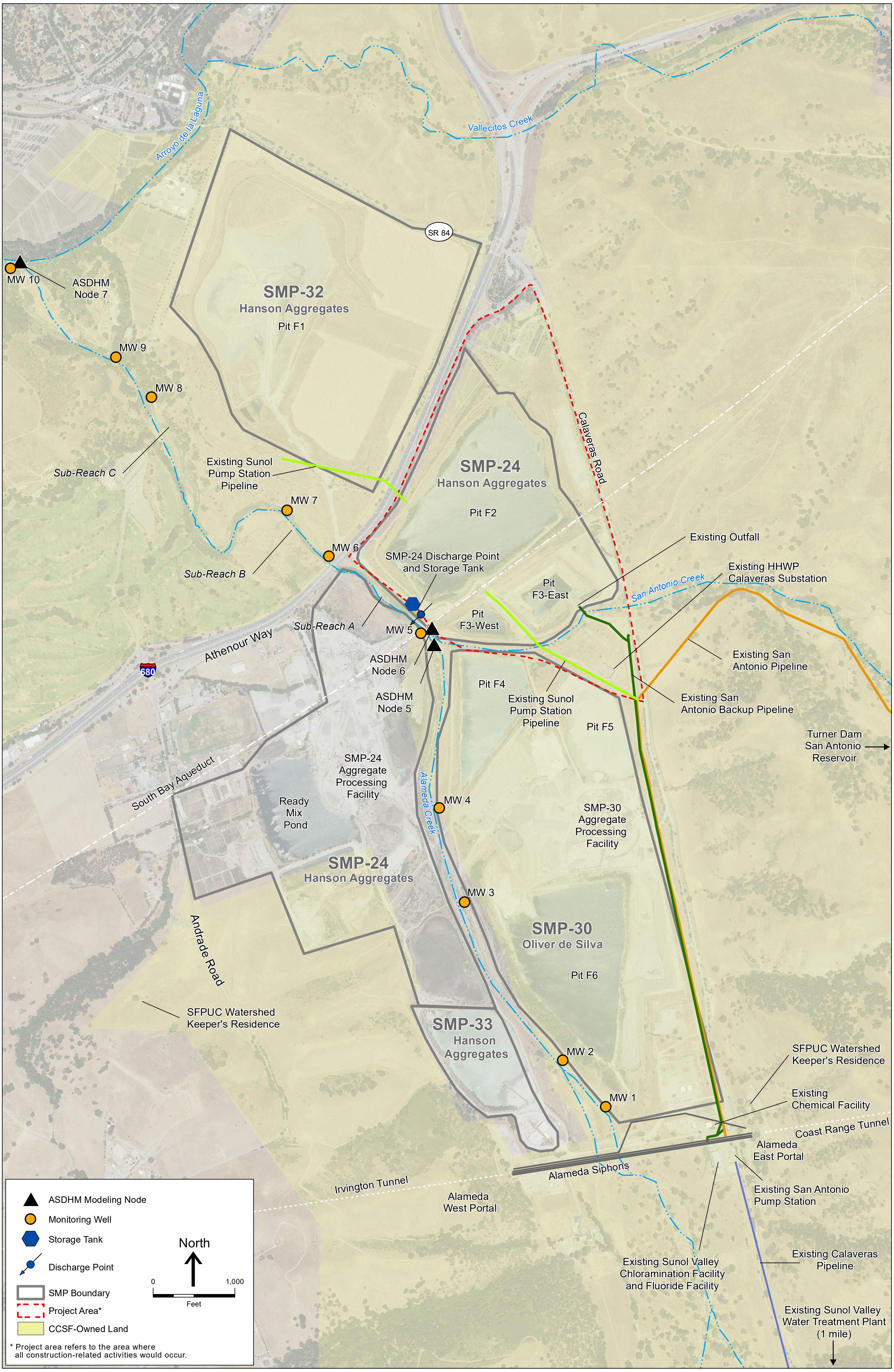
Quarry pit depths vary but several pits reportedly approach 250 feet below grade.[16] **Figure HYD3-1** shows the quarry reach of Alameda Creek, the layout of the gravel quarries, and their location relative to Alameda Creek. The quarries occupy four plots of land, which are either owned by Hanson Aggregates or leased from the City and County of San Francisco. The four plots are designated SMP-24, SMP-30, SMP-32, and SMP-33. Hanson Aggregates operates quarries and aggregate processing facilities on the SMP-24, SMP-32, and SMP-33 areas. Quarries and aggregate processing facilities in the SMP-30 area are operated by ODS.

The operational schedule of the aggregate mines and processing facilities depends on market demand and weather conditions and may occur year round. Operations are usually suspended during wet weather. As mining proceeds, and after aggregate is extracted, the total size of the pits increases. This will enable an increase in the volume of water that can be stored in the pits in the future. When mining is completed, the pits will have a large capacity for water storage that could serve as an ancillary water storage facility for the regional water system, as called for in the SFPUC's Alameda Watershed Management Plan.[17] The approximate storage capacities of the quarry pits based on current reclamation requirements and mining practices are shown in **Table HYD3-1**.

Water seeps into the quarry pits from Alameda Creek and the surrounding areas through a band of stream channel deposits that underlies the northern Sunol Valley (for more information, see Appendix HYD2-R, Section 4, *Regional and Project Area Geology*). If needed to create a dry work area for aggregate extraction, the quarry operators remove water that seeps into the active pits by pumping it into inactive pits, inactive areas of active pits, and other storage ponds. The operators use some of the water that seeps into the pits to wash aggregate and produce concrete and asphalt. Wash water is returned to inactive pits and ponds where silt settles out. If the water level in a pit rises too high, the quarry operators pump the excess water into a pit or pond with available storage capacity or into Alameda Creek as a regulated discharge. Both Hanson Aggregates and ODS hold permits to discharge water to

[16] URS, 2009. Final Updated Alternatives Analysis Report, Alameda Fishery Enhancement Project, SFPUC Project CUW352.01. January 30, 2009.

[17] San Francisco Public Utilities Commission (SFPUC), 2001. *Final Alameda Watershed Management Plan*. April 2001.



SOURCE: ESA, 2019; Date of aerial photo is 2014.

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Figure HYD3-1
Quarry Reach of Alameda Creek

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Alameda Creek that were issued by the San Francisco Bay Regional Water Quality Control Board (San Francisco Bay RWQCB Order No. R2-2008-0011, NPDES General Permit No. CAG982001 (Aggregate Mining, Sand Washing, and Sand Offloading). The NPDES permits are intended to regulate the quality of the water that is discharged to Alameda Creek. The quarry operators have no requirements to discharge a minimum amount of water; however, their permits do restrict the maximum volume of water that can be discharged. The permits are updated from time to time. Future permits could include additional restrictions that may affect their ability to discharge (see EIR Chapter 5, Section 5.16.3.1 for more information on the quarry discharge permits).

TABLE HYD3-1
APPROXIMATE STORAGE CAPACITY OF MAJOR QUARRY PITS AND PONDS

Pit	Quarry Operator	SMP	Estimated Water Storage Capacity on Completion (acre-feet)	Mining Condition
F1	Hanson Aggregates	SMP-32	14,000-16,000	Active
F2	Hanson Aggregates	SMP-24	8,800	Completed and currently used for water storage
F3-East	Hanson Aggregates	SMP-24	1,350	Completed and currently used for water storage
F3-West	Hanson Aggregates	SMP-24	280	Completed and currently used for water storage
F4	Oliver de Silva	SMP-30	1,900	Active but portions of the pit are used for water storage
F5	Oliver de Silva	SMP-30	N/A	Active for silt management and mining
F6	Oliver de Silva	SMP-30	24,900	Active

SOURCE: SFPUC, 2015. Personal communication with Ellen Levin of SFPUC.

The quarry operators' general practice is to conserve water within the pits for use in aggregate processing and concrete and asphalt production and to discharge water to the creek only when absolutely necessary. When discharge is necessary, it generally occurs for about 11 hours during the night when lower cost off-peak power rates are available. However, during periods of active mining, discharges can occur at any time consistent with permit conditions.

3.2 Hanson Aggregates

Hanson Aggregates extracted aggregate from the SMP-24 area until 2006. The quarry operator currently extracts aggregate from the SMP-32 area, which is located north of the SMP-24 area, on the north side of Alameda Creek between I-680 and Arroyo de La Laguna. Aggregate extraction usually occurs in the dry season (generally April through November) but may occur year-round.

Water that seeps into the pit in SMP-32 must be moved to keep the active mining area dry. Water is pumped out of the active mining area and conveyed to areas within SMP-32 that are not being actively mined or to the pits and ponds within the boundary of SMP-24, including Pit F3-West on the east side of Alameda Creek, and a pond on the west side of the creek referred to as the Ready Mix Pond. Gravel from SMP-32 is conveyed to an aggregate processing facility located in SMP-24/33, on the west side of Alameda Creek. Hanson Aggregates also collects water from a small creek and several springs that emerge from the hills to the west and stores it in the Ready Mix Pond and in other ponds on SMP-24. Water from these ponds is pumped to the aggregate processing facility where it is used to wash gravel. If the amount of water in the ponds is insufficient to meet the needs of the aggregate processing facility and the concrete batch plant, supplementary water is pumped to the Ready Mix Pond from Pit F2, Pit F3-East or Pit F3-West. Hanson Aggregates uses approximately three million gallons per day of water for production purposes.

Pumping from the Ready Mix Pond to the aggregate processing facility is not continuous; it only occurs when the facility is operating. The facility does not operate in wet weather. Spent wash water from the aggregate processing facility is conveyed to pits that are no longer used for aggregate extraction (inactive pits) where silt in the wash water settles out. Currently, when Hanson uses water from Pits F2, F3-East and F3 West, or discharges water to Alameda Creek, the water is first pumped to a 2,000-gallon tank. Water from the tank is then discharged under its NPDES permit to Alameda Creek or to a piping system that distributes the water for dust control and irrigation in the SMP-24 and SMP-32 areas. The 2,000-gallon tank also has an overflow structure that results in water discharging to Alameda Creek whenever the tank is used. Hanson reports its regulated NPDES discharges to the RWQCB. The volumes of water reported are based on the pump rate of the pumps and not a meter at the discharge point.

Water in Hanson Aggregates' inactive pits and ponds must be managed to address certain risks. Water cannot be allowed to rise to levels where it poses a threat to the stability of the levees that separate the pits one from another and from Alameda Creek. Water levels are also managed to limit seepage from one pit to another or to prevent oversaturation of soils adjacent to the pits. In addition, the SFPUC uses Pit F3 East as a discharge point for Hetch Hetchy water, which is then pumped to San Antonio Reservoir. Per the lease agreement with Hanson, Hanson is required to maintain a freeboard in Pit F3 East so that there is room for a Hetch Hetchy water discharge. To maintain water levels, Hanson Aggregates pumps excess water stored in Pits F2, F3-East and F3-West and other pits it manages into other pits where water levels are lower or into Alameda Creek under its NPDES discharge permit, just downstream of its confluence with San Antonio Creek.

3.3 Oliver de Silva

ODS is actively mining gravel from Pit F6. In 2012, as part of the SMP-30 expansion project, ODS revised its surface mining permit and renewed its lease with SFPUC to allow for increasing the mining depth from 140 feet to a maximum of 400 feet below the ground surface. The ground surface in the vicinity of Pit F6 is at about elevation 260 feet. Also as part of the project, ODS expanded its mining area by 58 acres, and added a new asphalt batch plant. ODS has permits to build a new ready-mix concrete batch plant.

Water that enters the active mining area in Pit F6 is pumped to either an inactive area of Pit F6 or to Pit F4, which serves as a source of wash water for the SMP-30 aggregate processing facility, and for production of asphalt.[18] Water levels in Pit F6 and Pit F4 fluctuate. During seasons when the mine is inactive, water levels rise and can exceed elevation 220 feet. During the active mining season, the water level in Pit F6 may be held below elevation 220 feet, but the water surface elevation in Pit F4 may remain at a high elevation throughout the season. Water can overflow from Pit F4 to Alameda Creek over a weir with a crest elevation of about 247 feet so the water level in the pit can never exceed elevation 247 feet by more than a few inches. This overflow weir is one of two NPDES discharge points for ODS. ODS uses about five million gallons per day of water for aggregate, and asphalt production. Spent wash water from aggregate production is conveyed to Pit F5.

The SFPUC has the ability to discharge Hetch Hetchy water from the regional water system to Pit F6 under unplanned circumstances. If this water cannot be contained in the SMP-30 pits, ODS has an additional regulated discharge point at the southern end of SMP-30 and can discharge this water to Alameda Creek under its NPDES permit.

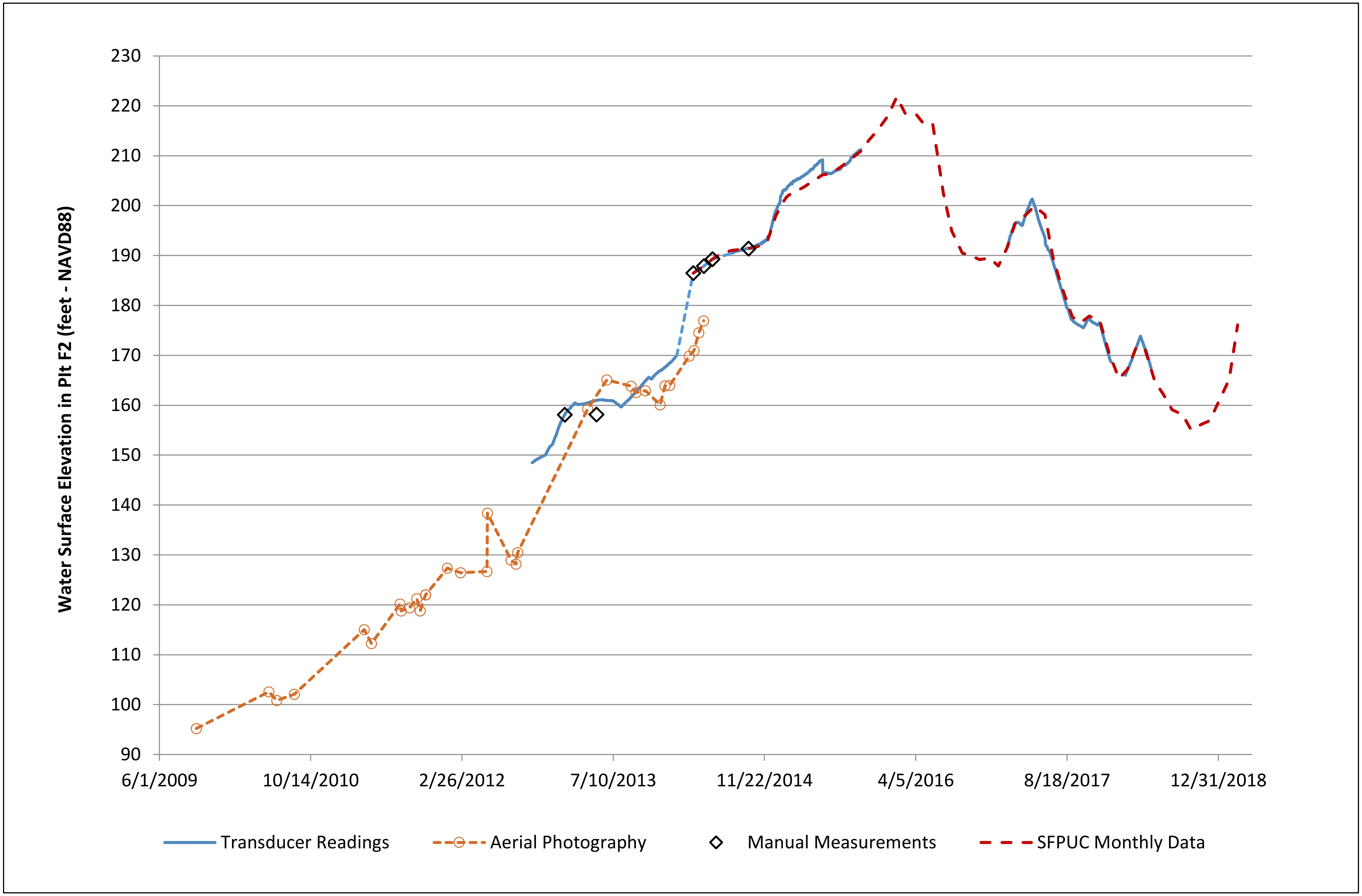
3.4 Water Levels in Pits

The quarry operators do not record water levels in their various pits. Because the proposed ACRP would affect water levels in Pit F2 and could affect water levels in other pits and ponds, the SFPUC has been measuring water surface elevations in four SMP-24 quarry pits—Pit F2, Pit F3-East, Pit F3-West, and the Ready Mix Pond—since early 2011.[19] Pit F2 is the site of the proposed ACRP and Pits F3-East and F3-West are adjacent to it. Pressure transducers installed in the quarry pits record water levels continuously; on occasion the transducer data are supplemented with manual measurements. Water levels in the Ready Mix Pond are not pertinent to the analysis of the ACRP and not discussed further in this report.

A plot of historical water surface elevations in Pit F2 from 2009 to early 2019 is shown in **Figure HYD3-2**. Although water surface elevation monitoring in the pit did not begin until late 2012, the record of water levels was extended back to October 2009 using aerial photography and satellite imagery. In July 2009, the water surface elevation in Pit F2 was estimated to be about 95 feet above mean sea level. By late spring in 2010, it was at elevation 102 feet. Water surface elevation monitoring in the pit began in 2012 at a recorded elevation of 148 feet. It has risen gradually since then reaching elevation 223 feet in February 2016, before falling back to elevation 210 feet by June 2016. The water surface elevation continued to decline until October 2018 when the pit began to fill gradually. As of March 2019, the Pit F2 water surface elevation was approximately 178 feet.

[18] ODS has approval for a concrete batch plant as well however, it has not yet been constructed.

[19] The monitoring of water levels in the pits is performed by Luhdorff and Scalmanini for the SFPUC. The water level data reported here is from a series of reports and technical memoranda prepared by that company.



SOURCE: Luhdorff and Scalmanini (L&S), 2019. Sunol Pit Monitoring Data Transmittal. Excel spreadsheet files provided by Tom Elson on January 10, 2019.

SFPUC, 2019. Pit F2 Monitoring Data provided by Amod Dhakal on March 7, 2019.

SFPUC Alameda Creek Recapture Project

Figure HYD3-2

Historical Water Surface Elevations in Pit F2

The water surface elevation in Pit F3-East varied between elevation 182 feet and elevation 227 feet during the 30-month period from March 2011 to September 2013, as shown in **Figure HYD3-3**.[20] In the fall of 2013, the water surface elevation was lowered from elevation 225 feet to about elevation 115 feet to accommodate construction of facilities associated with the San Antonio Backup Pipeline. Since then it gradually rose to about elevation 152 feet in late 2014, before rising sharply to about elevation 237 feet in early 2015. From then until May 2018, the water surface elevation has risen and fallen between elevation 237 feet and elevation 197 feet. There is a clause in the SFPUC's lease agreement with Hanson Aggregates that calls for the latter to maintain water levels in Pit F3-East at elevation 195 feet or below so that there is always sufficient storage capacity in the pit to contain discharges of water from the Hetch Hetchy Aqueduct. The SFPUC then conveys the discharged water to San Antonio Reservoir.

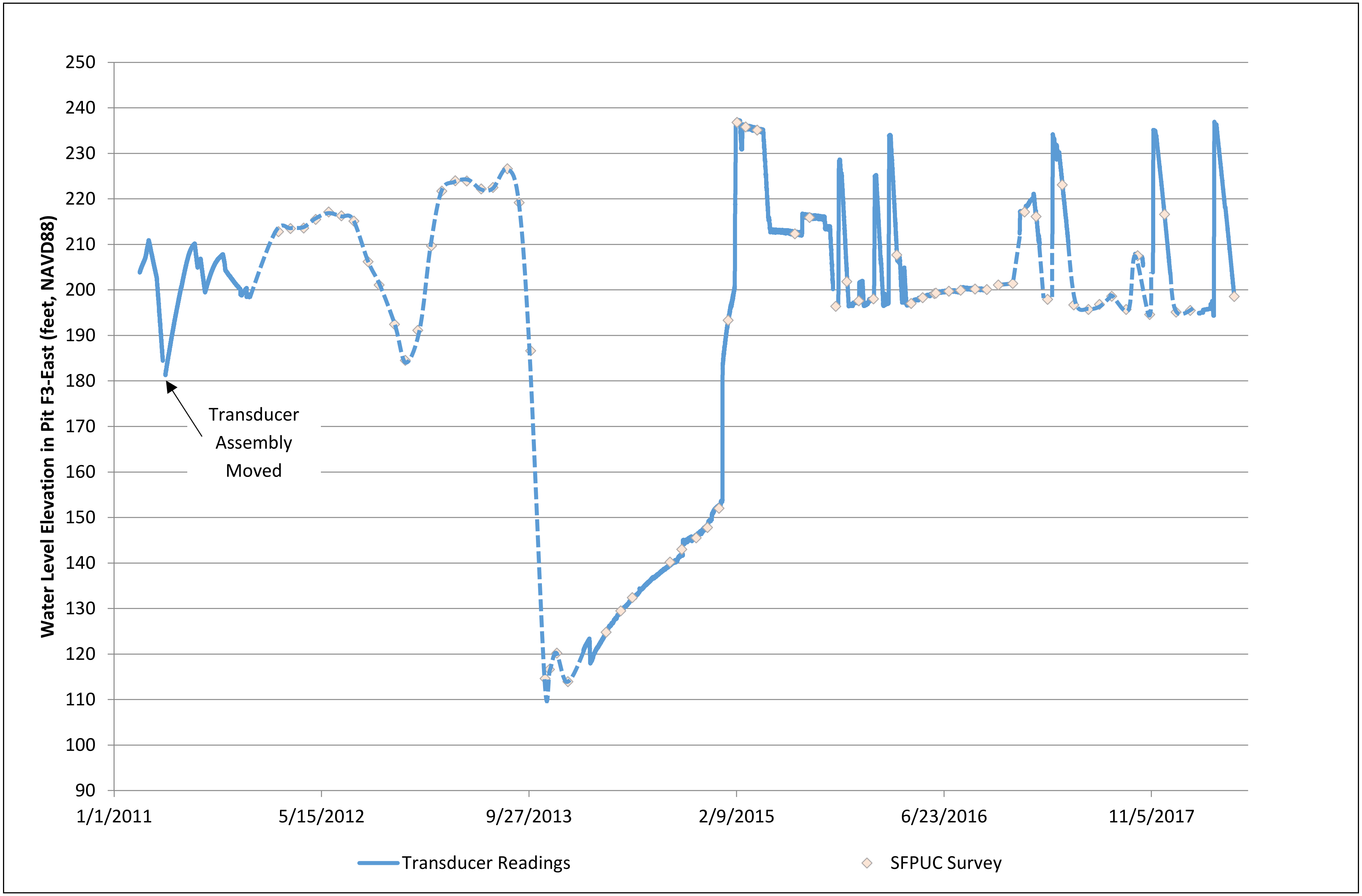
A plot of the water surface elevation in Pit F3-West is shown in **Figure HYD3-4**. It varied between elevation 244 feet and elevation 205 feet during the six-year period from March 2011 to February 2018, with multiple fluctuations, probably in response to pumping by Hanson Aggregates.

The SFPUC has been monitoring water surface elevations in two pits on ODS-leased lands, Pit F4 and Pit F6, since 2011. As shown in **Figure HYD3-5**, the water surface elevation in Pit F4 fell from elevation 247 feet in May 2011 to elevation 223 feet in December 2012, before rising sharply to elevation 233 feet in January 2013. It has remained in the range of elevation 233 feet to elevation 251 feet since then, with the exception of a brief drawdown to 226 feet in June 2016. Pit F4 is equipped with a weir with a crest elevation of 247 feet over which one of ODS' NPDES discharges occurs. Discharges are infrequent and have occurred in May 2011 and March 2016. The water surface elevation in Pit F6, which is actively mined, has fluctuated considerably in the last several years, as shown in **Figure HYD3-6**.

When monitoring began in March 2011, the water surface elevation in Pit F6 was at 158 feet. It rose sharply to elevation 177 feet in May and then fell sharply to elevation 129 feet in June, where it stayed until March 2012. It then began rising, reaching a maximum elevation of 218 feet in May 2013, although it is not known whether there were water level fluctuations between March 2012 and December 2012 because the measuring equipment failed. Since May 2013, the water surface elevation has continued to fluctuate between an elevation of 206 feet and elevation 132 feet.

The data on water surface elevations in Pit F3-East, Pit F3-West, Pit F4, and Pit F6, reported above, are based on measurements made with sensors or taken manually. No analysis of aerial photography or satellite imagery was undertaken to extend the record of water levels for these pits. Water enters and leaves the pits by percolation through the stream channel deposits that underlie the Sunol Valley. The direction of water movement depends on the hydraulic gradient between the pits and the surrounding stream channel deposits. Below the stream channel deposits are the Older Alluvium/Livermore

[20] Dashed lines shown in Figure HYD3-3 are interpolated from monthly data collected independently by the SFPUC.

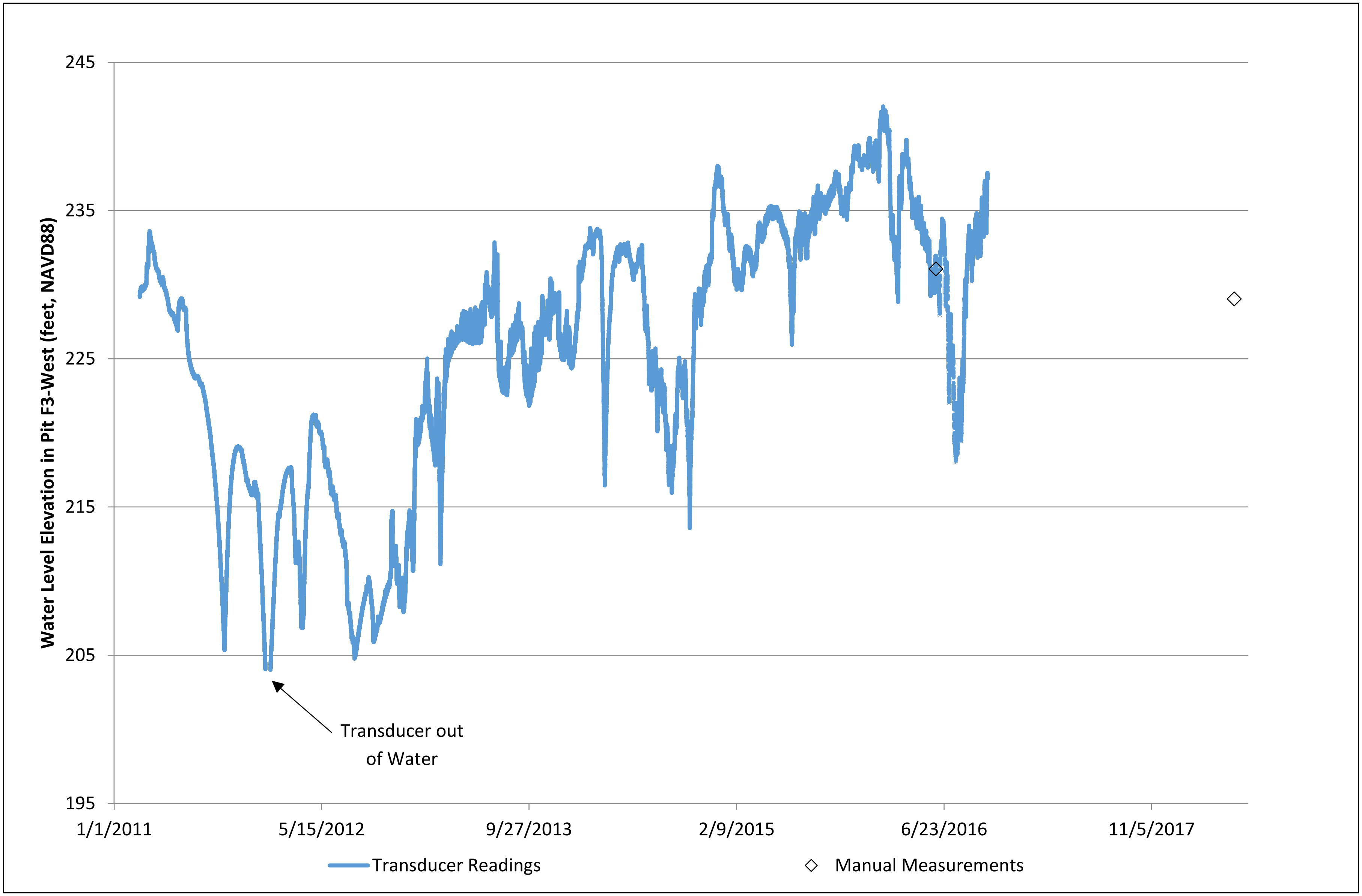


SOURCE: Luhdorff and Scalmanini (L&S), 2019. Sunol Pit Monitoring Data Transmittal. Excel spreadsheet files provided by Tom Elson on January 10, 2019.

SFPUC Alameda Creek Recapture Project

Figure HYD3-3

Historical Water Surface Elevations in Pit F3-East

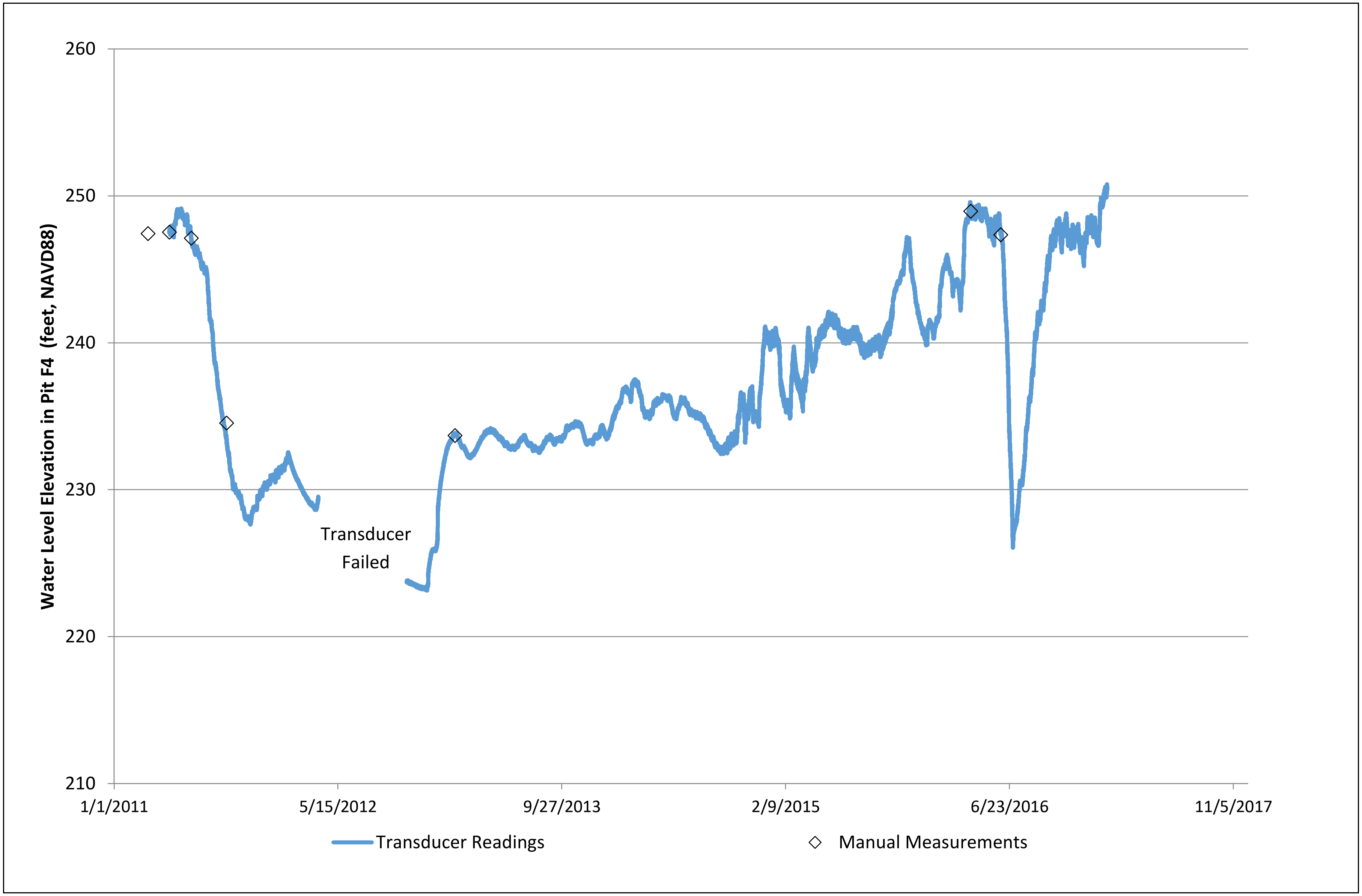


SOURCE: Luhdorff and Scalmanini (L&S), 2019. Sunol Pit Monitoring Data Transmittal. Excel spreadsheet files provided by Tom Elson on January 10, 2019.

SFPUC Alameda Creek Recapture Project

Figure HYD3-4

Historical Water Surface Elevations in Pit F3-West



SOURCE: Luhdorff and Scalmanini (L&S), 2019. Sunol Pit Monitoring Data Transmittal. Excel spreadsheet files provided by Tom Elson on January 10, 2019.

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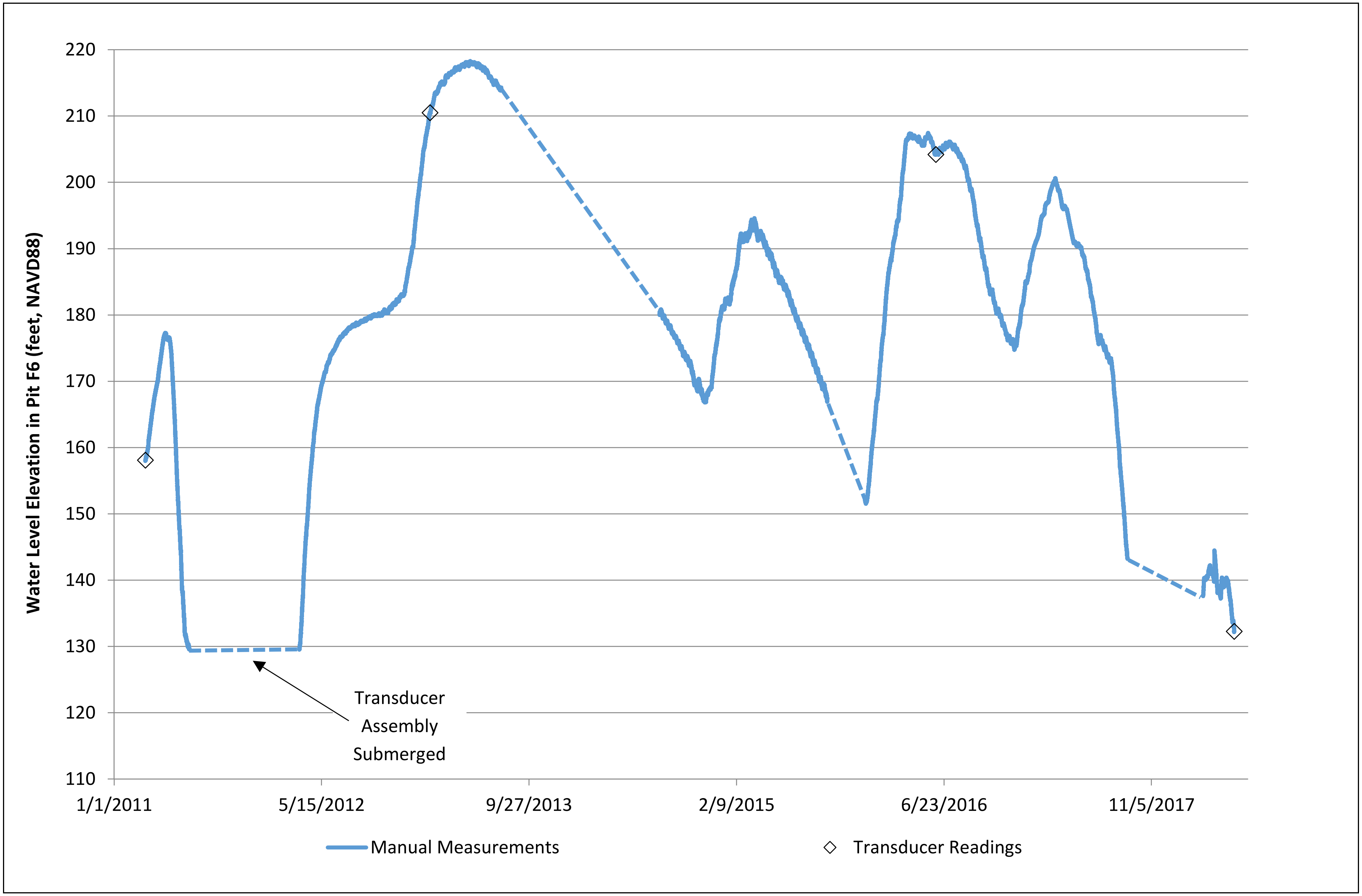
Figure HYD3-5

Historical Water Surface Elevations in Pit F4



SOURCE: Luhdorff and Scalmanini (L&S), 2019. Sunol Pit Monitoring Data Transmittal. Excel spreadsheet files provided by Tom Elson on January 10, 2019.

Figure HYD3-6

Historical Water Surface Elevations in Pit F6

Gravels, which transmit water poorly, and so little water enters or leaves the pits below the base of the stream channel deposits. In the vicinity of Pit F2, the base of the stream channel deposits is estimated to be at about elevation 224 feet (for more information, see Appendix HYD2-R, Section 4, *Regional and Project Area Geology*). The elevation of the bed of Alameda Creek (thalweg) in the same location is at about 242 feet.

Water enters Pit F2 from the stream channel deposits when the water level in the deposits is above elevation 224 feet and the water surface elevation in the pit is lower than elevation 224 feet. As shown in Figure HYD3-2, from 2009 until March 2019, the water level in Pit F2 was at or below elevation 224 feet and so water has entered the pit whenever the water level in the stream channel deposits under Alameda Creek was high enough to create a positive hydraulic gradient. Although it has not done so between 2009 and 2019, water could leave Pit F2 and percolate into the stream channel deposits if the water surface elevation in the pit rose higher than the water level in the deposits.

Hanson Aggregates reports that subsurface water migrates from Pit F2 into Pit F1 in the SMP-32 area even when the water level in Pit F2 is below elevation 224 feet. This suggests that there is a discontinuity in the stream channel deposits between Pit F2 on the south side of I-680 and Pit F1 on the north side of I-680, perhaps attributable to removal of Livermore Gravel during the I-680 construction, which may have been replaced with fill that is more permeable than the gravel.

During the seven-year period in which water surface elevations in the pits have been monitored, Pit F3-East has probably gained water from the surrounding stream channel deposits almost all the time until October 2013 when cut off walls were placed around it. Pit F3-West has probably gained water from the surrounding ground from early 2011 until the present.

The base of the stream channel deposits is estimated to be at about elevation 228 feet in the vicinity of Pit F4. Except for a short period in 2012 and briefly again in 2016, water levels in Pit F4 have been higher than elevation 228 feet. During such times, Pit F4 has lost or gained water from the stream channel deposits under Alameda Creek, with the direction of subsurface flow determined by the subsurface water level in the stream channel deposits. The base of the stream channel deposits is estimated to be at about elevation 245 feet in the vicinity of Pit F6. Pit F6 has probably gained water from the stream channel deposits for the five-year period during which water levels in the pits have been monitored.

3.5 Regulated Discharges from Quarry Pits to Alameda Creek

Hanson and ODS discharge water to Alameda Creek under an NPDES discharge permit issued and managed by the Regional Water Quality Control Board (RWQCB), as mentioned above. Their permits do not require a minimum discharge amount but their maximum discharge amounts are restricted. The discharge is permitted for water quality purposes only. The RWQCB can at any time discontinue the discharge permit or update the permit to restrict discharges further (see EIR Chapter 5, Section 5.16.3.1 for more information on the quarry operators discharge permits).

As noted above, Hanson Aggregates pumps excess water in the pits it manages into Alameda Creek under NPDES discharge permits. Excess water is typically discharged to the creek during the night to take advantage of lower rates for electrical power, but some water may be discharged to the creek in the day. Hanson Aggregates discharges relatively small amounts of water to Alameda Creek even when there is no need to discharge excess water from its pits because of the characteristic of its piping at SMP-24. When Hanson Aggregates pumps water from Pits F2, F3-East and F3-West into the 2,000-gallon tank that is used as a source of water for dust control and irrigation, the tank overflows and the overflow is routed to Alameda Creek. These overflows can occur at any time when the quarries run by Hanson Aggregates are operating.

The volume of water discharged to the creek varies considerably from year-to-year and from month-to-month. **Table HYD3-2** shows the amount of water discharged from Hanson Aggregates into Alameda Creek between Water Year 2002 and Water Year 2015 as reported to the RWQCB. The annual volume of water reported as discharged to the creek under Hanson's NPDES permit during this period varied from a maximum of 5,328 acre-feet in Water Year 2010 to a minimum of 103 acre-feet in Water Year 2012 and averaged 3,245 acre-feet.

TABLE HYD3-2
SUMMARY OF HISTORICAL NPDES DISCHARGES FROM QUARRIES TO ALAMEDA CREEK

Water Year	Hanson Aggregates Mean Discharge (cfs)	Hanson Aggregates Annual Volume (acre-feet)	Cemex/ODS Mean Discharge (cfs)	Cemex/ODS Annual Volume (acre-feet)	Year Type	SMP 24 Mining Status
2002	6.9	4,970	0	0	Dry	Active
2003	6.3	4,578	0	0	Dry	
2004	3.7	2,688	0	0	Dry	
2005	5.4	3,928	0.3	236	Normal/Wet	
2006	6.8	4,953	1.7	1,252	Normal/Wet	
2007	6.3	4,542	0.2	140	Dry	
2008	5.1	3,718	0.2	149	Dry	Used for Water Storage
2009	3.2	2,302	0.3	208	Normal/Wet	
2010	7.4	5,324	1.2	893	Normal/Wet	
2011	6.2	4,480	4.4	3,181 [1]	Normal/Wet	
2012	0.1	103	0	0	Dry	
2013	1.5	1,069	0	0	Dry	
2014	1.4	1,023	0	0	Dry	
2015	1.7	1,206	0	0	Dry	

1 The high discharge volume in 2011 resulted because of a discharge of water by the SFPUC into one of the pits managed by ODS.

SOURCE: San Francisco Public Utilities Commission (SFPUC), 2015. SMP-24 discharge to Creek. Excel spreadsheet file provided by Amod Dhakal on April 1, 2015 for data through 2009. Data for 2010-2015 was obtained from reports provided to the RWQCB.

It should be noted that the reported amounts of water discharged by Hanson Aggregates to Alameda Creek under their NPDES permit are estimated based on a pump-rating curve and should not be regarded as precise. Although pumps may have a nominal rating, 1,000 gallons per minute for example, their actual performance depends on the circumstances of their application. Pump manufacturers provide rating curves for their pumps. The curves relate flow to the hydraulic head that the pump must overcome. The higher the hydraulic head the lower the flow rate. The quarry operators estimate the hydraulic head that one of their pumps is working against by estimating the vertical height between the pump intake and its outlet, with an adjustment made for friction loss in the pipes. They then use the pump rating curve to estimate flow. If used carefully the procedure provides a reasonable but imprecise estimate of flow.

Because ODS usually keeps the water level in Pit F4 above the base of the stream channel deposits at about elevation 228 feet, water percolates northward beneath San Antonio Creek towards Pit F3-West. This reduces the need to discharge water from the SMP-30 pits to maintain safe water levels and consequently, regulated discharges by ODS are infrequent. If it is necessary to remove water in the SMP-30 pits, ODS fills Pit F4 to about elevation 247 feet and the water discharges by gravity over a weir to Alameda Creek, just upstream of its confluence with San Antonio Creek. This is one of ODS's NPDES discharge points. ODS has a second regulated discharge point near the south end of Pit F6, but it is rarely used.

The amount of water discharged from SMP-30 to Alameda Creek varies considerably from year-to-year and month-to-month. Table HYD3-2, shows the annual volumes of water discharged to Alameda Creek by ODS from Water Year 2003 until Water Year 2015. The annual volume of water discharged under ODS's NPDES permit to the creek varied from a maximum of 3,181 acre-feet in the Water Year 2011 to a minimum annual volume of zero, which occurred in several years. The average annual volume of water discharged over the period was 512 acre-feet. It should be noted that some of the reported amounts of water discharged under the NPDES permit by ODS are estimates rather than measured values. Discharges from Pit F4 are measured at the weir, but discharges from Pit F6 are estimated from pump manufacturer rating curves. In addition, the volume of water discharged by ODS in the fourth quarter of 2011 was an anomaly because it resulted from a discharge by the SFPUC into one of the pits managed by ODS. Little water has been discharged from the SMP-30 quarry to Alameda Creek since late 2011. This is because ODS has adopted a different approach to water management from the approach used by the former operator, Cemex.

4. Analytical Methods

4.1 General Approach

The SFPUC's Alameda System Daily Hydrologic Model (ASDHM) was used to simulate surface water flows in Alameda Creek under the four scenarios analyzed in this report. The ASDHM is a spreadsheet model based on the law of conservation of mass. The ASDHM simulates losses of water to the subsurface but does not simulate subsurface water movements in the ground. Information on subsurface water movements is provided in Appendix HYD2-R, Section 8, *Groundwater Movement and Surface Water Interactions*.

4.2 Alameda System Daily Hydrologic Model

The SFPUC uses the Hetch Hetchy/Local Simulation Model to simulate operation of its overall water system operations. The model operates on a monthly time-step and estimates monthly releases from the SFPUC's reservoirs and consequently monthly streamflows. Recognizing that a model that can estimate daily streamflows would be needed to analyze the effects of its water system operations on fisheries in Alameda Creek, the SFPUC developed the ASDHM. The ASDHM enables estimation of daily flows at various locations on Alameda Creek and its tributaries. The model was developed in 2009 by the SFPUC to aid discussion of potential releases and bypasses associated with the CDRP with regulatory agencies. It was expanded in 2012 for use by the Alameda Creek Fisheries Restoration Workgroup (Workgroup), and the agencies and stakeholders that comprise the workgroup. The workgroup is attempting to recover steelhead trout (*Oncorhynchus mykiss*) populations in the Alameda Creek watershed. The workgroup developed a plan that called for several technical analyses, including Ecosystem Diagnosis and Treatment, Numbers of Good Days and Spawning Risk. These analyses require information on hydrology, channel geometry, and water temperature. The ASDHM was developed to provide the hydrology information. Development of the model and its use in support of the Alameda Creek Fisheries Restoration Workgroup are described fully in a draft technical memorandum.[21]

The SFPUC has extended the simulation period of the ASDHM to Water Year 2013 since its use by the Alameda Creek Fisheries Restoration Workgroup and has recently updated it to include the ACRP.[22] The model's underlying computational concept is shown in **Figure HYD4-1**. The current version of the model enables estimation of daily flow values at 12 locations (or nodes) on Alameda Creek and its tributaries.[23] The locations of the nodes, together with a description, are shown in

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[21] Dhakal A.S., Buckland E., and McBain S., 2012. Overview of Methods, Models, and Results to Develop Unimpaired, Impaired and Future Flow and Temperature Estimates along Lower Alameda Creek for Hydrologic Year 1996-2009. Draft Technical Memorandum for the Alameda Creek Fisheries Workgroup. April 24, 2012.

[22] Dhakal A.S. (memo to Steven Smith), 2016. Simulation Period, Scenarios, and Hydrologic Calculations incorporated in Alameda System Daily Hydrologic (ASDHM) for Alameda Creek Recapture Project (ACRP) Hydrologic Requirements.

[23] Although the flow estimates described in the following sections and used in the environmental assessment are expressed in a numerically exact form, they should be regarded as estimates only and not as precise amounts. The USGS reports that the measurement error in observed streamflow data is approximately +/- 10 percent. Because the ASDHM uses USGS gage data as an input and estimates watershed contributions based on measured flows, the SFPUC expects that daily flows estimated with the ASDHM upstream of the San Antonio Creek confluence (Node 6) would be no higher than 15 percent above or below actual flows.

Figure HYD4-2. The most upstream node is on Alameda Creek below the Alameda Creek Diversion Dam. The most downstream node is close to the point at which the creek discharges into San Francisco Bay.

4.2.1 ASDHM Development History

As described above, the ASDHM was jointly developed in 2009 by the SFPUC, ACWD, and McBain Associates under guidance from the Alameda Creek Fisheries Restoration Workgroup. Differences and modifications to the model subsequent to its 2010 development are shown below in **Table HYD4-1**. Version 3.4, last modified in 2016, was used in support of the ACRP EIR analysis.

TABLE HYD4-1
ASDHM MODEL BACKGROUND: USES, DEVELOPMENTS, AND MODIFICATIONS

Model Version	Modeling Nodes	Simulation Period	Additional Notes
CDRP Biological Opinion 2010 / v2.0	Nodes 1 - 7	HY 1996-2009 (Nodes 1 – 5) HY 2000-2009 (Nodes 6 – 7)[1]	– 17 cfs loss between Nodes 4 and 5 – Quarry input only for existing scenario – San Antonio Reservoir not modeled
Habitat Conservation Plan (HCP) Analysis 2012 / v3.2	Nodes 1 - 12	HY 1996-2009 (Nodes 1 – 12)[1]	– Same losses and gains assumptions as v2.0 – ACWD operations included – Updated Calaveras spillway rating
ACRP 2016 / v3.4	Nodes 1 - 12	HY 1996-2013	– Same losses and gains assumptions as v3.2 – Modified eastern watershed contribution to quarry pits rather than to Node 5 – San Antonio Reservoir modeled

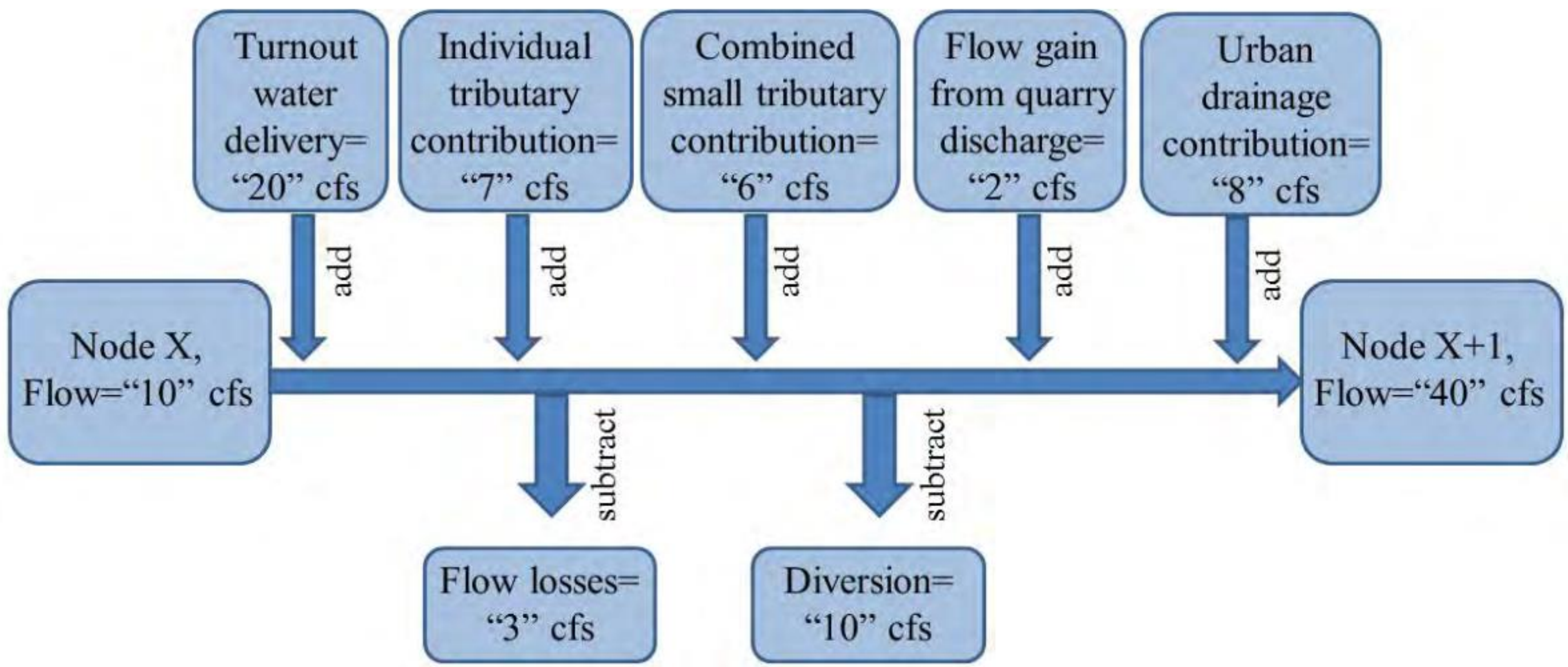
[1] Existing scenario modeled at all nodes for HY 2000 – 2009

SOURCE: SFPUC, 2018. Note: HY stands for Hydrologic Year, which is used interchangeably with Water Year (WY) in this document.

Revisions to the original (v2.0) of the ASDHM were primarily limited to expansions in the modeling period and the incorporation of additional downstream nodes. Importantly, the fundamental assumptions governing losses and gains in streamflow remained consistent between the different versions. Assumptions governing the 17 cfs loss between Nodes 4 and 5 and the gain in quarry NPDES discharge are discussed below.

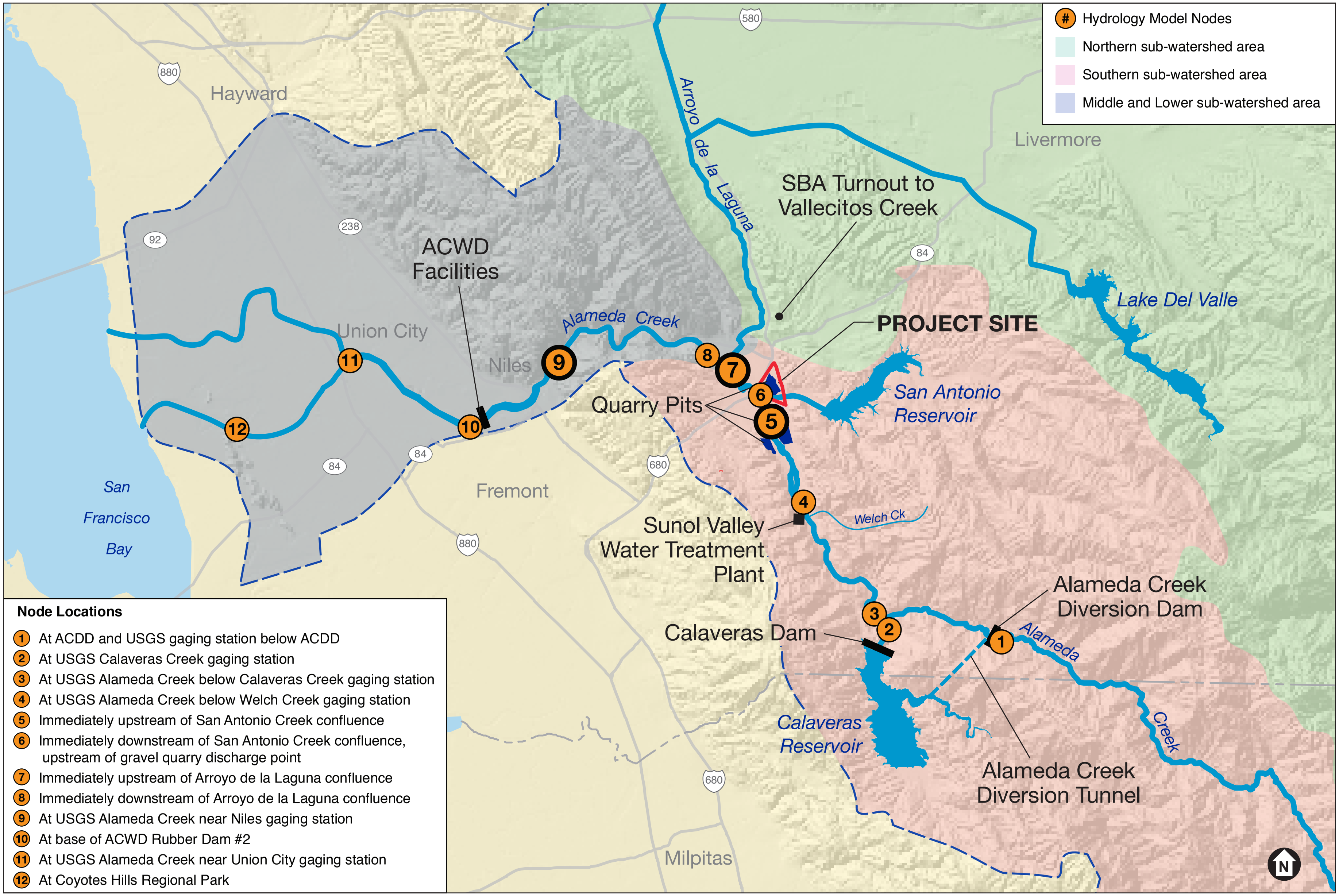
Losses to the Subsurface

One of the key hydrologic assumptions incorporated in the ASDHM is an observed loss of streamflow to the subsurface within the Sunol Valley. Alameda Creek loses water to the subsurface as it flows through the section of the Sunol Valley between the Welch Creek confluence and the Arroyo de la Laguna confluence. This water is lost to the stream channel gravels that lie under the creek. It is likely that losses to the subsurface have always occurred in this reach of Alameda Creek, but they have probably been increased by the excavation of deep gravel mining pits within a few hundred feet of the creek channel. See Appendix HYD2-R for a detailed discussion of the surface water and groundwater interactions in the Sunol Valley.



SOURCE: Dhakal A.S., Buckland E., and McBain S., 2012. *Overview of Methods, Models, and Results to Develop Unimpaired, Impaired and Future Flow and Temperature Estimates along Lower Alameda Creek for Hydrologic Year 1996-2009*. Draft Technical Memorandum for the Alameda Creek Fisheries Workgroup. April 24, 2012.

SFPUC Alameda Creek Recapture Project
Figure HYD4-1
ASDHM Computational Concept



SOURCE: ESA, 2019

SFPUC Alameda Creek Recapture Project

Figure HYD4-2
Location of ASDHM Nodes

Several efforts have been made to quantify these losses to the subsurface. In each study, water was released from Calaveras Reservoir and flow measurements were made at several locations along the creek.[24,25] In one study, conducted by Trihey, 24.5 cfs was lost to the subsurface zone between the Welch Creek gage (Node 4) and the Alameda Creek/Arroyo de la Laguna confluence (Node 7), of which 17 cfs was lost between the Welch Creek gage and the San Antonio Creek confluence. Another study made by the SFPUC confirmed that loss of Alameda Creek surface water to the subsurface between the Welch Creek gage (Node 4) and the San Antonio Creek confluence (Node 5) was 17 cfs.[26] The total of streamflow in Alameda Creek at the Welch Creek gage and any additional flow contributed by runoff between the Welch Creek and San Antonio Creek confluences had to be greater than 17 cfs for flowing water to be observed just upstream of the confluence with San Antonio Creek.

Based on the results of the studies, the ASDHM assumed that up to 17 cfs percolates into the ground between the Welch Creek confluence and the San Antonio Creek confluence. The ASDHM, as used for the Alameda Creek Fisheries Restoration Workgroup, did not include any further loss of Alameda Creek surface water to the subsurface downstream of the San Antonio Creek confluence.[27]

Gain from Quarry NPDES Discharges

As described above in Section 3, Quarry Operations, Hanson Aggregates maintain safe water levels in their pits and ponds by discharging excess water from the quarry Pit F2 to Alameda Creek in accordance with its NPDES permit. As a result, much of the time, Alameda Creek gains water at the NPDES discharge location, approximately 550 feet downstream of Node 6.

Although it was assumed that NPDES discharges from the quarries might continue in the future, the amount and timing of the discharge was unknown and so the SFPUC excluded quarry NPDES discharges, as well as losses in this reach, for all ASDHM model runs except for the existing conditions. Including the NPDES discharges was determined to be unnecessary and of little value to that analyses.[28] This was because the purpose of the model runs completed for the Alameda Creek Fisheries Restoration Workgroup was the maintenance of adequate flow for over-summering steelhead in the reach of the creek above the Welch Creek confluence, upstream of the quarry NPDES charges, and migration flows during the winter.

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[24] Trihey and Associates, Inc., 2003. *Sunol Valley Surface Flow Study, Fall 2001.* Prepared for the Office of the City Attorney, City and County of San Francisco.

[25] Entrix, Inc., 2004. Alameda Creek Juvenile Steelhead Downstream Migration Flow Requirements: Phase 1 Field Survey Results.

[26] There is no separate report documenting the 2008 experimental releases made by the SFPUC. The analysis of losses in surface water to the subsurface within Alameda Creek is summarized in the ASDHM technical memorandum (see footnote 21). An excel file with analysis and information was provided by Amod Dhakal to ESA/Orion on July 14, 2016.

[27] The workgroup decided not to include additional losses below the confluence with San Antonio Creek because, as the next few paragraphs describe, the workgroup chose to exclude NPDES discharges from the modeling. It was generally assumed that these accretions and depletions canceled each other out.

[28] SFPUC's ASDHM model runs as used by the National Marine Fisheries Service to support their analysis when it issued its Biological Opinion for the CDRP pursuant to the federal Endangered Species Act also did not include NPDES quarry discharges.

Modeled Spill from Calaveras Reservoir

When reviewing and interpreting the streamflow data, it is important to understand how the model portrays Calaveras Reservoir operations. The model is based on the law of conservation of mass, and under certain conditions, when the volume of water stored in the reservoir exceeds the capacity of the reservoir, the model expresses the excess water as spills, which in turn is reflected in the model output as increased streamflow downstream of the reservoir. However, this condition may not necessarily reflect actual reservoir operations. Typically, when reservoir storage approaches capacity, the SFPUC operators manage the system to avoid or minimize spill events, as discussed below.

Review of the model results indicate that in many cases, the differences in streamflow volumes between the with-CDRP and with-project conditions are due to the modeled spill from Calaveras Reservoir (**Table HYD4-2**). The ASDHM incorporates only unregulated spill. Spills are simulated by ASDHM in both scenarios, but can occur at different times with different rates depending on the Calaveras Reservoir water surface elevation at the onset of rainstorm events. Modeled spill events occur slightly more frequently under with-project conditions. This increased frequency occurs because reservoir elevations are generally higher under with-project conditions in the early portions of a water year as the ACRP meets a portion of water demand. This causes both an increase in modeled spill under the with-project condition, and a shift in the timing of spill events between the two scenarios. It is important to note that spills occur under both scenarios, the primary difference being the timing of these events. Modeled with-project spill typically occurs during the early winter of a water year, and modeled with-CDRP spill typically occurs in late winter and early spring months.

TABLE HYD4-2
MODELED CALAVERAS RESERVOIR SPILL WITH-CDRP AND WITH-PROJECT CONDITIONS
(Million Gallons)

Water Year	ACRP Spill Volume	CDRP Spill Volume
1996	13,175	13,077
1997	14,380	12,413
1998	26,091	24,583
1999	-	-
2000	3,420	1,330
2001	-	-
2002	-	-
2003	-	-
2004	-	-
2005	4,013	-
2006	12,275	5,647
2007	-	-
2008	-	-
2009	843	-
2010	1,772	-
2011	8,610	2,695
2012	-	-
2013	-	-

SOURCE SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include quarry NPDES discharges at Node 6 and losses between Node 6 and 7 by ESA/Orion.

While ASDHM predicts unregulated spills could occur frequently during wet conditions, during actual operation the SFPUC operates the reservoir to minimize spills from Calaveras Dam through a number of means prior to and during wet weather events (e.g., by reducing or eliminating diversions from ACDD, transferring water to San Antonio Reservoir, implementing regulated releases through cone valve etc.). The day to day operational decisions are not (and cannot be) reflected in the model (or post-processing). It is important to note that the avoidance of unregulated spill is the core principle of reservoir operations at SFPUC. Thus, if differences in flows between the with-CDRP and with-project scenario is due to a modeled spill event, this outcome is not expected to be representative of future conditions but likely to instead be a product (artifact) of the model.

4.3 Post-Processing of ASDHM

For the purposes of the CEQA analysis, ESA/Orion conducted post-processing of the ASDHM outputs downstream of Node 6 to simulate streamflow in the reach adjacent to and downstream of the ACRP project site in order to evaluate potential effects of the project on resources dependent upon streamflow. The CEQA analysts determined that for the purposes of the impact analyses, streamflow in this reach would be better represented if both the gains (Hanson's quarry NPDES discharge) and additional losses that occur between San Antonio Creek (Node 6) and Arroyo de la Laguna (Node 7) were accounted for in the ASDHM output.[29] The assumptions that govern the post-processing of the ASDHM output for the four scenarios analyzed in the ACRP analysis are shown below in **Table HYD4-3** and described in the subsequent sections.

TABLE HYD4-3
SUMMARY OF LOSSES AND GAINS IN STREAMFLOW
AS DEVELOPED FOR THE ALAMEDA CREEK RECAPTURE PROJECT EIR

	Included in v3.4 of the ASDHM	Post-Processing for CEQA Analysis	
Scenario	Sunol Valley Loss (between Nodes 4 and 5)	Quarry NPDES Discharge[1] (550 feet downstream of Node 6˚)	Quarry Reach Loss (between Nodes 6˚ and 7)
Pre-2001 Scenario	17 cfs infiltration loss	Variable gain from quarry NPDES discharges	7.5 cfs infiltration loss
Existing Scenario			
With-CDRP Scenario			
With-Project Scenario			

[1] Quarry NPDES discharge was included in v3.4 of the ASDHM for the existing condition only.

SOURCE: Dhakal A.S., Buckland E., and McBain S., 2012. ESA/Orion, 2019.

[29] Quarry discharge estimates under all scenarios are post-processed into daily ASDHM streamflow data at Node 6 given its close proximity to the discharge point. This imposes a geographical incongruity between the Node 6 data as derived directly from the ASDHM and the Node 6 data used in this analysis. As such, subsequent references to Node 6 are referred to as Node 6˚ to denote the incorporation of quarry NPDES discharge estimates approximately 550 feet downstream of the original ASDHM Node 6 location.

As described in Section 1, ESA/Orion analyzed four scenarios for the ACRP analysis (Table HYD4-3), they are:

- Pre-2001 Conditions: Conditions that existed before 2001, when the DSOD imposed storage restrictions on Calaveras Reservoir.
- Existing Conditions: Conditions that generally exist in 2015 (date of publication of the ACRP Notice of Preparation) with restricted storage in Calaveras Reservoir by order of the DSOD.
- With-CDRP Conditions: Conditions that will exist when the CDRP has been completed and is in operation, including implementation of the instream flow and ACDD bypasses schedules and restoration of the historical capacity of Calaveras Reservoir.
- With-Project Conditions: Conditions that would exist when both the CDRP and the ACRP are completed and are in operation.

4.3.1 Losses to the Subsurface

Losses between Welch Creek and San Antonio Creek Confluences

As described earlier, the ASDHM assumes a loss in streamflow to the subsurface of up to 17 cfs of Alameda Creek surface water between the Welch Creek confluence and the San Antonio Creek confluence for all four scenarios described above. Losses between Welch Creek and San Antonio Creek are different for the four scenarios because the seasonal pattern of flows differs among the scenarios, which affects the volume of losses to the subsurface. Losses to the subsurface could range from 0 to 17 cfs on any given day. Under pre-2001 and existing conditions, for most of the summer and fall, Alameda Creek is dry, or close to dry, downstream of the Welch Creek confluence during which time there is zero or close to zero loss. Under with-CDRP and with-project conditions, there is a small flow year-round at the Welch Creek confluence because of the CDRP required releases at Calaveras Dam and bypasses at the Alameda Creek Diversion Dam. This small flow percolates into the streambed between the Welch Creek and San Antonio Creek confluences for many months, substantially increasing the amount of water that enters the subsurface under with-CDRP and with-project conditions. The average annual loss to the subsurface between Welch Creek and San Antonio Creek, as modeled under the ASDHM, is shown below in **Table HYD4-4**.

TABLE HYD4-4
LOSS OF ALAMEDA CREEK SURFACE WATER TO THE
SUBSURFACE BETWEEN WELCH CREEK AND SAN ANTONIO CREEK (acre-feet per year)

	Pre-2001 Conditions	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Loss between Welch Creek and San Antonio Creek (Node 4 to Node 5)				
Average Annual	3,612	4,530	9,040	9,040
Maximum (water year)	6,460 (1998)	6,765 (2006)	10,747 (1998)	10,747 (1998)
Minimum (water year)	1,462 (multiple)	2,249 (2001)	7,164 (2012)	7,164 (2012)

SOURCE: SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018.

Losses between San Antonio Creek and Arroyo de la Laguna Confluences

As noted earlier (see Section 4.2.1), the studies of losses to the subsurface from Alameda Creek streamflow showed that 24.5 cfs is lost to the subsurface zone between Welch Creek and Arroyo de la Laguna, with up to 17 cfs lost between the Welch Creek and the San Antonio Creek confluences. This means that up to an additional approximately 7.5 cfs of surface water is lost to the subsurface between the San Antonio Creek (Node 6) and Arroyo de la Laguna confluences (Node 7).[30,31] This additional 7.5 cfs loss to the subsurface was not represented in the ASDHM as used for the workgroup, however it has been incorporated by ESA/Orion as part of the post-processing of the ASDHM data for the CEQA analysis to better reflect hydrologic conditions within the quarry reach of the Sunol Valley and particularly, downstream of Pit F2. The workgroup decided not to include the additional losses below the confluence with San Antonio Creek in the ASDHM because it was generally assumed that the gain in flow from NPDES discharge canceled this loss out. Because the reach between the NPDES discharge point (550 feet downstream of Node 6˚) and Arroyo de la Laguna confluences (Node 7) is downstream of Pit F2, the ACRP project site, a more detailed representation of physical processes occurring in the reach was necessary for the EIR impact analysis in order to distinguish differences among scenarios downstream of the project site. These losses during the dry season vary primarily because of quarry NPDES discharges. Different scenarios contribute variable amounts of additional streamflow to Alameda Creek through quarry NPDES discharges. Because of this, scenarios with greater volumes of quarry NPDES discharges also have higher volumes of streamflow loss (i.e., more water is present in the stream, thus more water can be lost). This is particularly true during dry seasons when quarry NPDES discharge makes up a higher percentage of overall streamflow below Node 6˚. Total annual losses in this reach assumed for the post-processing are shown in **Table HYD4-5** for the four scenarios used in the EIR analysis.

TABLE HYD4-5
LOSS OF ALAMEDA CREEK SURFACE WATER TO THE SUBSURFACE BETWEEN SAN ANTONIO CREEK AND THE ARROYO DE LA LAGUNA CONFLUENCE
(acre-feet per year)

	Pre-2001 Conditions	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Loss between San Antonio Creek and Arroyo de la Laguna (Node 6˚ to Node 7)				
Average Annual	3,078	3,693	5,006	3,022
Maximum (water year)	4,508 (2006)	5,213 (2006)	5,430 (2003)	3,593 (1998)
Minimum (water year)	216 (2012)	431 (2012)	3,987 (2008)	1,972 (2009)

SOURCE: ESA/Orion, 2019.

After the incorporation of the 7.5 cfs loss to the subsurface, overall losses in the Sunol Valley total approximately 24.5 cfs, consistent with the observed losses document in the Trihey study referenced

30 Trihey and Associates, Inc., 2003. *Sunol Valley Surface Flow Study, Fall 2001.* Prepared for the Office of the City Attorney, City and County of San Francisco.
31 Entrix, Inc., 2004. Alameda Creek Juvenile Steelhead Downstream Migration Flow Requirements: Phase 1 Field Survey Results.

above. While portions of the 24.5 cfs loss to the subsurface are incorporated into the ASDHM/post-processing at different locations as distinct events (up to 17 cfs at Node 5 and up to 7.5 cfs at Node 7.5), these two losses should be considered one, 24.5 cfs loss, in streamflow from Welch Creek (Node 4) to the Arroyo de la Laguna (Node 7), rather than two discrete phenomena. When viewed within this context, it is reasonable to assume that only a portion of streamflow losses to the subsurface within the Sunol Valley end up in Pit F2 (see Section 4.3.2, *Gains from Quarry NPDES Discharges to Alameda Creek*). Loss rates are discussed independently within this document to provide context on how gains and losses in streamflow are incorporated at different geographical locations (nodes) in the analysis of streamflow data, but this distinction is not intended to reflect a characterization of independent loss events. Lastly, while a portion of this streamflow loss does resurface near the top of Niles Canyon as active return flow, this is not incorporated into the post-processing of the ASDHM streamflow data, as no reliable information is available on the quantity of this return flow. As a result, it is possible that estimates of flows in Alameda Creek at Niles (Node 9) are understated in this analysis.

The method used to estimate the amounts of water added to Alameda Creek by the NPDES discharges from the quarries under pre-2001, existing, with-CDRP, and with-project scenarios is described in Section 4.3.2 below.[32]

Seepage into Pit F2

A portion of the 7.5 cfs streamflow loss described above that enters the shallow aquifer can seep into Pit F2 between the gaps in the slurry cutoff walls around Pit F2, depending on the hydraulic conditions in the adjacent shallow aquifer and water level in Pit F2. This contribution is referred to herein as "seepage." Modeling of the volume and rate at which seepage occurs was conducted for the with-CDRP and with-project conditions to better understand the potential impact of project operations on Alameda Creek streamflow immediately adjacent to the creek. The methodology used to generate these estimates is described in detail in Appendix HYD2-R, Section 9.3, *Quantification of Seepage into Pit F2*. Modeled seepage volumes are shown in **Table HYD4-6** for the with-CDRP and with-project conditions.

TABLE HYD4-6
MODELED SEEPAGE VOLUMES INTO PIT F2
(acre-feet per year)

	With-CDRP Conditions	With-Project Conditions
Seepage from aquifer adjacent to Pit F2		
Average Annual	317	203
Maximum (water year)	505 (1998)	297 (1998)
Minimum (water year)	151 (2012)	66 (2012)

SOURCE: Luhdorff and Scalmanini Consulting Engineers, 2019

32 The losses in active streamflow shown in Table HYD4-5 include the incorporation of quarry NPDES discharges at Node 6˚. See Section 4.3.2 *Gains from Quarry NPDES Discharges to Alameda Creek*.

4.3.2 Gains from Quarry NPDES Discharges to Alameda Creek

As described in Section 3 above, Quarry Operations, the quarry operators have NPDES permits to discharge water to Alameda Creek. At certain times, they discharge water fairly continuously in order to conduct aggregate mining in dry conditions and to maintain safe water levels in the pits they manage. The water that the quarry operators discharge to the creek affects flow in Alameda Creek from the NPDES discharge point downstream to the mouth of the creek. Thus, to make estimates of flow in the creek downstream of the quarries (the location of the proposed ACRP), the EIR analysts estimated quarry NPDES discharges under the four scenarios and incorporated the estimates into the post-processing of the ASDHM data.

The amount of water that the operators discharge to Alameda Creek depends on a number of factors, including what they are permitted to discharge under their NPDES permits and what their quarry management operating conditions require at any given time. However, one important factor is the rate at which water percolates into the bed of Alameda Creek in the reach of the creek upstream of the quarry pits. As noted in an earlier section, the rate at which losses to the subsurface occur varies from scenario to scenario depending on daily streamflow under each scenario, with larger losses occurring under with-CDRP and with-project scenarios than under pre-2001 and existing conditions (see Table HYD4-4). The method used to estimate the volume of the quarry NPDES discharges under the four scenarios is largely dependent on the volume of water entering the pits from subsurface sources (water lost to the subsurface in the creek upstream of the quarries) and other subsurface water entering from the east[33]). Additionally, for with-project conditions the volume of water recaptured by the ACRP would affect the volume of quarry NPDES discharges.

The methodology for generating quarry NPDES discharge estimates under the two future scenarios (with-CDRP and with-project) differ from the methods used for the pre-2001 and existing conditions. Under future conditions, to determine the potential daily impact of project operations on steelhead migration, the CEQA analysis required a comparison of streamflow conditions at the daily time-step; whereas, the CEQA analysis used the pre-2001 conditions only to examine seasonal and annual changes in streamflow as it relates to downstream water users, and not for steelhead migration. As such, refinement to a daily time-step was not required for the pre-2001 conditions. For the existing conditions, quarry NPDES discharges were derived directly from Hanson Aggregates NPDES reporting records.

Several assumptions were made in order to estimate the volume of the quarry NPDES discharges under pre-2001, with-CDRP, and with-project conditions.[34]

[33] A small, 359-acre watershed drains the hillside east of Pit F2. This water does not directly enter Alameda Creek, but instead drains into pit. The SFPUC estimates that on average approximately 1,034 acre-feet per year of water enters Pit F2 via this pathway.

[34] Quarry NPDES discharge estimates for the existing condition are derived directly from Hanson Aggregates NPDES reporting and are described within the subsequent section.

- First, it was assumed that all of the Alameda Creek surface water that percolates into the subsurface between the Welch Creek and San Antonio Creek confluences finds its way into Pit F2. Of the pits adjacent to Alameda Creek — Pits F2, F3-East, F3 West, F4 and F6 — Pit F2 is the farthest downstream. The SFPUC made this same assumption in its estimate of the amount of water it proposes to recapture from Pit F2.
    - As noted earlier, previous studies indicate that up to 17 cfs of surface water flow in Alameda Creek is lost to the subsurface between the Welch Creek confluence and the San Antonio Creek confluence. The estimated loss of 17 cfs of Alameda Creek surface water to the subsurface between the Welch Creek and San Antonio Creek confluences is based on measurements made during an experimental release of water from Calaveras Reservoir. The measurements were made over multiple months during dry, summer conditions and may not represent conditions for every single day of a given water year. However, losses are not expected to significantly vary because the 17 cfs loss was measured after flow was considered stable in the creek.[35] For a water year in which even a drier condition occurs it is possible that the losses to subsurface may be slightly greater than 17 cfs for certain days in the beginning of that water year. Similarly, during very wet, rainy periods losses to the subsurface may be slightly less than 17 cfs for certain days. However, since the loss was estimated when the flow was considered stable in the creek the use of 17 cfs loss was considered reasonable in the development of ASDHM. In this analysis, we use total subsurface loss for a given hydrologic year to estimate excess water available in the pit for each hydrologic year prior to calculating daily quarry discharge. Therefore, slight differences in day-to-day loss-rate variation is not expected to have a significant effect on the quarry NPDES discharge estimate below.
- Second, it was assumed that the proportional relationship between the volume of water entering Pit F2 and the volume of water leaving the pits under existing conditions remains the same for the other three scenarios.
- Third, it was assumed that only NPDES discharges by Hanson Aggregates enter into the calculations. Historically, Hanson Aggregates has discharged much more water from its pits to Alameda Creek than the other operator, ODS. As a result of recent changes in its water management practices, ODS has almost eliminated NPDES discharges to the creek, so it was reasonable to conclude that in the future any quarry discharges from ODS would be negligible.
- Fourth, it was assumed that the quarry operators continue to discharge excess water to Alameda Creek under their NPDES permits as at present. While this assumption is reasonable in the short-term, in the next decade or two, continued aggregate mining is expected to increase the total water storage capacity of the pits. The increase in total water storage capacity will be partially offset by Hanson's loss of Pit F2 storage capacity when the ACRP becomes operational. The effects of continued mining on the water storage capacity of the pits are described in a subsequent section.
- Fifth, it was assumed that the Regional Water Quality Control Board will not change the conditions of the NPDES permits or put new restrictions in place regarding discharges. Currently, permit conditions limit the maximum amounts of water that the quarry operators may discharge but they do not specify minimum discharge amounts.

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35 Meaning flow did not vary at any monitoring location during the constant Calaveras releases.

Existing Condition Quarry NPDES Discharge

As described in Section 3.5, Regulated Discharges from Quarry Pits to Alameda Creek, as part of their NPDES permit Hanson Aggregates records and reports their discharges to the RWQCB. The existing condition daily NPDES quarry discharge dataset was derived from these reports and additional information provided directly by Hanson Aggregates. Unfortunately, the record of NPDES discharges of water from the quarries operated by Hanson Aggregates for the entire 18-year study period is incomplete. Estimates of the missing records were made by the SFPUC to enable daily discharge estimates (in cfs) for the 18-year period from Water Year 1996 to Water Year 2013, the hydrologic period used in the analysis of the proposed ACRP. Data sources used to derive this dataset are shown below in **Table HYD4-7**.

TABLE HYD4-7
EXISTING CONDITION NPDES QUARRY DISCHARGE DATA SOURCES

Study Period	Data Source	Data Format
10/1/1995 - 3/29/1998	No Records Exist Data derived from same calendar days for 10/1/1998 -9/30/1999	NA
3/30/1998 - 9/30/1999	Data provided by Hanson Aggregates	Daily Values
10/1/1999 - 6/30/2008	Data provided by Hanson Aggregates Monthly data disaggregated to daily values	Monthly Volume
7/1/2008 - 9/30/2013	NPDES permits from Hanson Aggregates	Daily Values

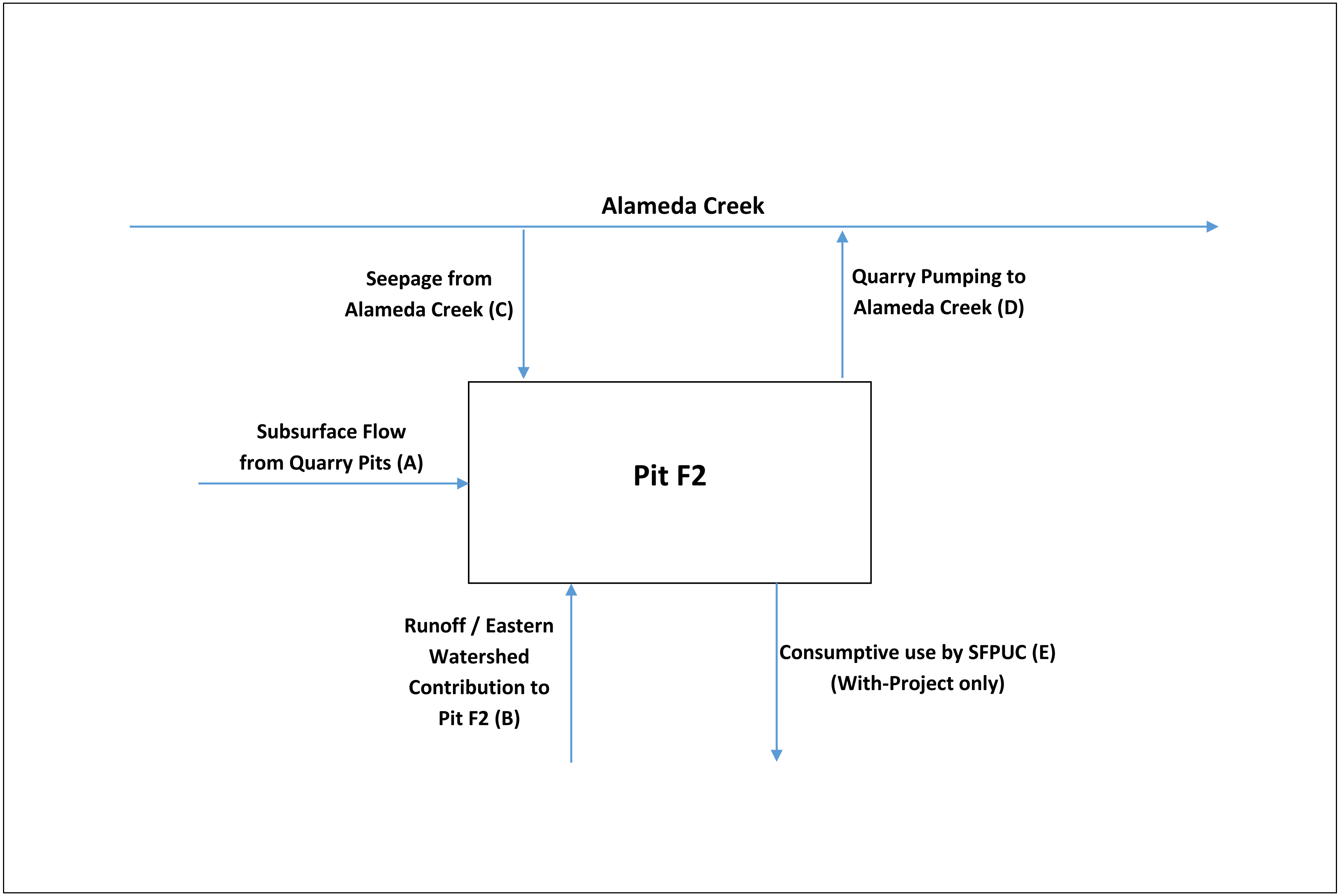
SOURCE: Hanson Aggregates

Hanson Aggregates Pit F2 operation and discharge practices are described above in Section 3, Quarry Operations. As derived from the information contained within Table HYD4-5, the average annual volume of water discharged under Hanson's NPDES permit between Water Year 1996 and Water Year 2013, the period used in the analysis of the proposed ACRP's hydrologic effects, was 3,436 acre-feet.

Pre-2001 Condition Quarry NPDES Discharge

Quarry NPDES discharge estimates for the pre-2001 conditions were derived using the assumptions outlined above and calculated based on the annual ratio of Pit F2 inflow as compared between the pre-2001 and the existing conditions. As less water is lost to the subsurface under the pre-2001 conditions (see Table HYD4-4), the resulting decrease in Pit F2 inflow would cause a reduction in quarry NPDES discharge under the pre-2001 condition relative to the existing condition.

Figure HYD4-3 is a simplified schematic showing the various pathways for water entering and leaving Pit F2 and is useful to explain the methodology used to estimate quarry NPDES discharges. The figure only shows the interaction of water entering and leaving Pit F2 as it relates to the calculation of quarry NPDES discharges used in this EIR. As such, inputs and outputs deemed to be constant between scenarios or unrelated to quarry NDPES discharge estimates (e.g., precipitation and evaporation) are



SOURCE: ESA, 2019.

SFPUC Alameda Creek Recapture Project

Figure HYD4-3

Simplified Schematic of Water Entering and Leaving Pit F2 not shown. Water used consumptively and water moved from Pit F2 to other quarry pits are also omitted from the schematic. Quarry operators are known to use a small portion of the pit inflow in support of their gravel mining operations and to move water from one quarry pit to another. This amount of water is not recorded by the quarry operators and as such is not incorporated into the post-processed quarry discharge estimates. Between scenarios, the relative amount of water managed by the quarry operators, is assumed to be proportional to total Pit F2 inflow (i.e., when there's more water entering the pit, more water is assumed to be used by quarry operators, either used consumptively or moved to other quarry pits). Under this assumption, the volume of water managed by the quarry operators would only affect the total volume of water discharged, and not affect the proportional relationship of discharge between scenarios. Under the with-project condition, the SFPUC would control operation of Pit F2 and no consumptive use of Pit F2 inflow or transfer of water to other quarry pits would occur.

As shown in Figure HYD4-3, the pathways for water entering and leaving the pit are labeled *A* through *E*. Water enters Pit F2 as a result of percolation from Alameda Creek between the Welch Creek and San Antonio Creek confluences and other subsurface pathways within the Sunol Valley (*A*). (*A*) is represented in the ASDHM as up to 17 cfs loss of streamflow to subsurface between Welch Creek and San Antonio Creek. Water also enters Pit F2 by percolation and runoff from a watershed to the east (*B*). While this value is likely constant between scenarios, this input affects the pit water surface elevation and therefore must be included in modeled NPDES discharge volumes. Lastly, a small amount of water enters Pit F2 directly as seepage from the portion of Alameda Creek directly adjacent to Pit F2 (*C*).[36] Water leaves the pit in the form of NPDES quarry discharge (*D*), and under the with-project condition only, water leaves as recaptured water (*E*).

For pre-2001 conditions the daily values of *D*, quarry NPDES discharges to Alameda Creek, were calculated based on the difference in the volume of water entering Pit F2 between the existing and pre-2001 scenarios. The methods used to generate D_{Pre2001} are outlined below:

1. For each water year, the modeled volume of water entering Pit F2 was estimated under both scenarios:[37]
   - *A + B*

[36] Seepage estimates are only included in quarry NPDES discharge estimates for the with-CDRP and with-project conditions to facilitate daily comparison between the two scenarios. For the purposes of this analysis, estimates of seepage are distinct from the 17 cfs loss between Welch and San Antonio creeks, and can be viewed as a portion of the observed 7.5 cfs loss in streamflow to the subsurface between San Antonio Creek and the Arroyo de la Laguna confluence. Seepage estimates are the product of a refined analysis of the hydrologic dynamics between water levels in Pit F2, saturation of the aquifer, and flow in Alameda Creek immediately adjacent to the pit. See Appendix HYD2-R, Section 9, *Quantification of Aquifer Flow and Seepage* for a discussion of seepage estimation assumptions and methodology.

[37] Seepage estimates (*C*) are not included for the pre-2001 scenario due to a lack of available data on Pit F2 water surface elevations during the period represented by this condition. However, seepage from the gap in the slurry wall immediately adjacent to Pit F2 comprises only a small portion of total inflow to the pit, and would have little impact on the annual and monthly flow estimates described in subsequent sections. As noted above, seepage from the aquifer immediately adjacent to Pit F2 is included in quarry NPDES estimates for the with-CDRP and with-project conditions to facilitate a direct daily comparison between the two scenarios.

2. For each water year, an annual correction factor was developed by comparing annual modeled Pit F2 inflow between the pre-2001 and existing conditions:
   - ($A_{Pre2001}$ + $B_{Pre2001}$) divided by ($A_{Existing}$ + $B_{Existing}$)
3. For each water year, the correction factor was multiplied by the existing condition quarry discharge dataset for each day within the corresponding water year:
   - $D_{Existing}$ multiplied by [($A_{Pre2001}$ + $B_{Pre2001}$) divided by ($A_{Existing}$ + $B_{Existing}$)]

Using these methods, the average annual pre-2001 quarry NPDES discharge was modeled to be 2,796 acre-feet per year over the 18-year ACRP study period.

With-CDRP Condition Quarry NPDES Discharge

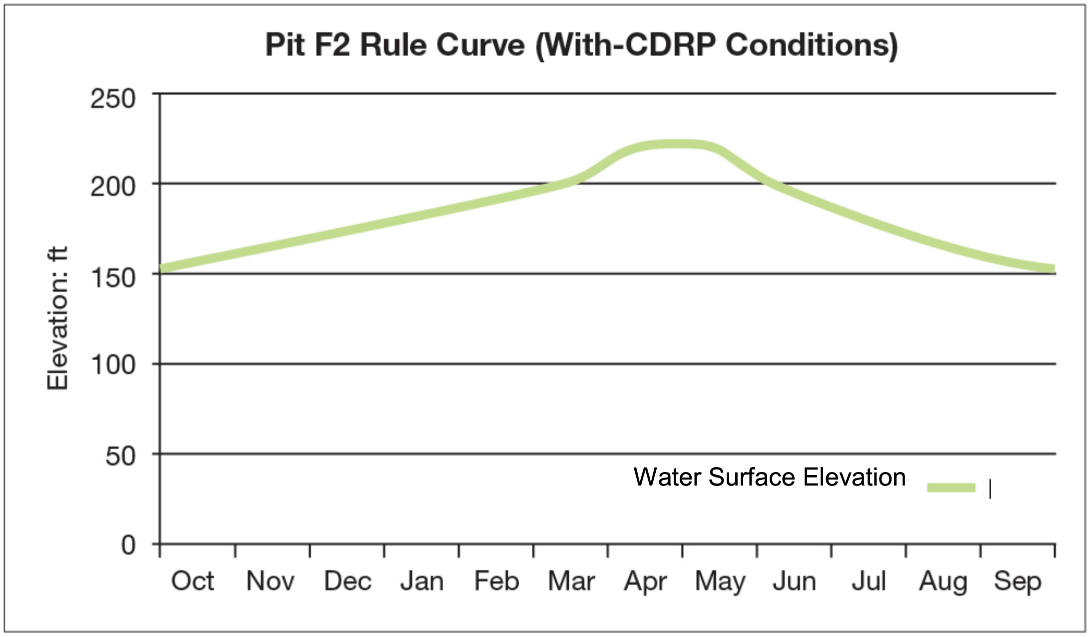
As described above, the methodology for generating quarry NPDES discharge estimates under the two future scenarios (with-CDRP and with-project) differ from the methods used for the pre-2001 and existing conditions. Under future conditions, to analyze the potential daily impact of project operations on steelhead migration a comparison of streamflow conditions at the daily time-step was required. The with-CDRP quarry NPDES discharge estimates are described below, and with-project discharge estimates are described in the subsequent section.

As with the pre-2001 condition, the volume of excess water available for discharge depends largely on the volume of Pit F2 inflow, as shown in Figure HYD4-3. For with-CDRP conditions, inflow into Pit F2 was calculated by summing the values on a daily time-step for *A*, *B*, and *C*. Daily values for *A* and *B* were obtained directly from the SFPUC, and daily values for *C* were calculated by Luhdorff and Scalmanini Consulting Engineers (see Appendix HYD2-R, Section 9.3, *Quantification of Seepage into Pit F2*).

As not all water that enters the pit is discharged, the modeled volume of inflow was scaled based on the historical relationship between pit inflow and quarry NPDES discharge. Over the 18-year period of record, using the existing condition relationship between modeled inflow and reported quarry NPDES discharges, it is estimated under the with-CDRP conditions approximately 68 percent of the water that enters the pit will ultimately be discharged to Alameda Creek. The remaining approximately 32 percent is likely lost as evaporation, used consumptively by the quarries, or moved to other quarry pits.

Using this relationship, Pit F2 inflow ($A + B + C$) was scaled on a daily time-step to generate an estimate of effective inflow (($A + B + C$) multiplied by 68 percent).[38] Once this daily estimate of effective inflow was generated under the with-CDRP conditions, this volume was directly tied to a modeled Pit F2 water surface elevation operational range (derived from historic water surface elevation patterns as described below), shown in the form of a rule curve as presented in **Figure HYD4-4**.

[38] Effective inflow is defined as the volume of water entering Pit F2 that is available for discharge to Alameda Creek.



SOURCE: ESA, 2019.

Figure HYD4-4
Example Pit F2 Rule Curve – With-CDRP Conditions

Rule curves allow for the modeling of a specific water surface elevation for each day during the 18-year period of record – following a pattern of fill and depletion over a water year. Each water surface elevation has an associated storage volume, derived from a Pit F2 elevation / storage relationship developed by the SFPUC. Using this relationship, the daily effective inflow was added to the modeled Pit F2 storage volume on each day. When the amount of effective inflow caused exceedance of the storage volume for a modeled Pit F2 elevation, the volume of water in excess was determined to be available for discharge.

To determine an appropriate range in water surface elevation, a modeled operational range was developed from historical water surface elevation monitoring within the pit. Monitoring within Pit F2 is currently being conducted by Luhdorff and Scalmanini Consulting Engineers (LSCE) for the SFPUC and also independently by the SFPUC. This monitoring, which began with the installation of transducers by LSCE in 2012, and continues to the present, shows a range of water surface elevations that fluctuate between a minimum of approximately 148 feet and a maximum 222 feet (see Figure HYD3-2). This range in elevations, simplified below to a minimum of 150 feet and maximum of 220 feet, provided the empirical underpinning for the with-CDRP condition Pit F2 rule curve shown in Figure HYD4-4.

Once the total volume of excess water was generated, it was then averaged and distributed evenly over the number of historical discharge days (as reported in NPDES permit records) for that water year period. It is unknown in what pattern and magnitude quarry NPDES discharge will occur in the future, thus, it was assumed that discharge under future scenarios would be best reflected by an average volume applied evenly over the existing condition discharge days for a given water year. This was done rather than attempt to predict the daily fluctuation in discharge under future conditions. This assumption was corroborated by quarry NPDES discharge reporting, which shows limited fluctuation day-to-day over the 18-year period of record (Table HYD4-7).

Lastly, once the excess water had been distributed evenly for each operational and non-operational period an additional methodological refinement was applied. Per Hanson Aggregate's NPDES permit (CAG982001), the maximum allowable discharge flow rate is 10 million gallons per day (mgd), or approximately 15.5 cfs. In accordance with Hanson Aggregate's NPDES permit, the maximum allowable daily discharge was capped at 15.5 cfs. This capping of the discharge resulted in certain operational periods with an excess amount of water in Pit F2, which is discussed in the section further below, "Quarry NPDES Discharge Estimates.".

Using these methods, the average annual with-CDRP quarry NPDES discharge was modeled to be 6,739 acre-feet per year over the 18-year ACRP study period.

With-Project Condition Quarry NPDES Discharge

The quarry NPDES discharge estimation methodology under the with-project condition is similar to the with-CDRP methodology. Consistency between these two scenarios was necessary to ensure that streamflow comparisons at the daily time-step was appropriate.

As with the with-CDRP conditions, inflow into Pit F2 was calculated using the pathways shown on Figure HYD4-3. For with-project conditions, effective inflow into Pit F2 was calculated by summing the values on a daily time-step for A, B, and C ($A + B + C$). Values of A and B are modeled by the SFPUC and values of C are derived from the LSCE analysis described in Appendix HYD2-R, Section 9.3, *Quantification of Seepage into Pit F2*. Unlike the with-CDRP condition, no scaling of this inflow is required under the with-project. This is because under with-project conditions, the SFPUC, not Hanson Aggregates, would be in control of Pit F2 operations. As such, there would be no active quarry mining and, therefore, no need to account for consumptive use by quarry operations or movement of water from Pit F2 to other quarry pits.

When the project is in operation, water would leave Pit F2 through two pathways (evaporation is constant for all scenarios and is not considered) — discharge (D) and recapture (E). Recapture volumes are modeled by the SFPUC based on the estimated volume of water entering Pit F2 (see above) and constrained by the revised operational protocols shown below in **Figure HYD4-5**. As shown in Figure HYD4-5, to avoid impacts on steelhead, the revised recapture operations would be limited to months outside of the migration season. On average recapture operations would withdraw approximately 6,000 acre-feet per year over the 18-year study period. After accounting for recapture operations, the amount of water available for discharge under with-project conditions is estimated as $((A + B + C) - E)$.

MONTH	REVISED OPERATIONS	JUNE 2017 EIR OPERATIONS	REMARKS
Oct	Pumping permitted if pit water levels greater than 180 ft	Pumping permitted if pit water levels greater than 150 ft	Pumping period reduced from 9 months to 5 months, with additional pumping in May and June only under specified conditions
Nov			
Dec	No Pumping*		
Jan		No Pumping	No pumping period extended from December to June compared to January to March
Feb			
Mar			
Apr		Pumping permitted if pit water levels greater than 150 ft	
May	No pumping if pit water levels less than 225 ft or if flow at San Antonio Creek is greater than zero		Pit Level will not be drawn down below 180 ft compared to 150 feet
Jun			
Jul	Pumping permitted if pit water levels greater than 180 ft		Recapture volume reduces from an average of about 7,200 acre-feet/yr to about 6,000 acre-feet/yr
Aug			
Sep			

No Pumping | Revised Operations | Pumping Permitted up to Specified Limit

*The only exception during this period would be for safety purposes, in which case pumping could occur if the water levels in Pit F2 reach an elevation of 240 feet and there is a danger of the pit spilling and flooding. In this case, pumping water from Pit F2 would be conducted until the water level is brought down to an elevation of 230 feet.

SOURCE: SFPUC, 2019.

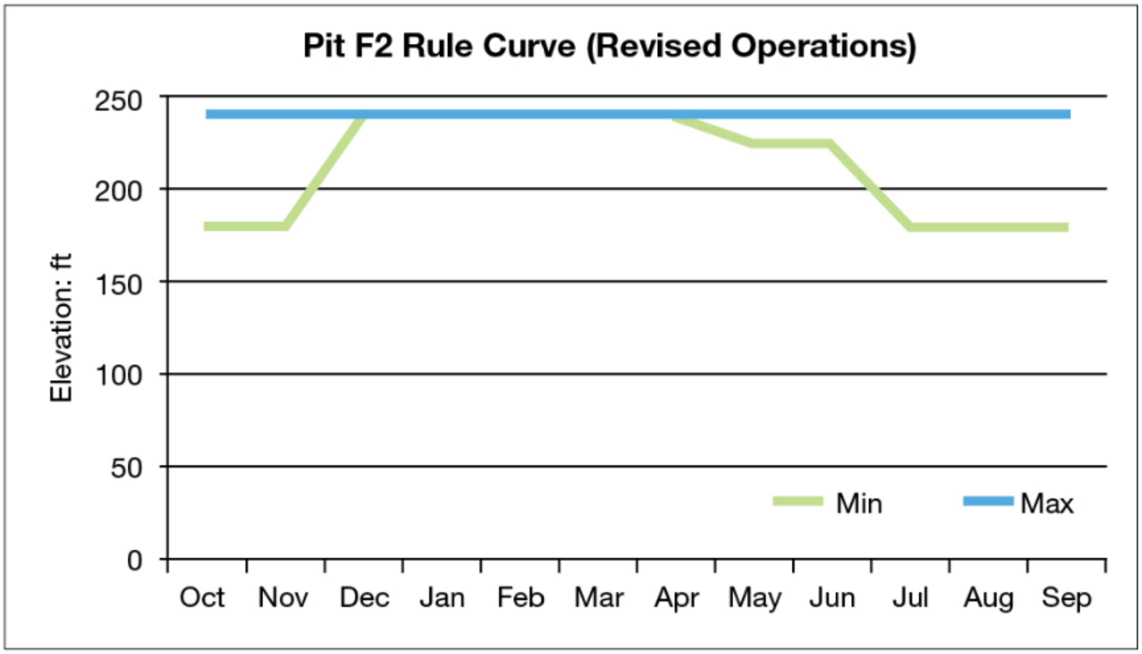
Figure HYD4-5
Revised ACRP Operations

Consistent with the with-CDRP conditions, the volume of water available for discharge was tied directly to an assumed operational range of Pit F2. Under the with-project condition, however, the SFPUC would control the daily operation of Pit F2 and proposes to manage the pit between a minimum of 180 feet and a maximum of 240 feet. Proposed Pit F2 water level management is described in Figure HYD4-5 and shown as an operational rule curve in **Figure HYD4-6**.

The volume of water available for discharge was totaled for each project operational (July to November) and non-operational (December to June) period during the 18-year period of record.[39] This total volume of excess water, for each non-operational and operational period, was then averaged and distributed evenly over the number of historical discharge days (as reported in NPDES permit records) for that water year period. Since recapture operations could substantially reduce the amount of water available for quarry NPDES discharges into the creek, daily quarry NPDES discharge estimates were calculated independently for the operational and non-operational periods.

As with the with-CDRP conditions, daily discharge rates were capped at 10 mgd or approximately 15.5 cfs. Using these methods, the average annual with-CDRP NPDES quarry discharge was modeled to be 3,870 acre-feet per year over the 18-year ACRP study period.

39 To ensure consistency between the scenarios, this was also done under the with-CDRP conditions.



SOURCE: SFPUC, 2019.

Figure HYD4-6
Example Pit F2 Rule Curve – With-Project Conditions

Quarry NPDES Discharge Estimates

The capping of daily discharge from Pit F2 to the approximately 15.5 cfs NPDES permit limit, means that occasionally there is an excess amount of water in Pit F2 that quarry operators or the SFPUC will need to manage without discharging it back into Alameda Creek. These volumes are shown below in **Table HYD4-8** for the modeled years.

TABLE HYD4-8
ESTIMATED ANNUAL VOLUME OF EXCESS WATER IN PIT F2
NOT DISCHARGED INTO ALAMEDA CREEK
(acre-feet per year)

Water Year	With-CDRP Conditions	With-Project Conditions
1998	231	-
1999	-	167
2003	604	-
2007	430	-

SOURCE: ESA/Orion, 2019.

It is assumed that the excess water unavailable to discharge due to the exceedance of permit limits would be moved to other quarry pits as storage for future use, as quarry operators are known to do.

Average annual NPDES discharges under the four scenarios analyzed for the EIR are summarized and shown below in **Table HYD4-9**.

TABLE HYD4-9
QUARRY NPDES DISCHARGE ESTIMATES UNDER CEQA POST-PROCESSING ASSUMPTIONS
(acre-feet per year)

	Pre-2001 Conditions	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Average Annual	2,796	3,436	6,739	3,870
Maximum (water year)	4,460 (2010)	5,328 (2010)	8,446 (1998)	6,787 (1999)
Minimum (water year)	68 (2012)	103 (2010)	4,455 (2008)	1,355 (2009)

SOURCE: ESA/Orion, 2019.

4.4 Post-Processing Validation for Fisheries Analysis

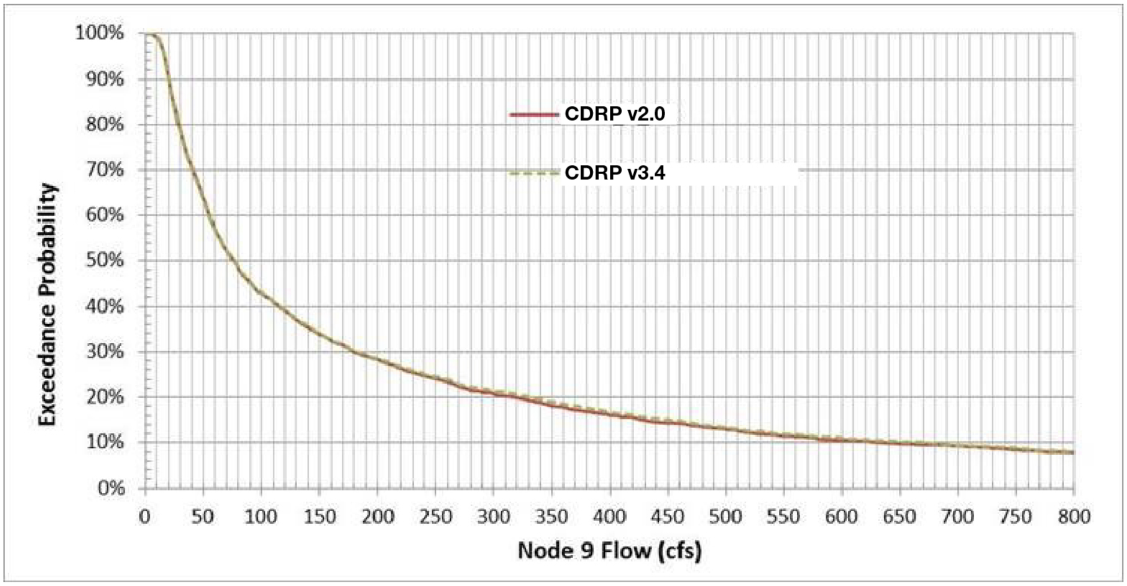
The CEQA fisheries analysis included an additional step in order to validate and confirm the reasonableness of the post-processing assumptions described in Section 4.3 above. This was done by comparing the with-CDRP scenario with an equivalent, but established scenario.

On March 5, 2011, NMFS issued a biological opinion (BO) for the construction and operation of the Calaveras Dam Replacement Project (CDRP).[40] In the BO, NMFS concluded that the construction and future operation of the CDRP will not jeopardize the continued existence of Central California Coast (CCC) steelhead. The CDRP BO scenario serves as the regulatory baseline for the CEQA analysis of impacts on steelhead, and represents the same conditions as the with-CDRP scenario used in the fisheries analysis. However, the model assumptions used in the CDRP BO differ from the post-processing assumptions used in the with-CDRP scenario.

The ASDHM model used as the basis for the CDRP BO in 2010, version 2.0, has been updated to version 3.4, which extended the modeling locations from seven to twelve nodes and the simulation period from an end date of 2009 to 2013 (see Table HYD4-1). Thus, the ASDHM model used in the fisheries analysis for the recirculated portions of the EIR differs from what was used in the CDRP BO scenario. The updated analysis includes additional post-processing that has been incorporated into the CEQA analysis to better simulate streamflow adjacent to and downstream of Pit F2. Specifically, these post-processing assumptions incorporate gains from quarry NPDES discharges and a 7.5 cfs loss between Nodes 6 and 7, which were not accounted for in the CDRP BO. In order to validate that the refinements in the post-processing assumptions approximate those conditions analyzed in the CDRP BO, this section provides a comparison of model results as used in the CDRP BO and in the with-CDRP scenario used in the CEQA analysis.

[40] National Marine Fisheries Service (NMFS), 2011. Biological Opinion for Calaveras Dam Replacement Project in Alameda and Santa Clara Counties. Tracking No. 2005/07436. March 5, 2011.

To facilitate a direct comparison between the post-processed results used in the CEQA analysis and the results used in support of the CDRP BO (without the post-processing), flows derived from the current version of the model (v3.4), but without the post-processed assumptions, were used to represent the CDRP BO condition. Given that the losses and gains assumptions are conserved, differences in streamflow between the earlier model version and the current model version are relatively minor. A comparison of the with-CDRP condition between model version 2.0 and 3.4 is shown below in **Figure HYD4-7**.



SOURCE: SFPUC, 2018.

Figure HYD4-7
Comparison of Modeled CDRP Streamflow at Node 9
Model Version 2.0 and 3.4

Due to the similarity between the two model versions, the with-CDRP condition without post-processing (but using model version 3.4) was used as a surrogate for the CDRP BO condition as analyzed in the CDRP Biological Opinion. The two scenarios compared in this validation analysis are the with-CDRP without post-processing (hereafter referred to as the CDRP BO condition) and the with-CDRP condition with post-processing[41] incorporated.

To accomplish the validation, certain threshold streamflow conditions in the Sunol Valley as represented by ASDHM Node 7 were examined and compared between the CDRP BO and with-CDRP conditions. These threshold conditions are derived from the NMFS CDRP BO, in which it was identified that adult upstream passage and juvenile downstream passage would be provided in the Sunol Valley (Node 7) with flows of approximately 20 cfs and 10 cfs, respectively. The number of days the threshold conditions would be met or exceeded were calculated for the CDRP BO condition and with-CDRP scenarios for each water year in the 18-year model period of record. The change in

[41] Quarry NPDES discharge incorporated at Node 6˚ and 7.5 cfs loss in streamflow between Nodes 6˚ and 7.

number of days for each year, total days for each scenario, and average number of days per year for each scenario were also calculated. For those days where there was a change in achieving the threshold conditions between the CDRP BO condition and with-CDRP scenario, the magnitude of change (increase or decrease) in daily flow was also calculated. **Table HYD4-10** shows the number of days flow is predicted to equal or exceed 20 cfs between December 1 to April 30 (adult upstream migration period) for each water year from 1996 to 2013 for both the CDRP BO and with-CDRP conditions.

TABLE HYD4-10
MIGRATION OPPORTUNITY DAYS AT NODE 7 – ADULTS: DEC 1 TO APRIL, 20 CFS, CDRP BO COMPARED TO WITH-CDRP CONDITIONS

Water Year	Migration Period		Opportunity Days at Node 7 flow >= 20cfs (CDRP BO)	Opportunity Days at Node 7 flow >= 20cfs (With-CDRP)	Change in Days
1996	12/1/1995	4/30/1996	108	109	1
1997	12/1/1996	4/30/1997	111	112	1
1998	12/1/1997	4/30/1998	122	122	0
1999	12/1/1998	4/30/1999	104	104	0
2000	12/1/1999	4/30/2000	57	57	0
2001	12/1/2000	4/30/2001	36	35	-1
2002	12/1/2001	4/30/2002	46	46	0
2003	12/1/2002	4/30/2003	51	51	0
2004	12/1/2003	4/30/2004	45	45	0
2005	12/1/2004	4/30/2005	110	112	2
2006	12/1/2005	4/30/2006	115	118	3
2007	12/1/2006	4/30/2007	25	24	-1
2008	12/1/2007	4/30/2008	43	43	0
2009	12/1/2008	4/30/2009	34	34	0
2010	12/1/2009	4/30/2010	90	90	0
2011	12/1/2010	4/30/2011	99	99	0
2012	12/1/2011	4/30/2012	21	18	-3
2013	12/1/2012	4/30/2013	16	14	-2
		total	***1233***	***1233***	
		average	***69***	***69***	

CDRP BO flows: SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018.

CDRP flows: SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6* and losses between Node 6* and 7 by ESA/Orion.

As shown above, there is little difference in the modeled number of days between the CDRP BO and with-CDRP conditions when flows equal or exceed 20 cfs. Over the period of record, the total number of opportunity days is 1,233 under both scenarios, or an average of 69 per year during the adult migration period. The maximum fluctuation within a given year is 3 days, whereas the majority of years show zero change between scenarios.[42]

The results of this cross-comparison suggest that the model post-processing assumptions approximate conditions evaluated in the NMFS CDRP BO, and that the with-CDRP scenario provides an appropriate condition against which to compare the with-project scenario. See Section 15.2, Fisheries Resources, in the recirculated portions of the EIR for a detailed analysis of how project operations affect streamflow as it relates to CCC steelhead movement in the watershed.

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[42] Similar differences in migration opportunity days were observed at Node 7 for 10 cfs juvenile passage condition.

5. Effects of ACRP Operations on Surface Water Hydrology

Operation of the proposed ACRP would affect surface water levels in Pit F2 and the SFPUC's operation of its Alameda System, particularly Calaveras Reservoir, as well as quarry NPDES discharges, all of which could affect surface water flow in Alameda Creek. The effects of the ACRP are determined by comparing surface water hydrology with the ACRP in operation to surface water hydrology under existing and with-CDRP conditions using the analytical methods described in Section 4.

5.1 Effects of ACRP on Pit F2

The top of the berms that separate Pit F2 from the Alameda Creek channel are at about elevation 260 feet and the bottom of the pit is at about elevation 10 feet. The thalweg, or lowest point in the Alameda Creek channel, is at about elevation 242 feet in the vicinity of the proposed project.

Operation of the ACRP would alter water levels in Pit F2 directly by pumping water from the pit, and it could also affect water levels in the pit indirectly by altering the rate at which water seeps into the pit. The rate at which water seeps into Pit F2 depends on the relative elevations of the subsurface water level in surrounding stream channel deposits and the water level in Pit F2. Because operation of the ACRP would change the water level in Pit F2, it has the potential to alter the rate of seepage of subsurface water into the pit.

5.1.1 Water Level Changes in Pit F2 Caused by ACRP Pumping

When the ACRP is in operation, the SFPUC would maintain the water surface elevation in Pit F2 between 180 feet and 240 feet under normal hydrologic conditions. Figure HYD4-6, Pit F2 Rule Curve — With-Project Conditions, shows the expected annual pattern of water surface elevations in Pit F2 with the ACRP in operation.

Comparison to Existing Conditions

Since monitoring of Pit F2 water levels began in 2012, the water surface elevation in Pit F2 has risen gradually, reaching an elevation of 223 feet in the winter of Water Year 2016 before falling back to elevation 155 feet by October of 2018, as shown in Figure HYD3-2. As of March 2019, water levels in Pit F2 have risen to 176 feet. With the proposed ACRP in operation, the SFPUC would manage the water surface elevations in Pit F2 such that they would fluctuate between elevations 180 feet and 240 feet (Figure HYD4-6). Under existing conditions since 2015, water surface elevations have recently dipped below this operational range. For much of 2017 up to March 2019, water surface elevations within Pit F2 were below the minimum project operational elevation of 180 feet. As such, water levels in Pit F2 with ACRP operation would be higher than those under existing conditions since continuous monitoring has been conducted (2012 to through 2018).

Comparison to With-CDRP Conditions

As noted above, by the winter of Water Year 2016, the water surface elevation in Pit F2 had reached elevation 223 feet before dropping to an elevation 155 feet by October of 2018 (See Figure HYD3-2). As of March 2019, water levels in Pit F2 have risen to 176 feet. Hanson Aggregates has been pumping water out of Pit F2, as needed, to maintain a safe water level and for aggregate and asphalt production purposes. The SFPUC expects that Hanson Aggregates will maintain the water surface elevation in the pit between elevation 150 feet and 220 feet for the next several years and will continue to do so once the CDRP is commissioned. When the ACRP is commissioned, the SFPUC would maintain the water level in Pit F2 between elevation 180 feet and 240 feet year round. So water levels in Pit F2 with the ACRP in operation would be higher than those under with-CDRP conditions.

5.1.2 Water Level Changes in Pit F2 Caused Indirectly by ACRP-Induced Changes in Seepage Rates

Water enters and leaves Pit F2 in several ways. Rainfall and local runoff enter directly into the pit and water evaporates from its surface. Most of the water that enters the pit does so by percolating from the subsurface through the layer of permeable stream channel deposits that, in the vicinity of Pit F2, extend from about elevation 250 feet to their base at about elevation 224 feet.[43] The primary source of water percolating into Pit F2 from the stream channel deposits is Alameda Creek, although much of it probably arrives after passing through one or more of the pits to the south. In this analysis, most of this volume of water is derived from the up to 17 cfs loss in streamflow to the subsurface between Welch Creek and San Antonio Creek. An additional volume of water enters Pit F2 between the cutoff walls immediately to the southeast of Pit F2. Estimates for this contribution, termed "seepage", are described within Appendix HYD2-R, Section 9.3, *Quantification of Seepage into Pit F2*. Seepage estimates are distinct from the 17 cfs loss in streamflow to the subsurface and, within the context of this analysis, should be viewed as related to the 7.5 cfs loss in streamflow to the subsurface between San Antonio Creek and the confluence with Arroyo de la Laguna. (See Section 4.3.1 and Tables HYD4-4 to HYD4-6.) The pits to the south have historically had higher water levels than Pit F2. Some of the water percolating into the pit may originate in water from runoff from hills to the east. The SFPUC estimates that the quantity of water originating from the east averages 1,034 acre-feet per year.

Differences in hydraulic head, a form of potential energy, cause water to make its way through the stream channel deposits. For example, if the subsurface water level in the stream channel deposits is at elevation 245 feet and the water surface elevation in Pit F2 is at elevation 230 feet, 15 feet of hydraulic head is available to overcome friction in the stream channel deposits and push subsurface water toward, and into the pit. As the subsurface water level in the stream channel deposits under

[43] It is difficult to precisely locate the base of the stream channel deposits when examining samples taken from boreholes so it was decided to rely on information from groundwater monitoring wells close to Pit F2. The water level in the monitoring wells has not fallen below elevation 224 feet during several years of monitoring so the base of the permeable stream channel deposits are assumed to be at that elevation. For more information, see Appendix HYD2-R, Section 4, *Regional and Project Area Geology*.

the creek falls, the amount of available hydraulic head decreases and the rate at which water moves toward the pit slows down and eventually stops when the water levels in the stream channel deposits and the pit equalize.

When the water level in the Pit F2 is above elevation 224 feet, the base of the stream channel deposits, it may cause water to move from the pit into the stream channel deposits depending on the water level in the deposits. For example, if the subsurface water level in the stream channel deposits is at elevation 225 feet and the water surface elevation in the pit is at elevation 240 feet, 15 feet of hydraulic head is available to drive water from the pit into the stream channel deposits.

If the water level in Pit F2 is below elevation 224 feet, the base of the stream channel deposits, it has no influence on the rate at which water percolates into the pit from the deposits. The rate at which water seeps into the pit from the stream channel deposits depends entirely on the water level in the deposits.

Comparison to Existing Conditions

As described above, and shown in Figure HYD3-2, since 2012 Pit F2 water levels have generally fluctuated between approximately a minimum 155 feet and a maximum of 223 feet. As of March 2019, water levels in Pit F2 have risen to 176 feet. As noted above, with the proposed ACRP in operation, the SFPUC plans to keep water levels in Pit F2 in the range of elevation 180 feet to 240 feet with the proposed ACRP in operation as indicated on the ACRP rule curve shown in Figure HYD4-6.

Using the ACRP rule curve, with the ACRP in operation, from January to April, the SFPUC expects the water level in the pit to be close to the maximum of 240 feet. During such times, if the water level is above elevation 224 feet, some water would move out of the pit into the stream channel deposits adjacent to Alameda Creek. Under existing conditions, the water level has always been below elevation 224 feet and so water has never moved from the pit to the stream channel deposits adjacent to Alameda Creek. Similarly, from May to June, the SFPUC expects the water level in the pit to be between 225 feet and 240 feet, above the maximum observed elevation under the existing conditions.

From July to December, the SFPUC expects the pit elevation to fluctuate between 180 feet and 225 feet, but not to drop below 180 feet. During that period, the rate of water movement to and from the pit to the stream channel deposits under Alameda Creek would be similar for with-project conditions as it is for existing conditions. Under both conditions, water would move from the stream channel deposits under Alameda Creek into the pit during this period. The rate of movement would depend entirely on subsurface water levels in the stream channel deposits under Alameda Creek and would be similar for existing and with-project conditions. With-project Pit F2 elevations are likely to be higher than the existing condition for much of this period, which would reduce the amount of movement from stream channel deposits into the pit.

Comparison to with-CDRP Conditions

Hanson Aggregates is assumed to maintain water levels in Pit F2 between elevation 150 feet and 220 feet until the CDRP is commissioned and is expected to do so, consistent with its current practices, when the CDRP is in operation. The SFPUC would keep the water level in Pit F2 at a higher operational range (180 feet to 240 feet) after the ACRP is commissioned. Consequently, the rates of seepage from Pit F2 to the surrounding ground would be higher under the with-project condition relative to the with-CDRP condition. Conversely, rates of seepage from the surrounding aquifer to Pit F2 would be higher under the with-CDRP than under the with-project condition (see Appendix HYD2-R, Section 9.3, *Quantification of Seepage into Pit F2,* for a discussion of seepage rates between the with-CDRP and with-project conditions).

5.1.3 ACRP-Caused Changes in Water Levels in Pit F2 and their relationship to flows in Alameda Creek

Under both the CDRP and ACRP, released and bypassed water would passively seep into Pit F2. Project operations would result in variable storage levels in Pit F2, and the pit water levels would be lowered by pumping during the operating period of July 1 to November 30. Storage levels would have the potential to affect the rate, timing, and duration of the movement of water in and out of the adjacent shallow aquifer. Since the creek is most directly connected to the shallow aquifer, seepage into the pit may affect streamflow.

In the project vicinity, the valley floor is overlain by highly permeable alluvium of shallow vertical extent that includes recent alluvium and stream channel gravels. These materials comprise a shallow aquifer which is incised by Alameda Creek. The shallow aquifer materials range in thickness up to 60 feet, though the saturated thickness is only 10 to 25 feet. Underlying the shallow aquifer materials are units of older alluvium including the Livermore Gravels, which may be up to several hundred feet in thickness. In the project setting, surface water in Alameda Creek readily percolates through the streambed and into the shallow aquifer. However, because of high clay content and comparatively lower permeability, surface water does not discernably interact with groundwater in the Older Alluvium and Livermore Gravels units.

Appendix HYD2-R quantifies groundwater-surface water interactions that are relevant to the proposed ACRP operation. Please see Appendix HYD2-R (in particular Section 9, *Quantification of Aquifer Flow and Seepage*) for the discussion of the project's potential to affect seepage into the pit and its relationship to Alameda Creek streamflow. $Inflow - Outflow = Change\ in\ StorageInflow - Outflow = Change\ in\ Storage$

5.2 ACRP-Induced Changes in Estimated NPDES Discharges by the Quarry Operators and their Effects on Flow in Alameda Creek

The ACRP would remove an annual average of 6,045 acre-feet of water from Pit F2 and transfer it to San Antonio Reservoir or the SVWTP for use as municipal water supplies. The removal of water from Pit F2 by the SFPUC would likely affect how Hanson Aggregates manages water in its other pits. If changes in the way that Hanson Aggregates manages water results in changes in the volume of water that it discharges to Alameda Creek under its NPDES permit, then flow in Alameda Creek downstream of the quarries would be affected.[44]

The amount of water that the operators discharge to Alameda Creek under their NPDES permits depends on a number of factors but, as described above in Section 4, one of the most important factors is the rate at which water percolates into the bed of Alameda Creek in the reach of the creek adjacent to the quarry pits. The method used to estimate the volume of the quarry NPDES discharges under the four scenarios depends on the relationship between the volume of water entering the pits from subsurface sources and the volume of water leaving the quarries in the form of NPDES discharges to Alameda Creek. The method is described above in Section 4, Analytical Methods.

The reported NPDES discharges from Hanson Aggregates for the period Water Year 1996 to Water Year 2013 have averaged 3,436 acre-feet per year and varied between a maximum of 5,328 acre-feet per year to a minimum of 103 acre-feet per year. Reported daily NPDES discharge volumes from Hanson Aggregates were input to the ASDHM just downstream of the San Antonio Creek confluence to calculate flow in Alameda Creek downstream of the NPDES discharge point under existing conditions.

As shown in Table HYD4-8, for with-CDRP conditions, quarry NPDES discharges were estimated to average 6,739 acre-feet per year and range from a maximum of 8,446 acre-feet in 1998 to a minimum of 4,455 acre-feet in 2008. For with-project conditions, NPDES discharges were estimated to average 3,870 acre-feet per year and range from a maximum of 6,787 acre-feet in 1999 to a minimum of 1,355 acre-feet in 2009.

The Hanson Aggregates NPDES discharges, which occur primarily during the night, have had an erratic effect on flow in Alameda Creek between the stretch of creek 550 feet downstream of Node 6 (the Alameda Creek confluence with San Antonio Creek) and the confluence with the Arroyo de la Laguna, sometimes adding considerable volumes of water and sometimes not. Although the volume of Hanson Aggregates' NPDES discharges is expected to change under with-CDRP and with-project conditions compared to existing conditions, the NPDES discharges are expected to continue to occur erratically and to have an erratic effect on streamflow between the NPDES discharge point and Alameda Creek's confluence with the Arroyo de la Laguna.

The effect of the NPDES discharges from the quarries on flow in Alameda Creek downstream of the confluence with Arroyo de la Laguna is much less than it is upstream of the confluence to the discharge point for two reasons. The first reason is that up to 7.5 cfs of the water contributed by the

[44] The other quarry operator, ODS, also discharges water from the quarries it manages to Alameda Creek under NPDES permits. ODS's past discharge volume has been small compared to the Hanson Aggregates' discharge volume, and water management changes at ODS' quarries has further reduced their NPDES discharge volume. For these reasons, ODS discharges were not included in the estimates of future discharges to Alameda Creek by the quarries.

NPDES discharges from the quarries percolates into the ground between the quarry discharge point and the confluence with the arroyo (see Table HYD4-5), reducing streamflow contributed by the discharges by the time it reaches Arroyo de la Laguna.[45] The second reason is that the flow of water entering Alameda Creek from the arroyo is considerably greater than the flow of water in Alameda Creek upstream of the confluence with the arroyo and so any effects of the NPDES discharges on streamflow are proportionally less than they are upstream of the arroyo.

5.3 Comparison of Streamflow between Scenarios

The following comparison of existing, pre-2001, with-CDRP, and with-project conditions was made using hydrology for the 18-year period from Water Year 1996 to Water Year 2013.

The ASDHM was used to estimate flow in Alameda Creek, existing, pre-2001, with-CDRP, and with-project conditions, at several locations, referred to as nodes, along the creek. The locations of the nodes are shown in Figures HYD2-2 and HYD4-2. The losses of Alameda Creek surface water to the subsurface, described above in Section 4, Analytical Methods, occur between the Welch Creek confluence (Node 4) and just upstream of the San Antonio Creek confluence (Node 5). Post processing for the CEQA analysis incorporated gain from the quarry NPDES discharges between just downstream of the San Antonio Creek confluence (Node 6˚, which is located 550 feet downstream of Node 6) and the Arroyo de la Laguna confluence (Node 7) as well as 7.5 cfs loss between Nodes 6˚ and 7. In this CEQA analysis flow estimates at Node 6, and all locations on Alameda Creek downstream of the Node 6, are influenced by the NPDES discharges from the quarries.

Information on daily, monthly, and annual flows was compiled and is described below. Daily flow information is needed for the comparison of conditions for fish and downstream water users under the different scenarios, and is represented in the form of hydrographs and flow duration curves and hydrographs. Information on monthly and annual flows is needed to compare conditions for vegetation, wildlife, and downstream water users under the different scenarios. Average monthly streamflow comparisons are primarily used for the riparian impact analysis and are contained within Section 6.3, Riparian Vegetation. Annual streamflow volumes are shown below for the Sunol Valley and within Section 7 as it relates to potential impacts on ACWD's operations.

5.3.1 Flow Duration Curves

Flow duration curves depict the percentage of time a specific stream flow is equaled or exceeded at specific locations and are a useful representation of streamflow under different conditions. The curves are based on daily time step data using the hydrology for the 18-year period from Water Year 1996 to Water Year 2013 and include the post-processing estimates of losses of up to 7.5 cfs to the subsurface between San Antonio Creek (Node 6˚) and Arroyo de la Laguna confluences (Node 7) and gains from quarry NPDES discharges, which occur at Node 6˚.

[45] Over the 18-year study period, the daily average quarry NPDES discharge under the with-CDRP and with-project scenarios are 9.3 cfs and 5.3 cfs, respectively.

Figures HYD5-1, **HYD5-2** and **HYD5-3** compare flow duration curves for pre-2001, existing, with-CDRP, and with-project conditions at three locations on Alameda Creek. The three locations are just downstream of the Welch Creek confluence (Node 4), just upstream of the San Antonio Creek confluence (Node 5), and just upstream of the Arroyo de la Laguna confluence (Node 7).

Node 4 was chosen as a comparison point because it is downstream from the compliance location for releases and bypass from Calaveras Reservoir, and because it is upstream of the modeled streamflow losses within the Sunol Valley. Node 5 was chosen for comparison because it is located downstream of the 17 cfs loss to the subsurface within the Sunol Valley, but upstream of Pit F2 and project operations. Node 7 was chosen because it is located downstream of Pit F2, the NPDES discharge point, and the stretch of creek in which the 7.5 cfs loss of streamflow to the subsurface occurs (i.e., downstream of the ASDHM and CEQA post-processed losses and gains in streamflow).

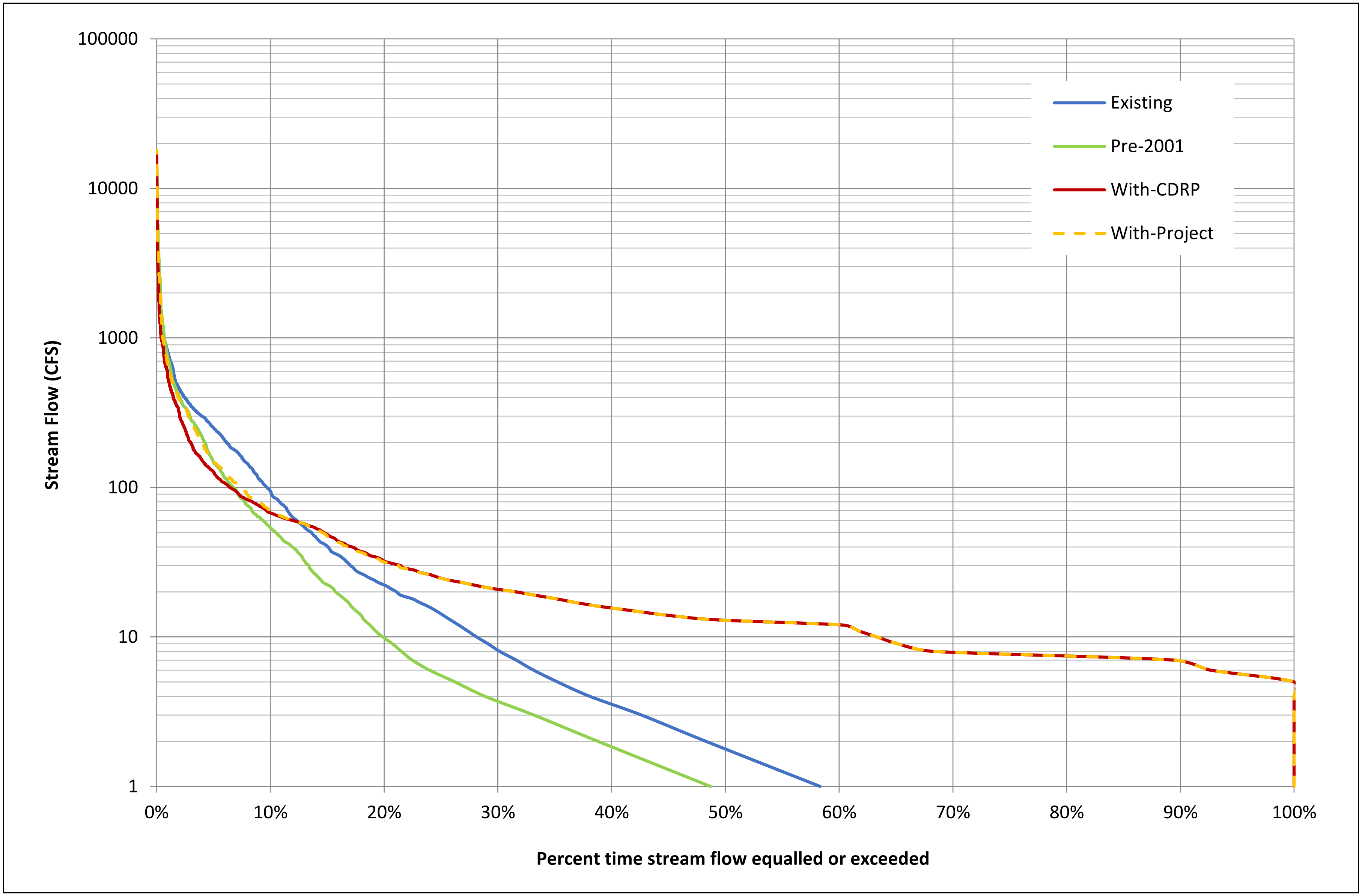
Figure HYD5-1 shows flow duration curves based on daily data for all four scenarios just downstream of the Welch Creek confluence (Node 4). Under pre-2001 conditions, flow exceeds one cfs on about 49 percent of the days. Under existing conditions, flow exceeds one cfs on about 58 percent of the days. Under with-CDRP and with-project conditions, flow is never less than 5 cfs on any day because of the releases from Calaveras Reservoir and bypasses at the ACDD that are part of the CDRP.

Figure HYD5-2 compares flow duration curves for pre-2001, existing, with-CDRP, and with-project conditions just upstream of San Antonio Creek confluence (Node 5). Node 5 is about 200 feet upstream of the proposed ACRP. Under pre-2001 conditions, flow exceeds one cfs on about 18 percent of the days. Under existing conditions, flow exceeds one cfs on about 25 percent of the days; under both with-CDRP and with-project conditions, flow exceeds one cfs on about 37 percent of the days.[46]

The reduced frequency of days (compared to Node 4) when flows exceed one cfs under all four conditions at this location is attributable to the losses to the subsurface that occur between the Welch Creek (Node 4) and San Antonio Creek confluences (Node 5). The increased frequency of days when flows exceed one cfs under with-CDRP and with-project conditions is attributable to the releases of water from Calaveras Reservoir and bypasses of water at the Alameda Creek Diversion Dam.

Figure HYD5-3 compares flow duration curves for pre-2001, existing, with-CDRP, and with-project conditions downstream of the proposed project area and just upstream of the Arroyo de la Laguna confluence (Node 7). Under pre-2001 conditions, flow exceeds one cfs on 19 percent of the days. Under existing conditions, flow exceeds one cfs on 27 percent of the days. Under with-CDRP conditions, flow exceeds one cfs on 78 percent of the days. Under with-project conditions, flow exceeds one cfs on 44 percent of the days. Under all four conditions, surface water is added between the San Antonio Creek and Arroyo de la Laguna confluences as a result of the quarry NPDES discharges but also lost to the subsurface by percolation. The estimated increase in flow due to the quarry NPDES discharges is greatest under with-CDRP conditions.

[46] Within the primary and extended study areas one (1) cfs does not have biological or regulatory significance. It is included in this analysis only as a point of comparison for low-flow conditions within the creek.

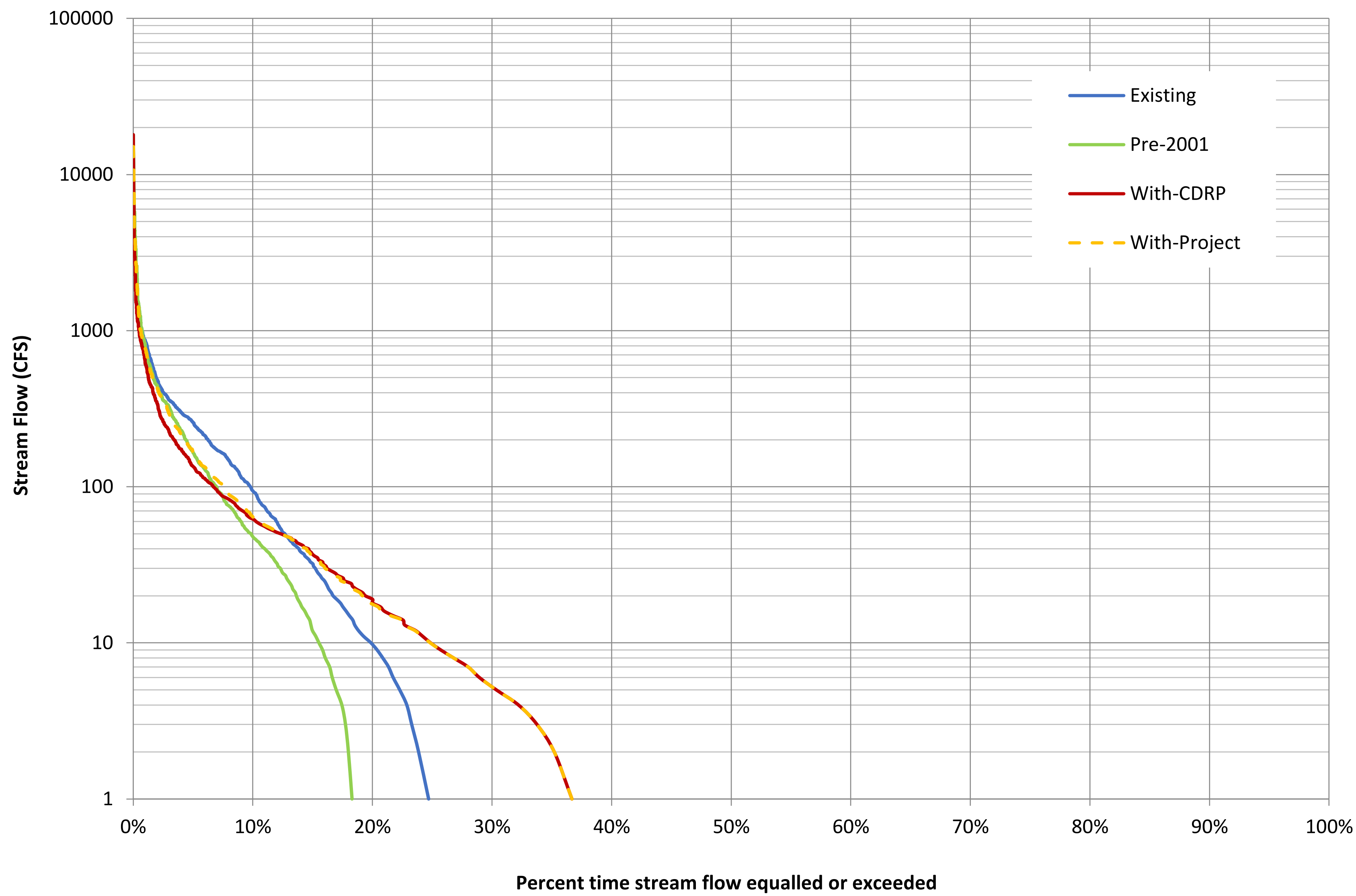


SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

Figure HYD5-1

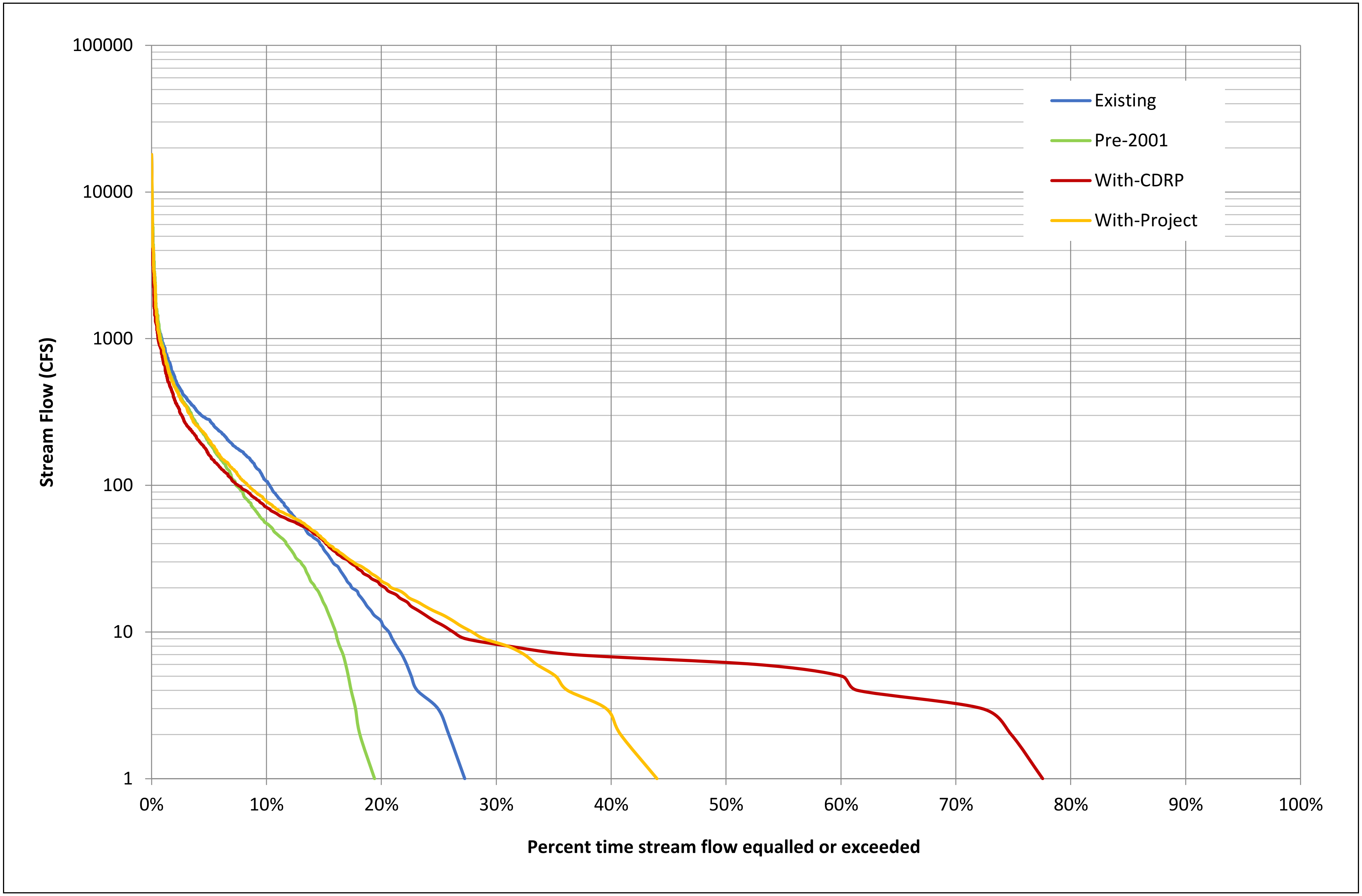
Flow Duration Curves for Node 4 (Alameda Creek below Welch Creek)
For Existing, Pre-2001, with-CDRP, and with-Project Conditions



SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

Figure HYD5-2
Flow Duration Curves for Node 5 (Alameda Creek above San Antonio Creek)
For Existing, Pre-2001, with-CDRP, and with-Project Conditions



SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6 and losses between Node 6 and 7 by ESA/Orion.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

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Figure HYD5-3

Flow Duration Curves for Node 7 (Alameda Creek above Arroyo de la Laguna) For Existing, Pre-2001, with-CDRP, and with-Project Conditions

5.3.2 Hydrographs

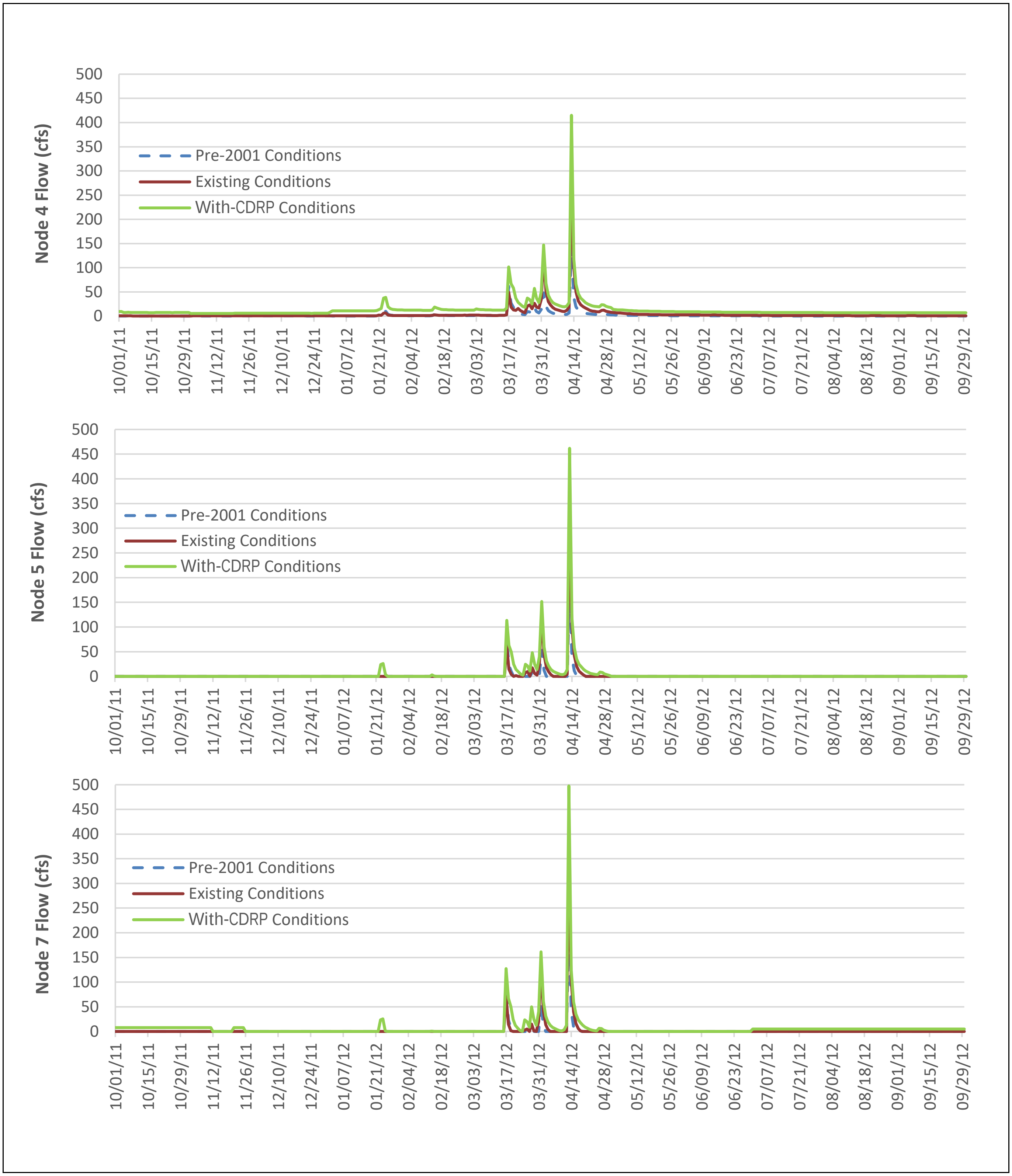
Daily hydrographs at three different nodes are presented below for three selected water years: Water Year 2012 (exceedance probability 91 percent), Water Year 2008 (exceedance probability 64 percent), and Water Year 2011 (exceedance probability 28 percent). These water represent a range of hydrologic conditions, with the exceedance probabilities from high to low indicating ranges of dry to wet water year types. For each of these water years, daily hydrographs are provided that include quarry NPDES discharges and additional streamflow losses between the confluences of Alameda Creek with San Antonio Creek and the Arroyo de la Laguna. These hydrographs are provided to illustrate the difference in streamflow among scenarios over the course of a water year.

Comparison of Pre-2001, Existing, and with-CDRP Conditions

A series of daily hydrographs are presented at Nodes 4, 5, and 7 for the pre-2001, existing, with-CDRP, and with-project conditions. Node 4 is downstream of SFPUC's compliance location and is the most upstream node in the Sunol Valley. The SFPUC's compliance location is the location in the watershed specified in the CDRP regulatory permit where streamflows are measured to ensure compliance with the instream flow schedule shown in Table HYD1-2. The change between Node 4 and Node 5 depicts the influence of creek losses to the subsurface in Sunol Valley. Node 7 represents flow downstream of the ACRP project site before Alameda Creek meets Arroyo de la Laguna Creek (**Figures HYD5-4A**, **HYD5-4B**, and **HYD5-4C**).

Due to continuous release of instream and bypass flows, in general, at Node 4, with-CDRP flows are higher than pre-2001 flows (Figures HYD5-4A and HYD5-4B); although when Calaveras Reservoir spills occur, pre-2001 flows are higher than with-CDRP flows (HYD5-4C). In drier years, during which Calaveras Reservoir does not spill, with-CDRP flows at Node 4 are always higher than pre-2001 flows. For example, in Water Year 2012, with-CDRP flows at Node 4 are always higher than pre-2001 flows, with the difference as high as 270 cfs. Although Water Year 2012 was very dry, with-CDRP peak flows exceed 100 cfs in March 2012 on two occasions due to reduced diversion capacity of the Alameda Creek Diversion Dam. During the Alameda Creek Diversion Dam non-diversion period, the with-CDRP conditions peak flow at Node 4 exceeds 400 cfs in April 2012.

However, in some years there are instances during which Calaveras Reservoir was full in pre-2001 conditions, resulting in spill, whereas the reservoir did not spill under with-CDRP conditions. Since there are no instream and bypass flow requirements in pre-2001 conditions, Calaveras Reservoir is generally at higher elevations than under with-CDRP conditions. For example, pre-2001 flows are greater than with-CDRP flows at Node 4 for five days in Water Year 2008 as Calaveras Reservoir spills for five days in pre-2001 conditions but it does not spill under with-CDRP conditions (see February 2008 storm in Figure HYD5-4B). In Water Year 2011 under the exceedance probability of 28 percent (wet year), Calaveras Reservoir spills in both with-CDRP and pre-2001 conditions. Since Calaveras is at much higher elevation in pre-2001 conditions compared to with-CDRP conditions, the spill rate is higher under the pre-2001 conditions.

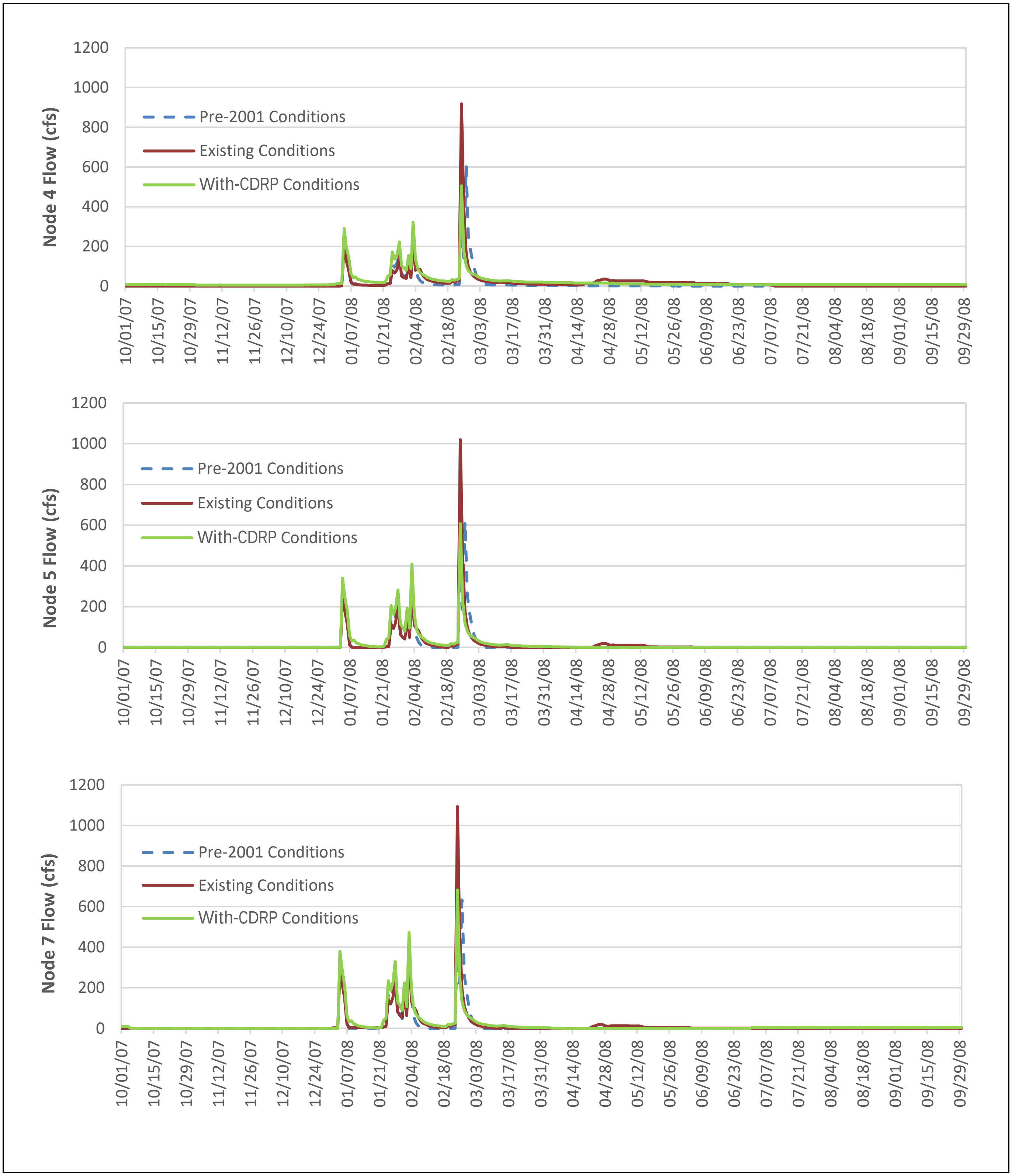


SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6 and losses between Node 6 and 7 by ESA/Orion.

SFPUC Alameda Creek Recapture Project

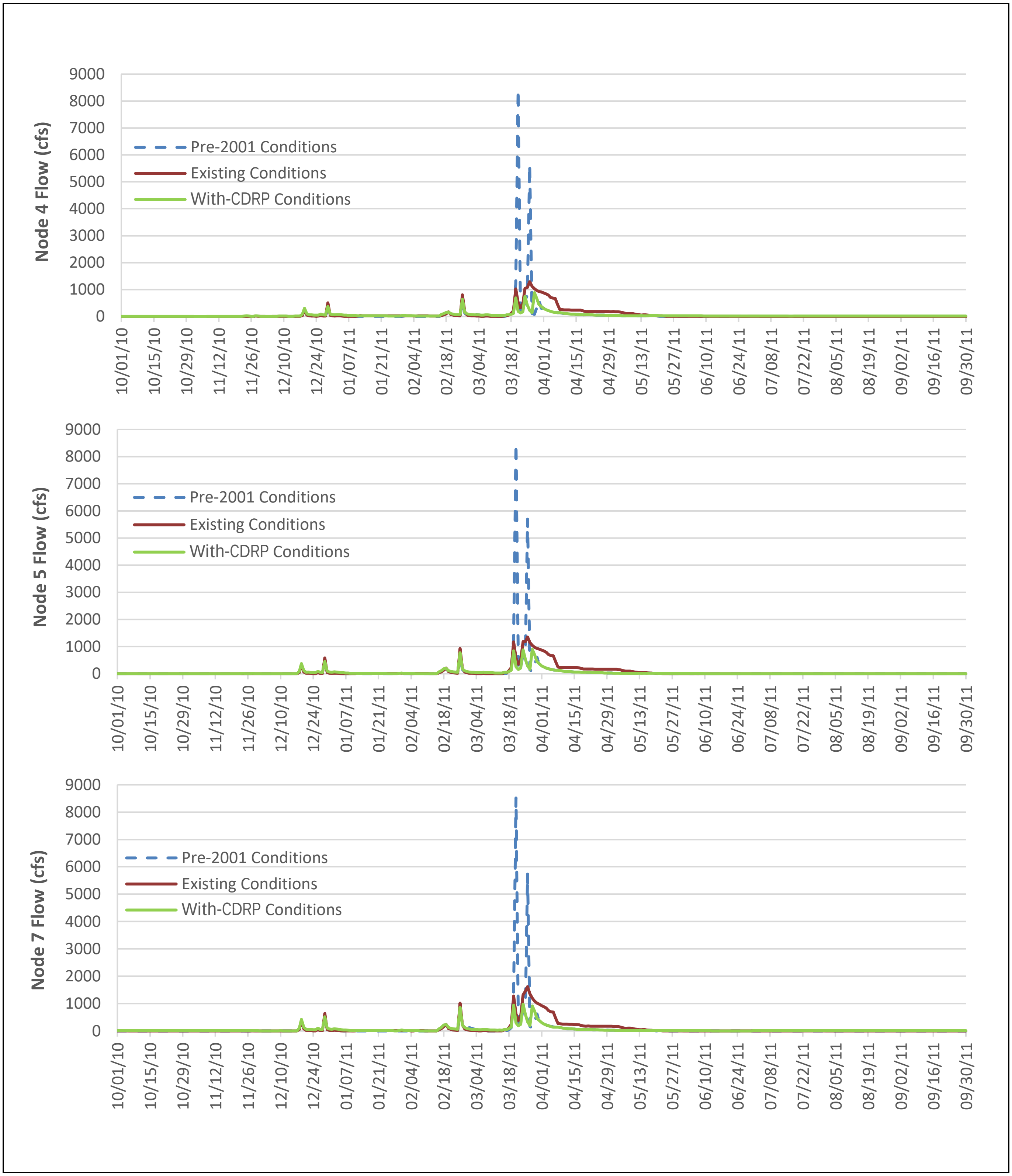
Figure HYD5-4A

Daily Hydrographs for WY 2012 (Ex. Prob. 91%) at Nodes 4, 5, and 7 for Pre-2001, Existing, and with-CDRP Conditions



SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6 and losses between Node 6 and 7 by ESA/Orion.

Figure HYD5-4B
Daily Hydrographs for WY 2008 (Ex. Prob. 64%) at Nodes 4, 5, and 7 for Pre-2001, Existing, and with-CDRP Conditions



SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6 and losses between Node 6 and 7 by ESA/Orion.

SFPUC Alameda Creek Recapture Project

Figure HYD5-4C

Daily Hydrographs for WY 2011 (Ex. Prob. 28%) at Nodes 4, 5, and 7 for Pre-2001, Existing, and with-CDRP Conditions

However, even in Water Year 2011 (wet year), flows at Node 4 are higher under the pre-2001 conditions for only 16 days compared to with-CDRP conditions. Water Years 2011 and 2012 represent the construction period of Calaveras Reservoir under the existing conditions and Water Year 2008 represents the DSOD period. During these periods, Calaveras Reservoir and the Alameda Creek Diversion Dam are operated as demanded by such limitations and does not represent a typical operation as represented in with-CDRP conditions. Flows are either lower or higher in existing conditions compared to with-CDRP conditions depending on how the Alameda Creek Diversion Dam and Calaveras Reservoir are operated to accommodate the limited operational capacity of Calaveras Reservoir. Nevertheless, the pattern of larger flows including peaks at Node 4 are in general similar between existing and with-CDRP conditions.

The pattern of flows at Node 5 is similar to Node 4 for larger flows. Node 5 receives additional contributions from the watershed between Node 4 and Node 5 during rainy periods. Therefore, flow peaks are slightly higher at Node 5 compared to Node 4 despite creek losses to the subsurface in the Sunol Valley. Due to the Sunol Valley creek loss of 17 cfs, in general, Node 5 does not have flows from June to November in all conditions. Although the Alameda Creek Diversion Dam is not operated between April and November during with-CDRP conditions, the reach of Alameda Creek in the vicinity of the Alameda Creek Diversion Dam does not have significant flows during June to November. The maximum instream flow from Calaveras Reservoir during June to November is 12 cfs.

The pattern of flows at Node 7 is similar to Node 5 for all flow ranges. Node 7 receives additional contributions from the watershed between Node 5 and Node 7 during rainy periods. Therefore, in all conditions, flow peaks are higher at Node 7 compared to Node 5. In the post-processed analytical results presented in this report both the creek gains from quarry NPDES discharges and creek losses to the subsurface between Node 6˚ and Node 7 have been incorporated. Creek losses of up to 7.5 cfs have been assumed between Node 6˚ and Node 7. When the quarry NPDES discharges at Node 6˚ are less than 7.5 cfs, Node 7 flows are the same in both methods of calculations. Therefore, the addition of the quarry NPDES discharge creek gains and losses incorporated between Node 6˚ and Node 7 do not pose hydrologic significance to affect hydrographs during rainy periods. However, Node 7 under this new calculation may receive small flows in all conditions during the period when the estimated quarry NPDES discharge at Node 6˚ is greater than 7.5 cfs. Therefore, at times, Node 7 has flows between June and November. During such hydrologic situation, there are no flows between Nodes 4 and 5 and there are flows between Nodes 6˚ and Node 7 albeit very small. For three examples presented here, the average creek gain from the quarry NPDES discharge in Water Years 2012, 2008, and 2011 in pre-2001 conditions are 0.1 cfs, 2.6 cfs, and 5.2 cfs, respectively. Similarly, under the existing conditions flows are 0.1 cfs, 5.1 cfs, and 6.2 cfs, respectively. Under with-CDRP conditions, in Water Years 2012, 2008, and 2011, they are 4.2 cfs, 6.3 cfs, and 8.8 cfs, from December to June, and 12.5 cfs, 11.1 cfs, 15.1 cfs, from July to November, respectively.

Comparison of with-CDRP and with-Project Conditions

Daily hydrographs Nodes 4, 5, and 7 are also used as a point of comparison between with-CDRP conditions and with-project conditions for the same three water years, Water Years 2012, 2008, and 2011. This series is shown in **Figures HYD 5-5A**, **HYD5-5B,** and **HYD5-5C**.

Because instream flows are the same in both conditions, in general, at Node 4, with-project conditions flows are the same as with-CDRP flows except in wet years when spills from Calaveras Reservoir occur. In hydrologic years during which Calaveras Reservoir does not spill, with-project condition flows at Node 4 are always the same as with-CDRP flows. For example, Calaveras Reservoir does not spill in Water Year 2012 and Water Year 2008 and as depicted in Figures HYD5-5A and HYD5-5B under with-project and with-CDRP conditions flows at Node 4 are identical throughout the hydrologic years.[47] However, in wet years there are instances during which Calaveras Reservoir is full resulting in spill under both conditions (or only in with- Project conditions like in Water Year 2005, not shown in the figure). Under the with-project conditions, because ACRP would be available to meet water demand, Calaveras Reservoir is generally at higher elevations than under with-CDRP conditions. This is because under with-CDRP conditions, Calaveras Reservoir is drawn down further to meet demand. In Water Year 2011 (wet year), Calaveras Reservoir spills under both with-project and with-CDRP conditions. Since Calaveras Reservoir is at a much higher elevation in with-project conditions compared to with-CDRP conditions spill rates are higher in with-project conditions (see peaks in March 2011 in Figure HYD 5-5C).

The pattern of flows at Node 5 is similar to Node 4 for all flows during both conditions. In Water Year 2012 and 2008, during which Calaveras Reservoir does not spill, flows at Node 5 are the same under both with-project and with-CDRP conditions for the entire hydrologic period. Node 5 receives the same additional contributions from the watershed between Node 4 and Node 5 during rainy periods under both conditions. Therefore, flow peaks are slightly higher at Node 5 compared to Node 4 under both conditions despite losses in the Sunol Valley. Due to the Sunol Valley loss of 17 cfs, in general, Node 5 does not have flows from June to November under both conditions. Although the Alameda Creek Diversion Dam is not operated between April and November under both conditions, the reach of Alameda Creek in the vicinity of the Alameda Creek Diversion Dam does not have significant flows during June to November. The maximum instream flow from Calaveras Reservoir during June to November is 12 cfs.

The pattern of flows at Node 7 is similar to Node 5 for all flows under both conditions. In Water Years 2012 and 2008, during which Calaveras Reservoir does not spill, flows at Node 7 are the same under both with-project and with-CDRP conditions for the entire hydrologic period. Node 7 receives the same additional contributions from the watershed between Node 5 and Node 7 during rainy periods under both conditions. Therefore, flow peaks are higher at Node 7 compared to Node 5.

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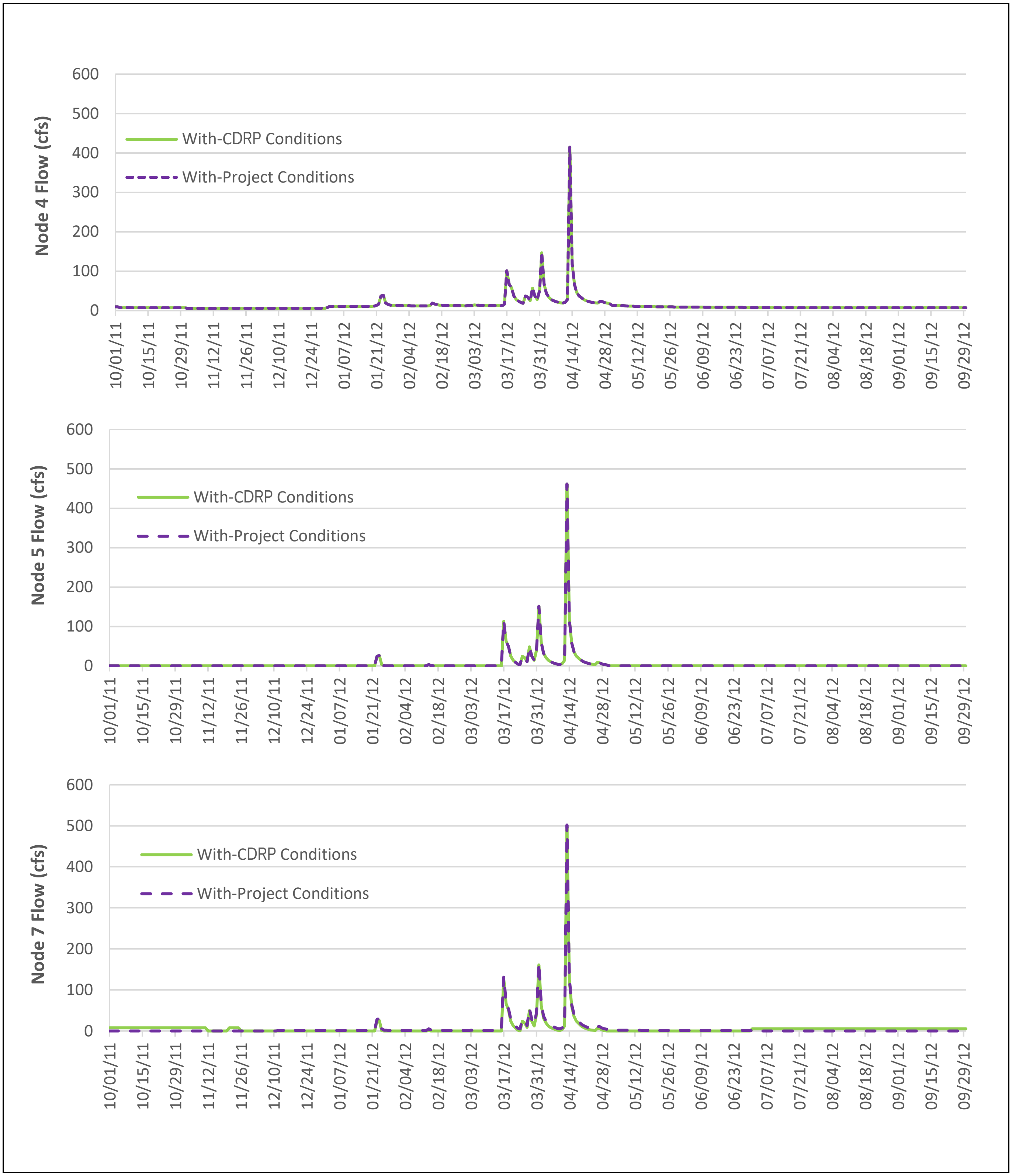
[47] As described above under Section 4.2.1, ASDHM Development History, Modeled Spills from Calaveras Reservoir, while unregulated spills occur semi-regularly during wet conditions in the modeling, during operation of the project the SFPUC would manage reservoir operations to minimize spill from Calaveras Dam. Table HYD4-2 shows that, when spill events are modeled, they typically occur under both the with-CDRP and with-project scenarios, but at different times (with-project spill events occurring earlier in the water year). Overall, the differences in spill events between scenarios over the 18-year study period has a minor impact on overall streamflow within Alameda Creek.

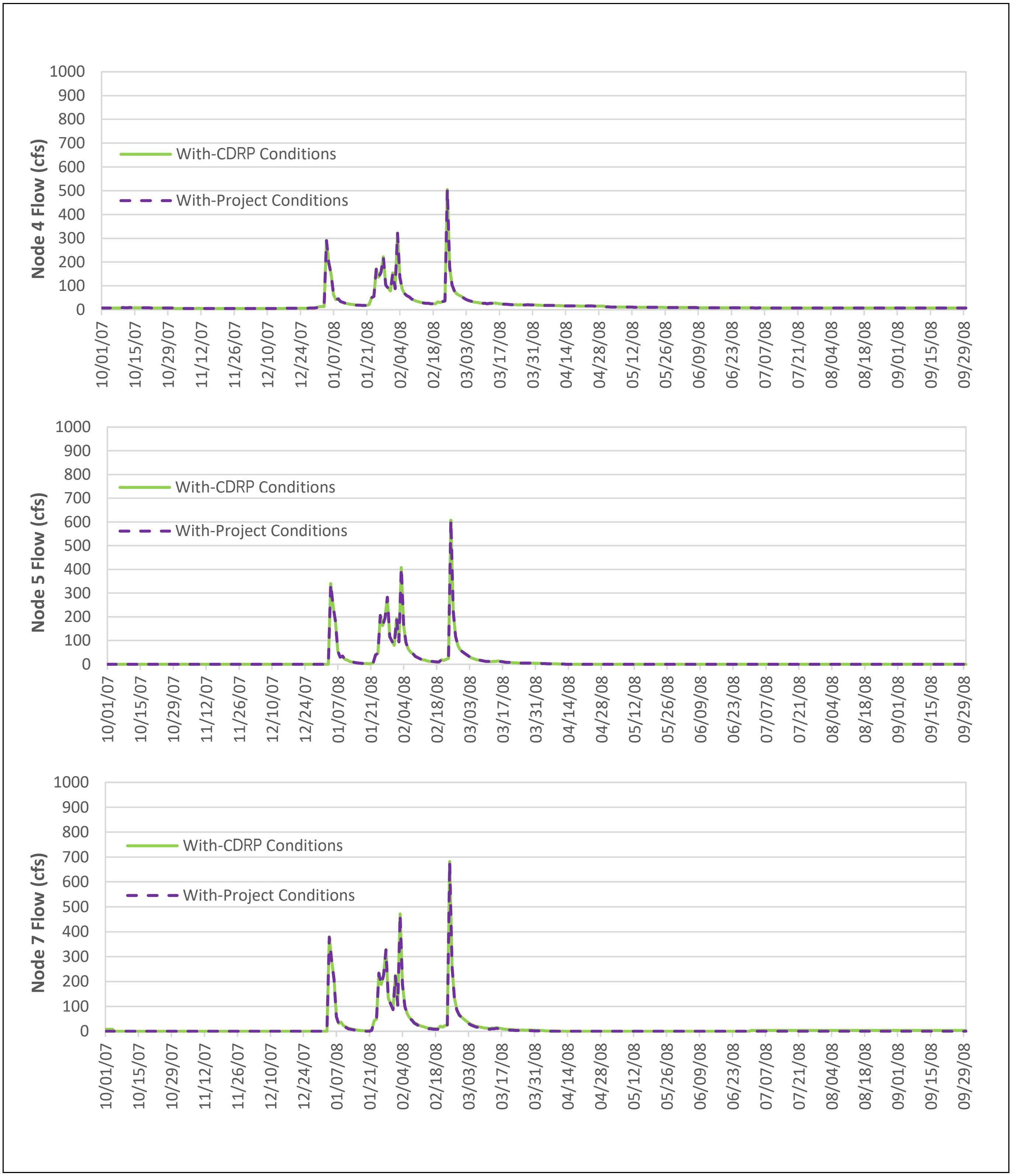


SOURCE: SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6 and losses between Node 6 and 7 by ESA/Orion.

SFPUC Alameda Creek Recapture Project

Figure HYD5-5A

Daily Hydrographs for WY 2012 (Ex. Prob. 91%) at Nodes 4, 5, and 7 for with-CDRP and with-Project Conditions

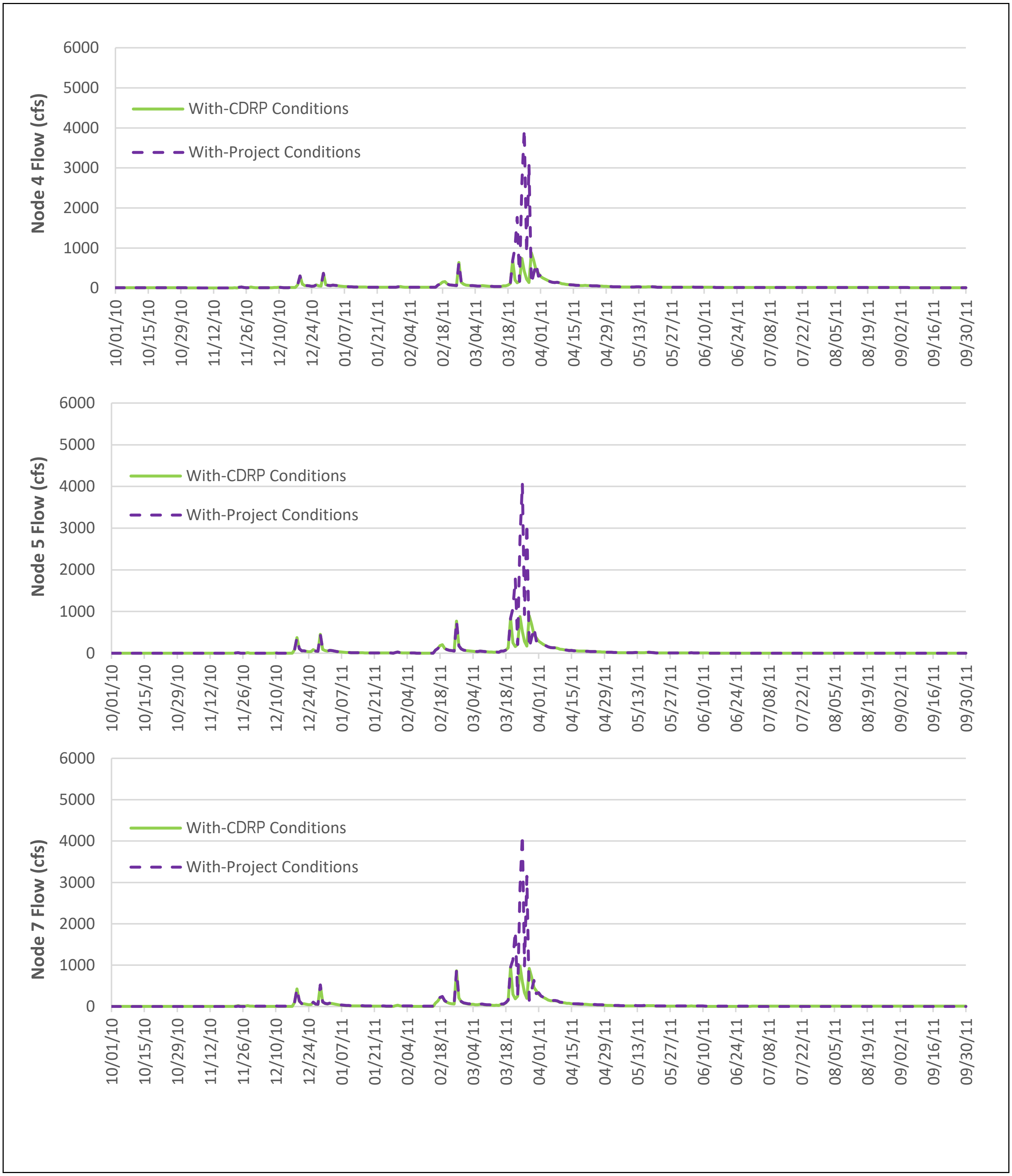


SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6 and losses between Node 6 and 7 by ESA/Orion.

SFPUC Alameda Creek Recapture Project

Figure HYD5-5B

Daily Hydrographs for WY 2008 (Ex. Prob. 64%) at Nodes 4, 5, and 7 for with-CDRP and with-Project Conditions



SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted by ESA/Orion. Adjusted to include NPDES quarry discharges at Node 6 and losses between Node 6 and 7 by ESA/Orion.

SFPUC Alameda Creek Recapture Project

Figure HYD5-5C

Daily Hydrographs for WY 2011 (Ex. Prob. 28%) at Nodes 4, 5, and 7 for with-CDRP and with-Project Conditions

In the post-processed analytical results presented in this report, both creek gains from quarry NPDES discharges and creek losses to the subsurface between Node 6˚ and Node 7 have been incorporated. Losses of 7.5 cfs have been assumed between Node 6˚ and Node 7. When quarry NPDES discharges at Node 6˚ are less than 7.5 cfs, Node 7 flows are the same in both methods of calculations. Therefore, the addition of the quarry NPDES discharge creek gains and losses incorporated between Node 6˚ and Node 7 do not pose hydrologic significance to affect hydrographs during rainy periods. However, Node 7 in this new calculation may receive small flows under both conditions during the period when the estimated quarry NPDES discharge at Node 6˚ is greater than 7.5 cfs. Therefore, at times, Node 7 has flows in this new calculation during June and November. During such hydrologic situations there are no flows between Nodes 4 and 5 and there are flows between Node 6˚ and Node 7, albeit very small. For the three examples presented here, under with-CDRP conditions, the average quarry NPDES discharge creek gain in Water Years 2012, 2008, and 2011, is 4.2 cfs, 6.3 cfs, and 8.8 cfs, from December to June, and 12.5 cfs, 11.1 cfs, 15.1 cfs, from July to November, respectively. Under with-project conditions, in Water Years 2012, 2008, and 2011, they are 8.7 cfs, 4.2 cfs, and 14.8 cfs, from December to June, and 0.2 cfs, 0.1 cfs, 0.6 cfs, from July to November, respectively.

5.4 Estimated Annual Flows

5.4.1 Annual Flow Volumes

Tables HYD5-1, **HYD5-2**, and **HYD5-3** show estimated annual surface flow volumes under the existing, pre-2001, with-CDRP, and with-project conditions for the 18-year period from Water Year 1996 to Water Year 2013 at three locations along Alameda Creek.[48] Table HYD5-1 shows estimated Alameda Creek flow volumes below the Welch Creek confluence (Node 4); Table HYD5-2 shows creek flow volumes above the San Antonio Creek confluence (Node 5); and Table HYD5-3 shows creek flow volumes above the Arroyo de la Laguna confluence (Node 7). Between the Welch Creek confluence and the Arroyo de la Laguna confluence, water is added to Alameda Creek by accretion; that is, water from storm runoff and tributaries. It is also added by NPDES discharges from the quarries. It is lost to the subsurface by percolation into the streambed. About 70 percent of the losses to the streambed occur between the Welch Creek and San Antonio Creek confluences and the remainder between the San Antonio Creek and Arroyo de la Laguna confluences.

As shown in Table HYD5-1, average annual flow volume in Alameda Creek below the Welch Creek confluence (Node 4) under existing conditions between Water Year 1996 and Water Year 2013 is estimated to be 36,011 acre-feet. Estimated annual flow volume ranged from 126,246 acre-feet in 1998 to 2,801 acre-feet in 2001. Average annual flow under pre-2001 conditions between Water Year 1996 and Water Year 2013 is estimated to be 31,881 acre-feet, ranging from 126,246 acre-feet in 1998 to

[48] The underlying post-processed daily streamflow data for the existing and pre-2001 conditions remains unchanged from the June 2017 EIR. However, modifications were made to the calculation methodology used to convert daily data to annual volumes. In summarizing the daily streamflow data as annual volumes, the June 2017 EIR methodology did not account for the additional days during leap years. As such, the annual volumes shown for the existing and pre-2001 conditions are slightly different than contained within the June 2017 EIR.

1,609 acre-feet in 2012. Estimated average annual flow volume under existing conditions is greater than under pre-2001 conditions because, under the former, DSOD restrictions on storage in Calaveras Reservoir limited the amount of water the SFPUC could divert from Alameda Creek.

TABLE HYD5-1
ESTIMATED ANNUAL FLOW VOLUME IN ALAMEDA CREEK
BELOW WELCH CREEK CONFLUENCE (NODE 4) FOR WY1996-WY2013 (acre-feet)

Water Year	Pre-2001 Conditions	Existing Conditions	With-CDRP Conditions	With-Project Conditions	Year type
1996	85,655	85,655	90,758	91,227	Wet
1997	76,077	76,077	75,973	84,024	Wet
1998	126,246	126,246	124,727	130,305	Wet
1999	21,127	21,127	25,949	25,949	Wet
2000	28,297	32,833	25,577	34,485	Wet
2001	3,280	2,801	12,001	12,001	Dry
2002	3,341	30,167	13,406	13,406	Dry
2003	7,152	15,525	20,808	20,808	Dry
2004	4,729	6,031	14,652	14,652	Dry
2005	49,554	56,543	27,737	40,869	Wet
2006	67,811	78,148	48,558	72,748	Wet
2007	2,562	6,759	11,193	11,193	Dry
2008	7,960	11,761	15,383	15,383	Dry
2009	16,321	9,782	14,953	17,374	Wet
2010	17,913	14,861	20,000	25,045	Wet
2011	50,784	54,059	34,002	54,839	Wet
2012	1,609	3,278	9,730	9,730	Dry
2013	3,444	16,544	11,473	11,473	Dry
Average	31,881	36,011	33,160	38,084	
Maximum	126,246	126,246	124,727	130,305	
Minimum	1,609	2,801	9,730	9,730	

SOURCE: SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018.

Average annual flow volume in Alameda Creek below the Welch Creek confluence under with-CDRP conditions between Water Year 1996 and Water Year 2013 is estimated to be 33,160 acre-feet. Estimated annual flow volume in the 18-year period ranged from 124,727 acre-feet in 1998 to 9,730 acre-feet in 2012. The estimated average annual flow volume at Node 4 is lower under with-CDRP conditions than under existing conditions by about 3,000 acre-feet. This is because the volume of water needed to be released from Calaveras Dam or bypassed at ACDD to maintain DSOD requirements under existing conditions is greater than the volume required to be released when CDRP is in operation.

Average annual flow volume in the same location between Water Year 1996 and Water Year 2013 under with-project conditions is estimated to be 38,084 acre-feet. Estimated annual flow volume would range from 130,305 acre-feet to 9,730 acre-feet. The average annual flow volume in Alameda Creek at the Welch Creek confluence under with-project conditions is greater than under with-CDRP conditions because of differences in storage in Calaveras Reservoir. Under with-CDRP conditions, the water level in Calaveras Reservoir will be drawn down in the drier months to meet water demand and as a result of the releases that will be made to meet the instream flow schedule. Under with-project conditions, a portion of the water demand is met with water from the ACRP and so the water level in Calaveras Reservoir is not drawn down as far as it is under with-CDRP conditions. Because of this, spills in wet years would be relatively larger under with-project conditions than they are under with-CDRP conditions. As a result, average annual flow volumes in Alameda Creek at the Welch Creek confluence would be greater under with-project conditions than they are under with-CDRP conditions.

As shown in Table HYD5-2, average annual flow volume in Alameda Creek above the San Antonio Creek confluence (Node 5) under existing conditions is estimated to be 35,002 acre-feet. Estimated annual flow volume in the 18-year period ranged from 128,360 acre-feet in 1998 to 1,677 acre-feet in 2012. Average annual flow volume in Alameda Creek above the San Antonio Creek confluence under pre-2001 conditions is estimated to be 31,790 acre-feet, ranging from 128,360 acre-feet in 1998 to 839 acre-feet in 2012. Average annual flow volume in Alameda Creek above the San Antonio Creek confluence under with-CDRP conditions is estimated to be 27,640 acre-feet. Estimated annual flow volume in the 18-year period ranged from 122,553 acre-feet in 1998 to 3,257 acre-feet in 2012. Average annual flow volume in Alameda Creek at the same location under with-project conditions is estimated to be 32,564 acre-feet, ranging from 128,131 acre-feet to 3,257 acre-feet in 2012.

Between the Welch Creek confluence and the San Antonio Creek confluence, Alameda Creek gains water from accretion and loses it to the subsurface. Accretion is the same for the four conditions,but losses to the subsurface are different. The average annual loss to the subsurface under existing conditions is estimated to be 4,530 acre-feet and for pre-2001 conditions is 3,612 acre-feet. The average annual loss to the subsurface under with-CDRP and with-project conditions is estimated to be 9,040 acre feet (see Table HYD4-4). The reason for this is the different seasonal flow pattern between the conditions. Implementation of the CDRP instream flow schedules under with-CDRP and with-project conditions will result in a small flow in Alameda Creek between its confluences with Calaveras Creek and Welch Creek during the summer and fall, when the creek is usually dry under the existing conditions. Consequently, there is a much greater opportunity for water to percolate into the subsurface under these conditions than under existing and pre-2001 conditions.

TABLE HYD5-2
ESTIMATED ANNUAL FLOW VOLUME IN ALAMEDA CREEK
ABOVE SAN ANTONIO CREEK CONFLUENCE (NODE 5) FOR WY1996-WY2013 (acre-feet)

Water Year	Pre-2001 Conditions	Existing Conditions	With-CDRP Conditions	With-Project Conditions	Year Type
1996	89,259	89,259	88,962	89,431	Wet
1997	77,472	77,472	71,873	79,924	Wet
1998	128,360	128,360	122,553	128,131	Wet
1999	19,335	19,335	19,683	19,683	Wet
2000	29,005	32,365	19,897	28,804	Wet
2001	2,586	2,035	5,990	5,990	Dry
2002	1,960	26,050	6,484	6,484	Dry
2003	6,487	13,972	14,981	14,981	Dry
2004	4,147	5,338	8,638	8,638	Dry
2005	49,809	55,514	22,823	35,956	Wet
2006	67,602	76,476	43,758	67,948	Wet
2007	1,846	4,915	4,333	4,333	Dry
2008	8,053	9,056	10,260	10,260	Dry
2009	15,685	8,783	7,896	10,316	Wet
2010	16,547	12,591	13,134	18,179	Wet
2011	50,079	52,164	28,129	48,965	Wet
2012	839	1,677	3,257	3,257	Dry
2013	3,153	14,679	4,874	4,874	Dry
Average	31,790	35,002	27,640	32,564	--
Maximum	128,360	128,360	122,553	128,131	--
Minimum	839	1,677	3,257	3,257	--

SOURCE: SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018.

As shown in Table HYD5-3, average annual flow volume in Alameda Creek above the Arroyo de la Laguna confluence (Node 7) under existing conditions is estimated to be 38,277 acre-feet. Estimated annual flow volume in the 18-year period ranged from 142,643 acre-feet in 1998 to 1,637 acre-feet in 2012. Average annual flow volume just upstream of the Arroyo de la Laguna confluence is estimated to be 34,456 acre-feet under pre-2001 conditions, ranging from 142,623 acre-feet in 1998 to 911 acre-feet in 2012. Annual average flow volume just upstream of the Arroyo de la Laguna under with-CDRP conditions is estimated to be 32,509 acre-feet. Estimated annual flow volume ranged from 140,842 acre-feet in 1998 to 4,912 acre-feet in 2012. Average annual flow volume in Alameda Creek at the same location under with-project conditions is estimated to be 36,540 acre-feet, ranging from 146,089 acre-feet to 4,148 acre-feet.

Below the San Antonio Creek confluence, Alameda Creek gains water from accretion and from NPDES discharges from the quarries and loses it to the subsurface. Differences in annual flow between these scenarios at Node 7 is driven in part by variable discharge rates between the scenarios (see Section 4, *Gains from Quarry NPDES Discharges to Alameda Creek*).

**TABLE HYD5-3
ESTIMATED ANNUAL FLOW VOLUME IN ALAMEDA CREEK ABOVE ARROYO DE LA LAGUNA CONFLUENCE (NODE 7) FOR WY1996-WY2013 (acre-feet)**

Water Year	Pre-2001 Conditions	Existing Conditions	With-CDRP Conditions	With-Project Conditions	Year Type
1996	98,049	98,049	100,564	100,044	Wet
1997	84,530	84,530	82,661	89,137	Wet
1998	142,623	142,623	140,842	146,089	Wet
1999	21,010	21,010	24,463	25,400	Wet
2000	30,680	34,149	23,804	32,577	Wet
2001	3,217	2,799	7,738	6,517	Dry
2002	2,306	26,771	8,196	6,587	Dry
2003	7,813	15,640	18,871	16,869	Dry
2004	4,841	6,740	10,160	9,115	Dry
2005	51,907	57,700	27,776	39,932	Wet
2006	70,022	84,571	49,133	72,493	Wet
2007	2,198	5,410	6,813	5,209	Dry
2008	9,141	10,760	12,207	11,091	Dry
2009	16,336	9,404	10,220	10,760	Wet
2010	18,433	14,989	16,495	22,095	Wet
2011	52,663	57,623	33,536	54,666	Wet
2012	911	1,637	4,912	4,148	Dry
2013	3,523	14,589	6,763	4,981	Dry
Average	34,456	38,277	32,509	36,540	--
Maximum	142,623	142,623	140,842	146,089	--
Minimum	911	1,637	4,912	4,148	--

SOURCE: SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include quarry NPDES discharges at Node 6* and up to 7.5 cfs losses between Node 6* and 7 by ESA/Orion, 2019.

5.5 Summary of ACRP Effects on Streamflow

5.5.1 Annual Flow Volumes

The SFPUC's operation of its Alameda System, and particularly its operation of Calaveras Reservoir, would differ under the four scenarios. The full storage capacity of the reservoir was available under pre-2001 conditions and will be again under with-CDRP and with-project conditions. Storage in the reservoir is limited under existing conditions. The need to make bypasses at the ACDD and releases from Calaveras Reservoir under with-CDRP and with-project conditions create a deficit in Calaveras Reservoir that did not exist under pre-2001 conditions. Recapture of some of the water bypassed and released under with-project conditions reduces the size of the deficit in Calaveras Reservoir and increases the frequency of spills from the reservoir as compared to the with-CDRP scenario. As a result, average annual flows in Alameda Creek downstream of the Calaveras Creek confluence would be greater for with-project conditions than they are for the with-CDRP conditions.

Flow in Alameda Creek is altered downstream of the San Antonio Creek confluence by NPDES discharges from the aggregate quarries that are located near the confluence. Under with-CDRP conditions, the amount of water the quarry operators would have to manage would increase and therefore quarry NPDES discharges are estimated to increase compared to existing conditions. Under with-project conditions, the SFPUC would pump water from Pit F2 for municipal use. The pumping by the SFPUC would substitute for part of the amount of water the quarry operators would have to manage. However, the average annual amount of water discharged to Alameda Creek under NPDES permits by the quarry operators under with-project conditions is estimated to be greater than the average annual amount discharged under existing conditions due to the instream releases and bypasses required under the CDRP but less than under with-CDRP conditions.

Downstream of the quarries and just upstream of the Arroyo de la Laguna (Node 7), average annual flow volume in Alameda Creek would be about 5 percent less under with-project conditions than it is under existing conditions. The flow volume under with-project conditions would be about 11 percent greater than it will be under with-CDRP conditions. The slight increase in the annual flow volume between the with-project and the with-CDRP condition is driven in part by the modeled increased spill from Calaveras Reservoir under the with-project (see Section 4.2.1, ASDHM Development History, Modeled Spills from Calaveras Reservoir).

During the summer months, there is no streamflow in Alameda Creek under existing conditions at the San Antonio Creek confluence just upstream of the quarry discharge points. There will be no streamflow in the summer at this location under with-CDRP conditions nor would there be under with-project conditions. The only flow in Alameda Creek below the San Antonio Creek confluence and below the quarry discharges in the summer is that provided by the NPDES discharges from the quarries under their NPDES permits. Estimated quarry NPDES discharges under with-project conditions would be greater than they are under existing conditions, but are estimated to be less than they would be under with-CDRP conditions.

6. Implication of ACRP-Caused Surface Water Hydrology Changes for Biological Resources

Hydrologic conditions under existing conditions, with-CDRP, and with-project conditions are described in detail in Section 5, Alameda Creek Surface Water Hydrology. This section describes the implications of ACRP-caused hydrologic changes on fish, terrestrial wildlife, and riparian vegetation.

6.1 Fish

A number of fish species exist in Alameda Creek including migratory species. This section describes the relationship between fish habitat and surface water flow in Alameda Creek under existing, with-CDRP, and with-project conditions.

6.1.1 Existing Conditions

Alameda Creek and its tributaries provide habitat for a diverse assemblage of native and non-native fishes. A total of 14 native and at least 13 non-native species have been observed in non-tidal reaches of the Alameda Creek watershed during the past century. Several other species may have also occurred in the watershed based on collections from tidal portions of the creek, evidence from archeological investigations, and other accounts.[49,50] Anadromous species including steelhead (*Oncorhynchus mykiss*) are excluded from most of the watershed by passage barriers in the lower catchment, most notably by the Bay Area Rapid Transit (BART) weir.[51]

Fish habitat is extremely limited between the Welch Creek confluence and the Arroyo de la Laguna confluence because there is little flowing water in this reach for much of the year and the physical habitat is heavily altered and degraded. Some native and non-native warm water fish survive in isolated pools that form within the Alameda Creek channel during the dry season. The pools extend from just upstream of the I-680 bridge to just upstream of the Arroyo de la Laguna confluence. The fish populations inhabiting the pools appear to be dominated by non-native species that compete and prey on native species and are of little conservation concern. Consequently, the pools are not described in this section, but they are discussed in Section 6.2, because any changes to the pools could affect terrestrial wildlife, and in particular special status amphibians.

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49 Gunther, A.J., J.M. Hagar, and P. Salop, 2000. *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed*. Prepared for the Alameda Creek Fisheries Restoration Workgroup. February 7, 2000.

50 Leidy, R.A., 2007. Ecology, Assemblage Structure, Distribution, and Status of Fishes in Stream Tributary to the San Francisco Estuary, California. San Francisco Estuary Institute, April 2007. Contribution No. 530.

51 Environmental Science Associates, 2016. *Alameda Creek Recapture Project, Alameda Creek Fisheries Habitat Assessment Report.* Prepared for the San Francisco Public Utilities Commission, November 2016 (see Appendix BIO2).

6.1.2 With-CDRP and With-Project Conditions

Under the two future conditions (with-CDRP and with-project), the CDRP will be completed and placed into operation and releases and bypasses will be made at Calaveras Reservoir and the Alameda Creek Diversion Dam in accordance with instream flow schedules shown in Table HYD1-2 and described in the text in Section 1.3.3. To be conservative, the EIR impact analysis also assumes that human-made barriers to anadromous steelhead migration will be removed or other measures taken to enable fish migration.

Due to limiting factors, specifically warm water temperatures, steelhead are not expected to spawn or rear within the reaches of Alameda Creek between the Welch Creek confluence and the Arroyo de la Laguna confluence, but would be expected to migrate through this area during winter spawning migrations and late spring out-migrations. Given that steelhead would use the Sunol Valley as a migration corridor, impacts on streamflow that may affect migration are described briefly below, and in greater detail within the recirculated Chapter 15.2, Fisheries Resources.

Impacts to fisheries under the with-project condition are made relative to the with-CDRP conditions, rather than existing conditions. The reason for using a future baseline condition is that the with-CDRP conditions represent the baseline under which the ACRP would actually operate; the ACRP is reliant on implementation of the CDRP instream flow schedules in order to recapture released and bypasses flow. In order to analyze changes in streamflows and associated potential impacts on migration, the CEQA analysis identifies the threshold conditions for steelhead migration based on the National Marine Fisheries Service CDRP Biological Opinion (BO). The CDRP BO concluded that adult upstream passage and juvenile downstream passage would be provided in the Sunol Valley with flows of approximately 20 cfs and 10 cfs (with physical modifications required as part of the CDRP BO), respectively.[52] A 20-cfs streamflow condition is required for adult upstream passage, which typically occurs from December 1 through April 30. A 10-cfs streamflow condition is required for juvenile downstream passage, which typically occurs from March 1 through June 30.[53]

Using the ASDHM model, migration opportunity days (the number of days the threshold conditions would be met or exceeded) were calculated for the with-CDRP and the with-project conditions for each water year in the 18-year model period of record. The model was used to calculate a change in number of days for each year, total days for each scenario, and average days per year for each scenario. Migration opportunity days for adult and juvenile steelhead as represented by Node 7 (Alameda Creek downstream of the project site and above Arroyo de la Laguna) for with-CDRP compared to with-project are shown below in **Tables HYD6-1** and **HYD6-2** for their respective migration periods.

[52] National Marine Fisheries Service (NMFS), 2011. *Biological Opinion for the Calaveras Dam Replacement Project*. Santa Rosa, CA.

[53] Gunther, A.J., J.M. Hagar, and P. Salop, 2000. *An Assessment of the Potential for Restoring a Viable Steelhead Trout Population in the Alameda Creek Watershed*. Prepared for the Alameda Creek Fisheries Restoration Workgroup. February 7, 2000.

TABLE HYD6-1
MIGRATION OPPORTUNITY DAYS – ADULTS: DEC 1 TO APRIL 30
20 CFS AT NODE 7, WITH-CDRP COMPARED TO WITH-PROJECT CONDITIONS

WY	Migration Period		Opportunity Days at Node 7 flow >= 20cfs (with-CDRP)	Opportunity Days at Node 7 flow >= 20cfs (with-Project)	Change in Days
1996	12/01/95	4/30/1996	109	111	2
1997	12/1/1996	4/30/1997	112	95	-17
1998	12/1/1997	4/30/1998	122	124	2
1999	12/1/1998	4/30/1999	104	104	0
2000	12/1/1999	4/30/2000	57	62	5
2001	12/1/2000	4/30/2001	35	35	0
2002	12/1/2001	4/30/2002	46	43	-3
2003	12/1/2002	4/30/2003	51	51	0
2004	12/1/2003	4/30/2004	45	44	-1
2005	12/1/2004	4/30/2005	112	113	1
2006	12/1/2005	4/30/2006	118	122	4
2007	12/1/2006	4/30/2007	24	25	1
2008	12/1/2007	4/30/2008	43	38	-5
2009	12/1/2008	4/30/2009	34	37	3
2010	12/1/2009	4/30/2010	90	100	10
2011	12/1/2010	4/30/2011	99	105	6
2012	12/1/2011	4/30/2012	18	21	3
2013	12/1/2012	4/30/2013	14	14	0
		total	***1233***	***1244***	
		average	***69***	***69***	

SOURCE: SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6* and losses between Node 6* and 7 by ESA/Orion.

As shown in Table HYD6-1, for adult passage, the number of opportunity days for the with-project compared to with-CDRP was the same in four years, increased in nine years, and decreased in four years. Average opportunity days per year for the 18-year period of record was 69 days under both scenarios, indicating no change in the number of opportunity days would occur over the long term. The greatest decrease in opportunity days was a deficit of 17 days in the 1997 water year, and the greatest increase was 10 days and 6 days in the 2010 and 2011 water years, respectively. The 17-day deficit was caused by the model predicting a reservoir spill at Calaveras Dam under the with-project scenario (See Section 15.2.3.3, Operational Impacts – Fisheries Resources, for a detailed explanation of the 17-day deficit).

TABLE HYD6-2
MIGRATION OPPORTUNITY DAYS – JUVENILES: MAR 1 TO JUNE 30
10 CFS AT NODE 7, WITH-CDRP COMPARED TO WITH-PROJECT CONDITIONS

HY	Migration Period		Opportunity Days at Node 7 flow >= 10cfs (with-CDRP)	Opportunity Days at Node 7 flow >= 10cfs (with-Project)	Change in Days
1996	3/1/96	6/30/96	77	80	3
1997	3/1/97	6/30/97	34	38	4
1998	3/1/98	6/30/98	118	120	2
1999	3/1/99	6/30/99	82	109	27
2000	3/1/00	6/30/00	44	57	13
2001	3/1/01	6/30/01	19	20	1
2002	3/1/02	6/30/02	32	28	-4
2003	3/1/03	6/30/03	64	63	-1
2004	3/1/04	6/30/04	22	18	-4
2005	3/1/05	6/30/05	86	88	2
2006	3/1/06	6/30/06	95	98	3
2007	3/1/07	6/30/07	13	14	1
2008	3/1/08	6/30/08	17	15	-2
2009	3/1/09	6/30/09	23	22	-1
2010	3/1/10	6/30/10	76	96	20
2011	3/1/11	6/30/11	84	107	23
2012	3/1/12	6/30/12	24	32	8
2013	3/1/13	6/30/13	0	0	0
		total	***910***	***1005***	
		average	***51***	***56***	

SOURCE: SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6˚ and losses between Node 6˚ and 7 by ESA/Orion.

As shown in Table HYD6-2, similar to the adult period for the primary study area, for the with-project scenario compared to the with-CDRP scenario, the number of opportunity days were the same in one year, increased in twelve years and decreased in five years for the juvenile migration period. Average opportunity days per year for the 18-year period of record was 51 under the with-CDRP and 56 under the with-project, indicating that a net increase in number of opportunity days would occur over the long term under the with-project condition. The greatest reduction in migration opportunities days under the with-project condition compared to the with-CDRP condition (four days) occurred in the 2002 and 2004 water years. The greatest increase in migration opportunities days under the with-project compared to the with-CDRP condition was 27, 20, and 23 days in the 1999, 2010, and 2011 water years, respectively. These increases in days are the result of difference in the magnitude of quarry NPDES discharges between the with-CDRP and with-project conditions (see Section 15.2.3.3, Operational Impacts – Fisheries Resources, for a discussion of the influence of quarry NPDES discharge on steelhead migration conditions).

Overall, changes in streamflow resulting from project implementation would not result in a substantial change in juvenile or adult steelhead migration opportunities in the Sunol Valley, downstream of the project site (i.e., Node 7). For a more detailed discussion of project-related impacts on steelhead see recirculated Chapter 15.2, Fisheries Resources.[54]

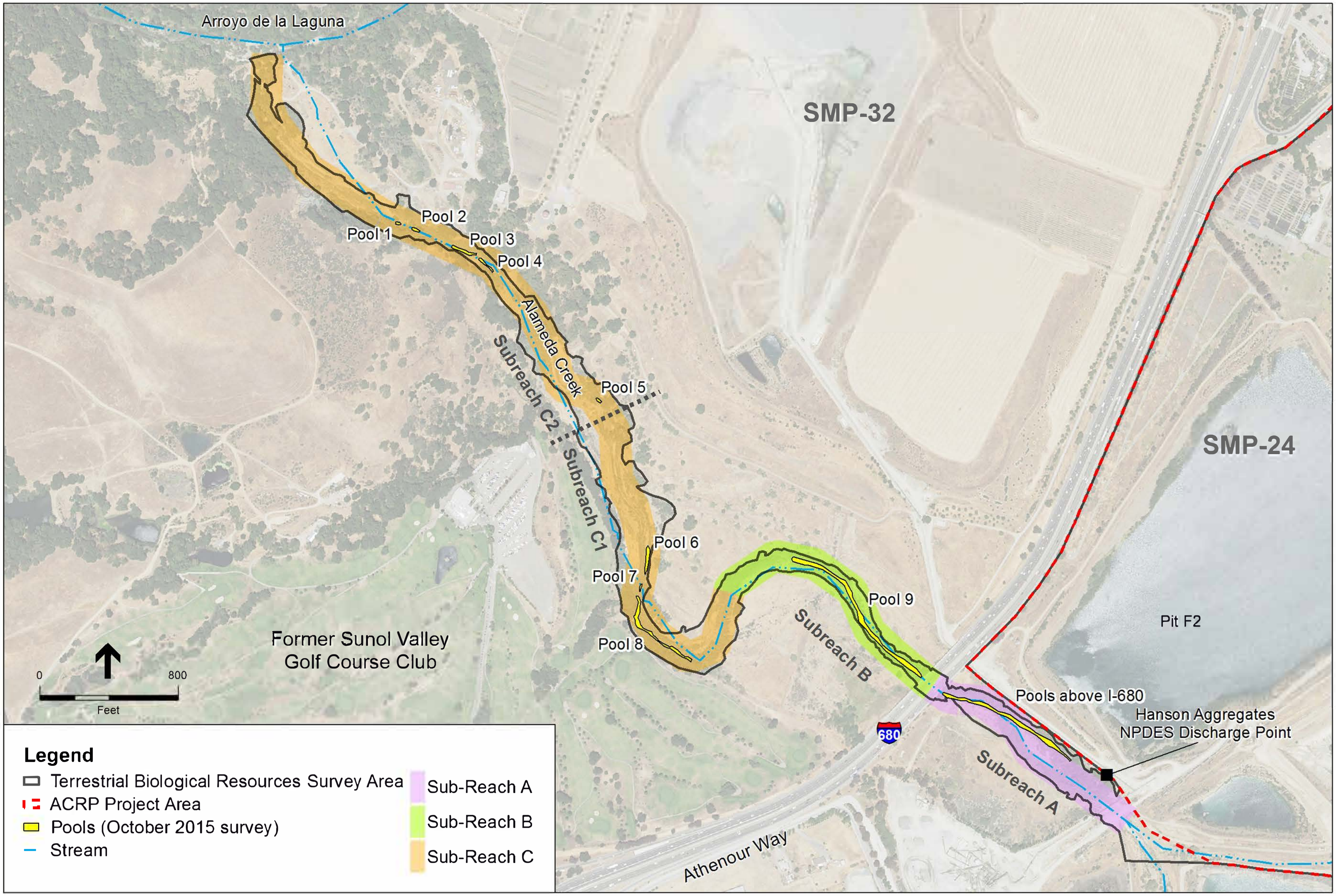
6.2 Terrestrial Wildlife

Terrestrial wildlife species are present in a reach of Alameda Creek that could be affected by changes in surface and subsurface hydrology attributable to the proposed ACRP. The wildlife species are associated with a series of pools within the Alameda Creek channel that are shown in **Figure HYD6-1**.

Table HYD6-3 is a summary description of hydrologic and riparian conditions in the Alameda Creek channel between Pit F2 and the Arroyo de la Laguna under existing, with-CDRP and with-project conditions for each of the subreaches identified in Figure HYD6-1. Separate descriptions are provided for surface water conditions, subsurface water conditions, instream wetlands and woody riparian vegetation. The evaluation of surface water conditions was made by ESA/Orion and the evaluation of subsurface water conditions was made by Luhdorff & Scalmanini. The probable effects of the surface and subsurface flow changes on the pools within the Alameda Creek channel were made jointly by ESA/Orion and Luhdorff & Scalmanini. The probable effects of the changes in surface and subsurface flow on biological resources were made by ESA/Orion biologists.

This section provides information on those aspects of Alameda Creek's surface water hydrology that affect terrestrial wildlife habitat under existing, with-CDRP and with-project conditions. As described in EIR Section 5.1.2, this EIR uses two baseline conditions where appropriate to evaluate the impacts of the ACRP: existing conditions and with-CDRP conditions. Existing conditions represent the physical conditions at the time of publication of the Notice of Preparation; and with-CDRP conditions represent the future, long-term hydrologic and streamflow conditions that will occur when CDRP becomes operational. Information on those aspects of subsurface water hydrology that affect terrestrial wildlife habitat is contained in Appendix HYD2-R, Section 11, *CEQA Considerations: Riparian Habitat*. Conditions for terrestrial wildlife under both future conditions, the with-CDRP and with-project scenarios, are compared against the terrestrial wildlife habitat under the existing condition.

54 Migration opportunity threshold conditions are also evaluated at Node 9 within Chapter 15.2. That analysis yields similar results to those shown above for Node 7.



SOURCE: ESA

SFPUC Alameda Creek Recapture Project

Figure HYD6-1

Pools in Alameda Creek channel observed in October 2015

TABLE HYD6-3
SUMMARY OF HYDROLOGICAL AND RIPARIAN CONDITIONS ALONG ALAMEDA CREEK SUBREACHES A, B, AND C UNDER EXISTING, WITH-CDRP, AND WITH-PROJECT CONDITIONS

Location	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Subreach A	**Surface Water**. Surface water conditions in this reach are represented by Node 6˚ in the ASDHM. Average annual flow volume at Node 6˚ = 40,104 acre-feet per year, including quarry NPDES discharges. Live stream in wet months. Average total flow volume over the 18-year study period of 834 acre-feet (min: 21 acre-feet, max: 1,534 acre-feet) in dry-season 3-month period of July, August and September, entirely attributable to quarry NPDES discharges.	**Surface Water**. Average annual flow at Node 6˚ = 35,545 acre-feet per year, including quarry NPDES discharges. Live stream in wet months. Average post-processed ASDHM total flow volume over the 18-year study period of 2,445 acre-feet (min: 2,017 acre-feet, max: 2,823 acre-feet) in dry-season 3-month period of July, August and September, entirely attributable to quarry NPDES discharges.	**Surface Water**. Average annual flow volume at Node 6˚ = 37,600 acre-feet per year, including quarry NPDES discharges. Live stream in wet months. Average post-processed ASDHM flow volume over the 18-year study period of 87 acre-feet (min: 12 acre-feet, max: 348 acre-feet) in dry-season 3-month period of July, August and September, entirely attributable to quarry NPDES discharges.
	Subsurface Water. Subsurface water conditions in this reach are represented by measurements in MW5. Subsurface water levels at MW5 have varied seasonally from at or above the projected creek thalweg[1] elevation of 242 feet elevation in the winter and spring to 223 feet at the end of the dry season in the fall. Altered water management by ODS since 2012 has raised minimum elevations in the fall from 223 feet to about 230 feet. Subsurface water elevations fluctuate within the observed range as a function of hydrology and mining activities, including timing and duration of precipitation through spring, timing and magnitude of dewatering activities by mining operators, and in recent years, water management practices such as by ODS.	**Subsurface Water**. Subsurface water levels at MW5 will vary seasonally from at or above the thalweg elevation of 242 feet in the winter and spring to 230 feet at the end of the dry season in the fall.[2] Fluctuations will occur within this range and will resemble existing conditions as a function of hydrology and mining activities.	**Subsurface Water**. Subsurface water levels at MW5 would vary seasonally from at or above the thalweg elevation of 242 feet in the winter and spring to 230 feet at the end of the dry season in the fall.[1] Fluctuations will occur within this range and will resemble existing conditions as a function of hydrology, mining activities, and variations in ACRP operations.
	Pools. Live stream through pools in wet months. Pools persist through dry months.	**Pools.** Live stream through pools in wet months. Pools persist longer in dry months. Pools will be larger in the dry months than under existing conditions due to greater quarry NPDES discharges.	**Pools.** Live stream through pools in the wet months. Pools persist in dry months. Pools would be larger at the start of the dry season due to increased discharge under the with-project condition from December to June relative to the existing and with-CDRP conditions. However, in some places pools may dry out at a faster rate in the dry season compared to with-CDRP conditions and existing conditions due to ACRP recapture and projected smaller quarry discharges. In some years, about one in three of the hydrologic base period, ACRP would have limited operations leading to a wetter condition. The range from dry to wetter conditions as a function of ACRP operations would produce pooling that is consistent with variability seen under existing conditions.

TABLE HYD6-3 (Continued)
SUMMARY OF HYDROLOGICAL AND RIPARIAN CONDITIONS ALONG ALAMEDA CREEK SUBREACHES A, B, AND C UNDER EXISTING, WITH-CDRP, AND WITH-PROJECT CONDITIONS
(See Figure HYD6-1 for Location of Subreaches)

Location	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Subreach A (cont.)	**Instream Wetlands.** Instream wetlands are of two types: **perennial instream wetlands** occupy margins of more or less permanent pools and other perennial reaches of the creek. Perennial instream wetlands are the result of the combination of surface and subsurface flows. In Subreach A, perennial instream wetlands exist only because of the additional contribution of quarry NPDES discharges and would not exist due to surface flows alone. **Seasonal instream wetlands** occupy the periphery of pools, isolated seasonal pools within the floodplain, and other low areas subject to seasonal saturation or inundation from surface flows or groundwater seepage, generally drying in the dry season.	**Instream Wetlands.** The extent of instream perennial wetlands around the margins of permanent pools and other perennial reaches of the creek could increase compared to existing conditions because of increased CDRP releases, potentially replacing seasonal wetlands in these areas. The extent of isolated seasonal pools and the instream seasonal wetlands they support would not change substantially from existing conditions because the seasonal pattern of groundwater elevations would not change substantially due to instream flow schedules.	**Instream Wetlands.** The extent of instream perennial wetlands around the margins of permanent pools and other perennial reaches of the creek could increase from December to June compared to with-CDRP and existing conditions, although seasonal wetlands may replace areas supporting perennial wetlands to some extent. During the dry season instream perennial wetlands around the margins of permanent pools may dry at a faster rate compared with with-CDRP and existing conditions due to decreases in quarry NPDES discharge under the with-project condition during late-summer months. However, he extent of isolated seasonal pools and the seasonal wetlands they support would not change substantially from with-CDRP or existing conditions. No net loss of wetlands expected, although the proportion (seasonal vs. perennial) could vary slightly.
	Woody Riparian Vegetation. Tree-supporting riparian alliances (including willow thicket and riparian forest alliances) and dense mulefat thicket are found in areas along the low-flow channel. Dense vegetative growth depends on consistent access to surface or shallow groundwater supplied by quarry NPDES discharges, especially during the dry summer months. Sparse mulefat thicket alliance is found in the floodplain away from the low-flow channel.	**Woody Riparian Vegetation.** Tree-supporting riparian alliances could increase compared to existing conditions due to increased dry-season flows attributable to increased quarry NPDES discharges. Extent of mulefat thicket would not change except that some might be replaced by tree-supporting alliances. Density of mulefat could increase along the low-flow channel.	**Woody Riparian Vegetation.** Tree-supporting riparian alliances could decrease compared to existing and with-CDRP conditions due to reduction in dry-season quarry NPDES discharges. Mulefat thicket alliance could replace tree-supporting alliances and mulefat density could decrease in some areas.
Subreach B	**Surface Water.** Live flow in wet months. Average post-processed ASDHM annual flow volume lower than at Node 6˚ (40,104 acre-feet per year) in Subreach A due to streamflow losses to groundwater. Lower total dry-season flow volume in July, August, and September in Subreach B than at Node 6˚ for the same reason. Dry-season flow and pooling attributable to quarry NPDES discharges.	**Surface Water.** Live flow in wet months. Average post-processed ASDHM annual flow volume lower than at Node 6˚ (35,545 acre-feet per year) in Subreach A due to streamflow losses to groundwater. Lower total dry-season flow volume in July, August, and September than at Node 6˚ for the same reason. Greater dry-season flow compared to existing conditions due to expected increased quarry NPDES discharges.	**Surface Water.** Live flow in wet months. Average post-processed ASDHM annual flow volume lower than at Node 6˚ (37,600 acre-feet per year) in Subreach A due to streamflow losses to groundwater. Lower total flow volume in July, August, and September than at Node 6˚ for the same reason. Lower dry-season flow volume compared to existing or with-CDRP conditions because of expected reduced dry season quarry NPDES discharges.
	Subsurface Water. Subsurface water conditions in this reach are represented by measurements in MW6. Subsurface water levels at MW6 have varied seasonally from at or above the projected creek thalweg elevation of 236 feet elevation in the winter and spring to 221 feet in the fall. Altered water management by ODS since 2012 has raised minimum elevations to about 227 feet.	**Subsurface Water**. Subsurface water levels at MW6 will vary seasonally from the thalweg elevation of 236 feet in the winter and spring to 227 feet in the fall.[1] Fluctuations will occur within this range and will resemble existing conditions as a function of hydrology and mining activities.	**Subsurface Water**. Subsurface water levels at MW6 would vary seasonally from as high as the thalweg elevation of 236 feet in the winter and spring to 227 feet in the fall.[1] Fluctuations would occur within this range and would resemble existing conditions as a function of hydrology, mining activities, and variations in ACRP operations.

TABLE HYD6-3 (Continued)
SUMMARY OF HYDROLOGICAL AND RIPARIAN CONDITIONS ALONG ALAMEDA CREEK SUBREACHES A, B, AND C UNDER EXISTING, WITH-CDRP, AND WITH-PROJECT CONDITIONS
(See Figure HYD6-1 for Location of Subreaches)

Location	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Subreach B (cont.)	**Pools**. Live stream through pools in wet months. Pools persist through dry months.	**Pools**. Live stream through pools in wet months. Pools persist longer in dry months. Pools will be larger than under existing conditions due to greater quarry discharges and greater subsurface flow.	**Pools**. Live stream through pools in wet months. Pools persist in dry months. Pools would be smaller and possibly dry out in the dry season compared to with-CDRP conditions and somewhat smaller in the dry season compared to existing conditions due to ACRP recapture and projected smaller quarry discharges. In some years, about one in three of the hydrologic base period, ACRP would have limited operations leading to a wetter condition. The range from dry to wetter conditions as a function of ACRP operations would produce pooling that is consistent with variability seen under existing conditions.
	Instream Wetlands. Instream perennial wetlands occupy margins of permanent pools and other perennial reaches of the creek. Instream seasonal wetlands occupy the periphery of permanent pools, isolated seasonal pools within the floodplain, and other low areas subject to seasonal saturation or inundation from surface flows or groundwater seepage, generally drying in the dry season.	**Instream Wetlands.** The extent of instream perennial wetlands around the margins of permanent pools and other perennial reaches of the creek could increase compared to existing conditions. The extent of seasonal pools and the instream seasonal wetlands they support will not change substantially from existing conditions.	**Instream Wetlands.** The extent of instream perennial wetlands could decrease compared to with-CDRP and existing conditions, although instream seasonal wetlands may replace areas supporting perennial wetlands somewhat. The extent of isolated seasonal pools and the instream seasonal wetlands they support would not change substantially from with-CDRP or existing conditions. No net loss of wetlands expected, although the proportion (seasonal vs. perennial) could vary slightly.
	Woody Riparian Vegetation. Tree-supporting willow and riparian forest alliances and dense mulefat thickets found in areas along the low-flow channel. Dense growth depends on consistent access to surface or shallow groundwater supplied by quarry NPDES discharges, especially during the dry summer months. Sparse mulefat thicket alliance found in the floodplain away from the low-flow channel.	**Woody Riparian Vegetation.** Tree-supporting willow and riparian forest alliances could increase compared to existing conditions due to increased dry-season quarry NPDES discharges. Extent of mulefat thicket alliance would not change except that a small amount might be replaced by tree-supporting riparian vegetation because of increased dry-season flows.	**Woody Riparian Vegetation.** Tree-supporting willow and riparian forest alliances could decrease compared to existing and with-CDRP conditions due to reduction in dry-season quarry NPDES discharges. Mulefat thicket could replace tree-supporting alliances.
Subreach C1	**Surface Water.** Live flow in wet months. Average annual flow volume lower than at Node 6˚ (40,104 acre-feet per year) and in Subreach B due to streamflow losses to groundwater. Lower total flow volume in dry-season July, August, and September than at Node 6˚ and in Subreach B for the same reason. Dry-season flow and pooling attributable to quarry NPDES discharges.	**Surface Water.** Live flow in wet months. Average annual flow volume lower than at Node 6˚ (35,545 acre-feet per year) and in Subreach B due to streamflow losses to groundwater. Lower total flow volume in dry-season July, August, and September than at Node 6˚ and in Subreach B for the same reason. Greater dry-season flows compared to existing conditions due to increased quarry NPDES discharges.	**Surface Water.** Live flow in wet months. Average annual flow volume lower than at Node 6˚ (37,600 acre-feet per year) and in Subreach B due to streamflow losses to groundwater. Lower total flow volume in July, August, and September than at Node 6˚ and in Subreach B for the same reason. Lower dry-season flow volume compared to existing or with-CDRP conditions because of reduced dry-season quarry NPDES discharges.

TABLE HYD6-3 (Continued)
SUMMARY OF HYDROLOGICAL AND RIPARIAN CONDITIONS ALONG ALAMEDA CREEK SUBREACHES A, B, AND C UNDER EXISTING, WITH-CDRP, AND WITH-PROJECT CONDITIONS
(See Figure HYD6-1 for Location of Subreaches)

Location	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Subreach C1 (cont.)	**Subsurface Water.** Subsurface water conditions in the downstream portion of this subreach are represented by measurements in MW8. Groundwater levels at MW8 have varied seasonally within a narrow range from at or above the projected creek thalweg elevation of 224 feet in the winter and spring to 220 feet in the fall. In the absence of a monitoring well in the upstream portion of this reach, using the aquifer profile, it can be inferred that the subsurface water in the upstream portion of this subreach would fluctuate similar to Subreach B and the downstream portion similar to Subreach C2. Streambed gravels are thin and the aquifer has less storage capacity than in upstream reaches.	**Subsurface Water**. Subsurface water levels at MW8 will vary seasonally from at or above the thalweg elevation of 224 feet in the winter and spring to 220 feet in the fall. Subsurface water levels in average years could be comparable to subsurface water levels in wetter years under existing conditions. Fluctuations will occur within this range and will resemble existing conditions as a function of hydrology and mining activities.	**Subsurface Water**. Subsurface water levels at MW8 would vary seasonally from at or above the thalweg elevation of 224 feet in the winter and spring to 220 feet in the fall. Fluctuations would occur within this range and would resemble existing conditions as a function of hydrology, mining activities, and variations in ACRP operations.
	Pools. Live stream through pools in wet months. Pools probably persist through dry months. Water-bearing streambed gravels are thin and the pools may extend to their base.	**Pools.** Live stream through pools in wet months. Pools persist in dry months. Pools could be larger than under existing conditions due to greater quarry discharges and greater subsurface flow. Live flow may persist longer through pools in dry months.	**Pools**. Live stream through pools in wet months. Pools persist in dry months. Pools would be smaller and possibly dry out in the dry season compared to with-CDRP conditions and somewhat smaller in the dry season compared to existing conditions due to ACRP recapture and smaller quarry NPDES discharges. In some years, about one in three of the hydrologic base period, ACRP would have limited operations leading to a wetter condition. The range from dry to wetter conditions as a function of ACRP operations would produce pooling that is consistent with variability seen under existing conditions.
	Instream Wetlands. Instream perennial wetlands occupy margins of permanent pools and other perennial reaches of the creek. Instream seasonal wetlands occupy the periphery of permanent pools, isolated seasonal pools within the floodplain, and other low areas subject to seasonal saturation or inundation from surface flows or groundwater seepage, generally drying in the dry season.	**Instream Wetlands.** The extent of instream perennial wetlands around the margins of permanent pools and other perennial reaches of the creek could increase compared to existing conditions. The extent of seasonal pools and the instream seasonal wetlands they support will not change substantially from existing conditions.	**Instream Wetlands.** The extent of instream perennial wetlands around the margins of permanent pools and other perennial reaches of the creek could decrease compared to with-CDRP and existing conditions. Instream seasonal wetlands may replace areas supporting instream perennial wetlands to some extent. Other than this small effect, the extent of seasonal pools and the instream seasonal wetlands they support would not change substantially from with-CDRP or existing conditions. No net loss of wetlands expected, although the proportion (seasonal vs. perennial) could vary slightly.

TABLE HYD6-3 (Continued)
SUMMARY OF HYDROLOGICAL AND RIPARIAN CONDITIONS ALONG ALAMEDA CREEK SUBREACHES A, B, AND C UNDER EXISTING, WITH-CDRP, AND WITH-PROJECT CONDITIONS
(See Figure HYD6-1 for Location of Subreaches)

Location	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Subreach C1 (cont.)	**Woody Riparian Vegetation.** Tree-supporting willow and riparian forest alliances, and dense mulefat thickets found along the low-flow channel. Dense growth depends on consistent access to surface or shallow groundwater supplied by quarry NPDES discharges, especially during the dry summer months. Sparse mulefat thicket alliance found in the floodplain away from the low-flow channel.	**Woody Riparian Vegetation.** Tree-supporting willow and riparian forest alliances could increase compared to existing conditions due to increased dry-season quarry NPDES discharges. Extent of mulefat thicket would not change except that some might be replaced by dense woody riparian vegetation because of increased dry-season flows.	**Woody Riparian Vegetation.** Tree-supporting willow and riparian forest alliances could decrease compared to existing and with-CDRP conditions due to reduction in dry-season quarry NPDES discharges. Mulefat thicket alliance could replace tree-supporting alliances.
Subreach C2	**Surface Water.** Surface water conditions in this reach are represented by Node 7 in the ASDHM. Average annual flow volume at Node 7 = 38,277 acre-feet per year, about 5 percent lower than at Node 6˚. Average total flow volume over the 18-year study period of 16 acre-feet (min: 0 acre-feet, max: 275 acre-feet) in dry-season 3-month period of July, August, and September, entirely attributable to quarry NPDES discharges.	**Surface Water.** Average post-processed ASDHM annual flow volume at Node 7 = 32,509 acre-feet per year, about 8 percent lower than at Node 6˚. Average ASDHM total flow volume over the 18-year study period of 1,093 acre-feet (min: 650 acre-feet, max: 1,465 acre-feet) in dry-season 3-month period of July, August, and September, entirely attributable to quarry NPDES discharges.	**Surface Water.** Average post-processed ASDHM annual flow at Node 7 = 36,540 acre-feet per year, about 3 percent lower than at Node 6˚. During the dry-season 3-month period of July, August, and September, losses between Node 6˚ and 7 are always greater than quarry NPDES discharges, thus no streamflow input at Node 6˚ reaches Node 7.
	Subsurface Water. Subsurface water conditions in this reach are represented by measurements in MW10. Subsurface water levels at MW10 have varied seasonally within a narrow range from at or above the projected creek thalweg elevation of 215 feet in the winter and spring to 211 feet in the fall. Streambed gravels are thin and the aquifer has less storage capacity than in upstream reaches. Groundwater elevations higher than 215 feet may occasionally occur as a result of inundation from nearby Arroyo de la Laguna.	**Subsurface Water.** Subsurface water levels at MW10 will vary seasonally from 215 feet in the winter and spring to 211 feet in the fall. Subsurface water levels in average years could be comparable to ground water levels in wetter years under existing conditions. Fluctuations will occur within this range and will resemble existing conditions as a function of hydrology and mining activities.	**Subsurface Water.** Subsurface water levels at MW10 will vary seasonally from 215 feet in the winter and spring to 211 feet in the fall. Little change from existing conditions due to the limited aquifer thickness. Fluctuations would occur within this range and would resemble existing conditions as a function of hydrology, mining activities, and variations in ACRP operations.
	Pools. Live stream through pools in wet months. Pools may persist through dry months as permeable streambed gravels are thin.	**Pools.** Live stream through pools in wet months. Pools will persist through dry months. Extent of pools in average years will be similar to extent of pools in wetter years under existing conditions.	**Pools.** Live stream through pools in wet months. Pools may persist through dry months. Little change from existing conditions.
	Instream Wetlands. Instream perennial wetlands occupy margins of permanent pools and other perennial reaches of the creek. Instream seasonal wetlands occupy isolated seasonal pools within the floodplain and other low areas subject to seasonal saturation or inundation from surface flows or groundwater seepage, generally drying in the dry season.	**Instream Wetlands**. Slight increases in groundwater water levels may more consistently support instream perennial wetlands. The extent of seasonal pools and the instream wetlands they support will not change substantially from existing conditions.	**Instream Wetlands**. Little change from with-CDRP and existing conditions.

TABLE HYD6-3 (Continued)
SUMMARY OF HYDROLOGICAL AND RIPARIAN CONDITIONS ALONG ALAMEDA CREEK SUBREACHES A, B, AND C UNDER EXISTING, WITH-CDRP, AND WITH-PROJECT CONDITIONS
(See Figure HYD6-1 for Location of Subreaches)

Location	Existing Conditions	With-CDRP Conditions	With-Project Conditions
Subreach C2 (cont.)	**Woody Riparian Vegetation.** Tree-supporting willow and riparian forest alliances dominate most of this subreach. Dense growth depends primarily on consistent access to shallow groundwater rather than from quarry NPDES discharges. Sparse mulefat thickets found in the floodplain in the upstream portion of this subreach.	**Woody Riparian Vegetation.** Tree-supporting willow and riparian forest alliances expected to change little if at all because increased dry-season flows are likely to simply flow through the shallow stream channel gravels. Most of this subreach already contains tree-supporting alliances.	**Woody Riparian Vegetation.** Tree-supporting willow and riparian forest alliances expected to change little if at all compared to with-CDRP and existing. Increased dry-season flows with-CDRP are likely to simply flow through the shallow stream channel gravels. With-project dry-season flows are nearly the same as existing. Most of this subreach already contains tree-supporting alliances.

NOTES: See Appendix HYD1-R for details and further explanation of surface water conditions, and see Appendix HYD2-R for details and further explanation of subsurface and ground water conditions.

1 Thalweg is the path of a line connecting the lowest points of cross-sections along a streambed.
2 Future scenarios assume that water management changes made by ODS in 2012 will continue in the future.

SOURCE: ESA, LSCE, and Orion, 2019

6.2.1 Existing Conditions

There are a number of isolated pools that form within the Alameda Creek channel during the dry season between Pit F2 and the creek's confluence with the Arroyo de la Laguna. The pools are a consequence of current hydrologic conditions in Alameda Creek including the NPDES discharges from the quarries which occur just upstream of the pools. The pools provide habitat for amphibians, including the federally-listed California red-legged frog.[55]

The pools are shown in Figure HYD6-1 and were plotted based on a survey made in October 15, 2015. There was no significant streamflow in this reach of Alameda Creek for many months before the survey and so the inflow needed to maintain these ponds is presumed to be from a combination of NPDES discharges from the quarries and emerging subsurface flow. These processes are described in greater depth in Appendix HYD2-R, Section 11, *CEQA Considerations: Riparian Habitat*.

6.2.2 With-CDRP Conditions

As described in Table HYD6-3, the pools within the Alameda Creek channel that support amphibians are supplied with water by a combination of NPDES discharges of surface water from the quarries and subsurface water emerging from the ground. A change in the rate of NPDES discharge of water by the quarries or a change in the rate of emergence of water from the subsurface would alter the water supply to the pools. As a result, the attributes of the pools could change, which could in turn affect habitat for amphibians. Completion and commissioning of the CDRP could affect both the volume of water discharged by the quarries and subsurface water flow in the vicinity of the quarries.

Under with-CDRP conditions, the NPDES discharges from the quarries are estimated to average 6,739 acre-feet per year as compared to 3,436 acre-feet per year under existing conditions (see Section 4, Analytical Methods, for more information). Because the volume of water discharged by the quarries under with-CDRP conditions is estimated to be greater than under existing conditions, the pools in the creek channel could increase in size. However, the increase in size is likely to be temporary because the proposed ACRP would be commissioned as soon as possible after the CDRP. The proposed ACRP would likely cause a reduction in NPDES discharges from the quarries during summer months compared to existing conditions, as described below.

6.2.2 With-Project Conditions

As described in Table HYD6-3, the pools in the Alameda Creek channel that support amphibians receive their water from the quarry NPDES discharges and water emerging from the subsurface. If the ACRP resulted in a change in the volume of the quarry NPDES discharges or a change in the amount of subsurface water moving north in the Sunol Valley, it could alter habitat for amphibians.

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55 Environmental Science Associates, 2016. *Alameda Creek Recapture Project, Alameda Creek Terrestrial Biological Resources Report.* Prepared for the San Francisco Public Utilities Commission, November 2016 (see Appendix BIO1).

As noted earlier, the NPDES discharges from the quarries are expected to average 6,739 acre-feet per year under with-CDRP conditions as compared to 3,436 acre-feet per year under existing conditions. When the proposed ACRP is in operation, the SFPUC would pump an average of 6,045 acre-feet per year from Pit F2 for municipal use. Under with-project conditions, the volume of water discharged from the quarries is estimated to average 3,870 acre-feet. During summer months, when the ACRP is in operation, quarry NPDES discharges under the with-project would be lower than the existing condition. However, it is unlikely that the reduction in quarry NPDES discharges would make a substantial impact on pool habitat over the course of a water year. Since quarry NPDES discharge would be larger from December to June under the with-project condition, relative to the existing condition, there should be a corresponding increase in the size of the pool habitat at the end of the June under the with-project condition. Pools may dry at a faster rate under the with-project, relative to the existing condition, but would still be supplemented with quarry NPDES discharge. Thus, the variation in pool size and persistence over the course of a hydrologic year, between the existing and with-project condition, should be minimal.

6.3 Riparian Vegetation

Riparian vegetation is present in a reach of Alameda Creek that could be affected by changes in surface and subsurface hydrology attributable to the proposed ACRP. The riparian vegetation includes woody riparian vegetation and instream wetland vegetation.

Table HYD6-2 is a summary description of hydrologic and riparian conditions in the Alameda Creek channel between Pit F2 and the Arroyo de la Laguna under existing, with-CDRP, and with-project conditions for each of the subreaches identified in Figure HYD6-1. Separate descriptions are provided for surface water conditions, subsurface water conditions, instream wetlands and woody riparian vegetation.

This section provides information on those aspects of Alameda Creek's surface water hydrology that affect riparian vegetation habitat under existing, with-CDRP, and with-project conditions. Information on those aspects of subsurface water hydrology that affect riparian vegetation is contained in Appendix HYD2-R, Section 11, *CEQA Considerations: Riparian Habitat*.

6.3.1 Existing Conditions

Most of the Alameda Creek channel from the San Antonio Creek confluence to the Arroyo de la Laguna confluence is currently covered with riparian shrubs and trees. Emergent wetland vegetation exists around the pools shown in Figure HYD6-1 and elsewhere in the creek channel. During the dry season when there is no surface water flow in Alameda Creek at the San Antonio Creek confluence, the riparian vegetation is probably sustained by a combination of water discharged from the quarries under their NPDES discharge permit and groundwater. Riparian vegetation upstream of the I-680 bridge is probably primarily sustained by the quarry NPDES discharges because groundwater levels fall to 15 or 20 feet below the ground surface in this location in the dry season. Groundwater probably plays a more important role in sustaining riparian vegetation downstream of the I-680 bridge because, even in the dry season, groundwater levels there only fall to 5 or 10 feet below the ground surface.[56]

The riparian vegetation that exists in the Alameda Creek channel between the San Antonio Creek and Arroyo de la Laguna confluences in 2016 is a product of the conditions that have existed in the channel over the last several decades, including the amount, depth and seasonal pattern of surface and subsurface water flow, the soil conditions, exposure to sunlight, among other factors. The CDRP will not, and the ACRP would not, alter any of the factors important to the abundance and health of riparian vegetation other than to the extent that it would indirectly affect the amount, depth and seasonal pattern of surface and subsurface water flow.

Daily streamflow is probably too transient to have much effect on the abundance and health of riparian vegetation except the rare very high daily flows that may uproot vegetation. Of more importance for riparian vegetation, is the season in which surface flow exists in the Alameda Creek channel. Surface water in the channel and associated elevated levels of subsurface water in the spring and summer supplies water to growing riparian vegetation; the vegetation is dormant in the fall and winter. Average annual streamflow is also important to riparian vegetation because if there was a long-term trend toward drier conditions, then the abundance and perhaps health of riparian vegetation would be expected to decline.

The rate of subsurface water flow is only important to riparian vegetation in the sense that it affects the groundwater level under the channel which, depending how far it is below the surface, may sustain riparian vegetation during periods when there is no surface water flow. Groundwater levels change less rapidly than surface water levels in the creek channel and their location on any particular day is not of much importance for riparian vegetation. Much more important is the seasonal pattern of groundwater levels and their relationship to the root zone for vegetation. Information on subsurface water conditions in the reach of Alameda Creek between Pit F2 and the creek's confluence with the Arroyo de la Laguna is contained in Appendix HYD2-R and summarized in Table HYD6-1, together with information on surface water conditions. The following paragraphs focus on those aspects of surface water flow that most influence the abundance and health of riparian vegetation; that is low flows and flows during the growing season.

6.3.2 With-CDRP and With-Project Conditions

Post-processing of the ASDHM data was used to estimate surface water flow in Alameda Creek immediately above and below the San Antonio Creek confluence (i.e., above and below Pit F2). Flow immediately above San Antonio Creek depends solely on runoff from upper Alameda Creek.Figure HYD5-2 shows flow duration curves at that location (Node 5) for existing, pre-2001, with-CDRP conditions and with-project conditions. It is estimated that flow exceeds one cfs on 25 percent

56 ibid.

of the days under existing conditions. There is little or no flow in the creek at this location most of the time under existing conditions. Under with-CDRP and with-project conditions, it is estimated that flow will exceed one cfs on 37 percent of the days. The increase is attributable to the bypasses at the Alameda Creek Diversion Dam and releases at Calaveras Reservoir that are part of the CDRP.

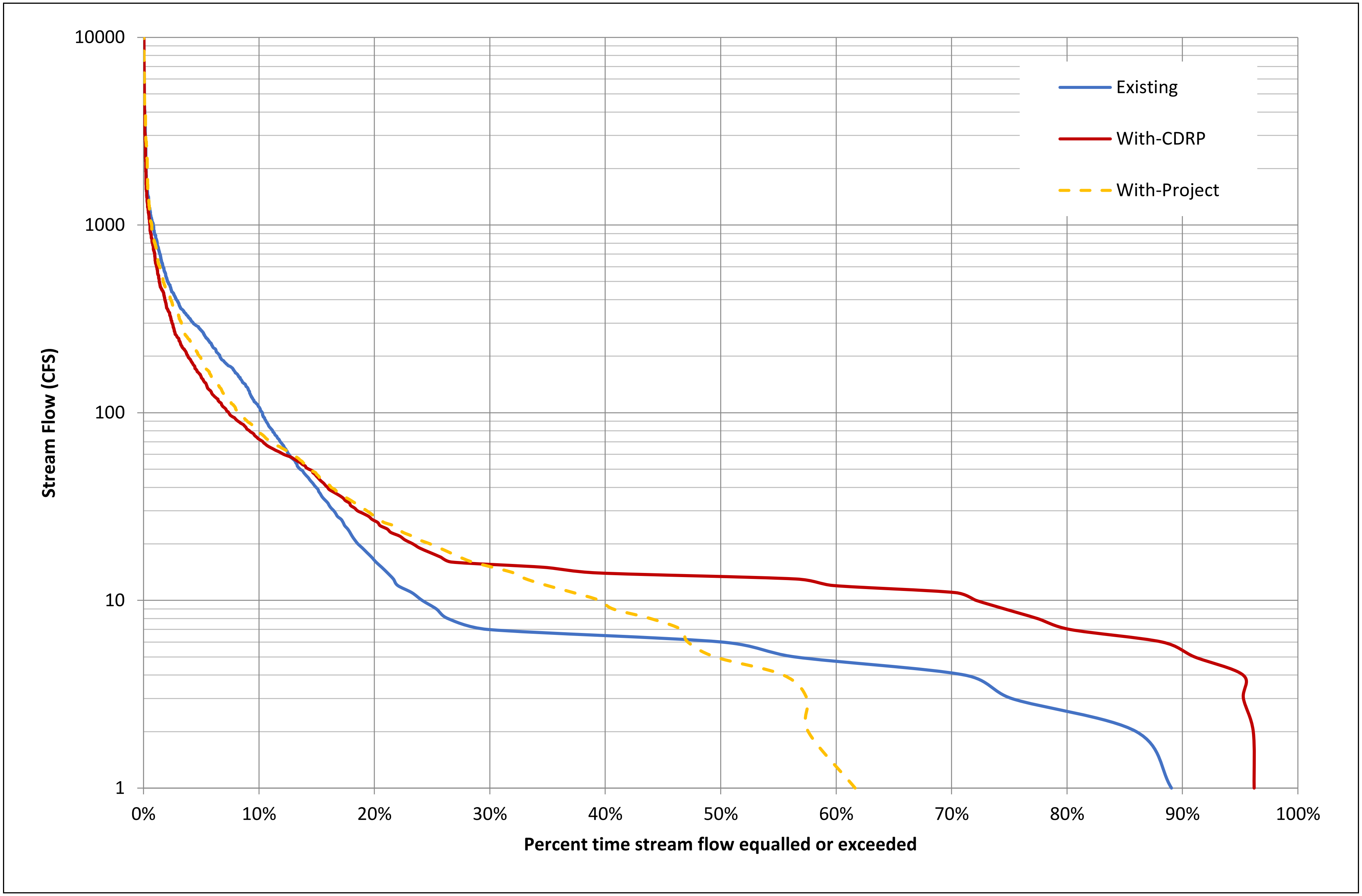
Node 6, immediately below the San Antonio Creek confluence is at the upstream end of the reach where the proposed project could affect riparian vegetation. This reach is affected by flow from upper Alameda Creek, flow from San Antonio Creek, and the NPDES discharges of water from the quarries. **Figure HYD6-2** shows flow duration curves for Alameda Creek below the San Antonio Creek confluence (Node 6) for the existing condition, with-CDRP condition, and with-project condition. The vertical axis is exaggerated in Figure HYD6-2 to show low flow conditions (when flow is less than one cfs) at Node 6.

Flow exceeds one cfs on about 89 percent and 96 percent of the days under existing and with-CDRP conditions, respectively. Under the with-project condition, flow exceeds one cfs only 62 percent of days. This is due to a reduction in quarry NPDES discharges during summer months when recapture is occurring and the quarry operators have less water to manage. Nevertheless, because of quarry NPDES discharges, some streamflow is generally always present at Node 6˚ under with-project conditions. and would provide some water to the vegetation community downstream of the discharge point during summer months.

Flow downstream of the quarry NPDES discharge point exceeds 10 cfs for about 72 percent of the days under with-CDRP conditions but only for about 24 percent of the days under existing conditions. The difference is a result of greater estimated quarry NPDES discharges under with-CDRP conditions. As noted above (Table HYD4-9), the average annual quarry NPDES discharge under existing conditions is 3,436 acre-feet per year; under with-CDRP conditions it is estimated to be 6,739 acre-feet per year, andunder the with-project condition it is estimated to be 3,870 acre-feet per year.

Table HYD6-4 shows average monthly flows in Alameda Creek below the San Antonio Creek confluence (Node 6) for existing, with-CDRP conditions, and with-project conditions, calculated from daily flows. Average monthly flow volume will be greater under with-CDRP conditions than under existing conditions, half the time. Average flow volume under with-CDRP conditions will be greater than under existing conditions in October, November, February, July, August, and September. Because riparian vegetation is dormant through the fall and winter, the health of the vegetation depends on spring and summer flows. Average monthly flow will be greater under with-CDRP conditions in July, August, and September than it is under existing conditions.

Monthly average flows under with-project conditions would be greater than they are under existing conditions in two months of the year February and March, and less in the other ten months of the year. Monthly average flows under with-project conditions would be greater than they are under with-CDRP conditions in seven months of the year, December through June, and less in the other five months of the year. In both cases, flows under with-project conditions would be less in most drier



SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6 by ESA/Orion.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

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Figure HYD6-2

Flow Duration Curves for Node 6 (550 feet downstream of San Antonio Confluence) For Existing, Pre-2001, and With-Project Conditions

TABLE HYD6-4
AVERAGE MONTHLY FLOWS
IN ALAMEDA CREEK DOWNSTREAM OF THE SAN ANTONIO CONFLUENCE (NODE 6˚)
FOR EXISTING CONDITIONS, WITH-CDRP, AND WITH-PROJECT CONDITIONS
WY 1996 TO WY 2013 (cfs)

Scenario	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Existing Conditions	4.3	4.5	44.5	137.1	198.1	131.2	95.6	32.0	12.3	4.8	4.3	4.6
With-CDRP Conditions	10.5	13.1	35.3	108.5	199.7	94.4	71.8	16.7	8.8	13.5	13.5	13.3
With-Project Conditions	0.4	3.0	37.2	123.0	204.1	151.9	82.8	18.4	10.4	0.5	0.5	0.4
Difference in flow between with-Project condition and existing condition (With-project conditions minus existing conditions)	-3.9	-1.5	-7.3	-14.2	5.9	20.7	-12.8	-13.6	-1.9	-4.3	-3.9	-4.1
Difference in flow between with-Project condition and with-CDRP condition (With-project conditions minus with-CDRP conditions)	-10.2	-10.1	1.8	14.5	4.3	57.5	11.0	1.7	1.6	-12.9	-13.0	-12.8

SOURCE SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include quarry NPDES discharges at Node 6˚ and loses between Node 6˚ and 7 by ESA/Orion, 2019.

months than they are under existing and with-CDRP conditions. Riparian vegetation is most affected by flows in the drier months when it is actively growing but water supply may be limited. The differences in drier month flows between scenarios are primarily attributable to differences in estimated quarry NPDES discharges.

Table HYD6-5 shows average flow volumes in Alameda Creek downstream of the San Antonio Creek confluence in the spring and summer for existing, with-CDRP, and with-project conditions. Under with-project conditions, estimated flow volumes are higher in spring months than they are under the with-CDRP condition, but lower than existing condition. Flow volume during summer months is lowest under the with-project condition, followed by the existing and then with-CDRP condition.

TABLE HYD6-5
ESTIMATED AVERAGE FLOW VOLUMES IN ALAMEDA CREEK BELOW THE SAN ANTONIO CREEK CONFLUENCE (NODE 6˚) IN SPRING AND SUMMER (acre-feet)

Scenario	Total flow volume in spring (April, May and June)	Total flow volume in summer (July, August and September)
Existing Conditions	8,390	834
With-CDRP Conditions	5,821	2,445
With-project Conditions	6,677	87

SOURCE SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6˚ and losses between Node 6˚ and 7 by ESA/Orion, 2019.

Flow volumes are lower under the with-CDRP and with-project conditions, compared to the existing condition, in the spring because of changes in operations at Calaveras Reservoir due to DSOD requirements under the existing condition. Flow volumes are lowest under the with-project conditions for summer months because of differences in estimated quarry NPDES discharges during the recapture period. Thus, the water supply to the riparian vegetation in and around the Alameda Creek channel downstream of the San Antonio Creek confluence in summer would be lower under with-project conditions than it is under existing conditions and will be under with-CDRP conditions. The reduction in surface water in Alameda Creek could have an adverse effect on riparian vegetation particularly in the creek reach between the San Antonio Creek confluence and I-680, where the persistence of the vegetation in dry periods appears to rely primarily on NPDES discharges by the quarry operators.

7. Implications of ACRP-Caused Surface Water Hydrology Changes for Alameda County Water District Water Supply Operations

Surface water hydrology under existing, pre-2001, with-CDRP, and with-project conditions within the Sunol Valley is described in detail in Section 5. This section describes the implications of ACRP-induced changes in surface water hydrology for Alameda County Water District (ACWD), the only other downstream user of Alameda Creek water besides the SFPUC that could potentially be affected by the ACRP. The question to be answered for the CEQA impact analysis is whether ACRP-induced changes in surface water hydrology could cause a change in ACWD operations that has adverse environmental effects.

7.1 Alameda County Water District's Water Sources

ACWD obtains its water from three sources, local supplies, the State Water Project and the San Francisco regional water system. The District obtains about 40 percent of its water from local sources, 40 percent from the State Water Project and 20 percent from the SFPUC regional water system.[57]

The primary source of the local supplies is Alameda Creek. Alameda Creek water, emerging from Niles Canyon, infiltrates into the Niles Cone groundwater basin. The Niles Cone groundwater basin extends from the foothills of the Diablo Range on the east to San Francisco Bay on the west and from the city of Hayward on the north to the Alameda/Santa Clara County line on the south. ACWD pumps hard water from the Niles Cone groundwater basin, blends it with soft water purchased from San Francisco, and supplies it to its customers. San Francisco delivers Tuolumne River water to the ACWD blending facility from the Hetch Hetchy Aqueduct.

ACWD also collects and stores water from the Alameda Creek watershed in Del Valle Reservoir in the Livermore-Amador Valley. Water from the Del Valle Reservoir is conveyed to ACWD's water treatment plants by the State Water Project's South Bay Aqueduct. State Water Project water from the Sacramento-San Joaquin Delta is also conveyed to the District's treatment plants by the South Bay Aqueduct.

In addition to being delivered directly to ACWD in the South Bay Aqueduct, State Water Project water is released to Alameda Creek at a turnout on the South Bay Aqueduct on Vallecitos Creek, a tributary of the Arroyo de la Laguna. The State Water Project water together with Arroyo de la Laguna and Alameda Creek water flows downstream through Niles Canyon to the Niles Cone. ACWD enhances infiltration of the water into the Niles Cone by diverting water from Alameda Creek at several temporary dams into percolation ponds, some of which were gravel quarries.

[57] ACWD, 2014. Reliability by Design: Integrated Resource Planning at Alameda County Water District.

The proposed ACRP has the potential to affect one of ACWD's water sources, Alameda Creek. It would not affect delivery of water to ACWD by the State Water Project or San Francisco. If the ACRP altered the amount of water or the seasonal pattern of water flowing through Niles Canyon to the Niles Cone, it could cause a change in ACWD operations that in turn could cause adverse environmental effects.

7.2 ACWD's Alameda Creek Operations

ACWD diverts water from Alameda Creek at two inflatable rubber dams near the downstream end of Niles Canyon. Diverted water is routed to the Quarry Lakes and other ponds, where it percolates into and recharges the Niles Cone. Water can be diverted from October 1 to May 31, with a maximum permissible diversion volume set by ACWD's water rights. The maximum permissible diversion volume does not constrain ACWD's operations because it is higher than the amount of water available. During the period the rubber dams are in place, ACWD is required to make releases of water to the downstream reaches of Alameda Creek to support aquatic life as described in the Biological Opinion issued by NMFS for the Joint Alameda Creek Fish Passage Improvements Project[58] and shown in **Table HYD7-1, ACWD Minimum Bypass Flows and Conditions of Bypass**. As indicated on the table, ACWD minimum bypass flows at the Alameda County Flood Control and Water Conservation District (ACFCD) Drop Structure are based on flows at the Nile gage ranging from 25 cfs to 700 cfs. ACWD's bypass rule does not require ACWD to release water from storage to meet bypass flow requirements.

Although many improvements have been made, ACWD basic operational mode has not changed for several decades. ACWD has been diverting water from Alameda Creek and purchasing it from San Francisco since the 1930s, and receiving water from the State Water Project since the 1960s.

As shown in Table HYD7-1, the bypass depends on measured flow in Alameda Creek at the Niles USGS gage. Between January 1 and March 31 when creek flow exceeds 30 cfs, ACWD proposes to bypass 25 cfs. Between January 1 and March 31 when creek flow is less than 30 cfs, ACWD proposes to bypass 20 cfs. If creek flow is less than 20 cfs, whatever flow is present would be bypassed. Between April 1 and May 31 in wet or normal years, bypass would not be dependent on flow at the Niles gage, ACWD would bypass 12 cfs. During that period in dry and critically dry years, bypass would be dependent on flow at the Niles gage. If creek flows at the gage exceed 25 cfs, 12 cfs would be bypassed. If creek flows are less than 25 cfs, 5 cfs or available flow would be bypassed. In this analysis, the values of 25 cfs (January 1 to March 31) and 30 cfs (April 1 to May 31) were used as thresholds for impact evaluation in order to be consistent with the operational conditions in the ACWD Biological Opinion.

[58] National Marine Fisheries Service, 2017. Endangered Species Act Section 7(a)(2) biological Opinion and Magnuson-Steven Fishery Conservation and Management Act Essential Fish Habitat Response for the Joint Alameda Creek Fish Passage Improvements Project in Fremont, California (Corps File No. 2013-00083S). October 5, 2017.

TABLE HYD7-1
ACWD MINIMUM BYPASS FLOWS AND CONDITIONS OF BYPASS

Season	Dates	Flow at Niles Gage[1]	Minimum Bypass Flow at ACFCD Drop Structure	Additional Conditions of Bypass
Year Round	Jan 1 - Dec 31	> 700 cfs	NA	Dams down; no off stream diversion.
		> 400 cfs	NA	Dams may be up; no off-stream diversions when turbidity is high.
Steelhead In-Migration	Jan 1 - Mar 31	100 - 400 cfs	25 cfs + Net SFPUC Releases at Niles Gage[1,2]	No water will be released from storage to meet bypass flow requirements.
		30 - 100 cfs	25 cfs	If less than 25 cfs arrives at the ACFCD Drop Structure, all flow arriving at ACFCD Drop Structure shall be bypassed. No water will be released from storage to meet bypass flow requirements.
		< 30 cfs	20 cfs	If less than 20 cfs arrives at the ACFCD Drop Structure, all flow arriving at ACFCD Drop Structure shall be bypassed. No water will be released from storage to meet bypass flow requirements.
Steelhead Out-Migration	Apr 1 - May 31, Normal to Wet Years	All Flows	12 cfs + Net SFPUC Releases at Niles Gage[1,2]	Normal/wet conditions are years when water-year rainfall to date (as of April 1, at Fremont) is greater than the 60% annual exceedance value. Dry/Critical conditions are years when water-year rainfall to date (as of April 1, at Fremont) is less than the 60% annual exceedance value. In such years, if less than 12 cfs of natural flow arrives at ACFCD Drop Structure then all flow arriving at ACFCD Drop Structure shall be bypassed. No water will be released from storage to meet bypass flow requirements.
	Apr 1 - May 31, Dry or Critical Dry Years	> 25 cfs	12 cfs + Net SFPUC Releases at Niles Gage[1,2]	If flows are less than 25 cfs under dry/critical conditions, ACWD will provide 12 cfs + Net SFPUC Releases at Niles Gage 7 consecutive days in April and 7 consecutive days in May (days to be specified by NMFS/CDFW). If ACWD diversions are zero and less than 12 cfs arrives at ACFCD Drop Structure, all of the flow at ACFCD Drop Structure shall be bypassed. No water will be released from storage to meet bypass flow requirements.
		< 25 cfs	5 cfs	
Outside of Peak Migration	Jun 1 - Dec 31	All Flows	5 cfs	If less than 5 cfs arrives at ACFCD Drop Structure, all of the flow at ACFCD Drop Structure shall be bypassed. No water will be released from storage to meet bypass flow requirements.

1 Daily average inflows as measured at the USGS Niles Gage.
2 Pursuant to the March 5, 2011, NMFS Biological Opinion issued to the Corps and SFPUC for the Calaveras Dam Replacement Project, water releases from Calaveras Reservoir and bypass flows at the Alameda Creek Diversion Dam may, at times, contribute to flow further downstream in Alameda Creek at Niles Gage, and if they do, any such flows contributing to total flow at Niles Gage would be bypassed by ACWD.

SOURCE: National Marine Fisheries Service, 2017. Endangered Species Act Section 7(a)(2) biological Opinion and Magnuson-Steven Fishery Conservation and Management Act Essential Fish Habitat Response for the Joint Alameda Creek Fish Passage Improvements Project in Fremont, California (Corps File No. 2013-00083S). October 5, 2017.

7.3 Effects of ACRP on Flow in Alameda Creek at Niles

Flow from upper Alameda Creek and Arroyo de la Laguna combine at their confluence upstream of Niles Canyon. Flow from the Arroyo de la Laguna is several times greater than flow from upper Alameda Creek. The proposed ACRP has the potential to affect flow in upper Alameda Creek but not flow from the Arroyo de la Laguna.

ACWD's locally-sourced water comes from Alameda Creek as it leaves Niles Canyon. If the proposed ACRP were to alter the rate of flow in Alameda Creek at that location, it could affect ACWD's operations.

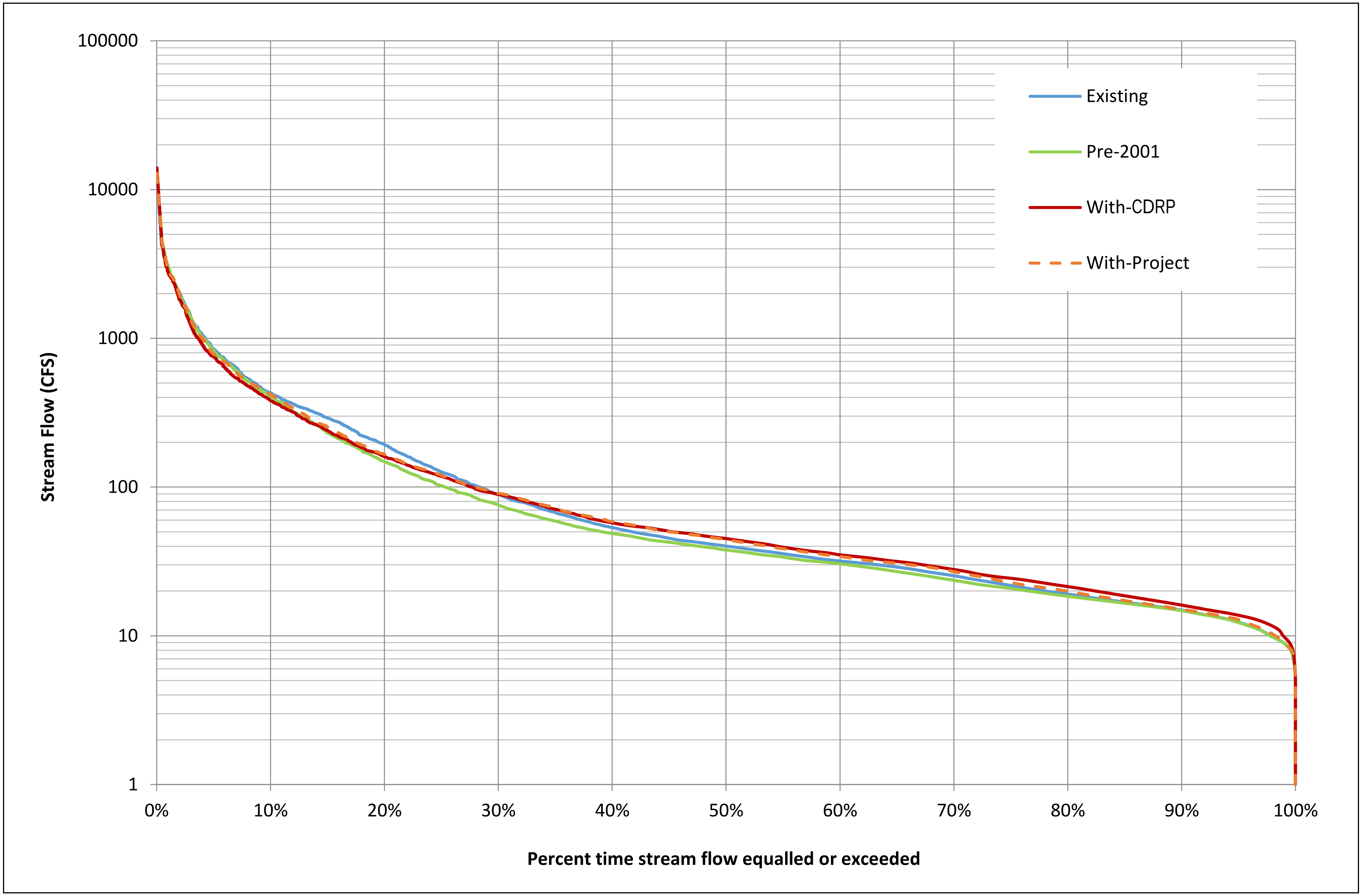
In the following analysis of surface water hydrology three comparisons are made. With-project conditions are compared to pre-2001 conditions (the conditions that existing before the DSOD imposed limitations on storage in Calaveras Reservoir), existing conditions, and with-CDRP conditions.

The ASDHM, with adjustments by ESA/Orion, was used to estimate daily flows in Alameda Creek at Niles (Node 9) for four scenarios: pre-2001 conditions, existing conditions, with-CDRP conditions, and with-project conditions. The comparisons between different conditions are made at the location of the USGS gage on Alameda Creek at Niles (Node 9). The gage is located close to the downstream end of Niles Canyon and upstream of ACWD's diversion point. Comparisons are made between the scenarios at flow rates of 25 cfs, 700 cfs, and 1,200 cfs.

7.3.1 Comparison of Flows

Figure HYD7-1 shows flow duration curves for Alameda Creek at Niles (Node 9) for the existing, pre-2001, with-CDRP, and with-project conditions. The flow duration curves were constructed using data from October 1 to May 31, the period during which ACWD is permitted to divert water from Alameda Creek.

Although the flow duration curves in Figure HYD7-1 provide useful information on the potential impacts of the ACRP on flow in Alameda Creek at Niles, they should be viewed with caution. The quarry NPDES discharges in the ASDHM under existing conditions are represented by historical daily NPDES discharges between Water Year 1996 and Water Year 2013. For pre-2001, with-CDRP and with-project conditions, ASDHM output was modified by ESA/Orion to include the estimated quarry NPDES discharges and the losses of surface water to the subsurface between the San Antonio and Arroyo de la Laguna confluences. Under pre-2001, the estimated NPDES quarry discharges are represented by the historical daily NPDES discharges between Water Year 1996 and Water Year 2013 multiplied by a factor. Under with-CDRP and with-project conditions quarry NPDES discharges are represented based on the amount of excess water in Pit F2 relative to the assumed operational range (see Section 4, Analytical Methods, for more information). The methodology used to estimate quarry NPDES discharges under pre-2001, with-CDRP, and with-project conditions is based on the best available information — existing quarry NPDES discharge data. But, the methodology necessarily



SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6 and losses between Node 6 and 7 by ESA/Orion.

Note: Data presented are derived from the Alameda System Daily Hydrologic Model (ASDHM) using Water Years (1996 – 2013).

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Figure HYD7-1

Flow Duration Curves for Node 9 (Alameda Creek at Niles)
For ACWD Diversion Period (October 1 – May 31)
For Existing, Pre-2001, With-CDRP, and With-Project Conditions

assumes the quarries will continue to operate in the future as they have in the past and given current daily variability, even if they continue to operate as before, they are unlikely to follow the exact same daily pattern. Changes in the daily pattern of NPDES discharges is expected to have little effect on the flow duration curves at Node 9 for pre-2001, existing, and with-project conditions because under these three scenarios the NPDES discharges from the quarries is generally less than or equal to the 7.5 cfs that percolates into the ground between the San Antonio Creek and Arroyo de la Laguna confluences.[59] Therefore, the quarry discharges have little influence on flow duration curve related to surface water flow downstream of the arroyo confluence. A change in the daily pattern of NPDES discharges could be expected to affect the flow duration curve for with-CDRP conditions. Under with-CDRP conditions, the NPDES discharges from the quarries are more voluminous than under the other three scenarios and so some of the water added by these discharges does not percolate into the ground between the San Antonio Creek and Arroyo de la Laguna confluences but continues downstream.

It is expected that some of the water that percolates into the ground between the San Antonio Creek and Arroyo de la Laguna confluences reemerges as surface water flow in Alameda Creek near the arroyo confluence and downstream towards Niles. No information is available on the quantity of return flow that might reenter the surface stream and so no allowance is made for it in the ASDHM results, as adjusted by ESA/Orion. As a result, it is possible that the estimates of flow in Alameda Creek at Niles shown in Figure HYD8-1 and **Table HYD7-1** are understated.

Figure HYD7-1 shows that flow at Niles (Node 9), under pre-2001 conditions is estimated to exceed 25 cfs on about 68 percent of the days and under existing conditions is estimated to exceed 25 cfs on about 70 percent of the days. Under with-project conditions, it would exceed 25 cfs on 72 percent of the days and under with-CDRP conditions it would exceed 25 cfs on 74 percent of the days. Under the existing, pre-2001, with-CDRP and with-project conditions, it would exceed 1,200 cfs on about 3 percent of the days and 700 cfs on 6 percent of the days under the with-project, existing, and pre-2001 conditions and 5 percent under the with-CDRP condition.

7.3.2 Flow Volumes for Period of October 1 through May 31

Table HYD7-2 shows flow volumes in Alameda Creek at Niles (Node 9) for the period when ACWD is permitted to divert water from the creek, October 1 through May 31, for pre-2001 and with-project conditions as estimated for the purposes of this EIR. Under pre-2001 conditions, the average flow volume for the 18-year model period is 97,439 acre-feet. The average flow volume under with-project conditions for the same period would be 99,300 acre-feet or about 1.9 percent more than under pre-2001 conditions. Under existing conditions, the average flow volume in Alameda Creek at Niles is estimated to be 100,837 acre-feet. With-project flow volume would be about 1.5 percent less than under existing conditions.

59 Over the 18-year study period, average daily quarry NPDES discharge under the pre-2001 condition is 3.9 cfs, under the existing condition is 4.7 cfs, under the with-CDRP condition is 9.3 cfs, and under the with-project condition is 5.3 cfs.

TABLE HYD7-2
FLOW VOLUME IN ALAMEDA CREEK AT NILES (NODE 9)
FROM OCTOBER 1 THROUGH MAY 31 FOR WY1996-WY2013 (acre-feet)

Water Year	Pre-2001 Conditions	Existing Conditions	With-CDRP Conditions	With-Project Conditions	Year type
1996	217,747	217,747	218,820	219,532	Wet
1997	190,426	190,426	187,236	194,825	Wet
1998	349,708	349,708	345,829	352,287	Wet
1999	72,542	72,542	74,658	76,341	Wet
2000	94,769	98,238	86,813	96,432	Wet
2001	30,722	30,304	34,587	34,022	Dry
2002	31,605	56,070	36,833	35,885	Dry
2003	57,872	65,692	67,409	66,881	Dry
2004	42,424	44,323	47,092	46,698	Dry
2005	122,270	128,063	96,681	109,904	Wet
2006	160,487	167,781	138,195	162,519	Wet
2007	29,376	32,588	32,535	32,354	Dry
2008	52,382	53,865	54,797	54,331	Dry
2009	46,405	39,463	39,262	40,850	Wet
2010	73,619	69,966	70,634	77,009	Wet
2011	122,111	127,064	101,286	123,479	Wet
2012	24,945	25,671	28,028	28,102	Dry
2013	34,495	45,561	36,535	35,954	Dry
Average	97,439	100,837	94,290	99,300	
Maximum	349,708	349,708	345,829	352,287	
Minimum	24,945	25,671	28,028	28,102	

SOURCE SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6˚ and losses between Node 6˚ and 7 by ESA/Orion, 2019.

Table HYD7-3 presents the same information, except for the eight dry years only during the same model period. During dry years, the average flow volume under the pre-2001 conditions is 37,978 acre-feet and under the with-project it is 41,778 acre-feet, an increase of about 9.1 percent.

During dry years the average flow volume under the existing conditions is estimated to be 44,259 acre-feet and under the with-project it is 41,778 acre-feet, a decrease of about 5.6 percent. However, the minimum flow volume during a dry year under the existing condition is 25,671 acre-feet in water year 2012, while, during that same water year flows under the with-project condition are 28,102 acre-feet. Thus, it is unlikely that flow volumes in the driest water years would be significantly reduced under the with-project condition.

Under with-CDRP conditions, the average flow in Alameda Creek at Niles is estimated to be 94,290 acre-feet over the 18-year model period. Under with-project conditions, flow would be about 5.0 percent more than under with-CDRP conditions. This is because the reduction in storage in Calaveras Reservoir caused by the bypasses and releases to meet the instream flow schedule is greater for with-CDRP conditions than it is for with-project conditions and, as a result spills are less frequent. During dry years, the average flow volume under the with-CDRP conditions was 42,227 acre-feet or about 1.1 percent greater than under the with-project condition (41,778 acre-feet).

TABLE HYD7-3
FLOW VOLUME IN ALAMEDA CREEK AT NILES (NODE 9)
FROM OCTOBER 1 THROUGH MAY 31
FOR DRY YEARS ONLY BETWEEN WY1996-WY2013 (acre-feet)

Water Year	Pre-2001 Conditions	Existing Conditions	With-CDRP Conditions	With-Project Conditions	Year type
2001	30,722	30,304	34,587	34,022	Dry
2002	31,605	56,070	36,833	35,885	Dry
2003	57,872	65,692	67,409	66,881	Dry
2004	42,424	44,323	47,092	46,698	Dry
2007	29,376	32,588	32,535	32,354	Dry
2008	52,382	53,865	54,797	54,331	Dry
2012	24,945	25,671	28,028	28,102	Dry
2013	34,495	45,561	36,535	35,954	Dry
Average	37,978	44,259	42,227	41,778	
Maximum	57,872	65,692	67,409	66,881	
Minimum	24,945	25,671	28,028	28,102	

SOURCE SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6˚ and losses between Node 6˚ and 7 by ESA/Orion, 2019.

7.4 Effects on ACWD Operations

7.4.1 Effects during High Flows

ACWD diverts water from Alameda Creek downstream of the Niles gage using inflatable dams. However, prior to reaching ACWD's facilities, as incorporated into the ASDHM, a constant loss of 12 cfs of streamflow occurs in the reach of Alameda Creek within the Niles Cone. The source of most of the water reaching ACWD's facilities on Alameda Creek is the northern drainage of the Alameda Creek watershed; that is, the portion of the watershed drained by the Arroyo de la Laguna. The SFPUC's Alameda water supply facilities are located in the smaller southern drainage of the Alameda Creek watershed (see Figure HYD2-1).

Flows at the Niles gage rise and fall rapidly when storms pass over the watershed. ACWD takes its inflatable dams down when instantaneous flow in Alameda Creek exceeds 1,200 cfs or average daily flow exceeds 700 cfs. Flows exceeding 700 cfs can occur for extended periods in wet years but usually only occur during, and in the immediate aftermath of storms, in dry years. An ACRP-caused change in average daily flow at around 700 cfs could affect the decision to inflate or deflate the dams. This could affect ACWD's ability to divert water. It should be noted that even when the dams are up, ACWD only diverts water when the turbidity level is acceptable.

ACWD is permitted to divert water from Alameda Creek from October 1 to May 31, a period of 243 days each year. The number of days in the 18-year period of record when the ACRP would affect the timing of dam inflation and deflation was determined for pre-2001 conditions, existing conditions, with-CDRP conditions, and with-project conditions. Using the daily flow data for four scenarios, the analysis identified the number of days during the October 1 to May 31 period for each of the 18 years when flows exceed 700 cfs; then for each water year, the analysis determined the number of days ACRP-caused flow changes would affect ACWD's dam deployment compared to pre-2001, existing, and with-CDRP conditions, as summarized in **Table HYD7-4**, **Table HYD7-5**, and **Figure HYD7-2**.

TABLE HYD7-4
ESTIMATED NUMBER OF DAYS ACRP-CAUSED INCREASES AND DECREASES IN FLOW AT NILES (NODE 9) ABOVE THRESHOLD (700 CFS) FOR THE ACWD DIVERSION PERIOD (OCTOBER 1 TO MAY 31) THAT COULD AFFECT DAM DEPLOYMENT (DAYS)

Water Year	With-Project Compared to Pre-2001 Conditions		With-Project Compared to Existing Conditions		With-Project Compared to With-CDRP Conditions	
	Increase	Decrease	Increase	Decrease	Increase	Decrease
1996	0	1	0	1	0	0
1997	0	0	0	0	1	0
1998	3	2	3	2	2	0
1999	2	1	2	1	1	0
2000	2	1	1	2	3	0
2001	1	-	1	0	0	0
2002	1	0	0	3	0	0
2003	0	0	0	0	0	0
2004	0	0	1	0	0	0
2005	0	8	0	4	2	0
2006	3	3	8	5	12	1
2007	0	0	0	0	0	0
2008	0	1	0	1	0	0
2009	0	1	0	0	0	0
2010	1	0	1	3	1	0
2011	0	0	0	8	1	1
2012	0	0	0	0	0	0
2013	0	0	0	1	0	0
Average	**0.7**	**1.0**	**0.9**	**1.7**	**1.3**	**0.1**

SOURCE: SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6* and losses between Node 6* and 7 by ESA/Orion, 2019.

In a typical diversion season, the ACRP would increase or decrease the amount of time the dams were in place by a day or two relative to pre-2001 conditions, existing conditions, and with-CDRP conditions; that is one or two days in a 243-day diversion season. Compared to pre-2001 and existing conditions, the ACRP would decrease slightly the number of days when the dams could be in place. Compared to with-CDRP conditions, the ACRP would increase slightly the number of days when the dams could be in place. Thus, the ACRP would be expected to have very little effect on ACWD's ability to divert water during high flows.

TABLE HYD7-5
NUMBER OF DAYS WITH FLOWS AT NODE 9 WHEN ACWD COULD DEPLOY DAM FOR EXISTING, PRE-2001, WITH-CDRP, AND WITH-PROJECT CONDITIONS

Water Year	Existing Conditions	Pre-2001 Conditions	With-CDRP Conditions	With-Project Conditions
1996	206	206	207	207
1997	223	223	224	223
1998	194	194	195	193
1999	236	236	236	235
2000	224	226	228	225
2001	242	242	241	241
2002	235	239	238	238
2003	232	232	232	232
2004	239	238	238	238
2005	222	218	228	226
2006	212	209	220	209
2007	240	240	240	240
2008	236	236	237	237
2009	239	238	239	239
2010	231	234	234	233
2011	219	227	227	227
2012	242	242	242	242
2013	237	238	238	238
Average	***228***	***229***	***230***	***229***

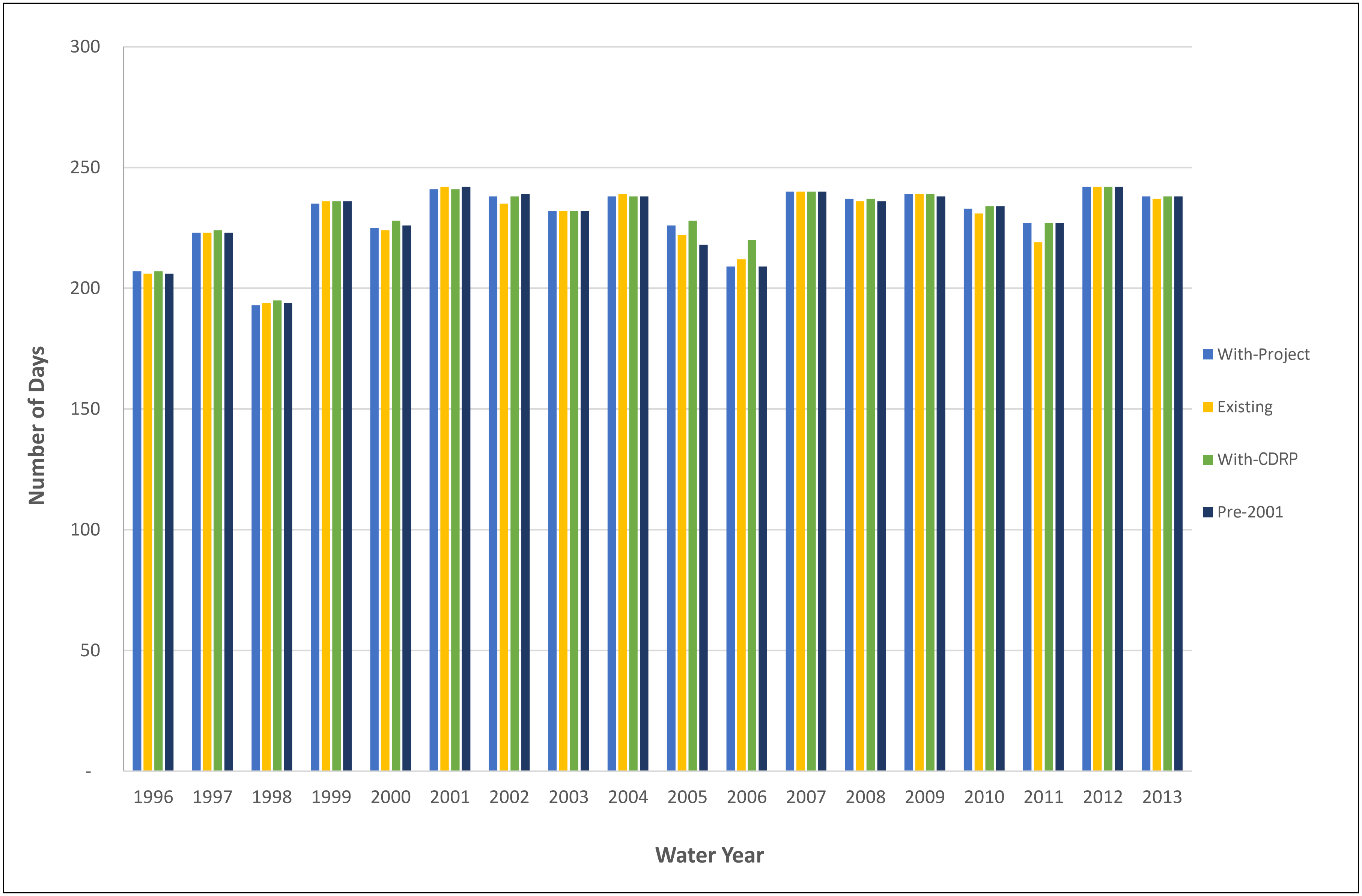
SOURCE: SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6˚ and losses between Node 6˚ and 7 by ESA/Orion, 2019

7.4.2 Effects during Low Flows

ACWD is permitted to divert water from Alameda Creek from October 1 to May 31. Under the ACWD’s operation rules stipulated by NMFS in the 2017 Biological Opinion on the Joint Lower Alameda Creek Fish Passage Improvements and shown in Table HYD7-1, ACWD must meet certain fish passage bypass amounts depending on measured flow in Alameda Creek at the Niles USGS gage at certain times of the year. As mentioned above, between the Niles gauge and the Alameda Creek Flood Control District Drop Structure, 12 cfs of stream flow is lost to within the Niles Cone.

The ACWD minimum bypass flows shown in Table HYD7-1 are tied temporally to the steelhead in-migration and out-migration seasons. During steelhead in-migration, defined as January 1 through March 31, if flow at Niles is less than 30 cfs (meaning less than 18 cfs arrives at the ACWD’s facilities), all arriving flow shall be bypassed.[60] **Table HYD7-6** shows a comparison of streamflow conditions at Niles (Node 9) as it relates to steelhead in-migration ACWD bypass operations.

[60] Importantly, no water will be released by ACWD from storage to meet bypass requirements.



SOURCE: SFPUC, 2019. Simulated stream flows for different scenarios at 5 nodes and pond elevation for ACRP. Excel spreadsheet provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6 and losses between Node 6 and 7 by ESA/Orion.

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Figure HYD7-2

Number of Days with Flow at Node 9 when ACWD could Deploy Dam For Existing, Pre-2001, with-CDRP, and with-Project Conditions

TABLE HYD7-6
DAYS WHEN FLOW AT NILES (NODE 9) IS LESS THAN 30 CFS
ACWD STEELHEAD IN-MIGRATION BYPASS CONDITIONS, JANUARY 1 TO MARCH 31

Water Year Period		Pre-2001 Conditions	Existing Conditions	With-CDRP Conditions	With-project Conditions
01/01/96	3/31/1996	9	9	2	2
01/01/97	3/31/1997	-	-	-	-
01/01/98	3/31/1998	-	-	-	-
01/01/99	3/31/1999	6	6	6	3
01/01/00	3/31/2000	13	13	13	13
01/01/01	3/31/2001	21	21	19	18
01/01/02	3/31/2002	49	22	18	22
01/01/03	3/31/2003	35	34	20	20
01/01/04	3/31/2004	34	31	21	23
01/01/05	3/31/2005	13	6	-	-
01/01/06	3/31/2006	-	-	-	-
01/01/07	3/31/2007	48	47	34	30
01/01/08	3/31/2008	23	20	15	16
01/01/09	3/31/2009	26	25	21	23
01/01/10	3/31/2010	15	15	14	12
01/01/11	3/31/2011	29	15	18	9
01/01/12	3/31/2012	34	34	33	29
01/01/13	3/31/2013	51	40	49	50
	Total	**406**	**338**	**283**	**270**
	Average	**22.6**	**18.8**	**15.7**	**15.0**

SOURCE: SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6* and losses between Node 6* and 7 by ESA/Orion, 2019

For each scenario, the number of days in which flow at Node 9 is less than 30 cfs, between January 1 and March 31, is shown in Table HYD7-5. In general, under the with-CDRP and with-project conditions there are fewer days in which flow is less than 30 cfs at Node 9, compared to the pre-2001 and existing conditions. This increase in flow (decrease low-flow days) is due to increased quarry NPDES discharge during this late-winter early spring period under the two future conditions. Increased quarry NPDES discharge under the with-CDRP and with-project conditions is ultimately the result of increased seepage into Pit F2, driven by increased releases under the CDRP instream flow schedule (see Section 4.3.2, Gains from Quarry NPDES Discharges to Alameda Creek). The with-project condition contains the fewest number of days in which flow at Niles is less than 30 cfs, 270 total days during the 18-year period of record, compared with 283 total days under the with-CDRP condition.

For the steelhead out-migration season, defined as April 1 to May 31, dry years are of particular concern as it relates to ACWD operations. During dry conditions, if flows are less than 25 cfs at

Niles, the ACWD will provide 12 cfs + Net SFPUC Releases[61] at Niles Gauge seven (7) consecutive days in April and seven (7) consecutive days in May (days to be specified by NMFS/CDFW). If ACWD diversions are zero and less than 12 cfs arrives at Alameda Creek Flood Control District Drop Structure, all of the flow at the Drop Structure shall be bypassed.[62] **Table HYD7-7** shows a comparison of streamflow conditions during dry years in the 18-year modeled period at Niles (Node 9) as it relates to these steelhead out-migration ACWD bypass operations.

TABLE HYD7-7
DAYS WHEN FLOW AT NILES (NODE 9) IS LESS THAN 25 CFS IN DRY YEARS
ACWD STEELHEAD OUT-MIGRATION BYPASS CONDITIONS, APRIL 1 TO MAY 31

Water Year Period		Pre-2001 Conditions	Existing Conditions	with-CDRP Conditions	with-project Conditions	Year type
04/01/01	5/31/2001	52	51	47	45	Dry
04/01/02	5/31/2002	53	53	42	45	Dry
04/01/03	5/31/2003	25	21	13	13	Dry
04/01/04	5/31/2004	60	55	57	59	Dry
04/01/07	5/31/2007	2	2	2	1	Dry
04/01/08	5/31/2008	57	34	57	57	Dry
04/01/12	5/31/2012	32	32	31	25	Dry
04/01/13	5/31/2013	47	47	47	47	Dry
	Total	**328**	**295**	**296**	**292**	
	Average	**41.0**	**36.9**	**37.0**	**36.5**	

SOURCE: SFPUC, 2019. Simulated streamflows for different scenarios at 5 nodes. Excel spreadsheet file provided by Amod Dhakal on November 11, 2018. Adjusted to include NPDES quarry discharges at Node 6˚ and losses between Node 6˚ and 7 by ESA/Orion, 2019

For each scenario, the number of days in which flow at Node 9 is less than 25 cfs, between April 1 and May 31, for dry years within the 18-year period of record, is shown in Table HYD7-7. In general, under the existing, with-CDRP, and with-project conditions, there is on average a similar number of days in which flow is expected to be less than 25 cfs at Niles during dry years, 36.9, 37.0, and 36.5 respectively. The fewest number of total days, 292, occurs under the with-project condition and can be attributed to increased quarry NPDES discharge during spring months. Overall, low-flow conditions are expected to be relatively consistent between the existing, with-CDRP, and with-project conditions.

7.5 Implications of ACRP-caused Flow Changes for ACWD Operations

For decades before 2001, the SFPUC operated its Alameda System in a manner that took full advantage of Calaveras Reservoir’s full storage capacity. Under these pre-2001 conditions, the

[61] SFPUC fisheries releases are defined in the ACWD Biological Opinion, as flows that are released and/or bypassed by the SFPUC at Calaveras Reservoir and Alameda Creek Diversion Dam.
[62] Importantly, no water will be released by ACWD from storage to meet bypass requirements.

average flow volume in Alameda Creek at ACWD's diversion point for the eight-month period between October 1and May 31 when ACWD can divert water is estimated to be 97,439 acre-feet.

In 2001, the DSOD imposed restrictions on storage in Calaveras Reservoir and from 2001 until the present the SFPUC has operated the reservoir with a fraction of its pre-2001 storage capacity. Under existing conditions, the average flow volume in Alameda Creek at ACWD's diversion point for the eight-month period between October and May when ACWD can divert water is estimated to be 100,837 acre-feet.

In the future, when both the CDRP and the proposed ACRP (if approved) are in operation, the SFPUC will again take advantage of Calaveras Reservoir's full capacity. Under these with-project conditions, the average flow volume in Alameda Creek at ACWD's diversion point for the eight-month period between October and May when ACWD can divert water would be 99,300 acre-feet.

From the 2001 until the present, as a result of the SFPUC's reduced diversion of water necessitated by the storage restrictions at Calaveras Reservoir, an annual average of about 4,000 acre-feet more water has flowed down Alameda Creek to the ACWD diversion point between October and May than did prior to 2001. These conditions will continue until the CDRP and the proposed ACRP are commissioned. Once the CDRP and the proposed ACRP are commissioned and Calaveras Reservoir's full storage capacity is available to the SFPUC, flow volume at ACWD's diversion point between October and May would be reduced, but it would still be an annual average of about 1,500 acre-feet, or 1.6 percent, higher than under pre-2001 conditions.

Although operation of the proposed ACRP is not expected to have an adverse effect on the overall amount of water available to ACWD from Alameda Creek, it may have an effect on the amount of water available on individual days. However, during both high flow and low flow conditions, as indicated in the analysis above, the changes in flow conditions at Niles caused by the ACRP is expected to have a minimal effect on the number of days that ACWD would have to change its operations on Alameda Creek. Overall, the amount of water available from October to May under with-project conditions would be greater than the with-CDRP and pre-2001 conditions, but slightly less than the existing conditions. However, due to quarry NPDES discharges low flow conditions under the with-project condition are likely to improve with respect to the other three conditions.

Overall, it is expected that any effects of the proposed ACRP on ACWD operations would be too small to cause ACWD to make substantial changes in the way it operates and uses its various sources of water. Therefore, it is not expected that the proposed ACRP would result in environmental impacts that stem from changes in ACWD operating practices.

APPENDIX HYD2-R

Revised Groundwater/Surface Water Interactions (supersedes Appendix HYD2)

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Groundwater-Surface Water Interactions

ACRP Biological Study Area

Prepared for

ESA/Orion

Prepared By

Luhdorff and Scalmanini, Consulting Engineers

August 15, 2019

Groundwater-Surface Water Interactions
ACRP Biological Study Area

Prepared for

ESA/Orion

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August 15, 2019

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File No. 18-1-068

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LIST OF ABBREVIATIONS and ACRONYMS

ACDD	Alameda Creek Diversion Dam
ACRP	Alameda Creek Recapture Project
af	acre-feet
afy	acre-feet per year
ASDHM	Alameda System Daily Hydrologic Model
CDRP	Calaveras Dam Replacement Project
CEQA	California Environmental Quality Act
cfs	cubic feet per second
cm/sec	centimeters per second
DWR	California Department of Water Resources
EIR	Environmental Impact Report
ESA	Environmental Science Associates
ft/day	feet per day
GIS	Geographical Information System
gpm/ft	gallons per minute per foot
MW	Monitoring well
I-680	Interstate 680
LSCE	Luhdorff & Scalmanini Consulting Engineers
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
Qa	Younger Alluvium
Qg	Stream Channel Gravels
Qoa	Older Alluvium
Qt	Terrace Deposits
QTl	Livermore Gravels
SFPUC	San Francisco Public Utilities Commission
SMP	Surface Mining Permit
USGS	U.S. Geological Survey

1. INTRODUCTION AND SUMMARY

1.1 Introduction

This technical report updates, augments, and supersedes Appendix HYD2 that was included in the environmental impact report (EIR) on the SFPUC Alameda Creek Recapture Project (ACRP) (San Francisco Planning Department, June 2017) in compliance with the California Environmental Quality Act (CEQA). It has been prepared to support the updated and revised portions of ACRP environmental impact analysis as part of the recirculation process required under CEQA and includes discussion and analysis of the revised ACRP operations as described in EIR Chapter 14 of the recirculated portions of the EIR.

This report discusses groundwater and surface water conditions and interactions in the ACRP EIR study area[1], and in particular, supports the impacts analyses on aquatic and riparian resources, including consideration of stream-aquifer interactions. It describes the data and analytic methods used to describe and quantify the most direct connections and relationships between groundwater and streamflow in Alameda Creek, primarily in the Sunol Valley, and to determine how influences on streamflow under various scenarios identified in the ACRP EIR could affect flow in certain reaches of Alameda Creek containing aquatic and riparian habitats. Sources of data include groundwater levels from monitoring wells installed in the study area[2], surface water elevations in quarry pits, and Alameda Creek streamflow. The monitoring wells in the ACRP study area are distributed such that conditions through any reach can be inferred by interpolation. The periods of record for all data sources are representative of typical seasonal and water-year variations in the project setting.

Quantitative results from this report are used in the EIR impact analysis to assess effects of potential changes to creek flows and their resultant influences on aquatic habitat. Specifically, this report describes the development of time-series modeling of surface water and groundwater interactions and their effect on stream leakage and aquifer seepage, which are then used in the revised steelhead impact analysis in the recirculated portions of the EIR. Also, as cited below, the qualitative and quantitative analyses presented in this report do not purport to link the SFPUC's historic water rights connected to the ACRP project; rather, it delineates the pathways and rates at which water would be recaptured under proposed operations.

Luhdorff & Scalmanini Consulting Engineers (LSCE), which prepared this report, has conducted multiple field studies for SFPUC related to groundwater occurrence in the project vicinity including feasibility of groundwater development and recapture options associated with fisheries restoration (LSCE, 1993 and 2009).

[1] See Chapter 15 of the recirculated portions of the EIR for figures of the study area.
[2] See **Section 12 Glossary** for definitions of selected terms.

1.2 Summary

The ACRP project area is located in the Sunol Valley in Alameda County, within the southern portion of the Alameda Creek watershed and a portion of the Sunol Valley Groundwater Basin. The proposed ACRP project would recapture water released and bypassed in the upper Alameda Creek watershed under planned future operation of Calaveras Reservoir once seismic upgrading under the Calaveras Dam Replacement Project (CDRP) is completed. Under the ACRP, the SFPUC would recapture released and bypassed water that passively seeps into a formerly active quarry pit, Pit F-2, and divert it to existing water supply facilities for treatment and distribution for municipal use in the SFPUC regional water system.

Structural geology in the area is highly complex, with the Calaveras Fault Zone along the eastern edge of the Sunol Valley as a dominant structural feature. In the project vicinity, the valley floor is overlain by highly permeable alluvium of shallow vertical extent that includes stream channel gravels; these materials range in thickness up to 60 feet, though their saturated thickness is only 10 to 25 feet. The stream channel gravels are coincident with recent and current alignments of Alameda Creek. Below the alluvium and stream channel gravels occur the Livermore Gravels up to several hundred feet in thickness. The shallow alluvium and stream channel gravels on the Sunol Valley floor comprise a shallow aquifer system in the project vicinity through which groundwater and streamflow in Alameda Creek exhibit strong connectivity. By contrast, there is no evidence of significant direct interaction between groundwater occurring in the older Livermore Gravels, which has comparatively much lower permeability, and Alameda Creek streamflow.

This report provides a description and quantification of groundwater-surface water interactions that are relevant to the proposed ACRP operation based on empirical data including groundwater levels, surface water elevations, Alameda Creek streamflow; observations from other field studies; and analytical and numerical methods to quantify groundwater movement. Aquifer parameters, which govern groundwater movement, are detailed in **Section 6** and used in conjunction with analytic and numerical tools. The hydraulic conductivity of the shallow aquifer, consisting of stream channel materials and alluvium, was estimated to be 300 to 600 feet per day. Because of their coarse and unconfined nature, the specific yield for these materials were estimated at 0.10 to 0.25. The total storage volume of shallow aquifer system in the project area was estimated to be approximately 1,135 acre-feet. By contrast, hydraulic conductivity of the Livermore Gravels was estimated to be 0.4 feet per day consistent with its considerable clay content as reported in the literature and as seen in outcrops and quarry excavations. As a result, this report focuses on the shallow aquifer system as being the most relevant to stream interactions and the potential for project effects on aquatic and riparian habitats.

Streamflow studies have indicated surface water seepage losses from Alameda Creek between Welch Creek and San Antonio Creek at 17 cubic feet per second (cfs). These seepage losses accumulate in existing quarry pits, including Pit F2 proposed for use under the ACRP project. Examination of groundwater levels and pit surface water elevations indicate that groundwater levels are affected when quarry operators pump from quarry pits for mining operations (dewatering). Some pumped water is used for mine processing with excess water discharged to the creek (quarry discharges). Monitoring well data indicate limited available storage space in the aquifer system and when the stream no longer provides recharge into the summer and fall periods, groundwater levels decline further due to seepage into adjacent quarry pits and by movement out of Sunol Valley through Niles Canyon. The effective thickness of the shallow aquifer system is variable in the study area, with decreasing thickness in the lower reaches near Arroyo de la Laguna.

Groundwater movement in the shallow aquifer was quantified using an analytic solution for steady state flow in an unconfined aquifer. Upstream of the quarry reach of Alameda Creek, the range of volumetric flux[3] in the shallow aquifer is between zero and 1 cfs, as compared to the range of streamflow that varied from zero to 2,250 cfs. This is consistent with an aquifer of limited volume and creek serving as the predominant source of recharge, key characteristics of groundwater and surface water interactions in the study area that encompasses the quarry reach where Pit F2 is located. Seepage into Pit F2 was quantified with analytical and numerical methods, then verified with a mass balance that produced a good match. Peak seepage from Alameda Creek to Pit F2 was found to be less than 1 cfs, except in the very highest winter streamflow events. This result is consistent with empirical observations of stream losses through the same reach from prior field studies concerned with aquatic habitat restoration of Alameda Creek in Sunol Valley.

Using a simplified numerical model of stream seepage into Pit F-2 detailed in **Section 9**, verified by the mass balance of changes in pit volume, seepage rates at a daily time step were developed in conjunction with the SFPUC's Alameda System Daily Hydrologic Model (ASDHM) over an 18-year hydrologic period. The seepage estimates were used to quantify ACRP project impacts on streamflow that could affect aquatic habitats. CEQA considerations of the potential effects by ACRP on surface water and groundwater interactions with respect to riparian habitat are discussed for each sub-reach downstream of the project site to the Arroyo de la Laguna (see **Section 11**).

2. LOCATION

The ACRP project and study area in this report are located in Alameda County south of Pleasanton and due east of Fremont (see **Figures 2-1** and **2-2**). It is situated in the Sunol Valley comprising the downstream reach of the southern portion of the Alameda Creek watershed before Alameda Creek meets Arroyo de la Laguna and flows to San Francisco Bay through Niles Canyon. The San Francisco Public Utilities Commission (SFPUC) operates water supply facilities in the project vicinity including Calaveras and San Antonio Reservoirs (see **Figure 2-2**). Other SFPUC facilities include the Sunol Valley Water Treatment Plant and the Alameda Siphons that convey water from SFPUC’s Hetch Hetchy source to the SFPUC regional water system. Also as discussed in this report, the project area also is the site of infiltration galleries used historically and at present to divert Alameda Creek underflow as a source of supply for the San Francisco water system.

The project and study areas occur within the Sunol Valley Groundwater Basin as delineated in California Department of Water Resources (DWR) Bulletin 118, 2003 Update (see **Figure 2-2**). The basin is

[3] See Aquifer Volumetric Flux under ***Flux*** in **Glossary**.

approximately 30 square miles and does not contain significant sources of groundwater supply other than meeting small-scale local domestic and agricultural uses.

3. ACRP PROJECT

As described in the EIR, the proposed ACRP project would recapture water released and bypassed in the upper Alameda Creek watershed under planned future operation of Calaveras Reservoir once seismic upgrading under the Calaveras Dam Replacement Project (CDRP) is completed. The schedule of released and bypassed water is intended to support recovery of steelhead populations in the Alameda Creek watershed as specified in the Biological Opinion for the CDRP issued by the National Marine Fisheries Service (NMFS)[4]. Implementation of the proposed ACRP project would not occur until completion of the CDRP project and commencement of the NMFS-required in-stream flow schedule. Under the ACRP project, released and bypassed water for steelhead habitat restoration would flow in Alameda Creek through the Sunol Valley. Within the reach of the valley in which historical and current aggregate mining are located, released and bypassed water that passively seeps into a formerly active quarry pit (referred to as Pit F-2) would be recaptured and diverted to existing water supply facilities for treatment and distribution for municipal use in the SFPUC regional water system. The quantity of recaptured water would be in accordance with the historical contribution from the Alameda Watershed under the City and County of San Francisco's existing water rights.

The analysis in this report considers groundwater-surface water interactions in a portion of the Sunol Valley Groundwater Basin below the Alameda Creek-Welch Creek confluence through the Sunol Valley to the confluence with Arroyo de la Laguna (see **Figure 2-2**). As detailed in the EIR, three CEQA scenarios are discussed in this report: existing, with-CDRP (also, adjusted-existing), and with-Project scenarios.

4. REGIONAL AND PROJECT AREA GEOLOGY

To determine the relationship of aquifers to Alameda Creek and proposed ACRP operations, the regional and project area geology are reviewed in this section.

4.1 Regional Geology

The ACRP project site is located in a geologically complex area of the northern Diablo Range in central Alameda County. The regional geology of the area includes main geologic units of Mesozoic marine rocks, and Cenozoic (Tertiary) sedimentary rocks, and Quaternary alluvium (see **Figures 4-1** and **4-2**, and geology key on **Figure 4-3**). Regional geologic relationships are shown on Wagner, Bortugno, and McJunkin (1990) and detailed geologic maps by Dibblee (1980, a, b, c, and d). Other geologic studies of the general area are reviewed in Luhdorff & Scalmanini Consulting Engineers (LSCE 1993, 1998). Hydrogeologic studies which cover the region include the DWR (1963; 1966; 1974) and others reviewed in LSCE (1993, 1998).

The older Mesozoic (pre-65 million years[m.y.]) and older Cenozoic (Tertiary; pre-5 m.y.) rocks are well- to moderately-consolidated and deformed by faulting and folding. These geologic units are generally

[4] The bypass and in-stream release schedules are detailed in EIR Section 5.16.

considered to be non-water bearing. Locally, these older rocks may produce small quantities of water in wells used for domestic or stock supply, although water quality may be poor. The older geologic units occur in the uplifted, more mountainous areas of the region and at depth below the younger units (see **Figure 4-1**). The younger Cenozoic units (Late Tertiary post 5 m.y. and Quaternary post 2.5 m.y.) are nonmarine, weakly consolidated to unconsolidated, and slightly to un-deformed sedimentary rocks and deposits. These units are groundwater bearing and their local occurrence defines the Sunol Valley Groundwater Basin (see **Figures 4-1** and **4-2**).

Structural geology in the area is highly complex as reflected in the steeply dipping and highly deformed older geologic units in the mountainous areas. The dominant structural feature within the groundwater basin is the Calaveras Fault Zone along the eastern and western edges of the Sunol Valley floor. The Calaveras Fault is an active, right-lateral strike-slip fault where fault movement is dominated by horizontal motion with subordinate vertical offset (Herd, 1977a and b, 1978a and b). The trace of the fault is mostly concealed in the Sunol Valley area and upstream along Alameda Creek by recent stream-deposited alluvium and landslides (Herd, 1977a and b, 1978a and b). The fault zone delineates the eastern edge of Sunol Valley upstream to the Calaveras Road bridge crossing of Alameda Creek where the stream valley narrows and coincides with the groundwater basin boundary (see **Figure 4-2**). Vertical movement of the fault along this eastern edge of Sunol Valley has previously been described as a possible barrier to flow between the eastern upland areas and valley floor portions of the Sunol Valley Groundwater Basin (DWR, 1966).

4.2 Sunol Valley Groundwater Basin

The Sunol Valley Groundwater Basin has been delineated by DWR (1964, 1966, 1974, 2003, 2016a) by the areal extent of the Cenozoic alluvium occurring along Alameda Creek and tributary streams in the Sunol Valley area (see **Figure 4-2**). The Calaveras Fault Zone divides the groundwater basin into two parts. West of the fault zone is the low-gradient Sunol Valley floor along Alameda Creek. East of the fault zone are upland areas defined by the drainage divide of tributary slopes, largely underlain by Cenozoic deposits termed Livermore Gravels. The valley floor and upland areas are detailed in the following sections.

4.2.1 Sunol Valley Floor Area

West of the Calaveras Fault Zone, the low-gradient Sunol Valley floor is overlain by unconsolidated to weakly consolidated alluvium of stream deposits composed of sand and gravel with some interbedded fine-grained flood plain deposits. Maximum thickness of alluvium has been estimated to be as much as 60 feet and thinning towards the edges and ends of the valley floor (LSCE, 1993). As discussed in **Section 6** of this report, groundwater levels indicate that the maximum saturated thickness of the shallow alluvium materials ranges from about 10 to 25 feet along the Alameda Creek alignment in the project vicinity. The alluvium becomes more consolidated with depth and age. The deeper deposits have lower permeability due to increasing clay content filling pore space, either during deposition or later soil-forming processes.

Below the alluvium occurs Cenozoic (largely post 5 m.y., Pliocene and Pleistocene) sedimentary deposits termed the Livermore Gravels. These deposits appear to consist of moderately consolidated clayey sand and sandy gravel beds with some fine-grained beds. These deposits may reach a thickness up to several hundred feet, but delineation is limited by a lack of deep well control. Well yields in the Livermore Gravels are generally low to very low serving mainly small-scale supply uses. The poor yields are generally attributed to high clay content in the beds as evident in exposures in upland areas and in quarry pits located on the valley floor.

Much of the Sunol Valley floor has been modified by aggregate extraction operations through an area known as the quarry reach of Alameda Creek; this reach extends from the Alameda Siphons[5] to Interstate 680 (I-680) where mining has been historically concentrated. **Figure 4-4** shows current permitted mining areas through the reach. Mining is permitted through Alameda County's Surface Mining Ordinance and are designated by Surface Mining Permit (SMP) numbers. The proposed ACRP project facilities would be located at the SMP-24 site (see **Figure 4-4**). Along the quarry reach, aggregate mining excavations extend through the alluvium and into underlying older formations including Livermore Gravels. The gravel pits have been isolated from Alameda Creek by perimeter levees to mitigate flooding. Groundwater inflow to the pits is observed to be highest from the shallow alluvium, and much lower to negligible from the underlying Livermore Gravels formation (LSCE, 1993). In some instances, slurry cutoff walls have been installed to limit inflow of groundwater from the alluvium. The slurry walls target and are keyed into the lower permeability Livermore Gravels to cut off groundwater inflow (slurry walls in Sunol Valley are discussed further in **Section 6.4**).

Within the reach north of I-680 to Arroyo de la Laguna, SMP-32 has been operating for about 10 years. The SFPUC infiltration galleries and the Sunol Water Temple are located in this reach which is sometimes referred to as the infiltration gallery reach of Alameda Creek.

Upstream of the quarry reach, the valley floor narrows to about 1,500 feet at the Sunol Valley Water Treatment Plant (see **Figure 4-5**). Here, the alluvial plain adjacent to the stream channel becomes discontinuous. Subsurface geology in this reach is poorly known, as few boreholes or wells are present. At the southernmost end of the quarry reach, a monitoring well (MW 1[6]) installed to 50 feet encountered about 20 feet of alluvium overlying Livermore Gravels. LSCE (1993) reported on a 100-foot geotechnical boring (EB6[7]) that also encountered 20 feet of alluvium overlying Livermore Gravels (see locations in **Figure 4-5**). Upstream of these sites, shallow geotechnical borings and three seismic refraction lines were shot as part of SFPUC's Sunol Valley Water Treatment Plant Expansion and New Pipeline Projects. The project geotechnical data report (ARUP, 2007) provides the basis for interpreting conditions within this reach as discussed below.

Five of six geotechnical boreholes for the treatment plant expansion project described in the ARUP (2007) report were drilled on the valley floor and encountered less than 20 feet of alluvium (see **Figure**

[5] The Alameda Siphons are part of the SFPUC regional water system connecting the Hetch Hetchy supply system to facilities in the Sunol Valley.

[6] MW 1 is discussed later in this report.

[7] The geotechnical boring is EB6 described in LSCE (1993).

4-5). Below the alluvium, the boreholes encountered denser, harder materials which required rock-coring drilling techniques. In the project geotechnical data report by ARUP (2007), this unit was termed “bedrock” and classified as siltstone with some thin sandstone interbeds. The siltstone is described as weathered in the upper few feet but becoming less weathered with depth. The siltstone was classified as weak in relationship to the ability to break the rock. Common features noted were intensely fractured, shear zones, and polished surface (slickensides[8]) caused by movement between beds. Some beds were noted to be dipping 45 to 75 degrees. The seismic refraction lines are consistent with the boreholes showing 10 to 20 feet of low velocity alluvium overlying higher velocity, denser, lithified geologic material (bedrock) beneath. Additionally, the geotechnical report noted the exposure of bedrock-siltstone in the Alameda Creek channel with near vertically dipping beds at the proposed pipeline tunnel crossing. It is possible that this rock mass may not be in-place but may have been transported by mass-movement (landslide) processes. **Figure 4-6** shows photographs from the ARUP (2007) geotechnical report of slickenside surfaces of rocks encountered below the alluvium.

The “bedrock-siltstone” encountered in the geotechnical boreholes discussed above has characteristics most similar to those of older bedrock units described in LSCE (1993). Assigning this unit to the mapped geologic units is more problematic. West of the Calaveras Fault, the marine Cretaceous Panoche Formation of the Great Valley Sequence occurs. East of the fault, the younger marine Tertiary Briones Sandstone occurs. Thus, the “bedrock-siltstone” could be assigned to either of these units. Additionally, along large strike slip faults like the Calaveras Fault system, the fault zone may have multiple subparallel faults with complex and highly deformed blocks of variable rock types. The Calaveras Fault zone shows this pattern further south near Calaveras Reservoir (LSCE, 1993). Such possible faulting complexity beneath the Sunol Valley is concealed by the shallow alluvium materials and underlying Livermore Gravels formation.

Regardless of the assignment of the “bedrock-siltstone” to a specific geologic unit, its presence puts constraints on the subsurface geology below the southern portion of the Sunol Valley Groundwater Basin. The northwest borehole that encountered the “bedrock” underlying alluvium is about 4,000 feet from the quarry reach. The next boring is about 5,000 feet south of the quarry reach, in the center of the valley, and about 600 feet west of the edge of the valley. The implication of these observations is that the Livermore Gravels found at a depth of at least 100 feet at the southern end of the quarry reach would appear to either thin to zero or is truncated by a fault 4,000 to 5,000 feet to the south. By contrast, within the quarry reach to Arroyo de la Laguna, the Livermore Gravels may be as much as 500 feet thick. Additional geologic investigations by borehole and seismic methods to determine the extent of the Livermore Gravels would be required to resolve the apparent absence of the formation in this area. Nevertheless, geologic conditions within this southern reach inform some key findings regarding groundwater movement and magnitude in the greater Sunol Valley floor area as discussed in **Section 9**.

[8] Slickensides refer to smooth and striated rock surface resulting from movement along a fault or fracture.

4.2.2 Sunol Valley Upland Areas

Upland areas in Sunol Valley occur east of the Calaveras Fault Zone and is defined by exposures of the Cenozoic (Pliocene and Pleistocene) Livermore Gravels deposits. The area encompasses the tributary drainage of San Antonio and Vallecitos Creeks, underlain by the Livermore Gravels. Small areas of thin younger alluvium occur along the main streams, especially in the Vallecitos Valley.

Barlock (1988; 1989) studied the surficial exposures of the Livermore Gravels in detail in the Sunol Valley Groundwater Basin area and eastward around the Livermore Valley. The lower Livermore Gravels were found to consist of fine sandstones, siltstones, and mudstones deposited by braided streams and flood plains sourced from the northeast of the Livermore Valley. The upper Livermore Gravels was found to be composed of coarser conglomerate, sandstones mudstones of alluvial fan deposits, and sourced from the south off the Diablo Range. Both appear to be weakly to moderately consolidated and the coarser beds contain much fine-grained material. Groundwater usage in the Sunol Upland is limited by low yields in wells completed in the Livermore Gravels and is tapped mostly for small-scale domestic and stock watering uses (Webster, 1972, and DWR, 1974, Farrar, 1980). Consequently, there are no large domestic water systems or large-scale groundwater extraction for agricultural or industrial use in this area.

Besides low yields to wells, groundwater quality in the Sunol Valley Upland may also restrict beneficial use. As indicated by LSCE (1998), total dissolved mineral content may range from acceptable for most uses (500 to 1,000 parts per million) to elevated (>3,000 parts per million), with some elevated individual constituents that potentially restrict certain uses.

4.3 Relationship of Sunol Valley Groundwater Basin to Other Basins

The Sunol Valley Groundwater Basin is situated between two nearby basins, the Niles Cone Groundwater Subbasin to the west and the Livermore Valley Groundwater Basin to the northeast (see **Figure 4-1**). The Sunol Valley basin is 30 square miles in area and the Niles and Livermore basins are 103 and 109 square miles, respectively (DWR, 2003 and 2016). Drainage of surface water and groundwater from Alameda Creek flows north and west through the Sunol Valley Groundwater Basin, then across older geologic units through Niles Canyon and into the Niles Cone Groundwater Subbasin. There is no groundwater connection between the Sunol Groundwater Basin and the Niles Cone Subbasin as they are separated by non-water bearing bedrock (see **Figure 4-1**).

To the east, the Sunol Valley Groundwater Basin adjoins the larger Livermore Valley Groundwater Basin along a watershed divide. Along the southern side of the Livermore Valley, extensive exposures of the Livermore Gravels, both upper and lower members, occur in upland areas. Groundwater development in the upland areas is relatively minor. Low yields for wells completed in the Livermore Gravels formation suggests poor aquifer characteristics with respect to water supply development (Webster, 1972; DWR, 1974; Farrar, 1980; and LSCE 1993 and 1998). Some higher yields occur when wells are drilled on tributary valley floors where boreholes encounter younger alluvium materials.

Beneath the Livermore Valley floor, away from the upland areas, deep wells produce high yields and exhibit favorable aquifer characteristics for large-scale municipal, agricultural, and industrial uses. These wells are projected as completed into the upper Livermore Gravels, but their comparatively higher yields may be due to the presence of thick alluvium lacking in the Sunol Valley. Barlock (1988, 1989) found that upper Livermore Gravels exposures near the City of Livermore were of a cleaner, more fluvial, braided-stream nature than the alluvial fan deposits in the southern Livermore Valley highlands. These depositional characteristics may also explain why the upper Livermore Gravels are more productive as compared to the equivalent deposits to the south and in the Sunol Valley upland areas.

The western end of the Livermore valley has a drainage outlet via Arroyo de la Laguna which flows southward along the Calaveras Fault Zone and northern Sunol Valley upland areas. This drainage and Vallecitos Creek join with Alameda Creek downstream of the Sunol Valley where they then flow westward through Niles Canyon.

4.4 Summary of Key Water-Bearing Subunits in Sunol Valley Groundwater Basin

Water-bearing geologic subunits in the project area are of interest to the ACRP impact evaluation by their potential influence on groundwater movement in the Sunol Valley Groundwater Basin and interactions with surface water of Alameda Creek in the project vicinity. The key subunits are the younger Cenozoic deposits described above. They are divided between younger alluvial fan and stream-deposited alluvium that occur on the Sunol Valley floor along and adjacent to Alameda Creek, and the Livermore Gravels that comprise the upland areas and underlie the stream and fan deposits on the valley floor. The uppermost shallow alluvium materials have high porosity and permeability and favorable transmitting properties due to their loose nature. However, groundwater development within these materials in the groundwater basin is greatly restricted by their thin occurrence and limited storage capacity. The Livermore Gravels have demonstrably lower porosity and permeability primarily attributed to the high fraction of fine-grained materials mixed with coarse sand and gravel that are exposed in the upland areas and on the valley floor in aggregate mining pits.

Key water-bearing subunits have been mapped in the Sunol Valley based on topographic expression, relative elevations, soil development, and interpretation of age relationships. **Figure 4-2** shows the most common mapping subdivisions and includes four subunits of alluvium and the Livermore Gravels formation, which are explained in **Figure 4-3**. The subunits of alluvium are: Stream Channel Gravels (Qg); Younger Alluvium (Qa); Older Alluvium (Qoa); and Terrace Deposits (Qt). The alluvium subunits[9] and Livermore Gravels (QTl) are summarized below:

4.4.1 Stream Channel Gravels (Qg)

This subunit consists of sand and gravel along the lowest elevations of stream channels of Alameda Creek and San Antonio Creek, and other tributary streams. Its occurrence and properties are

[9] These are consistent with the alluvium units described in EIR Section 5.15, Geology and Soils, such that Qhc and Qha in Section 5.15 are equal to Qg and Qa in this report, respectively.

important because it comprises the Alameda Creek stream bed and serves as a conduit between surface water and groundwater.

4.4.2 Younger Alluvium (Qa)

Younger Alluvium underlies the Stream Channel Gravels and occurs on surfaces of slightly higher elevation adjacent to streams and on the valley floor. The subunit consists of unconsolidated sand and gravel with interbedded clay and silt and represents floodplain, stream channel and alluvial fan deposits. The Stream Channel Gravels and Younger Alluvium comprise a shallow aquifer system in the project vicinity. The Stream Channel Gravels and Younger Alluvium may extend up to 60 feet in thickness within the quarry reach upstream of the ACRP project area, decreasing to less than 15 feet near the Arroyo de la Laguna. As stated in **Section 4.2.1** and detailed in **Section 6**, the effective saturated thickness of these shallow aquifer materials ranges from about 25 feet to 10 feet.

4.4.3 Older Alluvium (Qoa)

Older Alluvium occurs on slightly steeper slopes marginal to the valley sides and extending as gently rising alluvial fan surfaces. These deposits would consist of slightly older alluvial fan deposits of sand and gravel possibly with a thin soil development at the surface. From interpretation of boring logs, the Older Alluvium appears to have higher clay and fines content from weathering and other processes which would reduce its ability to transmit groundwater.

4.4.4 Terrace Deposits (Qt)

Terrace deposits occur at slightly higher topographic elevations above the older alluvium surface and show a generally deeper dissection by erosion. Terrace Deposits occur as isolated benches above the stream channels to the south. By its limited occurrence in the project area, this subunit is not a prominent feature in the ACRP project area.

4.4.5 Livermore Gravels (QTl)

The older Livermore Gravels subunit is dominated by weakly compacted, thick, cobble to pebble gravel beds interlayered with sand and mudstone beds. The gravel and sand beds have variable quantities of clay matrix that reduce their porosity and permeability which are factors leading to low well yields in the project setting. The Livermore Gravels are exposed to the east of the Calaveras Fault north of San Antonio Creek and extensively around the Livermore Valley. West of the Calaveras Fault, outcrop exposures are more limited around Sunol Valley. The Livermore Gravels subunit may extend to depths greater than 500 feet and is the target of aggregate mining in the valley.

Differentiation of alluvium deposits in the Sunol Valley may be uncertain due to similar lithologic character. The uncertainty is complicated by similarities between Older Alluvium and underlying Livermore Gravels, where present. The contact between comparatively high permeability shallow alluvium (Stream Channel Gravels, Qg, and Younger Alluvium, Qa) and the more consolidated terrace deposits and Livermore Gravels are sometimes evident in exposures in quarry pits where seepage faces indicate the bases and tops of these subunits, respectively. LSCE (1993 and 2009) found limited available groundwater level data for the underlying Older Alluvium and Livermore Gravels. Testing of a deep well at one mining site on the valley floor had very low yield similar to bedrock formations and wells in the upland areas and water levels from deeper wells suggested either confinement and/or limited deep percolation of recharge into these formations (LSCE, 1993). Because of its relative low permeability, rainfall that falls directly on the Livermore Gravels in upland areas may contribute little direct recharge and mainly form runoff to local tributaries (DWR, 1966).

The distinctions between the shallow alluvium subunits (Qg and Qa) occurring on the Sunol Valley floor and underlying Livermore Gravels with respect to interactions with Alameda Creek are consistent with the DWR studies cited above and in the EIR for the CDRP project (San Francisco Planning Department, 2011). While there is no evidence of direct interaction of groundwater occurring in the Livermore Gravels with streamflow in Alameda Creek on daily to annual timeframes, it is relevant as a vertical boundary for characterizing shallow groundwater-surface water interactions of concern to CEQA scenarios in the ACRP EIR that are the subject of this report. Adapting a cross-section by LSCE (1993), **Figure 4-7** shows the relationships among the water-bearing subunits and older bedrock formations in the project area.

5. PROJECT SITE AND OPERATIONS

5.1 ACRP Project Area

Figure 5-1 shows the ACRP project site and vicinity. As defined in the EIR, the project site refers to the area within which all construction-related disturbances would occur including Pit F-2. The project site encompasses the former aggregate quarry, Pit F-2, within SMP-24. Pit F-2 would be used to recapture, impound, and pump water in an amount not to exceed the volume of water that SFPUC otherwise would have been able to store in Calaveras Reservoir but for the bypass and release of that volume of water under future CDRP operations (i.e., with-CDRP CEQA scenario).

5.2 Pit F-2 and the Alameda Creek Quarry Reach

The quarry reach of Alameda Creek, as referred to historically, is that portion extending from the Alameda Siphons to I-680 (see **Figure 5-1**). Aggregate mining is the principal land use along this reach and is conducted under Alameda County Surface Mining Permits (SMP). Active and formerly active mining areas occur within the quarry reach.

The ACRP project area is located within SMP-24, which encompasses Pit F-2 as well as Pit F-3 West and F-3 East. Pit F-3 East is used as an outfall for the San Antonio Back-up pipeline, which is part of the SFPUC regional water system. Quarry processing facilities operated by Hanson Aggregates are located on SMP-24 west of Alameda Creek. In this part of SMP-24, previously mined and backfilled areas are adjacent to the creek. The “Ready Mix Pond” is a former quarry pit located on the west side of Alameda Creek. Water level monitoring in that pit indicates that it is hydraulically isolated from Alameda Creek streamflow. As discussed in **Section 6.4**, SMP-24 is partially surrounded by a slurry cutoff wall installed to limit infiltration of groundwater from shallow alluvium overlying the Livermore Gravels formation.

Oliver de Silva Inc. operates the SMP-30 site immediately south of the ACRP project area. On this site, Pit F-6 is the largest active mining area adjacent to Alameda Creek. Also located within SMP-30 are Pits F-4 and F-5, which are used for water storage and gravel wash/spoils management, respectively.

Most of the SMP-24 area and all of the SMP-30 area are on SFPUC-owned lands that are leased by quarry operators.

Hanson Aggregates conducts mining operations within SMP-32, downstream of I-680. The SMP-32 site is separated from the existing Alameda Creek channel by riparian habitat and is surrounded by a slurry cutoff wall that further isolates it from hydraulic influences of streamflow.

5.3 ACRP Operations and Recapture Quantities

The SFPUC would implement ACRP operations in conjunction with bypass and in-stream flow schedules required under regulatory permits for future operation of Calaveras Reservoir and the Alameda Creek Diversion Dam (ACDD) which diverts water to storage in Calaveras Reservoir (see EIR Figure 14-1). Under the ACRP project, the SFPUC would use Pit F-2 for recapture operations. The recapture process would consist of passive infiltration (i.e., seepage) of stream underflow into Pit F-2 where it would be impounded and then pumped and treated for domestic and municipal use in the SFPUC regional water system. ACRP operations would be conducted under SFPUC's existing appropriative water rights. The main objective of the ACRP operations is to recapture water from Pit F-2 water that would have otherwise been stored in Calaveras Reservoir but for the in-stream releases and bypass flows from Calaveras Reservoir and the ACDD, thereby maintaining the historical annual transfers from the Alameda Watershed system to the San Francisco regional water system. The quantities of recaptured water would be monitored and recorded daily to ensure the operation is conducted within SFPUC water rights.

The bypass and in-stream release schedules to be implemented under the with-CDRP scenario are designed to support the recovery and protection of endangered steelhead populations. The bypass schedule refers to limits of operation of the ACDD from December through March and requires minimum bypass flows of 30 cubic feet per second (cfs) when water is present in upper Alameda Creek upstream of the ACDD. The maximum diversion rate is 370 cfs. The in-stream release schedule specifies releases from Calaveras Reservoir and will vary between 5 and 12 cfs depending on the time of year and water-year type as detailed in the EIR, Chapter 5.16, Table 5.16-2.

Estimated recapture volumes are based on the SFPUC Alameda System Daily Hydrologic Model (ASDHM) and the SFPUC's revised proposed operating parameters as set forth in Revised EIR Chapter 14. The ASDHM model incorporates hydrology for the 18-year period from October 1995 to September 2013. Under with-CDRP operations that include bypasses and releases for steelhead recovery, the average volume of water bypassed and released has been estimated to be 14,695 acre-feet per year (afy) for the 18-year hydrologic model period, while the average recapture quantity, based on available Calaveras Reservoir storage, is 6,045 afy under the revised operational protocols.

Besides bypasses and in-stream releases occurring upstream of the ACRP site, other sources that contribute to water stored in Pit F-2 including direct precipitation and runoff from watersheds east of the quarry reach.

Pumping from Pit F-2 under the ACRP proposed project operations would generally take place outside steelhead migration periods. Pumping would occur between July 1st and November 30th and would operate within a range of surface water elevations in accordance with the elevation-volume relationship of the pit and the prescribed recapture quantities (see EIR Chapter 14, Figures 14-3 and 14-4). The maximum water elevation[10] is 240 feet and the minimum elevation under proposed operations would be 180 feet. **Section 9** below incorporates the proposed operating plan to assess potential groundwater and surface water interactions that may affect streamflow.

6. GROUNDWATER AND SURFACE WATER IN THE PROJECT AREA

Groundwater systems are characterized by the attributes of aquifers (e.g., their composition, structure, thickness, extent), as well as processes of recharge, storage, and discharge. A conceptualization, or conceptual model, of the groundwater system is an essential tool for evaluating groundwater resources (DWR, 2016b). For the ACRP project, a conceptualization was developed providing a description of groundwater-surface water interactions that are relevant to the ACRP project operations (i.e., under the with-Project CEQA scenario). Groundwater levels, surface water elevations, and Alameda Creek streamflow provide an empirical basis to describe groundwater conditions and interactions under the CEQA scenarios and were used with analytical and numerical methods to quantify potential project impacts. The data sources were also informed by previous field studies and testing as discussed further in this report.

6.1 Groundwater Use and Shallow Aquifer System along Alameda Creek

As discussed in **Section 4**, the Sunol Valley Groundwater Basin consists of two distinct parts characterized by surface geology: 1) alluvium on the Sunol Valley floor and 2) older Livermore Gravels in the upland areas. Distinctions between the areas arise due to the presence of the Calaveras Fault zone, which may hydraulically isolate the valley floor from the upland areas. Further, the valley floor alluvium readily recharges from Alameda Creek flow while the Livermore Gravels, due to comparatively low permeability, does not readily transmit groundwater or readily recharge from precipitation. Because of the physical connection with Alameda Creek and close correlation between groundwater levels and streamflow, groundwater may be termed underflow[11] to Alameda Creek.

6.2 Groundwater Use

Information obtained from the local well permitting authority, Zone 7 Water Agency, indicates that groundwater in the Sunol Valley Groundwater Basin is used locally for small-scale domestic and irrigation purposes. The locations and types of wells in the Sunol Valley Groundwater Basin obtained from Zone 7

[10] Elevations cited in this report are NAVD88 unless otherwise noted.

[11] Underflow is the downstream movement of water through permeable materials underlying a streambed and which are limited by formations, or rocks, of less permeability (Langbein and Iseri, 1972).

records are detailed in the EIR Chapter 5.16. Within the ACRP project vicinity, there are no active supply wells located on the Sunol Valley floor along Alameda Creek from below Welch Creek to Arroyo de la Laguna. Practically all known supply wells in the project vicinity are completed at depths that tap the Livermore Gravels in the upland portions of the groundwater basin. These supply wells are low yielding due to the nature of the Livermore Gravels in which they are completed.

While the alluvium subunits (Stream Channel Gravels and Younger Alluvium) on the Sunol Valley floor have apparent high transmitting capacity, they are unsuitable as a target for conventional (i.e., vertical) supply wells due to their thin nature and limited storage capacity. In addition, monitoring indicates that they are only seasonally recharged by local streams resulting in highly fluctuating water levels between wet and dry periods.

The most notable groundwater development in the shallow alluvial materials was produced from horizontal infiltration galleries located on the Sunol Valley floor in the vicinity of the Sunol Water Temple (see **Figure 6-1**). The galleries intercepted underflow from Alameda Creek and were constructed by the Spring Valley Water Company prior to San Francisco's acquisition of the Alameda Creek watershed property and facilities. Galleries were installed at the base of the shallow alluvium overlying the less permeable Livermore Gravels subunits (San Francisco Planning, 2006). Historical drawings indicate these depths to be as shallow as 10 to 15 feet below ground surface. Groundwater development with these galleries included use of seasonal gravel dams to impound and divert surface water to the off-stream galleries upstream of Arroyo de la Laguna. The former Sunol Dam located below the confluence of Alameda Creek with Arroyo de la Laguna, was used to augment yield of a portion of the system (San Francisco Planning Department, 2006). The dam provided enhanced infiltration into underlying horizontal perforated piping for discharge into the Sunol Aqueduct and across San Francisco Bay for water supply to San Francisco. The dam was removed in the fall of 2006 because it acted as a barrier to fish passage. The Sunol Aqueduct connected to Sunol Dam was taken out of service in 1995. Since that time, use of the filter gallery system has been limited to local irrigation (see **Section 7.15**). The infiltration galleries continue to serve as a water supply source for the SFPUC.

Under the 2014 Sustainable Groundwater Management Act (SGMA)[12], the California state legislature directed DWR to rank all groundwater basins and subbasins according to criteria reflecting current and future sustainability. DWR used the California Statewide Groundwater Elevation Monitoring (CASGEM) basin prioritization process to rank basins as High, Medium, Low, or Very Low priority.[13] Notwithstanding the presence of the shallow infiltration galleries on the Sunol Valley floor and domestic uses in the upland areas, the Sunol Valley Groundwater Basin was ranked Very Low[14]. The ranking is consistent with the limited capability for either the shallow alluvial aquifer or, despite its substantial thickness, for the Livermore Gravels formation to provide a reliable source of water supply for domestic, agricultural, or industrial purposes. This

[12] http://www.water.ca.gov/groundwater/sgm/index.cfm, Accessed April 4, 2016.

[13] http://www.water.ca.gov/groundwater/casgem/basin_prioritization.cfm, Accessed April 4, 2016.

[14] The ranking criteria are listed in Chapter 5.16 of the EIR.

is primarily due to the thin occurrence of the shallow aquifer and the slow permeability of the Livermore Gravels as described in **Section 4**.

6.3 Shallow Aquifer

Alluvium on the valley floor consisting primarily of Stream Channel Gravels (Qg) and Younger Alluvium (Qa) subunits comprises a shallow aquifer system that exhibits a capacity to recharge, store, and discharge water primarily in response to flow in Alameda Creek.

6.3.1 Shallow Aquifer Parameters

LSCE (2009) conducted step-rate and constant-rate aquifer tests in a test well located in the reach below I-680. The step-rate tests indicated high specific capacity[15] (> 40 gallons per minute per foot of drawdown) in the uppermost completion corresponding to occurrence of Stream Channel Gravels and Younger Alluvium. When those materials were dewatered at higher pumping rates, yield dropped sharply consistent with the thin nature of the highly permeable alluvium subunits. The sharp drop in yield reflected the vertical boundary with the much lower permeability Older Alluvium/Livermore Gravels subunits. The apparent hydraulic conductivity of the shallow alluvium estimated from the step tests was interpreted to be as high as 300 feet per day (ft/day) and representative of a composite of Younger Alluvium and Stream Channel Gravels. The hydraulic conductivity of shallow aquifer materials is expected to be highly variable on smaller scales such as lenses of a foot or less evident in logs and quarry faces. The highest K values would be expected for the coarsest fraction of Stream Channel Gravels while the finest fraction of the Younger Alluvium may be as much as an order of magnitude, or more, lower. This reflects the heterogenous nature of geologic materials in the project setting. Nevertheless, values such as those developed from well testing or, as discussed in **Section 9.3**, single values from other sources are reasonably applied to groundwater flow problems.

Because of its coarse and unconfined nature, the specific yield (a dimensionless term, see **Section 12 Glossary**) for these materials is estimated at up to 0.25 for the very coarse Stream Channel Gravels[16] and 0.10 for the more mixed composition Younger Alluvium. The specific yield values were used in quantifying aquifer volume discussed below in the next subsection. Other analyses presented by LSCE (2009) suggest that these properties are consistent for the shallow alluvium in other reaches of the Sunol Valley floor area.

Contrasted with the thin shallow alluvium comprised of Stream Channel Gravels and Younger Alluvium, the Livermore Gravels formation occurs throughout the groundwater basin with a thickness up to hundreds of feet. In the valley floor area, the Livermore Gravels underlie the shallow alluvium materials. In the upland areas to the east where it is exposed at the surface, this formation exhibits

[15] Specific capacity is the discharge rate in gallons per minute divided by the pumping drawdown of the static level. It is closely related to aquifer transmissivity and conductivity of aquifer materials; e.g., a high specific capacity indicates a comparatively high transmissivity (also, see **Section 12 Glossary**)

[16] Texture descriptions of the streambed materials were obtained from habitat surveys along the Alameda Creek streambed in 2008 (personal communication with Scott Chenue, SFPUC Natural Resources and Land Management Division, Water Enterprises, November).

very low well yields attributed to high interstitial clay content and clay interbeds. Farrar (1990) reported specific capacities for four wells completed in Livermore Gravels in Vallecitos Valley of 0.05 to 0.5 gallons per minute per foot (gpm/ft) of drawdown. LSCE (1993) re-equipped an idle supply well at one of the quarry sites with a test pump. The well, pumping directly from the Livermore Gravels formation, exhibited a specific capacity of 1.5 gpm/ft, which is similar in magnitude to values reported by Farrar (1990). The hydraulic conductivity of the Livermore Gravels completed in the quarry well was estimated at 0.4 feet per day from the drawdown data reported by LSCE (1993).

From the above information and as discussed in **Section 4**, the shallow alluvium, consisting of Stream Channel Gravels and Younger Alluvium subunits, would have the most direct interactions with streamflow in Alameda Creek. While important as a boundary delineating the vertical extent of the overlying shallow aquifer materials, the Livermore Gravels subunit is not considered to have a dynamic influence on groundwater conditions that could affect daily to seasonal impacts of ACRP operations (i.e., under with-Project scenario). This is in large part because quantitative information indicates that the hydraulic conductivity of the Livermore Gravels subunit may be as much as three orders of magnitude smaller (0.4 ft/day versus 300 ft/day). Consistent with the quantitative differences in hydraulic conductivity, experience in quarry operations indicate that seepage from the creek occurs through the shallow alluvium materials while seepage from the underlying Livermore Gravels is inconsequential. This is why slurry cutoff walls are keyed into the Livermore Gravels unit to mitigate seepage. As a result, the CEQA impact analysis in this report focuses on the shallow aquifer system as being the most relevant to stream interactions and potential project effects on aquatic and riparian habitats.

6.3.2 Shallow Aquifer Extent and Volume

The extent and volume of shallow alluvium subunits (Stream Channel Gravels and Younger Alluvium) that constitutes the shallow aquifer system on the Sunol Valley floor along Alameda Creek were quantified in the project area vicinity using Geographical Information System (GIS) based calculations. The calculations involved multiple steps. First, the gross surface area of the shallow alluvium subunits was determined using historic maps of surface geology discussed in **Section 4**. Because of surface and subsurface land alterations by aggregate mining, areas were divided into segments upstream and downstream of the Alameda Siphons (see **Figure 5-1**). Second, bulk volumes of the subunits were determined using cross sections from which LSCE (1993 and 2009) delineated vertical extent. Third, maximum saturated thicknesses were based on observed water levels in monitoring wells using data by LSCE (2009) and data evaluated in this report (see **Section 7**, below). Fourth, computed volumes from mined areas were subtracted from the totals because, in those areas, the shallow alluvium subunits have been removed as overburden to the targeted aggregate in the underlying Livermore Gravels subunit. As discussed previously, different specific yield factors were employed to compute the effective storage space of the coarser Stream Channel Gravels (specific yield = 0.25) and the finer, more mixed composition Younger Alluvium (specific yield = 0.10). The calculations and estimated volumes are detailed in **Appendix 1** with the total storage volume of the shallow aquifer volume estimated at 1,135 acre-feet. A sensitivity on specific yield was performed by adjusting values by 20 percent; for Stream Channel Gravels values were 0.20 and 0.30 and for Younger Alluvium 0.08 and 0.12. The resultant volumes were 908 and 1,362 acre-feet compared to the base assumption.

The areal extent, excluded areas, and saturated thicknesses are shown on **Figures 6-2a** and **6-2b**. The effective storage volumes of the shallow aquifer of the Sunol Valley floor are summarized below and broken into three regions; A, B and C:

Table 6-1 Summary of shallow aquifer volumes (acre-feet)

Location	Storage Volume in Stream Channel Gravels (Qg)	Storage Volume in Younger Alluvium (Qa)	Total Storage Volume (Qg + Qa)
A. Upstream of Alameda Siphons to Welch Creek	375	115	490
B. Alameda Siphons to San Antonio Creek	257	85	342
C. San Antonio Creek to Arroyo de la Laguna	91	212	303
Grand Totals	723	412	1,135

6.4 Quarry Pit Seepage and Slurry Cutoff Walls

Groundwater seepage into quarry pits via the shallow alluvium occurs in parts of the quarry reach of Alameda Creek. Where seepage occurs, it is a nuisance for mining operations. To mitigate this nuisance, dewatering is commonly employed, and, in some locations, slurry cutoff walls have been installed to prevent seepage into the pits. As an example, a cutoff wall surrounding the SMP-32 site (see **Figure 5-1**) was installed 70 to 80 feet below ground surface with a reported permeability of 10^{-8} centimeters per second, or about 3×10^{-4} feet/day (personal communication with Mort Calvert and Eric Riddiough, Hanson Aggregates, January 9, 2008). The wall was installed with an extended backhoe that produced a trench of three-feet in width.

In 1988, Mission Valley Rock installed a cutoff wall adjacent to Alameda Creek at the ACRP project site. The cutoff wall partially isolates Pit F-2 from the creek, but gaps were left at the easement for the South Bay Aqueduct crossing. A geotechnical report by Harding Lawson Associates (1988) indicates that the wall is 3 feet wide by 48 feet deep and constructed with extended backhoes and bentonite slurry. The wall was intended to block groundwater inflow from the shallow alluvium into the adjacent mining areas and was keyed into the underlying Livermore Gravels. The estimated permeability was stated to be less than 10^{-6} centimeters per second (3×10^{-2} feet/day).

Seepage continues to be a nuisance to mining operations in the project vicinity. Significant seepage rates were noted in Trihey (2003) adjacent to SMP-30 (see **Figure 5-1**). At Pit F-2 in SMP-24, seepage rates are impeded by a slurry wall except at gaps at the South Bay Aqueduct crossing and other areas where it has been mined or was not installed. The ACRP project would rely on passive seepage via the shallow alluvium into Pit F-2 to recapture bypasses and in-stream releases.

A slurry cutoff wall was also installed around Pit F3-East which is used as an outfall for the Hetch Hetchy pipeline. The effects of this feature on the CEQA impact analysis are considered insignificant due to the location of the pit in relation to Alameda Creek.

Drawings showing the placement of cutoff walls for SMP-24 and SMP-32 are shown in **Appendix 2**.

6.5 Streamflow Studies

Multiple studies of Alameda Creek streamflow have been conducted to evaluate impediments to steelhead population recovery (Trihey, 2003; Entrix, 2004 and 2006; McBain & Trush, 2008; SFPUC, ACWD, and McBain & Trush, 2012). The studies identified seepage losses to alluvial materials from below Welch Creek to Arroyo de la Laguna as potential impediments to steelhead migration during critical periods. Trihey (2003) conducted flow studies in the fall of 2001 with a controlled release rate of 29 cfs from Calaveras Reservoir over two weeks in late October. Studies by Entrix (2004 and 2006) reported on observations with releases up to 300 cfs in early to mid-spring, and a report by the Flow Subcommittee of the Alameda Creek Fisheries Workgroup (SFPUC, ACWD and McBain & Trush, 2012) incorporates observations from SFPUC experimental releases up to 24 cfs from April to July 2008.

In addition to the stream flow studies cited above, Mission Valley Rock commissioned a study of Alameda Creek morphology including historical and current alignments of the stream channel (Entrix, 2003). The purpose was to evaluate potential constraints on stream restoration by a proposed mining project. Examination of historical maps indicated that the stream channel had been progressively altered by mining and re-aligned westward since at least 1953. The sinuosity of the stream channel also changed as the creek was straightened and constrained within levees to protect pits from flooding.

Trihey (2003) contains an assessment of streamflow losses through the quarry reach conducted in October 2001 during a period in which groundwater storage is observed to be at a seasonal low. It included a determination of time before stable flow[17] was observed at various locations. In addition, streamflow measurements were complemented by measurements of groundwater levels, though water levels in observation wells were not continuously monitored with transducers as was done with streamflow. Flow measurements were made at multiple locations from just below the release point from Calaveras Reservoir to the infiltration gallery reach between I-680 and Arroyo de la Laguna. It was concluded that losses of approximately 24.8 cfs occurred during the 2-week flow period from the release point to just upstream of Arroyo de la Laguna. This total included losses to groundwater upstream of the quarry reach of 8 cfs between the gage below Welch Creek and the Alameda Siphons. A total loss of 17.5 cfs was

[17] The Trihey (2003) report did not define "stable flow," but it was implied to be a flow rate which was not changing with time.

estimated between the gage below Welch Creek to the northern end of SMP-30. The time in which stable flows were reached ranged from 1 day at the Alameda Siphons (i.e., upstream end of the quarry reach) to over 12 days at I-680. Trihey (2003) reported loss rates ranging from 1 cfs per 825 feet to 1 cfs per 925 for channel segments between the gage below Welch Creek to just upstream of Arroyo de la Laguna. An exception was the channel segment that runs adjacent to Pit F-2 at SMP-24 where the loss rate was 1 cfs per 475 feet. The lower loss rate was recorded in the only segment where a cutoff wall to block seepage into pits existed; the segment as delineated in Trihey (2003) extended from about the South Bay Aqueduct crossing to just below I-680.

Groundwater level monitoring indicated direct response to the flow release (i.e., water level rise) in observation wells next to Alameda Creek, but not in wells situated farther away from the creek on the northern valley floor at the present-day SMP-32 mining site.

The 2008 SFPUC experimental releases reported by the Flow Subcommittee of the Alameda Creek Fisheries Restoration Workgroup (SFPUC, ACWD and McBain & Trush, 2012) occurred over nearly three months in April to July 2008. Flow measurements indicated losses of 17 cfs between Welch Creek and San Antonio Creek. At the same time, LSCE (2009) monitored groundwater levels in observation wells next to Alameda Creek and found little to no discernable groundwater response below I-680 at flows of 16 cfs or less, consistent with a general finding that flows greater than 17 cfs at the gage below Welch Creek through the quarry reach were required for surface water to occur past the area.

As a result of the findings concerning seepage losses, the Alameda System Daily Hydrologic Model incorporated a seepage loss of 17 cfs in the quarry reach between the Welch Creek, ASDHM Node 4, and San Antonio Creek, Node 5 (see **Figure 5-1**). Historically and at present, seepage that accumulates in a quarry pit may be either discharged by dewatering in accordance with an NPDES permit, stored and used for processing, evaporate, or seep back to groundwater when hydraulic conditions provide a gradient for outflow. Historical quarry discharge quantities generally approximate the seepage losses within the quarry reach (about 17 cfs; see SFPUC, ACWD, and McBain & Trush, 2012). Trihey (2003) estimated losses downstream of the quarry reach between SMP-24 and Arroyo de la Laguna to be approximately 7.5 cfs, corresponding approximately to ASDHM Nodes 6 (immediately downstream of San Antonio Creek) and Node 7 (immediately upstream of Arroyo de la Laguna); see node locations in **Figure 5-1**. These losses, which represent leakage to groundwater through the streambed, are not returned under the post-processing of the ASDHM model used in the project CEQA analysis (see Draft EIR Section 15 and revised Appendix HYD1). In contrast to the quarry reach where portions of stream leakage (or losses) seep into pits, the losses below the quarry reach reported by Trihey (2001) are expected to increase groundwater storage (seen as groundwater level rises) with a portion contributing to groundwater flow and a portion returning as surface flow where water levels rise above the stream thalweg (see discussions in **Sections 7** and **8**.). Below Arroyo de la Laguna, at the downstream terminus of the Sunol Valley Groundwater Basin, groundwater and surface water would merge. Accounting for water intercepted in the infiltration galleries for irrigation, the 7.5 cfs loss rate in ASDHM post processing produces a conservatively low estimate at Node 7 with respect to streamflow out of Sunol Valley that then flows through Niles Canyon.

6.6 Groundwater and Surface Water Monitoring

The analysis of ACRP impacts as related to groundwater conditions and interactions with Alameda Creek streamflow is informed by water level data collected from monitoring wells situated along the quarry reach alignment and below I-680 to Arroyo de la Laguna (see **Figure 6-3**). The analysis also uses surface level data for quarry pits and Alameda Creek streamflow data from U.S. Geological Survey (USGS) Gauge 1173575 located below Welch Creek. **Figures 6-4** and **6-5** present hydrographs of synchronized data from the three sources within the quarry reach to Arroyo de la Laguna. **Figure 6-4** shows groundwater level data and streamflow, and **Figure 6-5** shows surface water levels in pits and streamflow. These data sources support the characterization of groundwater and surface water interactions in subsequent sections of this report.

6.7 Scope of Potential Interactions with Bypasses and Instream Releases

Bypass flows and in-stream releases will be implemented under the with-CDRP scenario, and these upstream surface flows in Alameda Creek are expected to interact with groundwater within the shallow aquifer system along the Sunol Valley floor including the quarry reach and Pit F-2. Little interaction with underlying Livermore Gravels is expected due primarily to its low permeability as discussed in **Section 4** and further below in **Section 8**.

7. OBSERVED GROUNDWATER INTERACTIONS WITH SURFACE WATER

Data from the monitoring network presented in **Figures 6-4** and **6-5** are discussed below as they relate to potential impacts of the ACRP project on streamflow during steelhead migration periods. The descriptions of groundwater and surface water conditions focus on the shallow alluvial aquifer consisting of Stream Channel Gravels and Younger Alluvium overlying the Sunol Valley floor and within the Sunol Valley Groundwater Basin. These water-bearing subunits respond directly to streamflow while the underlying geologic subunits consisting of Older Alluvium and Livermore Gravels have quantifiably low transmitting properties and are observed to have insignificant influence on groundwater including limited seepage into quarry pits. Within the shallow alluvial aquifer, groundwater is connected to the stream as underflow. Water level observations in monitoring wells and quarry pits in conjunction with stream flow measurements aid in characterizing groundwater and surface water connections as discussed in this section and in **Section 8**. A quantitative analysis of groundwater flow and seepage is then presented in **Section 9** using the same data sources.

Other groundwater-surface water interactions in the study area were noted by LSCE (1993) in which gravel quarry operators at SMP-24 and SMP-30 have experienced nuisance caused by groundwater seepage into mining excavations. It was observed that the alluvium subunits readily contributed to inflow, but that the Livermore Gravels exhibited essentially no groundwater inflow. Trihey (2003) identified losses into quarry pits through the quarry reach, particularly SMP-30, as a potential impediment to fish passage. The same conditions are observed in current mining activities.

7.1 Groundwater and Surface Water Interactions by Reach

Figures 6-4 and **6-5** reflect groundwater conditions and surface water interactions at monitoring well locations in the study area and are discussed below. Installation of the monitoring wells and their completions[18] are detailed in LSCE (2009) and ARUP (2007).

Schematic cross sections were constructed for each location to illustrate key aspects of the aquifer system including the upper and lower boundaries of the shallow water table aquifer, relationship to adjacent quarry pits, and interpreted underflow associated with recharge from Alameda Creek. As the elevation of the shallow aquifer base is an inferred boundary, it is depicted as a dashed line to connote heterogeneity in the natural system.

7.1.1 Piezometers B3, B4, and B6 – Welch Creek to Alameda Siphons

Monitoring wells in this reach consist of three geotechnical piezometers that have been monitored continuously with transducers and data loggers. The data and a discussion of groundwater flow in this reach are detailed in **Section 9**, below.

7.1.2 MWs 1, 2 and 3 – Quarry Reach from Alameda Siphons to Project Vicinity

Monitoring wells in this reach, about 4,000 feet upstream of the project location, are not detailed in this report. They were installed prior to ACRP planning and feasibility studies and are discussed in LSCE (2009). These groundwater monitoring locations are adjacent to SMP-30 and active mining in Pit F-6 (see **Figure 6-3**). Monitoring data from these wells collected by SFPUC since December 2007 were reviewed and found to be consistent with characterizations of groundwater interactions downstream. Hydrographs of the SFPUC monitoring data for MWs 1, 2 and 3 are shown in **Figure 7-1** for reference.

7.1.3 MW 4 – Immediately Upstream of ACRP Project Area

MW 4 is located next to Pit F-4 immediately upstream of the ACRP project site. Interpreted conditions for MW 4 are schematically presented in **Figure 7-2**, which shows the projected Alameda Creek thalweg, the monitoring well profile, and Pit F-4. The drawing is scaled vertically while the horizontal scale is conceptual.

The maximum observed water level in MW 4, shown in **Figure 7-2(a)**, coincides with peak, or high, flow in Alameda Creek. This represents maximum storage in the shallow aquifer at this location as it cannot store water at higher elevations. Pit F-4 is shown at a stage in which it is filling from seepage from the shallow aquifer.

When streamflow recedes after wet months, groundwater levels are seen to rapidly decline as shown on the hydrographs in **Figure 6-4** and schematically in **Figure 7-2(b)**. Because of the aquifer geometry (i.e., its limited distribution and thin nature), groundwater levels exhibit the same flashy behavior associated with surface water in Alameda Creek. Here, the adjacent Pit F-4 is shown in a partially

[18] As reported in LSCE (2009), monitoring wells in the quarry reach are generally completed to about 50 feet in depth with 15-foot seals and 10-foot screens set near the bottom of the well.

dewatered state as quarry operators typically lower pit levels by pumping for mining purposes and discharge the water to the creek in accordance with NPDES requirements.

The minimum observed groundwater level at MW 4 is shown in **Figure 7-2(c)**. This is the interpreted base of the Stream Channel Gravels and Younger Alluvium layer (Qg/Qa) through which groundwater flows. In this figure, the entire aquifer thickness has dewatered as a result of seepage into pits and flow down the valley to Arroyo de la Laguna. This state would be typical for summer to late fall with Pit F-4 at a lower stage of storage than earlier in the year. From **Figure 6-4**, it can be seen that such drainage occurred in dry months of each year until 2015.

In 2015, the water level in adjacent Pit F-4 rose above the base of the shallow aquifer at MW 4. When this occurred, surface water in the pit seeped into the shallow aquifer in dry months and induced higher groundwater levels in MW 4 as compared to previous years (see **Figure 6-4**). The quarry pit and monitoring well levels are presented together in **Figure 7-3** showing the hydraulic connection between the pit and aquifer at this location.

The higher levels in Pit F-4 were a result of operational changes at the SMP-30 quarry where Pits F-6 and F-4 are located. Since 2012, the operator greatly reduced direct discharges to Alameda Creek except during extremely wet periods when spills occurred through a weir (outlet elevation = 247 feet). This practice resulted in higher storage levels in Pit F-4 compared to previous years.

Increased storage in Pit F-4 can be seen through the gradual increase in pit level, which directly influenced groundwater at MW-4 in winter 2014-15 when the pit level rose above the base of the shallow aquifer (Qg/Qa). As shown in **Figure 7-3**, when the pit level rose above the base of the shallow aquifer, groundwater levels in MW 4 fluctuated synchronously with pit levels. As discussed below for MWs 5 and 6, downstream monitoring wells were also influenced by surface water levels in Pits F-4 and F-3 West as seen their synchronous fluctuations. As discussed in **Section 9**, seepage from groundwater influenced by these pits has been identified as a source of passive accumulation of water in Pit F-2 that would be part of the recapture of bypasses and releases under the ACRP project.

7.1.4 MW 5 Immediately Upstream of ACRP Pit F-2

Figure 7-4 schematically shows conditions for MW 5 just upstream of the ACRP project area where Pit F-2 would serve as the storage facility and pumping location for the recapture project. The maximum observed groundwater water level is shown in **Figure 7-4(a)**. Also shown in **Figure 7-4(a)** is the maximum storage level for Pit F-2 is 240 feet elevation under with-Project operations, which would typically be expected to occur at the end of March, and its relation to maximum (243 feet) and minimum (224 feet) groundwater level elevations.

Figure 7-4(b) shows the recession of groundwater with declining stream flow and **Figure 7-4**(**c)** shows the minimum observed groundwater level corresponding to the interpreted base of the shallow aquifer (i.e., 224 feet at MW5 location). The minimum operating level for Pit F-2 under with-Project operations is 180 feet elevation and would be observed by the fall prior to the onset of the next wet season. In these figures, Pit F-2 is shown at progressively lower levels representing ACRP pumping. **Figure 7-4(c)** also shows the maximum drawdown that would occur according to the operations plan.

As discussed below, pools were observed in the reach from MW 5 to below MW 6 during a terrestrial survey conducted in October 2015. The surface of the pools in the stream channel is an expression of groundwater, or underflow, and are subject to evaporative losses. Seepage from upstream sources such as quarry pits F-4 and F-3 West would preferentially follow the stream and contribute to underflow. Examination of historical aerial photos in fall months (using Google Earth) indicate that pools occurred consistently in this area in years prior to 2012 including dry years such as 2008. The occurrence of pools into fall months are attributed to quarry NPDES discharges from SMP-24 and SMP-30. The occurrence of pools in reaches below MWs 5 and 6 in fall 2015 are attributed to quarry NPDES discharges plus groundwater seepage indicated by surface water levels in Pits F-4 and F-3 West, which influenced groundwater levels in MW 5. The inferred groundwater seepage would contribute to stream underflow occurring in this area.

7.1.5 MWs 8 and 9 – Infiltration Gallery Reach

Figure 7-5 schematically shows conditions in the vicinity of MWs 8 and 9 located within the infiltration gallery (the infiltration galleries are shown on **Figure 6-1**). The conditions at these sites are different than up-gradient locations due to decreasing aquifer thickness, and the potential for pools to occur on a year-round basis. The narrative description that follows for MWs 8 and 9 would be similar for MW 6, which is located at southernmost portion of the infiltration gallery reach.

At MWs 8 and 9, groundwater levels fluctuate in a narrower range than upstream sites MWs 4, 5, and 6. Also, the stream thalweg is nearer the interpreted base of the shallow aquifer. Notably at MW 9, groundwater elevations may exceed the projected creek thalweg even during dry months (see **Figure 6-4**). The source of water at these times is attributed to quarry discharges.

In wet months, pools would merge as Alameda Creek becomes a live stream. Like upstream reaches, groundwater levels exhibit a flashy nature during the winter, only with lower amplitudes governed by the thinner nature of the aquifer (see **Figure 6-4**).

MWs 8 and 9 are located near the existing SFPUC infiltration gallery system and Sunol Pump Station. The SFPUC used the infiltration gallery previously to capture groundwater and return it to San Antonio Reservoir (URS, 2007). The SFPUC used the wet well of the pump station until 2016 to pump water for irrigation at the adjacent Sunol Valley Golf Course (property leased from SFPUC). The SFPUC still diverts water from the infiltration gallery to maintain the water system on the former golf course and will continue to do so in the future.

7.1.6 MW 10 – Immediately Upstream of Arroyo de la Laguna

Figure 7-6 schematically shows conditions for MW 10. At this site, less pooling in dry months would occur due to the height of the thalweg relative to groundwater level fluctuations (see **Figure 6-4**).

Immediately downstream of this monitoring well, the thalweg drops 4 to 5 feet. Flow in Arroyo de la Laguna occasionally inundates the area during very wet periods.

8. GROUNDWATER OCCURRENCE AND PROCESSES

8.1 Groundwater Occurrence

DWR (1966) noted that groundwater in Sunol Valley is recharged primarily by Alameda Creek. This is consistent with other studies and evident through field observations described in this report. Other sources of recharge may be from older geologic formations of the mountain blocks to the east. However, this source would be diffuse and possibly hydraulically impeded by the Calaveras Fault (DWR, 1974). Downstream of the quarry reach north of I-680, some recharge may be sourced from the upland areas into the alluvial valley, but would also be impeded by the Calaveras Fault and, since about 2008, largely blocked by the slurry wall surrounding SMP-32 (see **Figure 5-1**).

Alameda Creek streamflow downstream of the USGS gage below Welch Creek splits into subsurface and surface components where surface water initially infiltrates the alluvium. Water in the saturated zone then flows under the prevailing down-valley gradient governed by the hydraulic properties of the aquifer materials. For this component of flow, the terms groundwater, subsurface flow, and underflow are interchangeable. As the system is unconfined, the terms water table, or phreatic, aquifer also apply. However, as indicated previously, underflow may be the most appropriate term due to the thin nature and small storage volume of the shallow alluvium and the close association between groundwater levels and streamflow observed in the study area.

The fraction of streamflow that enters the subsurface in Alameda Creek through the quarry reaches follows two pathways. The first pathway is lateral seepage into quarry pits through the coarse streambed and alluvium materials comprising the shallow aquifer that is incised by the stream channel. This lateral seepage is evident as seepage faces on the walls of quarry excavations and observed through the rise in water levels in pits in wet months when groundwater levels and surface water flows peak[19]. Water that seeps into the pits generally has no outlet unless pit levels rise higher than groundwater in the shallow aquifer system. That is, water that seeps into a pit is typically impounded unless it is discharged by pumping (e.g., operator discharges to the creek) or used in aggregate processing; a fraction would also be evaporated from the water surface. Additionally, water can seep out of pits when levels rise above the base of the shallow aquifer (i.e., at the contact with the Livermore Gravels).

A second pathway, or outlet, for underflow follows the stream channel along the stream axis past San Antonio Creek and Pit F-2 to the confluence of Alameda Creek and Arroyo de la Laguna where it exits the valley as surface flow (DWR, 1966). Groundwater monitoring data indicate that stream leakage recharges groundwater causing water levels to rise and provide a gradient for flow out of the valley. The groundwater levels are sufficiently shallow, particularly in the infiltration gallery reach, that riparian habitats may be supported by the shallow groundwater table and therefore some fraction of subsurface

[19] Observations and personal communications with quarry operators by LSCE (2009).

flow is consumed by evapotranspiration. Subsurface flow is also intercepted in the SFPUC infiltration gallery system near the Sunol Water Temple and used at the former Sunol Golf Course property.

The flow pathways described above are depicted schematically in **Figure 8-1**.

8.2 Groundwater Processes of Recharge, Storage, and Discharge

Groundwater systems are characterized through processes of recharge, storage, and discharge. For the ACRP setting, these characteristics are apparent in the groundwater monitoring data discussed previously and presented in **Figure 6-4**. Recharge is seen in the relationship between Alameda Creek flow and responses in groundwater levels in adjacent monitoring wells. The decline of groundwater levels after peak streamflow events indicates a cessation of recharge and limited available storage in the aquifer. When the stream no longer provides recharge into the summer and fall periods, groundwater levels decline due to seepage into adjacent quarry pits, evapotranspiration within riparian habitats, and by flow out of the basin at Arroyo de la Laguna. The data indicate that the shallow groundwater system exhibits the same flashiness associated with runoff in the watershed and flow in Alameda Creek, consistent with past characterizations of the system as being primarily recharged by flow from Alameda Creek.

Groundwater fluctuations are used in this analysis to verify assumptions about hydraulic processes in the shallow aquifer system as they relate to the CEQA scenarios. First, seasonally minimum groundwater levels in monitoring wells are interpreted as the vertical boundary between the shallow alluvium aquifer and older Livermore Gravels subunit. This boundary is the effective depth to which surface water readily percolates and moves as underflow. This contact between the alluvium subunits of Stream Channel Gravels/Younger Alluvium (Qg/Qa) and Older Alluvium/Livermore Gravels (Qoa/QTl) is annotated on hydrographs in **Figure 6-4** and in the schematic drawings of conditions at monitoring well locations discussed in **Section 7**. The base of the shallow alluvium aquifer, as interpolated between monitoring wells, and its relation to the stream thalweg[20] is shown in the aquifer profile in **Figure 8-2**. The thalweg elevation is relevant to conditions observed in the study area particularly in the absence of a live stream. That is, if the stream is not live and a groundwater level is at or exceeds the thalweg elevation, it will be observed as a pool. Thus, a pool is an expression of the shallow groundwater table and underflow. The Alameda Creek thalweg profile was obtained from a 2008 survey by Environmental Science Associates. Because of ongoing fluvial processes including streambed erosion, the thalweg elevation at any location is expected to change with time; however, not such that it would affect the analyses presented herein.

A second aspect of the shallow aquifer is interpreted from maximum groundwater elevations. These are interpreted as the upper vertical boundaries of the shallow water table aquifer through which groundwater flows. For example, the groundwater level hydrographs in **Figure 6-4** indicate that the maximum groundwater levels correspond to peak streamflow in winter months, which then recede as streamflow drops off. These observations were used to determine the maximum effective aquifer storage volumes quantified in **Section 6**.

[20] Thalweg is the path of a line connecting the lowest points of cross-sections along a streambed.

Groundwater fluctuations in monitoring wells also indicate that the effective thickness of the shallow aquifer system is variable in the study area. For example, the shallow alluvium has decreasing thickness in the lower reaches of the study area (from MW-8 to Arroyo de la Laguna) as indicated by lower amplitude fluctuations compared to upstream locations (see MW-4). Downstream of I-680, a spill point near MW 9 is indicated on **Figure 8-3**. This point constrains groundwater levels and storage in upstream reaches. That is, groundwater will continue to discharge, or drain, out of the valley from the upper reaches because there is no physical boundary to prevent it. This is also illustrated in **Figure 8-3**, which compares conditions for a wet period (February 2008) to a dry period (October 2007). For the period of February 2008, Alameda Creek is a live stream with groundwater levels in the adjacent monitoring wells at or exceeding the projected creek thalweg.

Like most groundwater systems in California, fluctuating groundwater levels in wet and dry months in the ACRP project area under existing conditions reflect seasonality of recharge. Examination of groundwater levels and pit surface water elevations indicate that groundwater level declines occur when quarry operators initiate pit dewatering and creek discharges for mining operations. The pattern and magnitude of discharges changed in 2013 when Pit F-4 at SMP-30 was used to store water rather than discharging it to Alameda Creek. This hydraulic condition is shown in **Figure 8-4** where pit levels are superimposed on the thalweg-aquifer profiles showing the gradient for seepage to the shallow aquifer from Pit F-4 and F-3 West. As a result, groundwater levels in the dry months since 2012 have been higher than previous years (for example, at MW 5 which is adjacent to Pit F3 West; see **Figure 6-4**).

9. QUANTIFICATION OF AQUIFER FLOW AND SEEPAGE

This section presents analyses of groundwater movement in the shallow aquifer of the Sunol Valley floor and seepage into Pit F-2 as related to the ACRP project. As stated previously, the shallow aquifer consists of the most permeable geologic deposits that occur in the study area and the greater Sunol Valley Groundwater Basin. These materials correspond to the uppermost subunits of alluvium discussed in **Section 4**. They consist of sand and gravel deposits in the Alameda Creek bed (termed Stream Channel Gravels), and unconsolidated sand and gravel with interbedded clay and silt of floodplain, stream channel and alluvial fan origins (termed Younger Alluvium). Groundwater levels and storage in these subunits fluctuate seasonally and by water-year type. By contrast, underlying water-bearing subunits of Older Alluvium and Livermore Gravels do not exhibit high transmitting capacities in wells or in quarry pits and their interactions with streamflow is considered a negligible factor with respect to quantitative analysis of potential impacts on streamflow and groundwater interactions associated with daily to seasonal ACRP operations.

The methods employed in quantifying shallow aquifer flow and seepage processes are analytical and numerical. The analytical solution for unconfined flow by Dupuit was used to evaluate steady state in the aquifer as well as seepage into Pit F-2 from groundwater along the southern edge that does not have a slurry cutoff wall. A numerical simulation was performed to evaluate seepage into Pit F-2 from Alameda Creek to show the transient nature of streamflow and seepage rate. The results were compared to a mass balance approach involving measurements of pit volume changes to optimize parameter selection.

9.1 Aquifer Flow – Upper Reach

To inform an understanding of flow in the shallow aquifer throughout the greater Sunol Valley floor area, groundwater conditions upstream of the quarry reach were reviewed and analyzed to characterize the shallow groundwater system and surface water interactions. Within this upper reach, there are no seepage losses to quarry pits, reducing the factors affecting aquifer flow. Consistent with stream flow study observations (e.g., Trihey, 2003), losses, or stream leakage, occur in this upper reach and are interpreted as refilling, or recharging, the aquifer after the dry season.

Three of the geotechnical borings drilled for the Water Treatment Plant expansion project (ARUP, 2007) in the upper reach were converted to groundwater piezometers and have been monitored for groundwater levels on a continuous basis using transducers and dataloggers since December 2010. The piezometers were discussed in **Section 4** and identified as B3, B4, and B6 (see **Figure 4-5**). Groundwater level data for piezometers B3, B4, and B6 are presented as hydrographs in **Figure 9-1**. The data indicate that seasonal fluctuations observed in downstream monitoring wells are also observed in the upper reach piezometers (see **Figure 6-4**)[21]. Further, the groundwater fluctuations in the upper reach reflect the same processes of recharge, or filling, and drainage of shallow aquifer materials overlying formations of very low to zero permeability similar to those downstream where the shallow aquifer overlies the Livermore Gravels subunit. This is consistent with characterization of the Livermore Gravels as having low permeability and, for this EIR analysis, treating the formation as having hydraulic characteristics similar to a bedrock formation with respect to daily to seasonal groundwater and surface water interactions.

9.2 Analytic Estimate of Aquifer Flow within Upper Reach

Subsurface flow within the upper reach discussed in **Section 9.1** can be conceptualized as groundwater flow through an unconfined aquifer with recharge “N". The flow through an unconfined aquifer can be approximated using the hydraulic approach using the Dupuit equation (Charbeneau, 2000). The Dupuit method was selected for analysis of aquifer flow because assumptions of horizontal streamlines and head gradient equal to the slope of the water table surface at all depths favorably match the ACRP setting.

The Dupuit equation approximation is expressed for a horizontal aquifer bottom as follows:

$$Q(x) = W.U(x)$$

$$U(x) = \frac{K}{2}.\frac{h_{us}^2 - h_{ds}^2}{L_{us_{ds}}} + N\left[x - \frac{L_{us_{ds}}}{2}\right] \qquad \text{(Equation 9-1)}$$

Where,

$Q(x)$: Aquifer volumetric flux at x between upstream “us” and downstream “ds” [L^3T^{-1}]

[21] The similarity between upper reach fluctuations with those downstream was most evident through about 2012. After 2012, high storage levels in Pits F-3 West and F4 attenuated fluctuations at MWs 5 and 6.

W: Aquifer width [L]

$U(x)$: Aquifer volumetric flux at x between upstream "us" and downstream "ds" [L^2T^{-1}]

N: Recharge [LT^{-1}]

K: Hydraulic conductivity [$L\,T^{-1}$]

h_{us}: Upstream hydraulic head measured from bottom of the aquifer [L]

h_{ds}: Downstream hydraulic head measured from bottom of the aquifer [L]

$L_{us_{ds}}$: Distance between upstream "us" and downstream "ds" locations [L]

Table 9-1 shows parameters values used for the Dupuit equation to estimate aquifer volumetric flux[22] between piezometers B3, B4, and B6. It should be noted that the aquifer in the upstream reach is sloped. The solution of the governing flow equation for a sloping aquifer was developed by Charbeneau and Barrett (2008) and considered in this case. However, the aquifer bed slope is sufficiently small that assuming a horizontal bed did not appreciably change the results. Therefore, Equation 9-1 can be used as an approximation to estimate the aquifer volumetric flux for the real system within the upper reach.

Table 9-1: Parameter values of the Dupuit equation to estimate aquifer volumetric flux between B3, B4, and B6

Parameters	B3	B4	B6
Aquifer width (W, *feet*)	1,390	1,765	1,730
Contact elevation (C, *feet, NAVD88*)	307	299	291
Distance between B3 and B4 ($L_{B3\text{-}B4}$, *feet*)	1,430		
Distance between B4 and B6 ($L_{B4\text{-}B6}$, *feet*)		910	
Hydraulic conductivity (K, *ft/d*)	600	600	600
Water elevation (h, *feet NAVD88*)	See **Figure 9-1**		

Equation 9-1 can be rewritten to reflect aquifer volumetric flux at the midpoint between two piezometer locations (i.e., evaluated at $x = L\_(us\_ds\ )/2)$ as follows:

$$Q_{us_{ds}} = \overline{W} * \overline{h} * q, \quad U(x) = \overline{h} * q \qquad \text{(Equation 9-2)}$$

$$\overline{W} = \frac{W_{us} + W_{ds}}{2}$$

[22] See definition in **Section 12 Glossary**.

$$\overline{h} = ([h_{us} + h_{us}] * 0.5)$$

$$h_{us} = H_{us} - \overline{C}$$

$$h_{ds} = H_{ds} - \overline{C}$$

$$\overline{C} = ([C_{us} + C_{us}] * 0.5)$$

$$q = \left(K \frac{h_{us} - h_{ds}}{L_{us_{ds}}} \right)$$

Where,

$Q_{us_{ds}}$:	Aquifer volumetric flux between upstream "us" and downstream "ds" locations [L^3T^{-1}]
$\overline{W}$:	Average aquifer width [L]
$\overline{C}$:	Average aquifer bed elevation (contact) [L]
$\overline{h}$:	Average saturated thickness measured from bottom of the aquifer [L]
h_{us}:	Upstream hydraulic head measured from bottom of F-2 pit [L]
h_{ds}:	Downstream hydraulic head measured from bottom of F-2 pit [L]
q:	Darcy flux [L T^{-1}]

Equation 9-2 is used to estimate the aquifer volumetric flux between B3-B4 and B4-B6 as a function of the recorded water levels in Piezometers B3, B4, and B6 and estimated length and width of the portion of aquifer being analyzed. Through matching aquifer and stream seepage with pit volume mass balance discussed below, hydraulic conductivity of 600 feet/day was selected for input in the Dupuit equation. This estimate was derived from verification of seepage rates into Pit F-2 with a mass balance as described **Section 9.3.4**. It is also considered reasonable for the upper reach predominantly consisting of the Stream Channel Gravels subunit.

9.2.1 Results

The time-series groundwater levels (i.e., hydraulic head, h) at locations B3, B4, and B6 in **Figure 9-1** indicate that heads are progressively lower from upstream to downstream; i.e., $h_{B3} > h_{B4} > h_{B6}$. The gradient corresponding to the decreasing head is the driver for flux in the aquifer from piezometer B3 to B6. **Figure 9-2** shows times-series aquifer volumetric flux using the Dupuit equation between B3-B4 and B4-B6 (y-primary axis) and Alameda Creek flux[23] as measured at the USGS gage below Welch Creek (y-secondary axis). The peaks in aquifer volumetric flux correspond closely with the peaks in Alameda Creek flux recorded at the USGS gauge below Welch Creek. Units for aquifer volumetric flux

[23] Flux in Alameda Creek refers to streamflow. Streamflow, stream flux, and creek flux are used interchangeably, and all have the units cubic feet per second (cfs) in this report.

and stream flux are cubic feet per second (cfs). **Figure 9-2** shows that, in general, $Q_{B4\text{-}B6}$ (red curve) is larger than $Q_{B3\text{-}B4}$ (blue curve) reflecting that the primary source of water to the aquifer is leakage from Alameda Creek which is seen to be accumulating in the downstream direction. For the period analyzed, the range of volumetric flux in the aquifer is between zero and 1 cfs while the range of measured streamflow (the source of water to the aquifer) is zero to 2,250 cfs.

The aquifer volumetric flux in the upper reach is consistent with 1) an aquifer of limited volume and 2) the creek serving as the predominant source of recharge. These are key characteristics of groundwater and surface water interactions in this upper and downstream reaches including at the ACRP project location at Pit F-2.

9.3 Quantification of Seepage into Pit F-2

The recapture process by which bypassed and released water would be stored and pumped from Pit F-2 under ACRP is described in the SFPUC alternatives analysis report by URS (2008). In that report, the passive accumulation of water in quarry pits was attributed mainly to seepage from Alameda Creek through anecdotal observations by quarry operators and water discharge records. URS (2008) cited a seepage pathway from the creek via gaps in the slurry wall installed around portions of SMP-24. The gap exists where the South Bay Aqueduct crosses Alameda Creek and totals approximately 250 feet in width. URS (2008) was unsuccessful in modeling volumetric changes in pit volume through this pathway using MODFLOW analysis software. URS reported that the results were not consistent with measurements and modeling was hampered by the need to assign parameter values that were either unknown or varied over a wide range. Additionally, sensitivity studies did not converge or produce consistent predictions of quarry discharges and it was concluded that the modeling approach was not reliable. Nevertheless, URS (2008) found that quarry operator discharges, offsetting accumulation of seepage in pits, was evidence that recapture pumping from Pit F-2 could be a viable alternative for recovery of bypassed and released water. It was further noted in URS (2008) that the location of the gap in the slurry wall corresponds with an historical streambed alignment and therefore represented a favorable seepage pathway through the presence of high conductivity streambed materials. The historical alignment was constructed by Entrix (2003) from a 1953 USGS topographic map, which predated the surface geology mapping discussed in **Section 4**.

The current analysis of seepage rates into Pit F-2 uses monitored water levels in quarry pits discussed in **Section 6** and considers two pathways for subsurface seepage into Pit F-2:

1) seepage from the creek through the SMP-24 slurry wall gap at the South Bay Aqueduct, and

2) seepage from groundwater along the southern edge using adjacent pit levels to represent aquifer head conditions.

Figure 9-3 shows the two seepage pathways. The transient[24] seepage rate is estimated by two independent methods. The first method estimates total subsurface seepage into Pit F-2 based on a water mass balance equation for Pit F-2. The second method estimates subsurface seepage rates using simple numerical and analytical solutions to solve the governing equation for flow through porous media for the two pathways stated above. The results of the mass balance and numerical and analytical solutions are consistent and produce a good match as discussed in the following sections.

9.3.1 Flow Mass Balance for F-2 Pit and Estimate of Total Subsurface Seepage

The general transient[25] water mass balance for Pit F-2 is governed by the following equation:

$$Inflow - Outflow = Change\ in\ Storage$$

The water mass balance equation for Pit F-2 can be expressed in terms of individual components that are associated with the project setting:

$$P(t) + R(t) + S(t) + Q_{in}(t) - E(t) - Q_{out}(t) = {(V(t) - V(t-1))}/{dt} \qquad \text{(Equation 9-3)}$$

Where:

$P(t)$: Direct precipitation rate into the pit at time "t" [$V^3 T^{-1}$]

$R(t)$: Watershed runoff rate into the pit at time "t" [$V^3 T^{-1}$]

$S(t)$: Total subsurface seepage rate into the pit at time "t" [$V^3 T^{-1}$]

$Q_{in}(t)$: Quarry addition rate into the pit at time "t" [$V^3 T^{-1}$]

$E(t)$: Evaporation rate from pit surface at time "t" [$V^3 T^{-1}$]

$Q_{out}(t)$: Quarry discharge rate out of pit at specific time "t" [$V^3 T^{-1}$]

$V(t)$: Pit water volume at time "t" [$V^3 T^{-1}$]

$V(t-1)$: Pit water volume at preceding time "t-1" [$V^3 T^{-1}$]

dt: Time interval [T]

The two unknown components of the mass balance for Pit F-2 in Equation 9-3 are total subsurface seepage, S(t), and quarry addition rates, $Q_{in}(t)$. As cited above, subsurface seepage into Pit F-2 is assumed to occur from Alameda Creek through gaps in the slurry wall adjacent to the creek alignment and from groundwater along the southern edge of the pit (along this edge, there is no slurry wall except surrounding Pit F-3 East). Additions of water into Pit F-2 are made by quarry operators and are not reported or tallied. As these additions may be significant, a time frame for the seepage analysis

[24] Transient refers to the fact that flow estimates vary with time; as contrasted with steady-state in which all flow parameters are constant with time.
[25] ibid.

was selected in which no quarry additions occurred. The time between about April 2014 and February 2016 was selected during which the SFPUC requested that the quarry operators make no additions to Pit F-2 so that water quality monitoring could be conducted for regulatory permitting to use Pit F-2 as a source of drinking water in a public water system. Because of dry conditions in 2014, the time frame of this analysis was further shortened to the period December 1, 2014 to January 27, 2016. Thus, the parameter representing quarry additions, $Q_{in}(t)$, is zero.

The seepage analysis is performed using a time interval of one day; i.e., *dt* = 1. The other components of the water mass balance for Pit F-2 in Equation 9-3 are either measured or inferred. By eliminating quarry additions, Equation 9-3 is reduced to Equation 9-4 below, which is used to estimate the seepage rate into F-2 pit:

$$S(t) = \big(V(t) - V(t-1)\big) - P(t) - R(t) + E(t) + Q_{out}(t) \qquad \text{(Equation 9-4)}$$

The sources of daily data for the Pit F-2 water mass balance components are listed below:

Precipitation rate, $P(t)$
Daily precipitation data from local gauges were reviewed including stations located at San Antonio and Calaveras reservoirs. The Sunol[26] rain gauge was considered consistent and representative for determining direct contributions of rainfall to Pit F-2 for the mass balance analysis.

Watershed runoff rate, $R(t)$
Runoff from the adjacent watershed of 359 acres was provided by SFPUC with the same algorithm used in ASDHM and proportioned according to the watershed area and observed flow above the ACDD.

Evaporation, $E(t)$

Daily evaporation as a function of pit surface area was obtained from SFPUC[27] and a depth-volume relationship for the pit.

Quarry discharge rate, $Q_{out}(t)$
Quarry discharge rates represents water discharged from Pit F-2 by quarry operators and were derived from NPDES reports. Hours of discharge operations reported on a daily basis were converted to flow rate using pump rating curves.

Pit water volume, $V(t)$
The water volume for Pit F-2 was derived from recorded pressure transducer readings of water surface height on a 15-minute frequency. The water surface height was converted to elevation and the daily change in volume then determined using the depth-volume relationship provided by SFPUC. It should be noted that in this evaluation, all measured water levels in Pit F-2 were

[26] Source: SFPUC Watershed Keeper

[27] Evaporation based on Hetch Hetchy Local Simulation model.

below the contact between the shallow aquifer of permeable materials (Stream Channel Gravels and Younger Alluvium) and older sedimentary deposits (Older Alluvium and Livermore Gravels) having comparatively very low permeability. Thus, there was always a gradient for seepage into Pit F-2 during the mass balance period.

9.3.2 Mass Balance Results

Figure 9-4 shows the time-series of surface water level in Pit F-2 (red curve on y-secondary axis) and the estimated subsurface seepage rate (black curve on y-primary axis) from the water mass balance method using Equation 9-4 (seepage to Pit F2 determined by the mass balance approach and is denoted S_{F2_WB}). **Figure 9-5** shows the water mass balance components in a stacked format showing each component in Equation 9-4 and expressed as a rate (cfs). The components are presented as a 5-day moving average as some measured parameters introduced considerable noise[28]. In **Figure 9-5**, a negative value for the term "dV/dt" represents an increase of water volume in Pit F-2 and a positive value represents a decrease in water volume. The overall symmetry above and below the zero value reflects that Equation 9-4 balances the inputs and outputs that produce the changes in pit volume. As will be discussed below, the pit volume generally increased throughout the study period; therefore, the change in volume is correspondingly negative for most of the period. The subsurface seepage component, S, shown on this figure in black is determined by solving Equation 9-4 and it would include seepage from the creek and from groundwater in the shallow aquifer materials as discussed further below.

The next section discusses numerical and analytical methods to compute and disaggregate subsurface seepage from the two pathways.

9.3.3 Pit F-2 Seepage Estimates for Two Pathways

Subsurface seepage into Pit F-2 can be disaggregated into two sub-elements of the water mass balance. The first is seepage from Alameda Creek to Pit F-2 through porous media (i.e., shallow aquifer materials). This occurs through the 250-foot slurry wall opening, or gap, at the South Bay Aqueduct and is designated as S_{creek_F2}.

The second sub-element of the water mass balance for Pit F-2 considered in this report is seepage sourced along the southern edge of Pit F-2 from groundwater and is designated as $S_{GW\text{-}F2}$. Seepage along the southern edge of it F-2 is inferred from measured surface water levels in the adjacent Pit F-3 West which, during the study period, were generally higher than the base of the shallow aquifer in Pit F-2; the base of the shallow aquifer is referred to as "contact." Since there is no slurry wall along the southern edge of Pit F-2, groundwater flow is estimated by the head gradient and volumetric flux through the shallow alluvium between them.

[28] Noise was predominantly due to transducer precision in the recorded pit levels. Because of large pit surface areas, even a high precision (e.g., 0.05 feet) resulted in a high daily inflow or outflow rate that produced noise.

Two groundwater flow models were developed to estimate magnitudes of seepage for these two pathways using the same time period as the mass balance described in **Section 9.3.1**: December 1, 2014 to January 27, 2016.

9.3.3.1 Seepage Estimate from Alameda Creek via Slurry Wall Gap

The flow between Alameda Creek adjacent to Pit F-2 pit was simulated using MODFLOW-NWT Version 1.1.2 (Niswonger et. al., 2011). MODFLOW is a numerical flow model by the U.S. Geological Survey that solves the groundwater flow equation to simulate the flow of groundwater through aquifers. MODFLOW-NWT is a FORTRAN code based on MODFLOW-2005 with Newton formulation[29]. The governing equation used to estimate seepage from the creek to the pit is a two-dimensional (x, z) transient groundwater flow equation for homogenous and isotropic porous media. This tool was selected to capture the dynamic changes in streamflow and their effect on seepage rates into Pit F-2. The applicable parameters used in the model for the project setting are listed in **Table 9-2**.

9.3.3.2 Groundwater Flow Model Development and Assigned Parameters

A schematic diagram of the numerical flow model to simulate seepage from the creek to the pit is shown in **Figure 9-6**. It consists of the creek as the point source of water to the aquifer with Pit F-2 pit as a point sink of water from the system.

The groundwater flow model is based on a finite-difference[30] model grid. The finite-difference model grid representing the seepage pathway from Alameda Creek to Pit F-2 consists of 1 row with 12 columns and 2 layers. The row width, dy, is equal to 250 feet corresponding to the slurry wall gap next to Pit F-2; this is the hydraulic connection between the porous media of the aquifer and the pit. The column length, dx, is equal to 175 feet except the last column (column 12), which is equal to 1 foot, to represent Pit F-2. The layer thickness, dz, represents the estimated vertical extent of the shallow aquifer adjacent to Pit F-2 from ground surface to the top of the Older Alluvium/Livermore Gravels contact (31 feet). This dimension was subdivided into two layers of 14 and 17 feet for Layers 1 and 2, respectively[31]. Temporal discretization is based on the recorded measurement frequency of 15 minutes for the creek flux using data collected by SFPUC just upstream at ASDHM Node 5 (see **Figure 5-1**). The implicit finite-difference Newton solver (NWT) was used to solve the finite difference equations in each stress period.

[29] Newton's method is a method for solving systems of nonlinear equations especially to those problems representing unconfined aquifers and surface water-groundwater interaction; https://www.usgs.gov/software/modflow-nwt-a-newton-formulation-modflow-2005.

[30] Finite difference is a numerical method for converting the governing groundwater flow partial differential equation, by approximating the derivatives with difference equations, to a system of linear or non-linear equations that can be solved by matrix algebra techniques.

[31] The vertical layering was done to assess vertical gradients.

Table 9-2: Parameters for numerical simulation using MODFLOW-NWT to estimate seepage from Alameda creek via slurry wall gap to Pit F-2

Parameter	Unit	Value
Model domain		
Number of Rows, Columns, Layers		12, 1, 2
Cell dimensions (dx, dy, dz)	*feet*	175,250, 14 (Layer 1) and 17 (Layer 2)
Top Elevation (*NAVD88)*	*feet*	253
Bottom Elevation (*NAVD88)*	*feet*	222
Input hydraulic parameters		
Hydraulic conductivity (K)	*feet/day*	600
Specific yield (S_y)		0.25
Specific Storage (S_s)		1E-05
Initial and boundary conditions		
Initial head	*feet*	222
Top boundary		Water Table
Creek		SFR package at Row 1 Column 8 (**Figure 9-7(a)**, creek flux)
F-2 pit		Drain package at Row 1, Column 12 with assigned head equal to contact elevation (222 feet)
Other boundaries		No flow
Numerical solution parameters		
Solver of the matrix		*Newton solver (NWT) package*
Time step length	*minutes*	15
Simulation time		4/14/2014 to 1/27/2016 with 15-min. stress periods

The initial condition of the aquifer is unsaturated, or dry, representing a condition typical of late fall when groundwater levels typically decline to seasonal lows at the base of the shallow alluvium. The live creek is represented using the MODFLOW Stream-Flow Routing (SFR)[32] package by assigning data for streamflow at Node 5, just upstream of San Antonio Creek confluence. The head in the stream was estimated using Manning equation[33] and then compared with measured field values to verify the relationship between head and streamflow. Alameda Creek is positioned at row 1, column 8. The streambed hydraulic conductivity is assigned to equal aquifer hydraulic conductivity. The elevation of the creek bed is assigned to be 244.3 feet based on a thalweg survey[34].

Pit F-2 is represented by a drain package with elevation equal to a contact elevation (222 feet) and with high conductance. As discussed further in **Section 9.3.4**, the parameter estimates for hydraulic conductivity and the contact elevation presented in **Table 9-2** were selected through an iterative process to achieve a good match with the water mass balance for Pit F-2. Results for Seepage from Alameda Creek into Pit F-2

9.3.3.3 Results for Seepage from Alameda Creek into Pit F-2

The model produces output on a 15-minute frequency corresponding to streamflow input. The 15-minute values were converted to daily values for consistency and comparison with the seepage estimation from the water mass balance, S_{F2_WB}, and the groundwater seepage along the southern edge of Pit F-2, $S_{GW\text{-}F2}$, discussed in the preceding sections. **Figure 9-7** shows the results of the numerical model simulation.

The seepage rate from the creek into Pit F-2 depends on the stream flux and porous media properties that hydraulically connect the creek and pit. The top panel **(a)** in **Figure 9-7** shows the time series of creek flux over the analysis period. In panel **(b)**, the aquifer starts dry with zero creek flux at the beginning of the simulation. Once stream flow occurs at Node 5, some surface water will leak via the streambed to the underlying aquifer, and the water volume will start to increase in the aquifer as seen in **Figure 9-7(b)**. The changes in aquifer water volume from a dry to filled state shows the same rapid peak as creek flux, but lags when the stream flow falls off due to the slower movement of water through the porous media of the shallow aquifer. This filling process continues until the creek and aquifer are hydraulically connected. Creek leakage, **Figure 9-7(c)**, occurs only when there is creek flux. Since the aquifer volume is small in relation to creek flux and leakage, seepage into Pit F-2 occurs in a very short time as shown by the rapid rise in seepage in **Figure 9-7(d)**. The peak of the seepage rate actually occurs when aquifer water storage

[32] The MODFLOW SFR package is used to model streamflow routing and interact with porous media beneath the stream.

[33] The Manning equation is an empirical formula used by SFR for estimating head in an open channel for given stream flow.

[34] November 2008, ESA.

peaks, which corresponds to the hydraulic connection between groundwater and the creek flow. That is, as the aquifer head increases, the gradient between the aquifer and the drain increases to a maximum.

The results of the numerical simulation of seepage from the creek into Pit F-2 show rates ranging from near zero to over 1.2 cfs. Leakage rates from the creek shown in **Figure 9-7(c)** range as high as 6 to 8 cfs, but only for a short duration when streamflow initially occurs and the aquifer fills. The seepage rates magnitudes and variations are discussed further in the context of applying this tool to the ASDHM base period in **Section 9.4**.

It should be noted that creek leakage depends on stream head when there is no hydraulic connection with the aquifer. Once the hydraulic connection is established with groundwater in the aquifer, the creek leakage will depend on the head difference between the creek and the aquifer head. Due to high conductance between the aquifer and the creek, the groundwater head will be very close to the stream stage head, though water will leave the creek to the aquifer. **Figure 9-7(c)** shows the creek leakage as an inflow component to the aquifer system.

9.3.3.4 Groundwater Seepage Estimate along Southern Edge of Pit F-2

Subsurface seepage into Pit F-2 along the southern edge of Pit F-2 is conceptualized as groundwater flow through an unconfined aquifer and was approximated using the Dupuit equation in **Section 9.2** (see Equation 9-2).

Equation 9-2 is used to estimate the seepage component termed S_{GW-F2} using surface water elevation in Pit F-3 West, h_{F3W}, to represent groundwater head at Pit F-3 West, such that the upstream hydraulic head, h_{us}, relative to Pit F-2 is $h_{us} = h_{F3W} - contact$ and the downstream head, h_{ds}, is $h_{ds} = 0$. As noted previously, the surface water elevation in Pit F-2 is always below the base of the shallow alluvium (i.e., contact) for the selected study period. As indicated above, the contact elevation was adjusted to 222 feet to produce a close match with the water balance method. Thus, for the ACRP setting, Equation 9-2 can be written as:

$$S_{GW-F2} = \frac{W.K}{2} . \frac{(h_{F3W} - contact)^2}{L_{F3W_{F2}}} \qquad \text{(Equation 9-5)}$$

Table 9-3 below shows the parameter values used to estimate the seepage from the direction of Pit F-3 West to Pit F-2 (S_{GW-F2}) using Equation 9-5.

Table 9-3: Parameter values of the Dupuit equation to estimate seepage rate along southern edge of Pit F-2

Parameters	Value
Average aquifer width (W, *feet*)	2,000
Contact elevation F-3 West (*feet, NAVD88*)	222
Contact elevation F-2 (*feet, NAVD88*)	222
Distance between F-3 West and F-2 (L_{F3W_F2}, *feet*)	275
Hydraulic conductivity (K, *ft/d*)	600
F-3 West water elevation (h_{F3W}, *feet*)	See **Figure 9-8**

Figure 9-8 shows the of estimated seepage rate "S_{GW-F2}" (y-primary axis), F-3 West and F-2 water levels, and contact elevations (y-secondary axis). In this figure, the surface water level in Pit F-3 is higher than the contact between shallow aquifer and its lower boundary. Thus, seepage into the pit from the aquifer occurs throughout the period analyzed. The black line representing the water level in Pit F-2 indicates it was always rising during the period. In accordance with the analytical solution, the seepage rate trend (solid blue) follows the trend of the water level in Pit F-3 west which produces the gradient for flux from the aquifer into the pit. Note that this pathway source ranges as high as 10 cfs in part due to the length of the southern pit edge through which seepage from the aquifer can occur. Again, this analysis assumes that the water elevation in Pit F-3 West represents head in the aquifer along that southern edge.

The next section discusses and compares the seepage rates derived from the two methods.

9.3.4 Verification of Seepage Rates into Pit F-2

The estimated seepage rate from the water mass balance analysis for Pit F-2, as described in **Section 9.2**, was compared with estimated seepage rates from Alameda Creek via the slurry wall gap and from groundwater moving from the direction of Pit F-3 west into Pit F-2 along its southern edge. **Figure 9-9(a)** shows these quantities as follows. The seepage rate from the water mass balance analysis for Pit F-2, S_{F2_WB}, is shown as the black line. A stacked time-series of estimated seepage rate consisting of numerical simulation results for seepage from Alameda Creek via the slurry wall gap, $S_{creek-F2}$, in red, and seepage from groundwater along the southern edge using Pit F-3 West heads, S_{GW-F2}, in blue. Note that the trends are generally consistent between the mass balance (black line) and the stacked quantities (red and blue). It is also notable that the numerical simulation results for seepage from the creek into Pit F-2 (red) is small in magnitude as compared to the groundwater pathway along the southern edge. This is in part because the period evaluated for the water mass balance was very dry with limited streamflow compared to other years (recall that the time period was selected to eliminate a large potential source for error due to lack of records on additions to the pit through quarry operations). However, it should also be noted that the seepage pathway from creek to Pit F-2 is constrained by the flow parameters including hydraulic conductivity of the aquifer materials, hydraulic gradient, aquifer saturated thickness, and width of the slurry wall gap.

Figure 9-9(b) compares cumulative seepage at the end of the mass balance study period as an x-y plot and average seepage components for the period as a pie chart. In the x-y plot, cumulative seepage by the mass balance method (black line) is closely aligned with the stacked sum of sources by the creek pathway and that along the southern edge of Pit F-2 (red and blue, respectively). In the pie chart, average volumetric fluxes are almost identical with the mass balance method producing a rate of 4.67 cfs and the combined creek and southern edge sources totaling 4.69 cfs (i.e., 4.43 + 0.16 cfs). Again, the small magnitude of seepage rate from the creek into the pit is partly due to dry hydrologic conditions but is also consistent with the hydraulic principles of the analytic methods and the volumetric fluxes estimated for the reach upstream of the Alameda Siphons in **Section 9.2**.

From this analysis, seepage magnitude from the creek pathway has a definitive maximum governed by the physical relationships between streambed and shallow alluvium contact. Since the stream is flashy, and because even high flows are constrained within a narrow range of stage elevation, the peak seepage rate directly from the creek, with the exception of unusually high stream flux in winter 2016, is generally less than 1 cfs as seen in **Figure 9-7(d)**. This result is also consistent with the field study of streamflow losses under controlled releases presented in Trihey (2003) which found that losses were about 1 cfs per 475 feet of channel next to SMP-24.

The favorable match between the mass balance and analytical estimates of seepage components was achieved through an iterative process in which adjustments were made in two parameters: hydraulic conductivity and contact elevation. These parameters were considered to have the greatest potential variability. The final parameter estimates, 600 ft/day for conductivity and 222 feet contact elevation, reflect reasonable assumptions for the project setting. In the case of hydraulic conductivity, the value is twice as large determined from a well test in the infiltration gallery reach. Noting that older alignments of Alameda Creek intersected the quarry pits (Entrix, 2003), the parameter selection for hydraulic conductivity appears well within a range of values for the types of materials that make of the Stream Channel Gravels subunit in this hydrogeologic setting. Similarly, the contact elevation, which is based on data from monitoring wells, would be expected to vary due to the inherent heterogeneity of geologic materials.

9.4 Creek Seepage into F-2 for ASDHM Base Period (1995-2013)

The numerical model used to estimate stream seepage described in **Section 9.3** was applied to the ASDHM base period to estimate the effects of seepage on streamflow under two CEQA scenarios. Using a modeled time series of flow from the ASDHM model for Node 5 (just upstream of Pit F-2 and the slurry wall gap) as input, and with stream head estimated as described in **Section 9.3**, daily values for volumetric flux between the aquifer and Pit F-2 from the creek through the slurry wall gap can be determined. The first scenario is with-CDRP in which it is assumed that the water level in Pit F-2 would be maintained between about 150 to 220 feet elevation[35]. In this scenario, flux is always leaving the aquifer to Pit F-2 and hence the pit acts as a sink. The other scenario incorporates ACRP proposed operations (i.e., with-Project) in which the pit fills to elevation 240 feet on a seasonal basis and then water is pumped to recapture bypasses and releases in accordance with San Francisco's water rights and the operating procedures set out in the Revised EIR Chapter 14. Under this scenario, the water level in Pit F-2 fluctuates above and below the contact elevation (assumed to be 222 feet based on mass balance verification discussed in **Section 9.3**). For the with-CDRP scenario, seepage was determined using flow at Node 5 in the ASDHM model run, while the with-Project scenario incorporated streamflow and pit levels[36]. Both scenarios encompassed the same ASDHM hydrologic period (1995 to 2013).

The parameters of the flow simulations are summarized below in **Table 9-4**. All parameters are the same as those described in **Section 9.2** except the downstream boundary condition at Pit F-2 which now varies according to proposed ACRP storage and recapture pumping. In the with-CDRP scenario, a boundary condition was modeled using a drain package with assigned head at the drain equal to the contact elevation (i.e., 222 feet from **Table 9-2**). In the ACRP with-Project scenario, the MODFLOW General Head Boundary (GHB) package was used to allow flow at the slurry wall gap to move in or out of Pit F-2 depending on the head in Pit F-2 and the head in the aquifer adjacent to the slurry wall gap. If the head in the aquifer is higher than the head in Pit F-2, then Pit F-2 will act as a sink and hence flow will leave the aquifer toward Pit F-2. If the head conditions are reversed, the flow will be out of the pit to the creek.

Figure 9-10(a) shows simulated ASDHM stream flux at Node 5 (y-primary) and Pit F-2 head (y-secondary) from SFPUC projected operations. **Figures 9-10(b) and 9-10(c)** show the resultant flux at the Pit F-2 boundary via the slurry wall gap using the numerical model for the with-CDRP and with-ACRP scenarios, respectively. In the with-CDRP scenario, the volumetric flux at the slurry wall is always positive and seepage flow is into Pit F-2. For the with-Project scenario, seepage peaks are truncated for the times when the pit elevation is higher than the contact and may be negative indicating flow out of the pit toward the creek.

Figures 9-11(a) and **11(b)** present histograms and cumulative distributions of simulated seepage through the slurry wall gap over the ASDHM base period for with-CDRP and with-ACRP scenarios, respectively. The histogram shows that most of the seepage rate values are less than or equal 1 cfs for the with-CDRP scenario (about 92-percent of the time).

[35] This is consistent with observations for Pits F-2 and F-6 since monitoring has been performed. Other pits such as F-3 west and Ready Mix have been used to store water for processing after being mined out and typically have higher surface elevations.

[36] Daily pit levels were provided by SFPUC based on the model base period and expected recapture quantities.

Table 9-4: Parameters for numerical simulation using MODFLOW-NWT to estimate seepage from Alameda creek via slurry wall gap to Pit F-2 for the ASDHM base period

Parameter	Unit	Value
Model domain		
Number of Rows, Columns, Layers		12, 1, 2
Cell dimensions (dx, dy, dz)	*feet*	175, 250, 14 (Layer 1) and 17 (Layer 2)
Top Elevation	*feet*	253
Bottom Elevation	*feet*	222
Input hydraulic parameters		
Hydraulic conductivity (K)	*ft/day*	600
Specific yield (S_y)		0.25
Specific Storage (S_s)		1E-05
Initial and boundary conditions		
Initial head	*feet*	222
Top boundary		Water Table
Creeks		SFR package at Row 1 Column 8 (**Figure 9-12(a)**, creek flux), y-primary)
F-2 pit		**CDRP:** Drain package at Row 1 Column 12 with assigned head equal to contact elevation (222 ft) **ACRP:** GHB package at Row 1 Column 12 with assigned head from ASDHM (**Figure 9-12(a)**, secondary)
Other boundaries		No flow
Numerical solution parameters		
Solver of the matrix		*Newton solver (NWT) package*
Time step length	*day*	1
Simulation time		Oct 1/1995- Sep 30/2013 with 1-day stress periods

Under the with-ACRP scenario, the seepage rates range from positive to negative with most positive values clustering around 0 to 0.5 cfs. The small negative fluxes occur at the slurry wall gap when the head in Pit F-2 is higher than the aquifer head at that location (see **Figure 9-10**).Thus, a prominent difference between the two scenarios is the condition at the end of the wet season where the head in Pit F-2 is above the contact which reduces and, at times, reverses the head gradient between the aquifer and pit.

The cumulative frequency curves in **Figures 9-11(a)** and **11(b)** differ from a normal distribution. For with-CDRP, there are two clusters of days in the histogram including a significant number of days at about zero and 1 cfs. The 1-cfs value corresponds to the predominant seepage rate seen in Figure **9-10** that is a near steady-state rate and that is when creek leakage is equal to seepage rate with sustained streamflow. The seepage rate value of around 1 cfs is governed by the seepage parameters (hydraulic gradient and conductivity, slurry wall gap width, and distance to the pit via the slurry wall gap). By contrast, the with-ACRP scenario exhibits three seepage rate clusters including the maximum of around 1 cfs similar to with-CDRP, but also a lower cluster of values around 0.3 to 0.4 cfs reflecting lower rates due to the fact that the pit level is higher than the contact each season during which the gradient for seepage is reduced (see **Figure 9-10**).

As with flow in the upper reach discussed in **Section 9.1**, the seepage rate variations for the two CEQA scenarios are consistent with an aquifer of limited volume with Alameda Creek serving as the predominant source of recharge. Additional details on the differences between with-CDRP and with-ACRP scenarios are discussed below.

Figures 9-12 and 9-13 present results from the numerical model simulations for with-CDRP and with-Project scenarios, respectively, and which link aquifer and stream leakage behavior to seepage. The top panel (a) in each figure shows the time series of creek flux at Node 5 from the ASDHM model. Panel (b) shows the percentage of aquifer water volume (relative to maximum aquifer volume) filled with water that has leaked from the creek. The maximum aquifer water storage volumes are 74.6 AF (see **Figure 9-12(b)**) and 77.1 AF (see **Figure 9-13(b)**). The slightly larger aquifer water volume in the with-Project scenario is a result of a reduced sink flux when head in Pit F-2 is above the contact compared to with-CDRP that fixes pit water levels below the contact. The third panel (c) shows the creek leakage. The leakage under the with-Project scenario (**Figure 9-13(c)**) is less than the with-CDRP scenario (**Figure 9-12(c)**) due to a reduced gradient for flux when Pit F-2 is above the contact elevation. Lastly, the bottom panel (d) shows volumetric rate, or seepage, occurring at the slurry wall gap. It should be noted that when the aquifer is stabilized, the seepage rate approximates the leakage rate in near steady state condition.

Table 9-5 summarizes simulation results showing average creek leakage by month for the ASDHM base period for with-CDRP and with-Project scenarios. Here, stream leakage is used to reflect potential effects on streamflow adjacent to Pit F-2. Monthly averages are presented in the table to show the magnitude of the leakage, but the actual data processing is based on a daily time step consistent with the ASDHM model (see Revised HYD1). The results indicate that average stream leakage rates are less under the with-ACRP scenario than the with-CDRP scenario, which is due to water being stored at higher elevations (up to 240 feet), thus reducing leakage when the level in Pit F-2 is higher than the contact. Consistent with the figures discussed above, average leakage rates are on the order of 1 cfs in both scenarios. Also, while there is no stream leakage from August through October (because there is no streamflow), seepage would still accrue to Pit F-2 via aquifer flow. This is seen by the presence of water in the aquifer in **Figures 9-12(b)** and **9-13(b)** and ongoing seepage (albeit small) in **Figures 9-12(d)** and **9-13(d)**.

Table 9-5: Average stream leakage (cfs) using numerical model for ASDHM base period

Month	with-CDRP	with-ACRP
January	0.97	0.87
February	1.02	0.77
March	0.95	0.50
April	0.81	0.27
May	0.47	0.14
June	0.24	0.07
July	0.03	0.02
August	0	0
September	0	0
October	0	0
November	0.12	0.12
December	0.66	0.65
Minimum	***0***	***0***
Maximum	***1.02***	***0.87***
Annual Average	***0.44***	***0.28***

10. CEQA CONSIDERATIONS: FISHERIES HABITAT

The ACRP project operations would result in variable storage levels in Pit F-2, and the pit water levels would be lowered by pumping during the operating period of July 1 to November 30. Storage levels would have the potential to affect the rate, timing and duration of seepage in and out of the adjacent shallow aquifer via the slurry wall gap in SMP-24. As indicated previously, streamflow studies identified seepage losses through the quarry reach as a potential factor affecting steelhead migration. Under the with-CDRP scenario, SFPUC would implement flow bypasses at the Alameda Creek Diversion Dam and in-stream releases from Calaveras Reservoir according to the NMFS Biological Opinion. Seepage losses would continue to occur under this scenario; however, analysis in the NMFS Biological Opinion concluded that the resulting condition would be adequate for steelhead migration. Under the with-Project scenario, the most direct potential impact of recapture pumping would be to lower pit elevations in the recapture phase (see EIR Chapter 14 for description of the proposed project operating protocols). However, in accordance with the proposed ACRP operating plan, which was revised to protect aquatic habitat, pumping would primarily occur between July 1 and November 30, which is outside the steelhead migration periods in Alameda Creek, and within a range of surface water elevation in Pit F-2 from 240 feet to 180 feet.

The quantitative analysis of aquifer flow and seepage into and out of the shallow aquifer adjacent to Pit F-2 indicates a finite and limited potential to affect streamflow. The maximum seepage into Pit F-2 is less than 1 cfs, except in the very highest streamflow events. The seepage and related stream leakage quantities are constrained by the aquifer thickness, hydraulic properties, and the stream stage. As indicated in the EIR, project impacts on Alameda Creek streamflow could affect fisheries habitat, particularly during the periods December 1 to April 30 (adult steelhead migration) and March 30 to June 30 (juvenile steelhead out-migration). The streamflow values used in the EIR fisheries analysis to represent minimum migration conditions for adult and juvenile steelhead in the Sunol Valley are 20 cfs for December 1 to April 30 and 10 cfs during March 1 to June 30, respectively, at critical locations in Alameda Creek. The time-series results developed in this report are used as input into the post-processing of the ASDHM model results used in the CEQA analysis in the EIR of operational impacts of the project on steelhead (refer to EIR Chapter 15 for details).

11. CEQA CONSIDERATIONS: RIPARIAN HABITAT

Based on the physical features of the creek thalweg and underlying shallow aquifer, the study area was subdivided to characterize potential changes to groundwater conditions for each CEQA scenario and effects on riparian habitat. The subreach classifications are listed below and shown in **Figure 11-1**. A location map is shown in **Figure 11-2**.

Subreach	Description	Approx. Stationing (feet)	Representative Monitoring Wells
A	San Antonio Creek to Interstate 680	98720 to 97200	MWs 4 - 6
B	Interstate 680 to Downstream MW 6	97200 to 95500	MWs 5 and 6
C1	Downstream MW 6 to Upstream MW 8	95500 to 93500	MW 6 and MW 8
C2	Upstream MW 8 to Upstream Arroyo de la Laguna	93500 to 90520	MWs 8 - 10

Subreaches A and B are the same as delineated in EIR Section 5.14, Biological Resources, and Subreaches C1 and C2 correspond to Subreach C in the EIR. Within these subreaches, groundwater conditions are governed by streamflow and aquifer thickness reflected in the vertical separation between the creek thalweg and base of the Stream Channel Gravels/Younger Alluvium (Qg/Qa) in **Figure 11-1** and the schematic cross sections discussed in **Section 7**. Aquifer thickness is greatest in Subreach A where the ACRP facilities are located and least in Subreach C2. Within Subreach B, aquifer thickness is relatively constant, then begins to thin in Subreach C1 with increasing thalweg slope. Subreach C1 represents a transition where the aquifer is thinnest in Subreach C2 and where intermittent pools are expected to be present year-round in the vicinity of MW 9.

11.1 Existing Scenario

The Existing scenario is represented by the range of groundwater conditions from 2006 to 2015, as reflected by groundwater levels and quarry pit levels shown on **Figures 6-4** and **6-5**, and a smaller discrete dataset from a study of local groundwater conditions in Sunol Valley (LSCE, 1993).

The relationship between groundwater and riparian habitat can be determined by relating water levels in MWs 4 – 6 to observed field conditions. For Subreach A, represented by MW 5, groundwater levels peak during storm events coincident with peak flows in Alameda Creek. At MW 5, the highest level recorded is just greater than the projected thalweg at 242 feet (see **Figure 6-4**). This elevation represents the upper limit of groundwater level fluctuations under the Existing scenario. Outside the wet season from April to October and up to 2012, groundwater levels exhibit seasonal low levels corresponding to the base of transmissive alluvial materials at about 223 feet elevation at MW 5 (due to heterogeneity in the project setting, the base of the shallow aquifer is expected to vary up to two or three feet). After 2012, the seasonal declines were not as great due to seepage effects from Pits F-4 and F-3 West with low water levels falling to only 230 feet in MW 5 (see **Figures 6-4** and **6-5**). Wet conditions observed in this reach, including damp soil visible on Google Earth imagery and from in-person site visits, would be due to direct quarry NPDES discharges to the streambed and, after 2012, contribution of seepage to underflow from elevated storage in Pits F-4 and F-3 West as well.

Subreach B is represented by conditions at MW 6. In this subreach, the creek thalweg and base of the shallow aquifer are relatively flat (see **Figure 11-1**). Like Subreach A, elevated groundwater levels in MW 6 due to routine quarry NPDES discharges and seepage from stored water in upstream quarry pits support pools in this area outside of the periods when Alameda Creek is a live stream to the Arroyo de la Laguna.

Within Subreach C1, the thalweg profile drops in elevation while the interpreted base of Stream Channel Gravels is roughly flat indicating a thinning of the shallow aquifer. As the aquifer thins, the separation between groundwater and the creek thalweg decreases. As shown in **Figure 11-1**, the separation is about 15 feet at the upstream end of Subreach C1 to nearly zero feet at the downstream end. Due to a lack of well control in this subreach, groundwater level data are not available. From the geometry of the aquifer system, it is assumed that the transition through which upstream conditions would be represented by data from MW 6 and downstream conditions by MW 8 is linear. From the October 2015 amphibian survey and in other years, pools were present to about halfway through the subreach. This would be the point where data from MW 8 are more representative of the subreach.

Within Subreach C2, groundwater was exposed in intermittent pools as observed in the October 2015 amphibian survey as well as other years (based on historical aerial imagery). Near MW 9 (see **Figure 6-4**), this condition would be typical in all years and would not be greatly influenced by upstream quarry practices since the aquifer system has little storage capacity at this location. While there are no available data to evaluate the effects of the historic filter gallery, Sunol Water Temple, and Sunol Pump Station on water levels in this subreach, influences would be the same for all CEQA scenarios.

11.2 With-CDRP Scenario

Under the with-CDRP scenario, the Calaveras Dam Replacement Project (CDRP) will be completed, Calaveras Reservoir will operate at full capacity, and bypasses and in-stream release schedules will be implemented. During wet months (November to April), peak Alameda Creek flows will exceed available storage space in the shallow aquifer and will also exceed seepage rates into mining pits. A live stream will prevail through all the subreaches with bypass flows at the Alameda Creek Diversion Dam serving to attenuate groundwater recession between storm events.

In dry months (April to November), after peak streamflow and groundwater levels recede, in-stream releases from Calaveras Reservoir will range from 7 to 12 cfs for dry and normal/wet schedules, respectively. At these release rates, two potential outcomes could occur depending on how water is managed in the quarries. First, if pit storage is employed to minimize direct NPDES discharges to Alameda Creek at SMP-30 (i.e., since 2012), the in-stream releases could induce a wetter condition through Subreaches A, B, and part of C1 as seepage to quarry pits would be rejected by high surface water elevations in pits. The pools observed in October 2015 and in other years would persist and expand or connect as groundwater elevations increase due to the addition of the continuous in-stream release flow. The increase might be on the order of a foot or less based on the relationship between streamflow and groundwater level responses. The largest influence would be due to the high storage elevations in Pits F-4 and F-3 West that induced groundwater levels to rise 5 to 10 feet at MWs 4 and 5 since 2013. A small rise in the water table could expose more underflow and create pools as the water table meets the thalweg in places where it was just below the surface. While wetter conditions are expected, the in-stream releases are not sufficient to produce a live stream throughout the quarry reach.

The second potential outcome considers quarry operations prior to 2012 in which quarry discharges occurred from both SMP-24 and SMP-30. In this case, quarry NPDES discharges would occur into about mid-summer after which dry conditions in the shallow aquifer would prevail from summer to fall. Under this assumption, a significant fraction of in-stream releases would seep into quarry pits (as evidenced from a 2008 experimental release study discussed below). In either case, the effects of bypasses and in-stream releases on groundwater levels are expected to fall within the range of past variations in hydrology and quarry NPDES discharges.

The proportion of releases that would seep into pits and be transmitted as underflow can be evaluated from the 2008 experimental releases from Calaveras Reservoir. The experimental releases were part of an in-stream flow assessment study by McBain and Trush (2008), which, among other purposes, sought to evaluate seepage losses through the quarry reaches. This led to quantification of a threshold flow, 17 cubic feet per second (cfs), below Welch Creek for which a live stream would be sustained below the quarry reaches (SFPUC, ACWD and McBain and Trush, 2012). Since the in-stream release schedule in dry months under the with-CDRP scenario consists of flows less than this threshold, no live stream would occur within or past Subreach A.

Examination of groundwater levels in MW 5 during the 2008 experimental release period was made to assess how the magnitude of the releases influence groundwater levels in the quarry reach. **Figure 11-3** shows groundwater levels and the experimental release flows measured at the USGS gauge below Welch Creek. The experimental releases were initiated at 33 cfs and followed by 4 two-week release periods at progressively decreasing rates from 24 to 6 cfs. At about 17 cfs and less, groundwater levels declined toward a baseline with no apparent stabilizing influences. It appears, then, that residual underflow from in-stream releases may have minor effects on riparian conditions in the lower subreaches. Thus, underflow from in-stream releases would be a contributory factor to conditions in the quarry reach where quarry NPDES discharges and seepage from pit areas are most evident in historical observations and groundwater data.

For the with-CDRP scenario, dry month in-stream releases would mainly influence groundwater levels in the study area subreaches by contributing to underflow and continuous seepage into quarry pits. Some portion of the releases may pass through the subreaches and extend or connect pools that are observed downstream through addition to quarry discharges and seepage from pits. If the SMP-30 quarry operator does not store water on-site to limit direct NPDES discharges to the creek, then much of the in-stream flow could seep into quarry pits. Based on the stream flow studies cited above, the in-stream releases are not sufficient on their own to create a live stream to Arroyo de la Laguna during the dry season. The combined in-stream releases, quarry NPDES discharges, and pit seepage would be expected to support pools within the same range as historical conditions.

11.3 With-Project Scenario

Under the with-Project scenario, water that naturally seeps into Pit F-2 would be stored in wet months and recaptured by pumping in dry months. The hydraulic connection between Pit F-2 and groundwater would undergo changes during storage and recovery cycles that result in gradients for seepage into and out of the pit. The main difference in groundwater conditions between with-Project and existing/with-CDRP scenarios is the storage and recapture of water in Pit F-2 that would occur with ACRP implementation, and the extended periods in which the water level in Pit F-2 would remain above the base of the shallow alluvium. Storage in Pit F-2 under the ACRP would generally maintain water elevations at a higher level than occurs under the with-CDRP scenario. In general, the water level in Pit F-2 would rise to 240 feet elevation[37] each year during the wet season, and then pumped down during the dry season to a minimum elevation of 180 feet, depending on the available storage volume in Calaveras Reservoir which governs recapture of bypassed or released water.

In years when the SFPUC does not fully recapture water stored in Pit F-2, water would seep into shallow groundwater as long as the water level in the pit is higher than the base of the shallow aquifer (i.e., the contact with the Livermore Gravels). This is analogous to, but slower than, quarry NPDES discharges that occur under the Existing scenario and that will occur under the with-CDRP scenario.

[37] For stability of pit walls, the surface water in Pit F-2 would not be permitted to rise above 240 feet.

When water is stored in Pit F-2 under the with-Project scenario, the surface water elevation is temporarily higher than groundwater, creating a gradient for seepage out of the pit as shown schematically in **Figure 11-4(a)** and quantified previously in **Sections 9** and **10**. Under a typical storage and recapture cycle, seepage out of the pit would occur until the pit is pumped down to the elevation of the groundwater table in the adjacent shallow aquifer as shown in **Figure 11-4(b)**. This occurs rapidly within the first month of pumping as groundwater elevations would typically be close to the maximum pit storage level in the Existing scenario (see **Figure 6-4**). When the water level in the pit is drawn below the groundwater level, there would be no seepage from Pit F-2 to the groundwater. When the water level falls below the base of the shallow aquifer at 221 to 224 feet elevation (corresponding to the base of the shallow aquifer between MWs 6 and 5, respectively), the pit and shallow aquifer are hydraulically disconnected as shown in **Figure 11-4(c)**. This would occur in most years based on the hydrologic period used in simulating ACRP recapture pumping.

In a wetter year with little or no recapture pumping, water stored in Pit F-2 would contribute to underflow from other sources including variable quarry NPDES discharges and seepage from pits influenced by SMP-30 water management practices. This storage condition has the potential to influence groundwater conditions within Subreaches A, B, and the upper half of C1 by increasing underflow and supporting more expansive pools in fall months.

The characteristics of each scenario according to the groundwater-surface water interactions described in this report are summarized on the following page.

Location	Existing	with-CDRP	with-Project
Subreach A	There is sufficient streamflow in wet months to support a live stream in Subreach A. In dry months after recession of the live stream, pools in this subreach may be observed and supported primarily by quarry NPDES discharges. Since 2012, groundwater levels in nearby monitoring wells have increased to shallower depths due to water management practices at SMP-30 where the operator has maintained greater storage levels in Pit F-4. This practice has in turn induced higher surface water levels in Pit F-3 West and causes seepage to groundwater. This seepage source would also support pools in combination with quarry NPDES discharges. Water in this area is likely perennial or nearly perennial.	In-stream flow releases and bypasses will have minor effect on groundwater conditions compared to the Existing scenario. Pools may expand slightly due to increases in groundwater levels induced by in-stream releases.	In wet months, live streamflow will prevail through Subreach A just as in the existing and with-CDRP scenarios. On average, the recapture amount is less than the bypasses and releases and quarry NPDES discharges will be greater than Existing scenario but less than the with-CDRP scenario under which no recapture occurs. In years that ACRP does not operate due to lack of available storage in Calaveras Reservoir, water will seep into shallow groundwater from Pit F-2 as underflow in the subreach resulting in conditions similar to wet years in Existing scenario. The variability in groundwater levels in Subreach A over the base hydrologic period used to model ACRP operations will be similar to the other scenarios due to the limited range of potential fluctuations as constrained by aquifer volume.
Subreach B	Same as Subreach A.	Same as Subreach A.	Same as Subreach A.
Subreach C1	Quarry NPDES discharges and high pit levels influence groundwater in the upper half of this subreach. The lower half has characteristics similar to Subreach C2.	Effects on groundwater levels due to bypasses and in-stream releases will contribute to underflow and make this subreach wetter than Existing scenario. The wetter condition will extend and expand ponding according to the stream channel geometry.	Due to small aquifer storage space, groundwater fluctuations and pooling is expected to be similar to with-CDRP scenario. In years that ACRP does not operate due to lack of available storage in Calaveras Reservoir, wetter conditions will result as water stored in Pit F-2 seeps to the shallow groundwater system and contributes to underflow and pooling.
Subreach C2	Intermittent pools exist year-round due to residual underflow. Quarry operations do not cause significant changes due to limited aquifer storage capacity.	No change.	No change.

12. GLOSSARY

Analytical Solution

An analytical solution is a mathematical treatment of a groundwater flow problem that has been solved in terms of known mathematical functions using the methods of algebra and calculus. Analytical solutions are typically constrained by a number of simplifying assumptions such as homogeneous aquifer parameters, horizontal flow, etc.

Aquifer/Aquifer (*also see* ***Shallow Aquifer/Shallow Alluvium)***

A geologic formation, typically sands and gravels, which transmits and stores water, and yields a significant quantity of water to a well. Significant quantity is sometimes defined as economically viable and/or sufficient to be beneficial as a source of supply.

Aquifer Properties/Parameters

Aspects that describe the ability of an aquifer to store and transmit water (after Lohman, 1972):

Hydraulic Conductivity (K)
The ease at which water flows through aquifer materials. Hydraulic conductivity is equal to the volume of water, at the prevailing kinematic viscosity, that flows in unit time under a unit hydraulic gradient through a unit area of aquifer and at right angles to the flow direction.

Porosity
The ratio of the voids or open spaces in alluvium and rocks to the total volume of the alluvium or rock mass.

Transmissivity (T)
Describes the ability of an aquifer to transmit water through its entire thickness. Transmissivity is equal to the rate at which water of the prevailing kinematic viscosity is transmitted through a unit width of aquifer under a unit hydraulic gradient. Transmissivity is the product of hydraulic conductivity and saturated thickness.

Storage Coefficient or Storativity (S)
A dimensionless term representing the volume of water an aquifer releases from, or takes into, storage for a unit surface area under a unit change in head.

Specific Yield (Sy)
The volume of water released by porous media under complete gravity drainage. Specific yield approximates the storativity of an unconfined aquifer and is also dimensionless.

Aquifer Test

A test designed to evaluate aquifer properties/parameters using analytical or numerical groundwater flow solutions. Tests referred to in this report utilized a pumping well and, in one instance, observation wells, to collect drawdown data with time to compute aquifer parameters by analytical solutions.

Aquifer Volumetric Flux

See ***Flux***.

Bedrock

Bedrock is typically a non-water bearing, older formation. Because of low to zero transmitting capacity, bedrock formation may serve to delineate lateral and vertical boundaries of groundwater systems, including groundwater basins (see definition for Groundwater Basin). The Sunol Valley Groundwater Basin has boundaries defined by contact with bedrock formations and is separated from the Niles Cone Subbasin by same.

Confined/Unconfined Aquifer

Confined and unconfined aquifers can be distinguished by how water moves in and out of storage:

> *Confined Aquifer*
> A confined aquifer is bounded above and below by aquitards, or confining beds. The pore space in a confined aquifer is completely saturated and the water level in a well completed in that aquifer will be above the bottom of the overlying confining layer. Water moves in and out of storage through elastic deformation of the aquifer and by the compressibility of the water.
>
> *Unconfined*
> An unconfined aquifer (also, water table or phreatic aquifer) is an aquifer with a water table serving as its upper boundary. As water moves in and out of storage by filling or draining pore space, the water table rises or declines in elevation.

Contact

As used in this report, "contact" refers to the vertical boundary between shallow aquifer materials consisting of water bearing subunits of Stream Channel Gravels (Qg) and Younger Alluvium (Qa) with underlying subunits of Older Alluvium (Qoa) and Livermore Gravels (QTl). This contact is also the base of the shallow aquifer materials. It represents the vertical limit of observed percolation and recharge from Alameda Creek flow and is treated as a no-flow boundary with respect to surface water and groundwater interactions for CEQA analysis of potential project impacts.

Drawdown

The difference between static and pumping water levels in a well. The static water level is measured before the pump is turned on and the dynamic level (also pumping level) is measured after the start of pumping.

Flux

The term aquifer volumetric flux is used throughout this report. It is defined below along with related terms of Darcy Flux and Aquifer Flux:

Darcy Flux
Darcy flux is the rate of groundwater flow per unit area of aquifer. The units of flux are [L/T]; for this report, units are generally feet/day.

Aquifer Flux
Aquifer flux is the flux per unit width of the aquifer which is the product of Darcy flux and the aquifer saturated thickness. The units of aquifer flux are [L^2/T]; for this report, units are generally feet^2/day.

Aquifer Volumetric Flux
The aquifer volumetric flux is Darcy flux integrated over the aquifer saturated thickness and its width. The units of volumetric flux are [L^3/T]; for this report, volumetric flux is expressed as cubic feet per second (cfs).

Groundwater

Water that occurs beneath the ground surface and saturates the pore spaces of the porous materials, or geologic formation, in which it occurs.

Groundwater Basin

Consists of an alluvial aquifer, or series of alluvial aquifers, with defined lateral and vertical boundaries. In California, boundaries may be physical (e.g., bedrock) or geopolitical (e.g., county line).

Head

Pressure created by the height of fluid above a given point.

Hydraulic Conductivity

A measure of the capacity for a rock or soil to transmit water; generally, has the units of feet/day or cm/sec. Usage in this report is feet/day.

Hydrogeology

The science concerning the occurrence and characteristics of groundwater and related geologic factors. Hydrogeology also encompasses how surface water is interrelated with groundwater.

Hydrogeologic Conceptualization

A fundamental description of a physical setting that serves as a basis for evaluating groundwater-surface water processes. The term "conceptualization" is used because many attributes of a groundwater system can only be inferred or interpreted from related observations or measurements. The hydrogeologic conceptualization seeks to identify major hydrologic processes, boundary conditions, temporal and spatial scale factors, and other hydrologic and hydraulic conditions that aid in describing the occurrence and movement of water in the aquifer and overlying surface water bodies, in this case Alameda Creek.

Hydrograph

A graph that shows some property of groundwater or surface water as a function of time.

Isotropic

A material, such as porous media, having the same property values in all directions.

Lithology

Study and characterization of the physical characteristics of a rock or formation; e.g., lithologic characteristics may include color, texture, and composition.

Monitoring Well

Any well used to measure groundwater levels or to collect samples for groundwater quality testing. A dedicated monitoring well is typically of small diameter (e.g., 1 to 4 inches) with perforations, or openings, positioned at depth-specific intervals corresponding to a particular aquifer or geologic formation.

Numerical Method for Groundwater Flow Estimates

Numerical methods convert the governing groundwater flow partial differential to a system of linear or non-linear equations that can be solved by matrix algebra techniques.

Permeability

The capability of porous media including soil or other geologic formations to transmit fluids. See Hydraulic Conductivity.

Piezometer

Also, see Monitoring Well. Typically, a small diameter well (e.g., 1 inch to 3 inches) installed to measure water levels or collect water samples. The term Piezometer may be used interchangeably with Monitoring Well.

Porosity

See Aquifer Properties/Parameters.

Project, Project Area, Project Site, and Study Area

Project
Refers to the ACRP project.

Project Area
Fisheries and Aquatic Habitat Study Area as defined in the project EIR.

<u>*Project Site*</u>
Pit F-2 and areas affected by ACRP construction.

<u>*Study Area*</u>
Refers to area within which groundwater-surface water interactions are evaluated with respect to the ACRP project impacts.

Recharge, Natural Recharge

Natural replenishment of an aquifer. For the Sunol Valley floor and shallow aquifer connected to Alameda Creek, recharge is interpreted to occur via leakage from the streambed surface when there is a live stream.

Shallow Aquifer/Shallow Alluvium (Study Area)

Refers to the unconfined aquifer directly connected to Alameda Creek through the streambed. The shallow aquifer, or shallow alluvium, consists of Stream Channel Gravels (Qg) and Younger Alluvium (Qa) geologic subunits. The occurrence of the shallow aquifer/shallow alluvium is on the Sunol Valley floor closely aligned with Alameda Creek. It has shallow vertical extent, less than 60 feet from ground surface, and limited storage space; saturated thickness ranges from 10 to 25 feet). It extends from about Welch Creek to Arroyo de la Laguna and is bounded on the east and west by faults and bedrock formations. Related terms are:

<u>*Alluvial*</u>
Of or pertaining to or composed of alluvium.

<u>*Alluvium*</u>
A general term for clay, silt, sand, gravel, or similar unconsolidated detrital material, deposited during comparatively recent geologic time by a stream or other body of running water, as a sorted or semi sorted sediment in the bed of the stream or on its floodplain or delta, as a cone or fan at the base of a mountain slope.

Stratigraphy

Grouping and interpretation of rock types according to age, form, distribution, lithologic composition, fossil content, geophysical and geochemical properties.

Specific Capacity

Yield of a well normalized by drawdown. Specific capacity is calculated by dividing the discharge rate in gallons per minute by the drawdown of the static level under pumping conditions at that discharge rate.

Specific Yield

See ***Aquifer Properties/Parameters***.

Stream-Aquifer System

For the Sunol Valley study area, the stream-aquifer system refers to the interrelationship between surface flow in Alameda Creek and the underlying shallow aquifer. The interrelationship stems from hydraulic connection through the streambed.

Test Well and Observation Well

A test well is larger than a monitoring well typically designed to conduct pumping and aquifer tests to evaluate water supply. An observation well refers to a well used for recording water levels during a pumping or aquifer test, such as to evaluate the propagation of pumping influences at distance from a pumping well.

Transmissivity

See Aquifer Properties/Parameters.

Volumetric Flux

See ***Flux/Volumetric Flux***.

Well Completion/Completion Interval

Well completion, or completion interval, refers to the depth at which the intake portion (well screen or perforations) of a well is positioned. A completion interval may correspond to a designated aquifer (e.g., shallow or deep) such that the perforations of the well structure are located within or across the defined boundaries of that zone.

Well Control

Refers to the number and distribution of wells and well information available for various purposes involving groundwater studies including construction of geologic cross-sections, interpretation and correlation of aquifers, etc. Poor well control implies that available well information is limited or inadequate for a particular purpose.

13. REFERENCES

ARUP. 2007. *Geotechnical Data Report Sunol Valley Water Treatment Plant Expansion and New Pipeline Project, Alameda County, California*. Prepared for the San Francisco Public Utilities Commission. November 26.

Barlock, V.E. 1988. *Geologic Map of the Livermore Gravels, Alameda County, California*. U.S. Geological Survey. Open File Report OF-88-516, 1 plate.

Barlock, V. E. 1989. *Sedimentology of the Livermore Gravels (Miocene - Pleistocene), Southern Livermore Valley, California*. U.S. Geological Survey. Open File Report OF-89-131, 93 pages, 1 plate.

California Department of Water Resources. 1963. *Alameda County Investigation*. Bulletin 13, 196 pages, 11 plates.

California Department of Water Resources. 1966. *Livermore and Sunol Valleys, Evaluation of Ground Water Resources. Appendix A: Geology*. Bulletin No. 118-2, Appendix A.

California Department of Water Resources. 1974. *Evaluation of Ground Water Resources: Livermore and Sunol Valleys*. Bulletin No. 118-2, 153 pages.

California Department of Water Resources. 2003. *California's Groundwater*. Bulletin 118 Update 2003. Online Basin Descriptions: 2-11.

California Department of Water Resources. 2016a. *California's Groundwater Working Toward Sustainability*. Bulletin 118 Interim Update 2016. Online Basin Descriptions: 2-11.

California Department of Water Resources. 2016b. *Best Management Practices for the Sustainable Management of Groundwater Conceptual Model BMP.* December.

Charbeneau, R. J. 2000. *Groundwater Hydraulics and Pollutant Transport*. Prentice Hall, Upper Saddle River, New Jersey.

Charbeneau, R. J., and M. E. Barrett. 2008*. Drainage hydraulics of permeable friction courses,* Water Resources Research, 44(4), W04417, doi:10.1029/ 2007WR006002.

Dhakal A.S. (SFPUC), Buckland, E. (ACWD) and McBain (McBain and Trush, Inc.). 2012. *Overview of Methods, Models, and Results to Develop Unimpaired, Impaired, and Future Flow and Temperature Estimates along Lower Alameda Creek for Hydrologic Years 1996-2009.* Prepared for Alameda Creek Fisheries Workgroup – Flows Subcommittee. April 13.

Dibblee, T.W., Jr. 1980a. *Preliminary Geologic Map of the La Costa Valley Quadrangle, Alameda County, California.* Scale 1:24,000. U.S. Geological Survey Open File Report 80-533A. (also Dibblee Foundation, 2005.)

Dibblee, T.W., Jr. 1980b. *Preliminary Geologic Map of the Livermore Quadrangle, Alameda and Contra Costa Counties, California*. U.S. Geological Survey OF 80-0533B. (also Dibblee Foundation, 2005.)

Dibblee, T.W., Jr. 1980c. *Preliminary Geologic Map of the Niles Quadrangle, Alameda County, California*. U.S. Geological Survey Open File Report 80-533C. (also Dibblee Foundation, 2005.)

Dibblee, T.W., Jr. 1980d. *Preliminary Geologic Map of the Dublin Quadrangle, Alameda and Contra Costa Counties, California*. U.S. Geological Survey OF 80-0537. (also, Dibblee Foundation, 2005.)

Entrix, Inc. 2003. *Re: Assessment of Alameda Creel in the Vicinity of Mission Valley Rock Co., including the proposed Ivaldi Parcel mining site, Sunol Valley Reach of Alameda Creek*. Prepared for Mission Valley Rock. January 8.

Entrix, Inc. 2004. *Alameda Creek Juvenile Steelhead Downstream Migration Flow Requirements Evaluation, Phase 1: Field Survey results*. Prepared for URS. July 12.

Entrix, Inc. 2006. *Alameda Creek Streamflow Study*. Prepared for Kennedy Jenks Consultants. January.

Farrar, C.D. 1980. *A Water-Quality Monitoring Network for Vallecitos Valley, Alameda County, California*. U.S. Geological Survey, WRI 80-59, 22 pages.

Harding Lawson Associates. 1988. *Final Report Cutoff Wall Construction Observation Mission Valley Gravel Quarry Sunol, California*. Prepared for Mission Valley Rock Company by Harding Lawson. Preparers R.C. Thompson and F.L. Rollo). January 28.

Herd, D.G. 1977a. *Map of Quaternary Faulting along the Hayward and Calaveras Fault Zones, Niles and Milpitas 7 ½-minute Quadrangles, California*. U.S. Geological Survey OF-77-0645, 2 sheets.

Herd, D.G. 1977b. *Geologic Map of the Las Positas, Greenville, and Verona Faults, Eastern Alameda County, California*. U.S. Geological Survey OF 77-689, 25 pages, 1 plate.

Herd, D.G. 1978a. *Map of Quaternary Faulting along the Northern Calaveras Fault Zone; Las Trampas Ridge, Diablo, Dublin, Niles, and La Costa Valley, 7.5-Minute Quadrangles, California*. U.S. Geological Survey OF 78-0307, 5 sheets.

Herd, D.G. 1978b. *Map of Quaternary Faulting Along the Northern Calaveras Fault Zone: Niles 7.5 Minute Quadrangle, California*. Scale 1:24,000, Sheets 4 and 5 of 5. U.S. Geological Survey Open File 78-0307.

Langbein, W.B. and Iseri, Kathleen T. 1972. *Manual of Hydrology: Part 1 General Surface Water Techniques; General Introduction and Hydrologic Definitions*. Geologic Survey Water-Supply Paper 1541-A. United States Department of the Interior Geologic Survey.

Lohman, S.W., et. al.; 1972. *Definitions of Selected Ground-Water Terms - Revisions and Conceptual Refinements.* USGS Water Supply Paper 1988.

LSCE. 1993. *Ground-Water and Aggregate Resources, Sunol Valley*. Prepared for San Francisco Water Department by Luhdorff & Scalmanini Consulting Engineers. Prepared by J.C. Scalmanini and K.U. Utley. December.

LSCE. 1998. *Assessment of Potential Ground-Water Supplies Sunol Valley Agricultural Enhancement Study*. Prepared for Alameda County Community Development Agency by Luhdorff & Scalmanini. Letter by J.C. Scalmanini and K.U. Utley. September 4.

LSCE. 2009. *Final Report, Feasibility to Recapture Reservoir Releases, Alameda Creek*. Prepared for San Francisco Public Utilities Commission by Luhdorff & Scalmanini Consulting Engineers. April 22.

McBain & Trush, Inc. 2008. *Alameda Creek Population Recovery Strategies and Instream Flow Assessment for Steelhead Trout, Final Study Plan*. Prepared for Alameda Creek Fisheries Restoration Workgroup. January 2008.

Niswonger, R.G., Panday, Sorab, and Ibaraki, Motomu. 2011. *MODFLOW-NWT, A Newton formulation for MODFLOW-2005*. U.S. Geological Survey Techniques and Methods 6-A37, 44 p.

San Francisco Planning Department. 2006. Environmental Impact Report*. Sunol/Niles Dam Removal Project*. Case No. 2001.1149E. State Clearinghouse No. 2004072049. February 24.

San Francisco Planning Department. 2011. Final EIR. *Calaveras Dam Replacement Project.* Case No. 2005.016E. State Clearinghouse No. 2005102102.

San Francisco Planning Department. June 2017. Environmental Impact Report. *SFPUC Alameda Creek Recapture Project*. Case No. 2015-004827ENV. State Clearing house No. 2015062072

SFPUC, ACWD, and McBain & Trush, Inc. 2012. *Draft Technical Memorandum, Overview of Methods, Models, and Results to Develop Unimpaired, Impaired, and Future Flow and Temperature Estimates along Lower Alameda Creek for Hydrogeologic Years 1996 to 2009*. Prepared for Alameda Creek Fisheries Workgroup – Flows Subcommittee. April 13.

Trihey & Associates, Inc. 2003. *Sunol Valley Surface Flow Study Fall 2001*. Prepared for Office of the City Attorney City and County of San Francisco. October.

URS Corporation. 2007. *Sunol, California Task 1.3 – Condition Assessment Report Alameda County, California for SFPUC Alameda Creek Fishery Enhancement*. Prepared for San Francisco Public Utilities Commission. September 26.

URS Corporation. 2008. *Updated Alternatives Analysis Report (Task 3) Alameda Creek Fishery Enhancement Project*. Prepared for San Francisco Public Utilities Commission. September 4.

Wagner, D.L., Bortugno, E.J., and McJunkin, R.D. 1990. *Geologic Map of the San Francisco-San Jose Quadrangle*. California Division of Mines and Geology. Regional Geologic Map Series, Map No. 5A.

Webster, D.A. 1972. *Map Showing Ranges in Probable Maximum Well Yield from Water-Bearing Rocks in the San Francisco Bay Region, California*. 1972 (1973). U.S. Geological Survey MF-0431, 1 sheet.

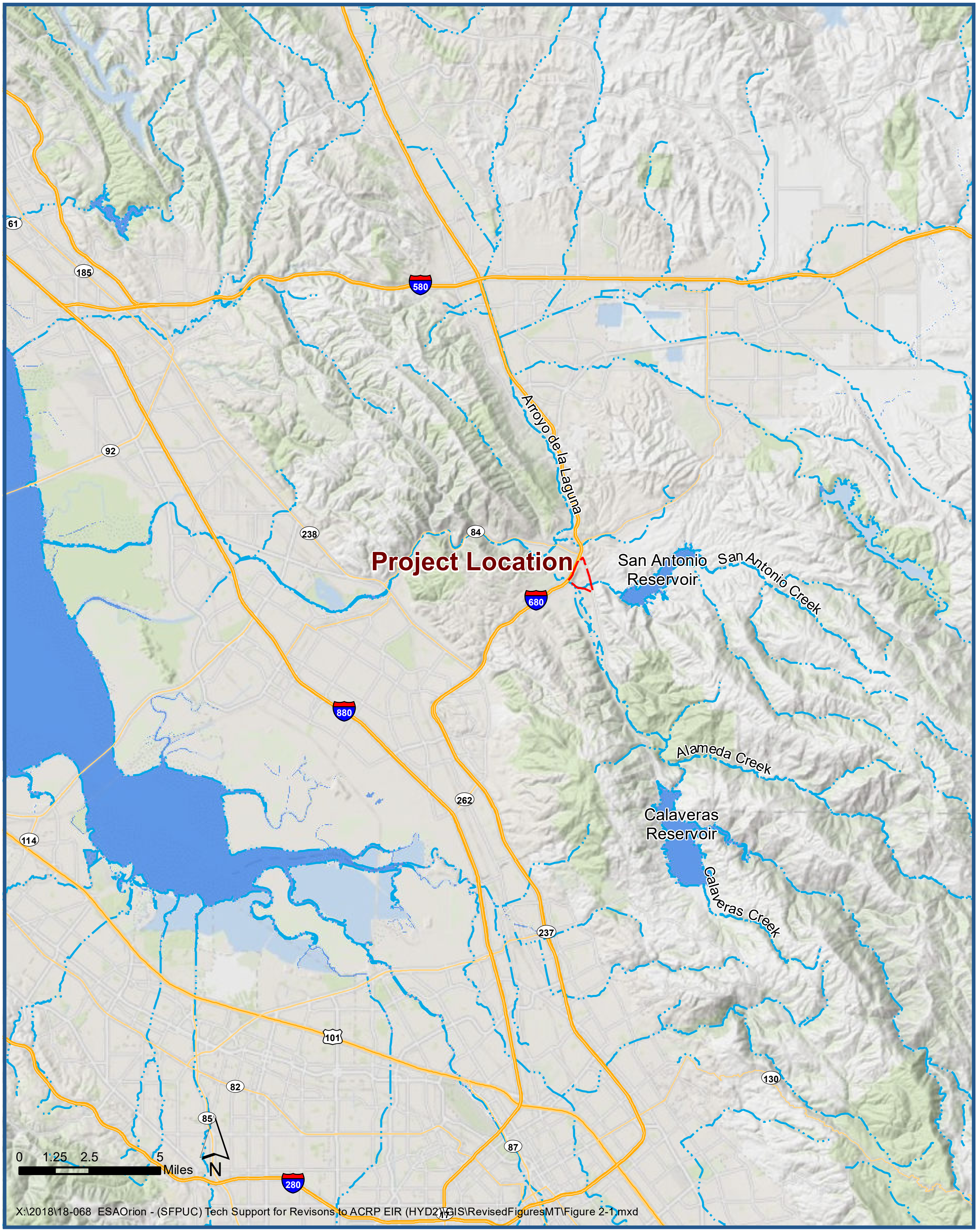

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Figure 2-1
ACRP Project Location

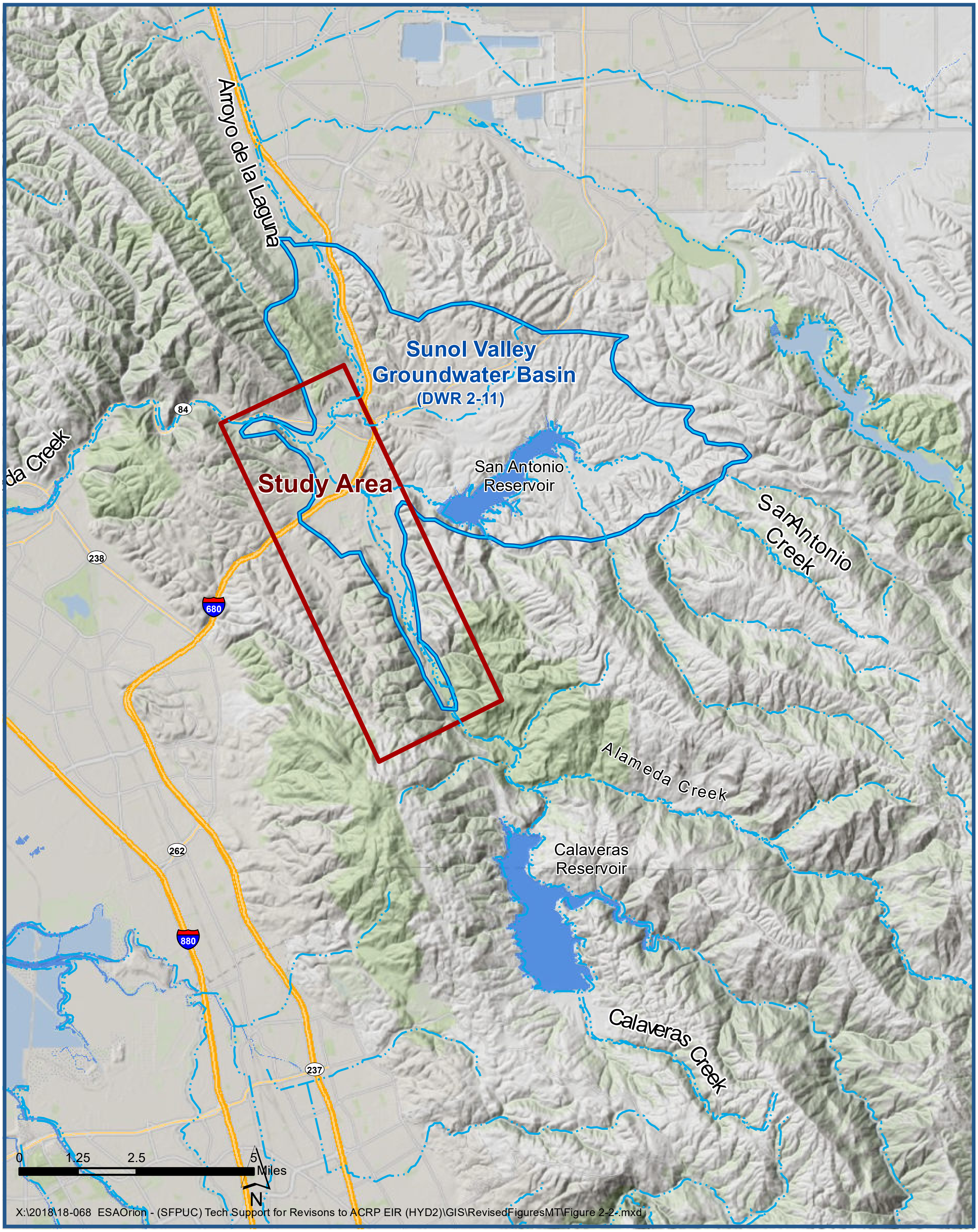

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Figure 2-2
Study Area and
Sunol Valley Groundwater Basin

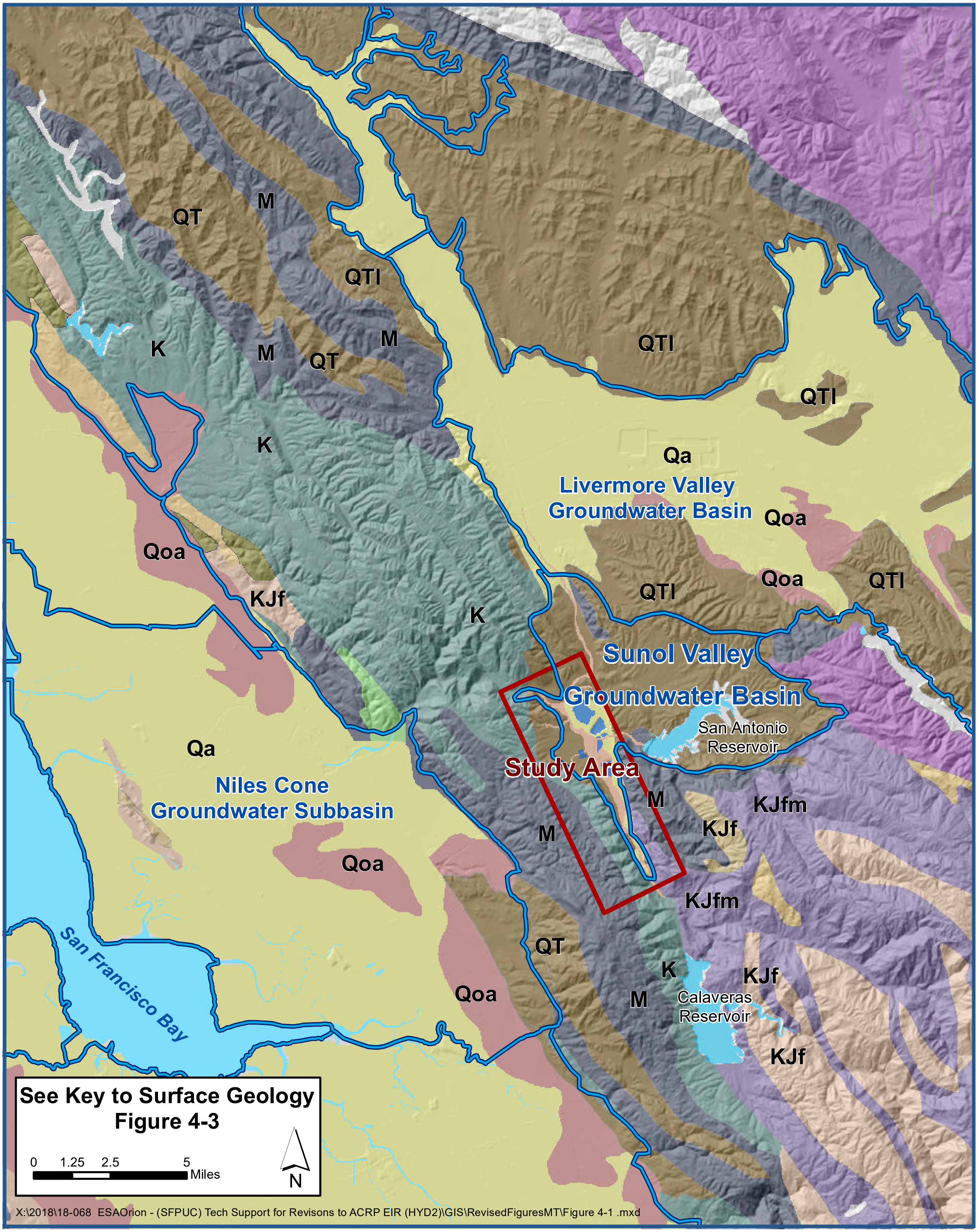

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Figure 4-1
Regional Surface Geology and Groundwater Basins
(DWR Bulletin 118)

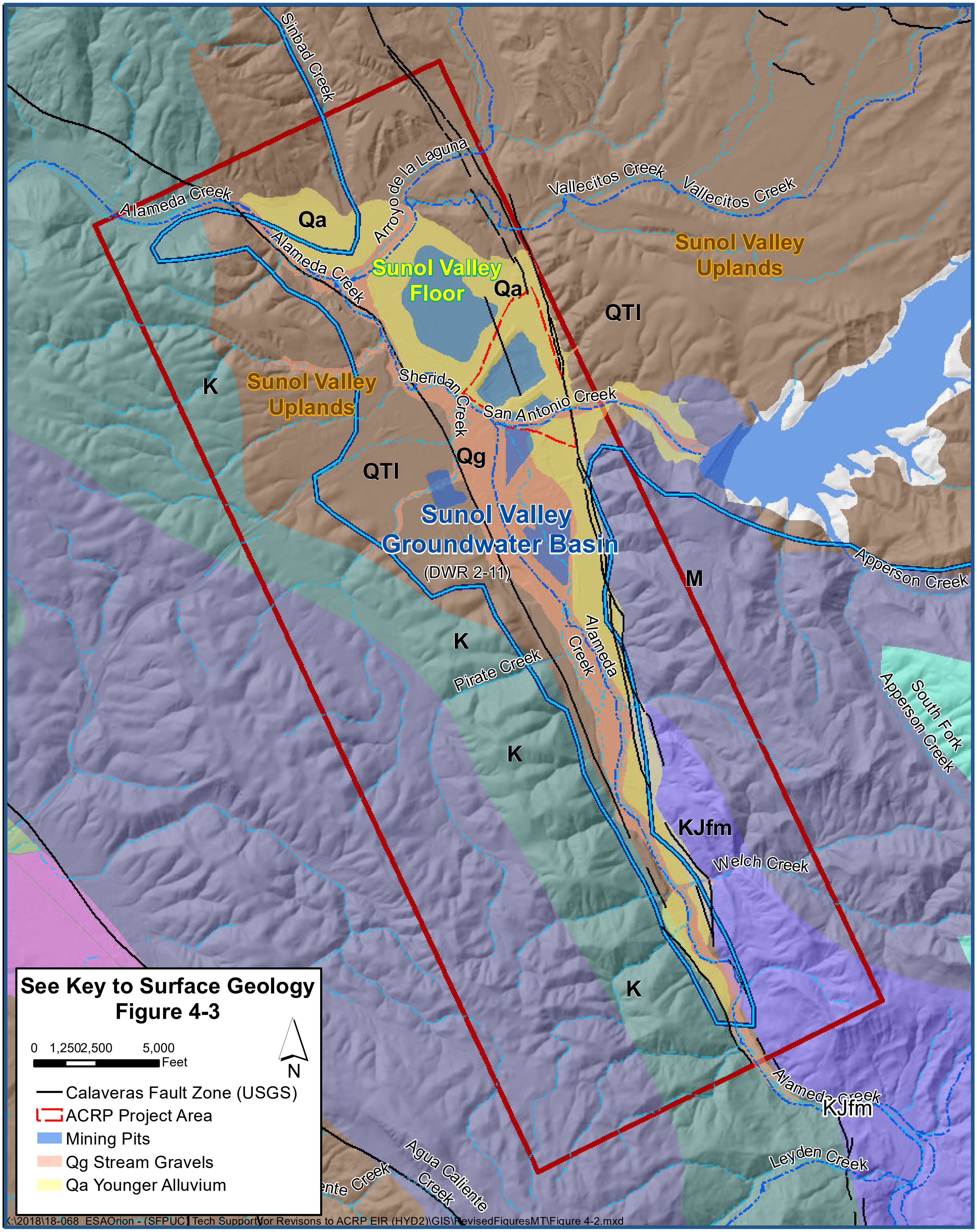

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Figure 4-2
Geology and Subareas
of a portion of the Sunol Valley Groundwater Basin

Age

Cenozoic

Quaternary - Pleistocene/Holocene

Qg Stream Channel Gravels

Qa Alluvium

Qoa Older Alluvium

Qt Terrace Deposits (Not Shown)

Shallow Aquifer

Water Bearing

Tertiary

Pliocene (Pre 2.5 my)

Upper

QT Livermore Gravels

Lower

Miocence (Pre 5.3 my)

M Sedimentary rocks - mostly marine claystone/sandstone

Older Tertiary Rocks (not differentiated)

Non-Water Bearing

Mesozoic (Pre 65 my)

Cretaceous

K Sedimentary Rocks

Jurassic

KJf Franciscan Complex

KJfm - melange

my = million years

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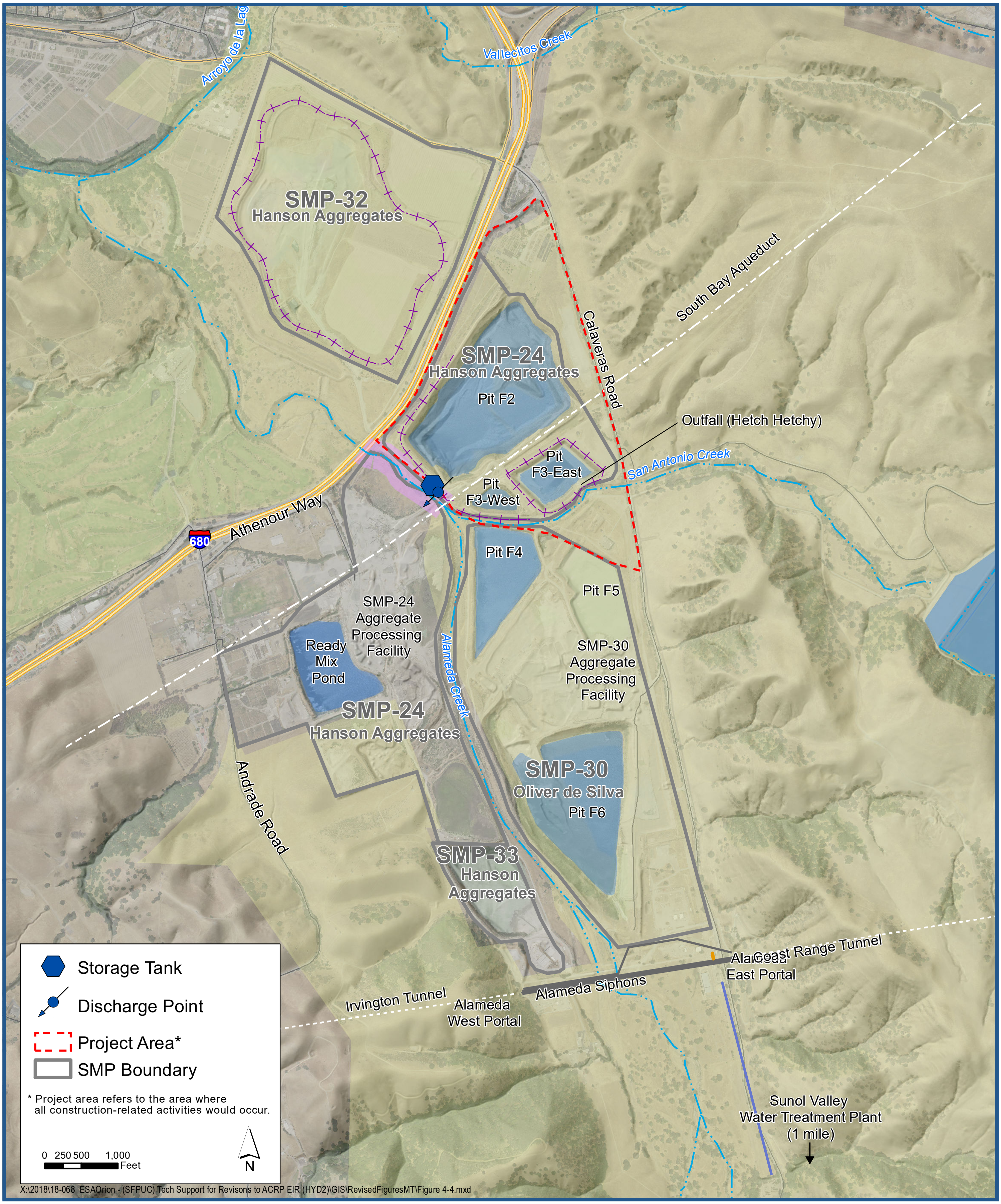
Figure 4-3
Key for Surface Geology



Adapted from ACRP EIR Figure 3-2 (ESA)

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Figure 4-4
ACRP Project Vicinity and Quarry Reach

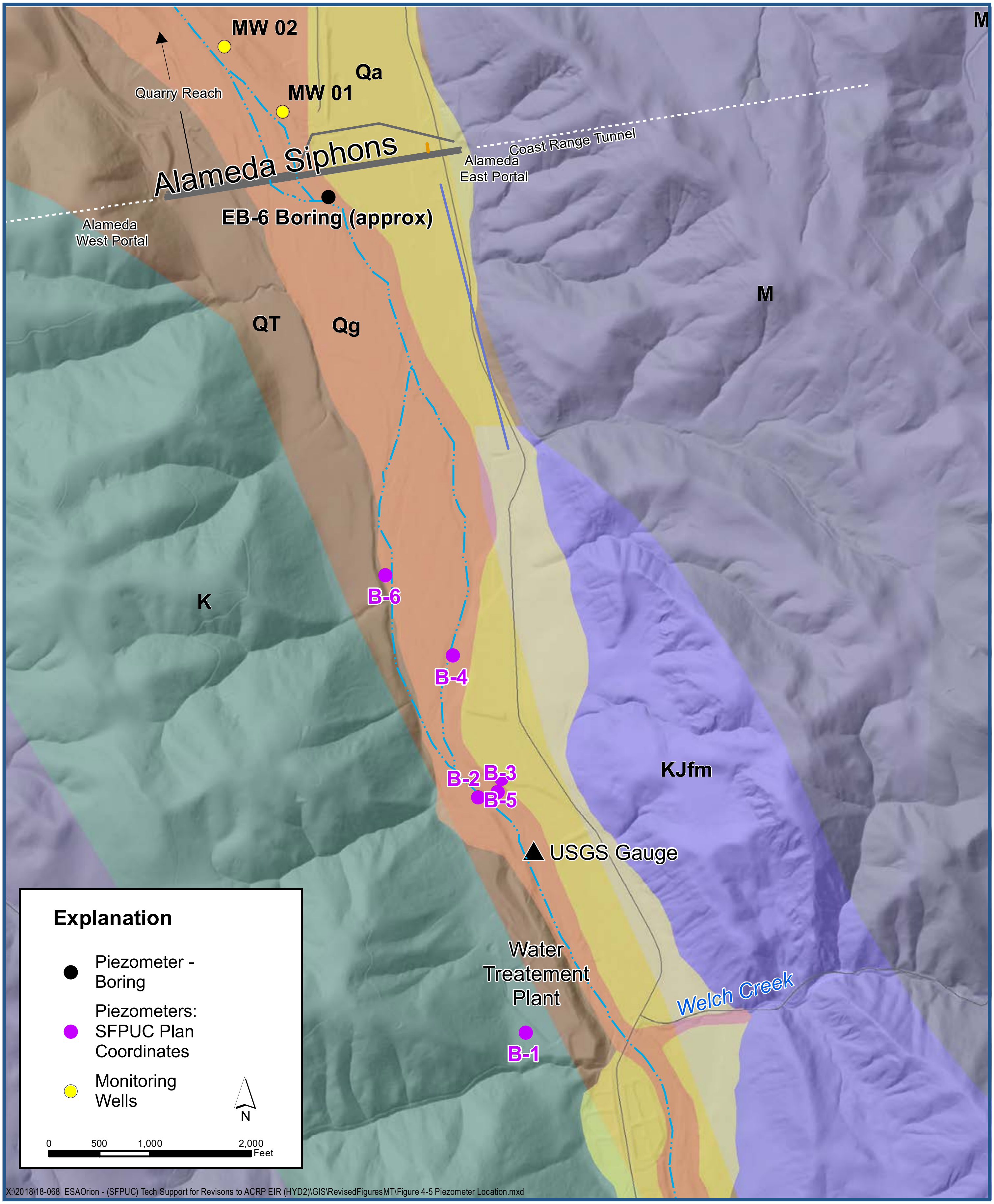

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Figure 4-5
Upstream of Quarry Reach
Welch Creek to Alameda Siphons

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Figure 4-6
Slickenside Surface of Rocks underlying Alluvium
(ARUP, 2007)

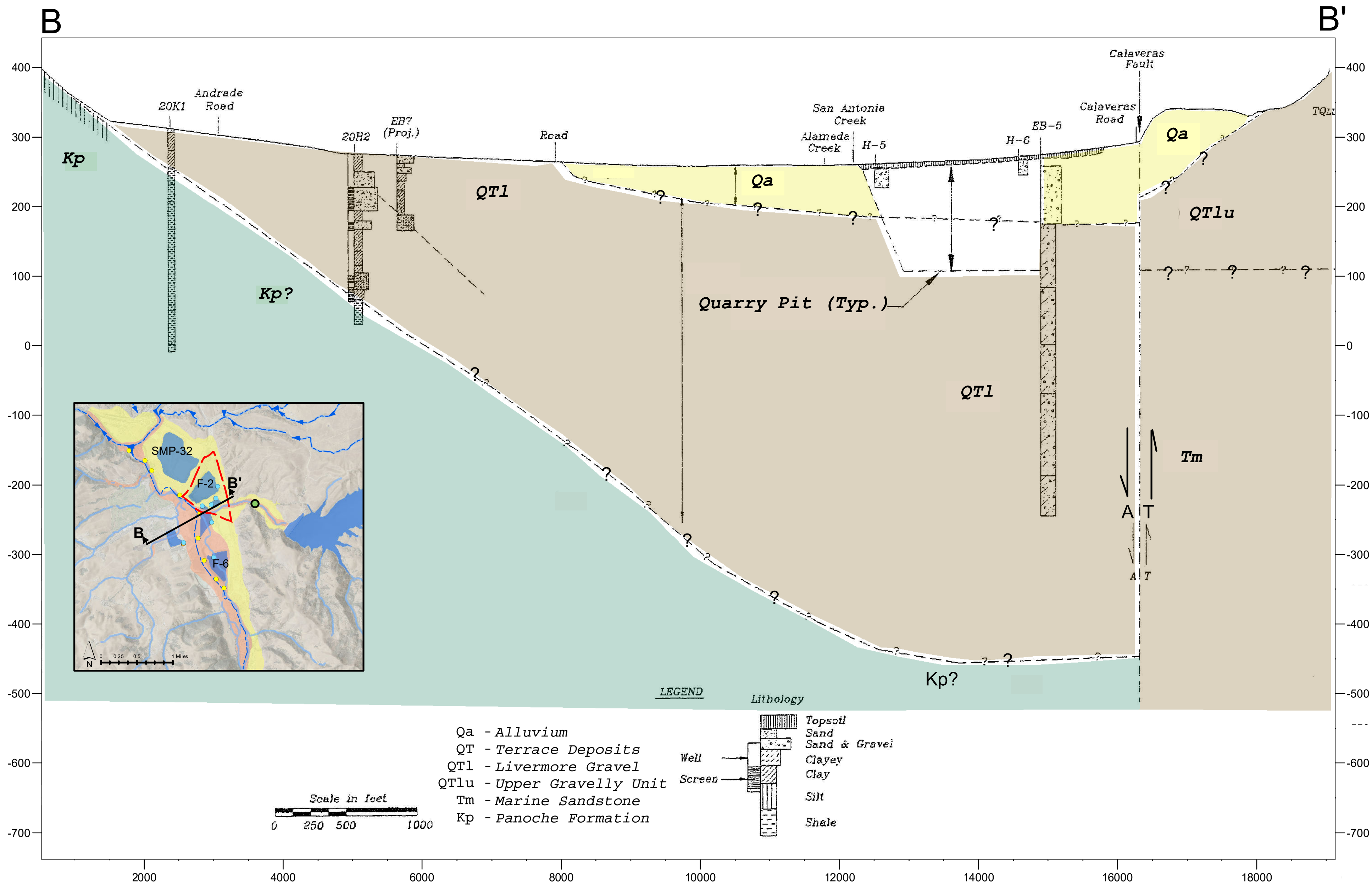

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Figure 4-7
Geologic Subunits of Shallow Aquifer
(After LSCE 1993)

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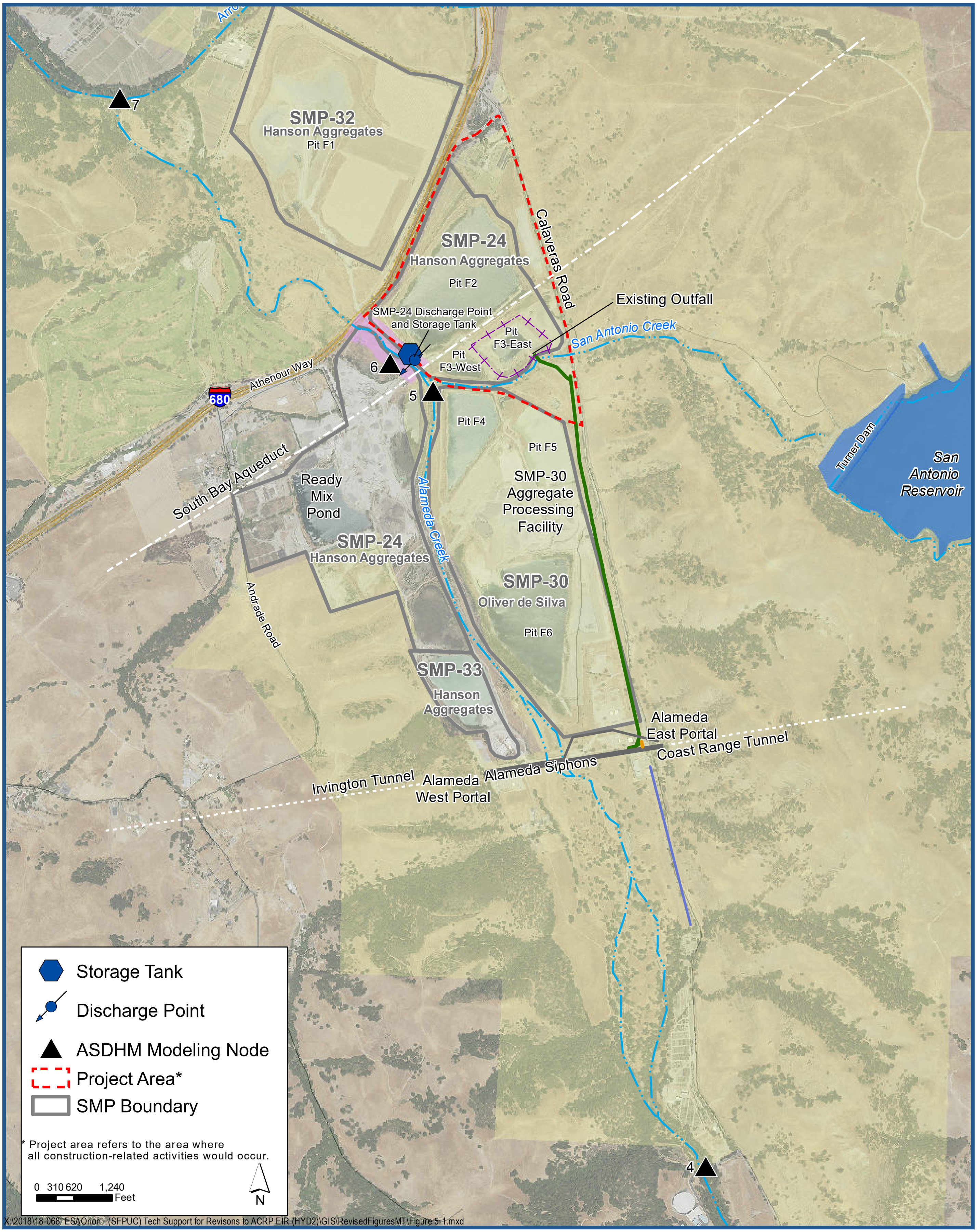

Adapted from ACRP EIR Figure 3-2 (ESA)

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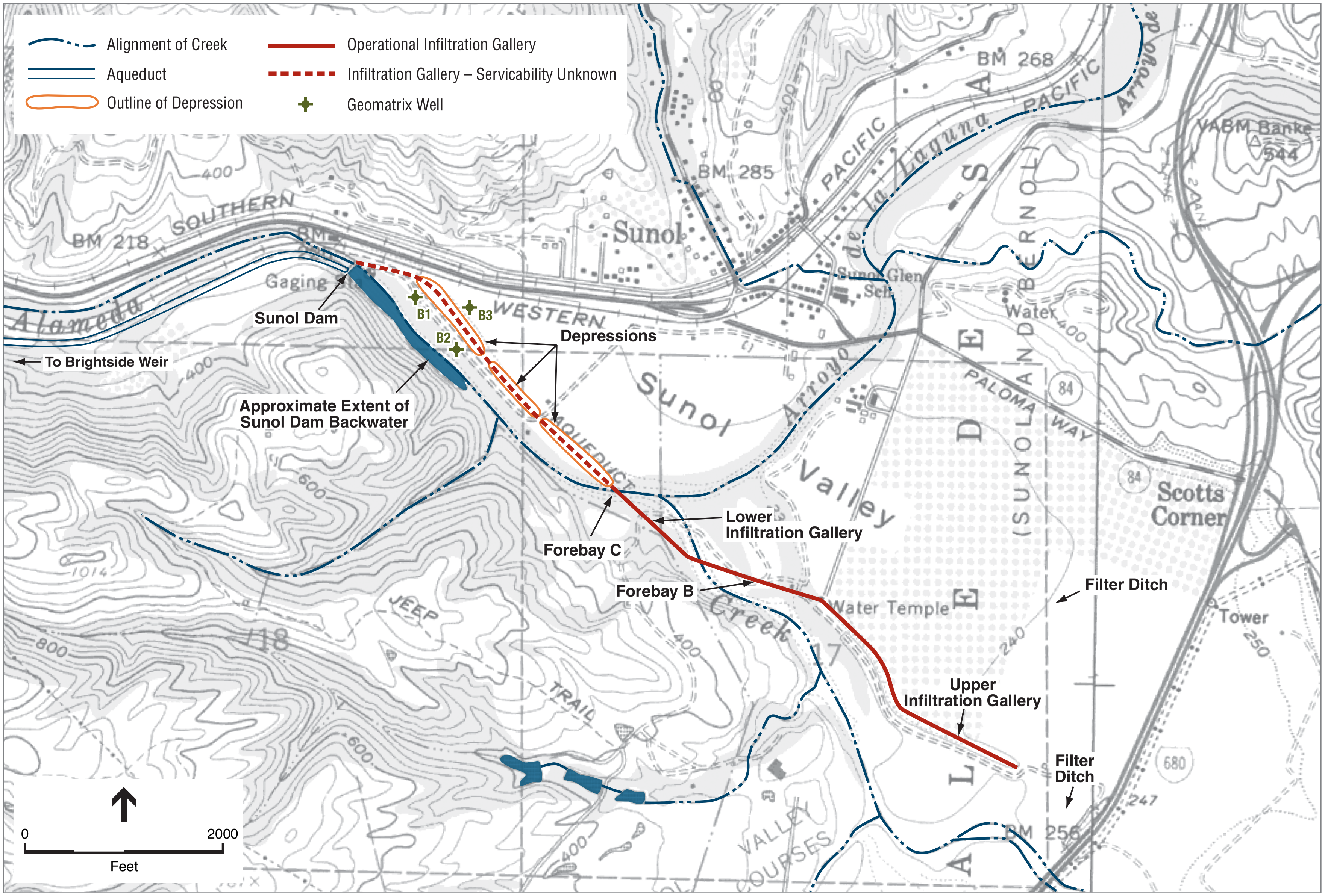
Figure 5-1
ACRP Project Site and Vicinity



Source: San Francisco Planning Sunol/Niles Dam Removal Project (2006)

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Figure 6-1
Location of SFPUC Infiltration Galleries

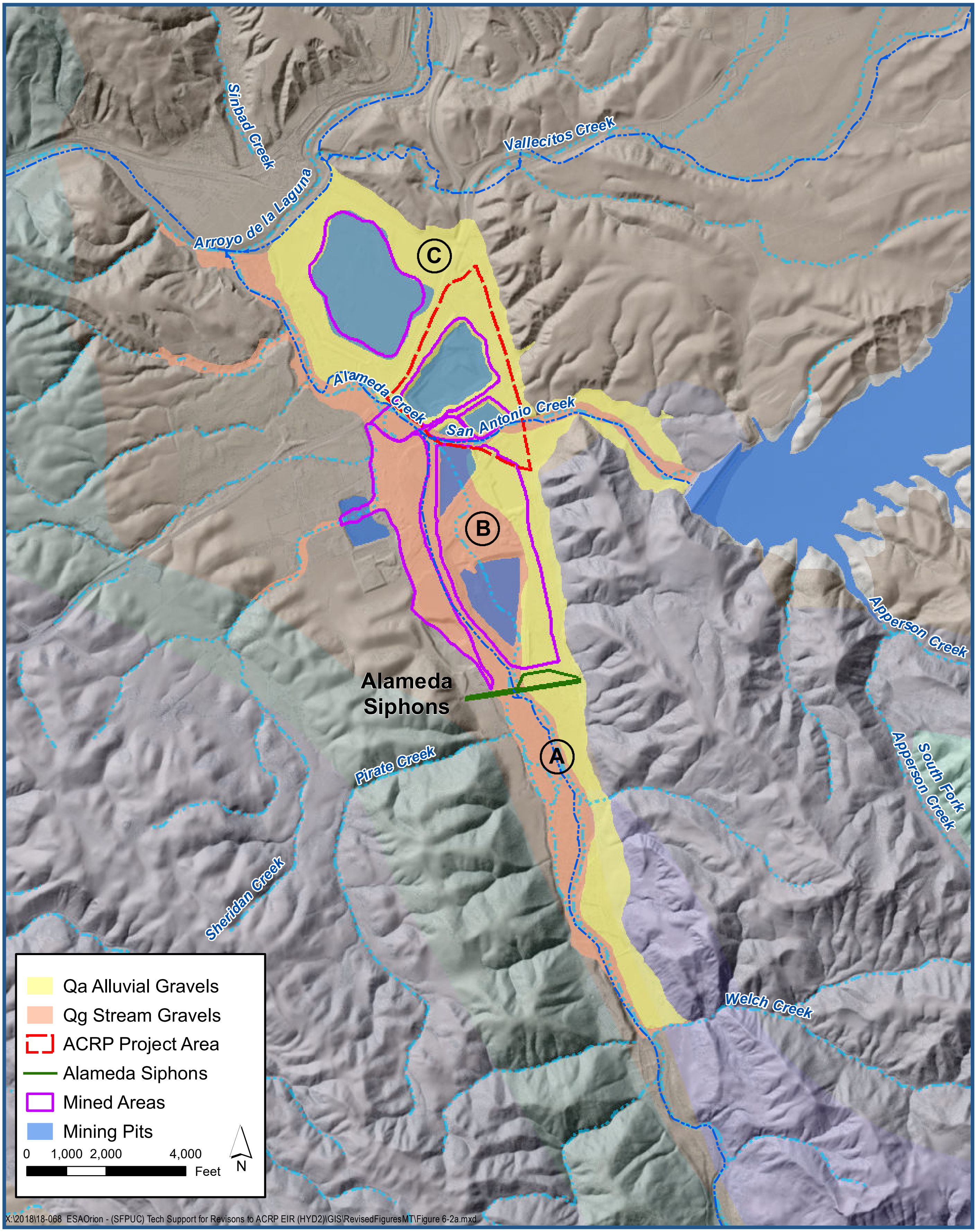

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Figure 6-2a
Areas for Volumetric Calculations of Alluvium
with Mined Areas

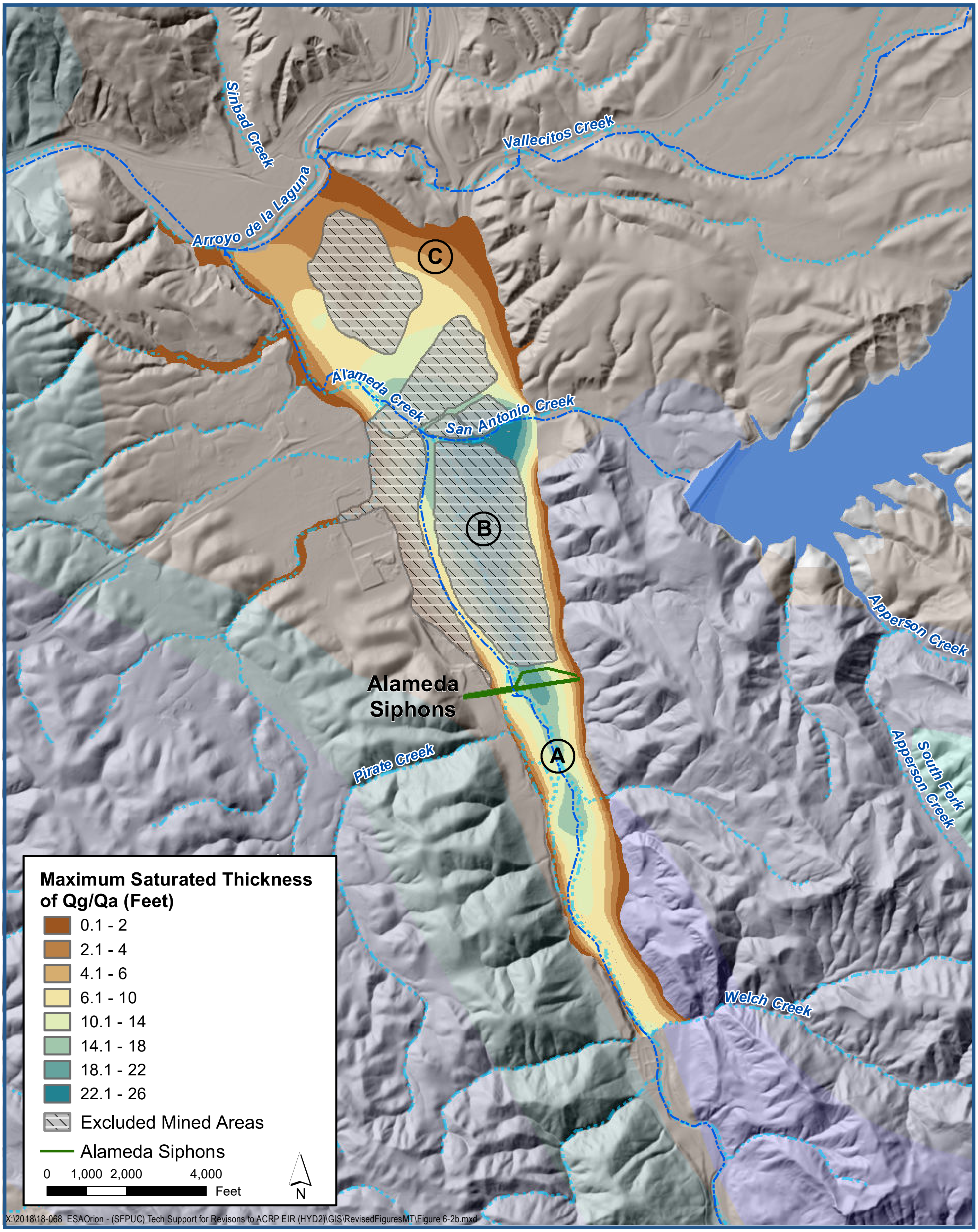

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Figure 6-2b
Maximum Saturated Thickness
of Alluvium for Volumetric Calculations

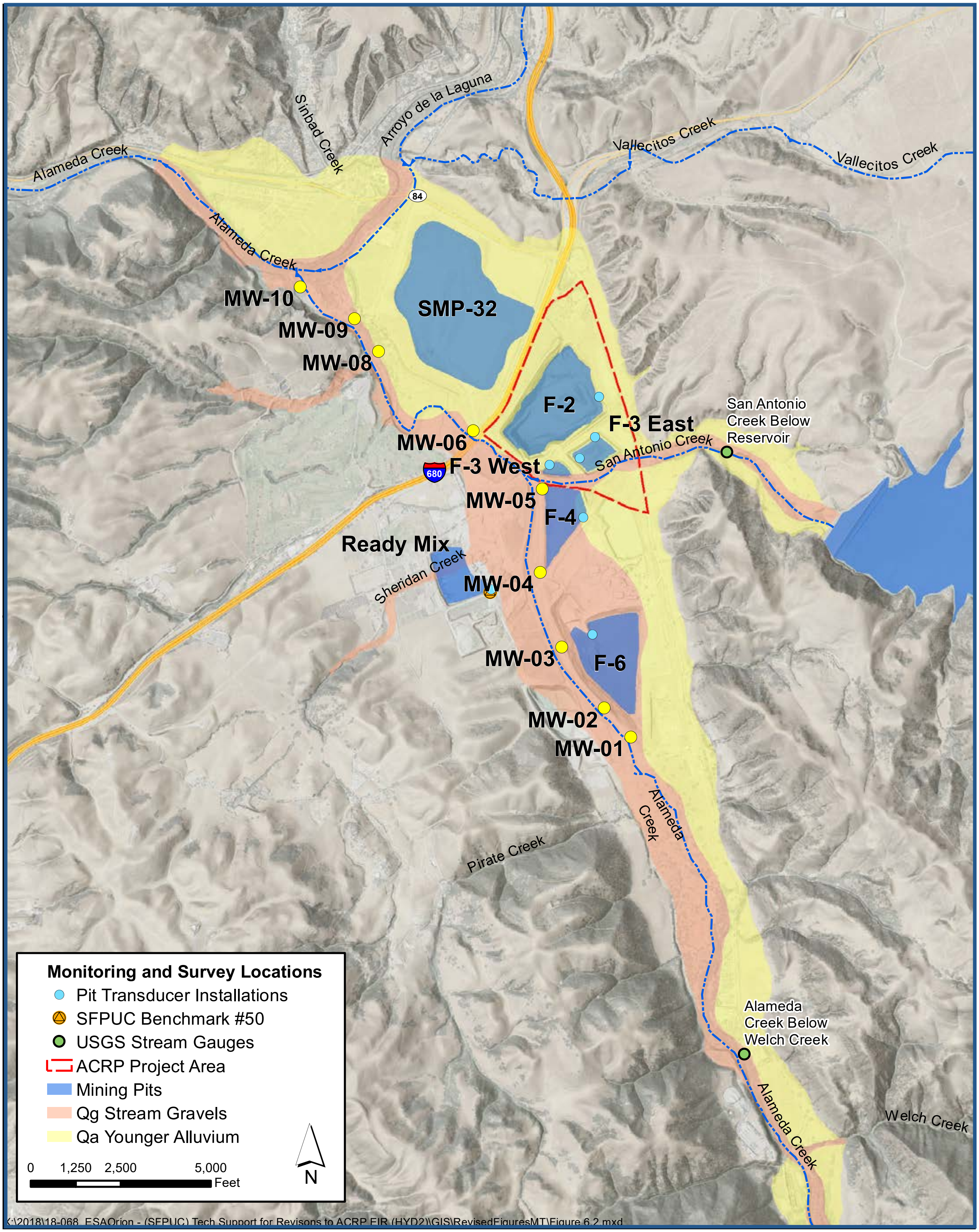

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Figure 6-3
ACRP Project Monitoring Locations

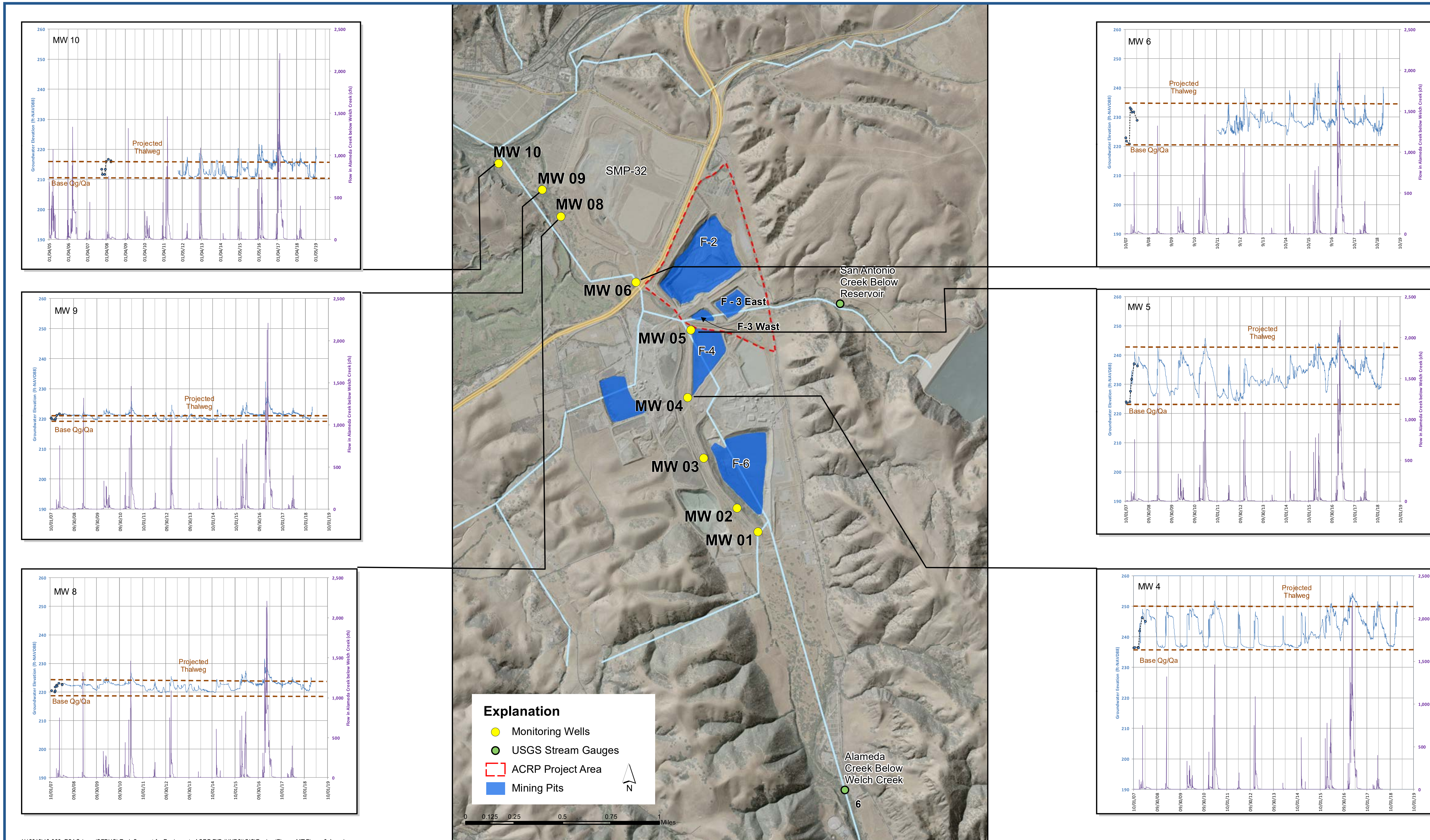

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Figure 6-4
Groundwater Level Data for WY 2006 to Present

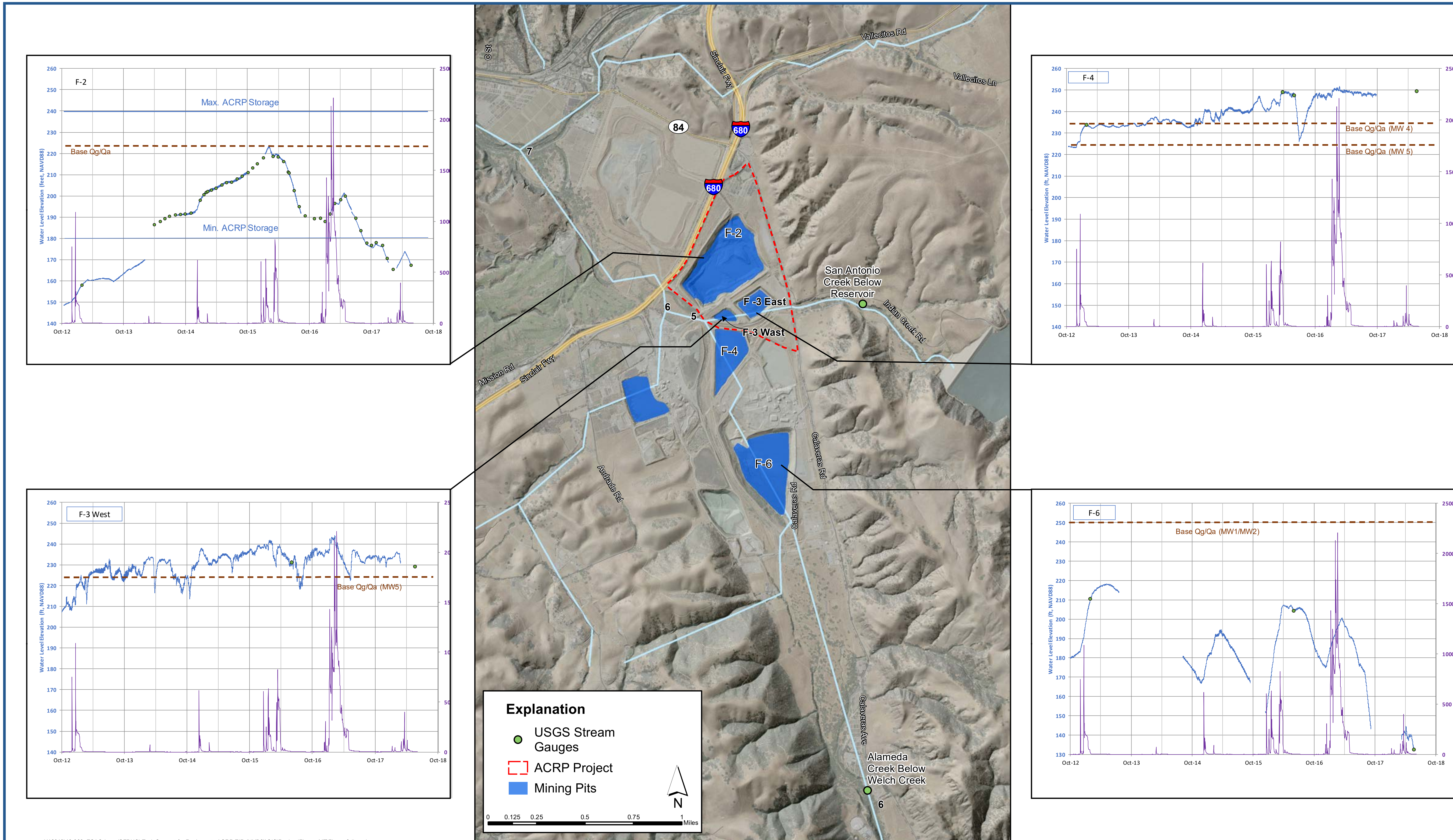

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Figure 6-5
Water Levels in Quarry Pits
for WY 2011 to Present

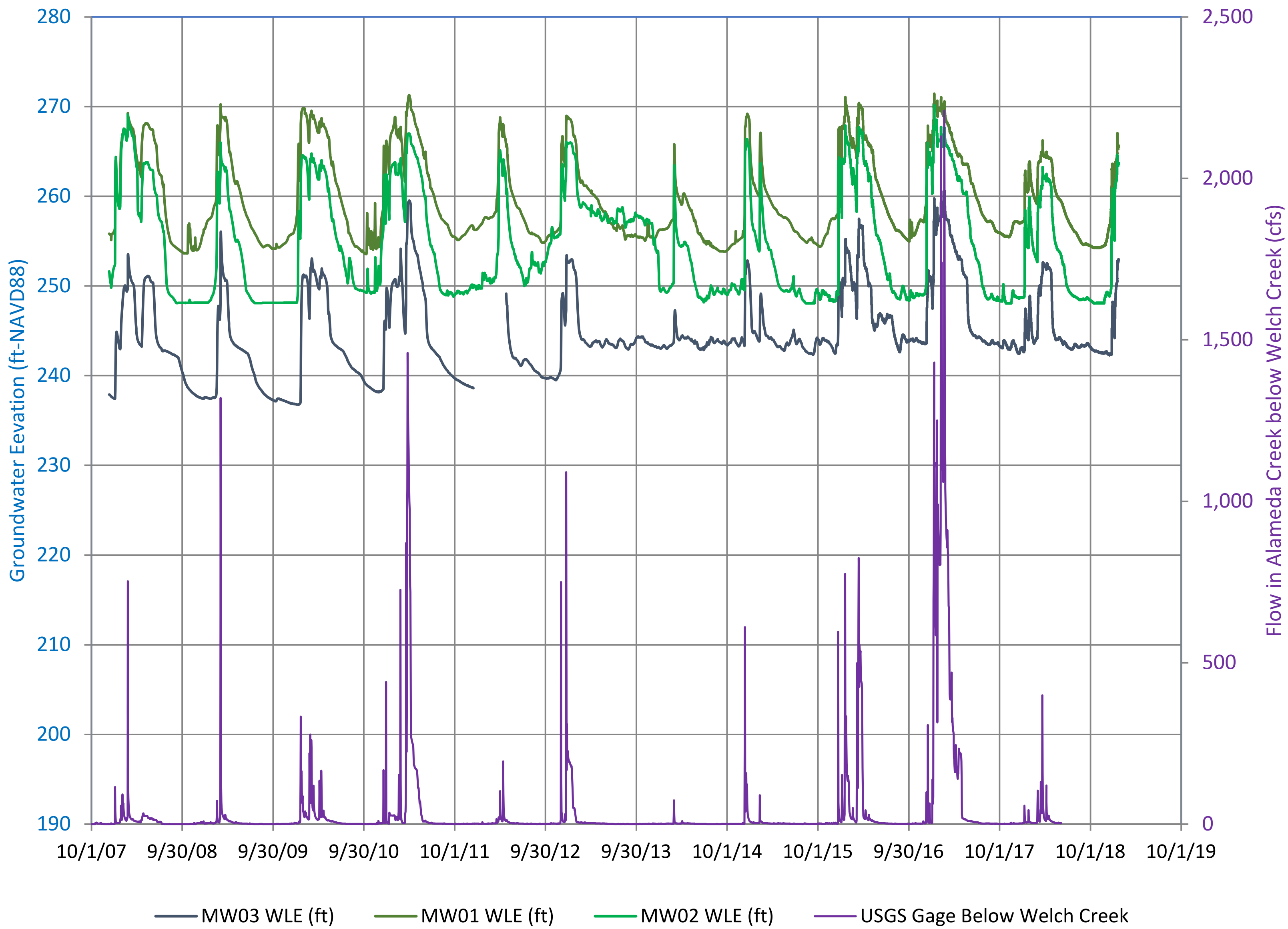

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Figure 7-1
Hydrograph for MW 1-3

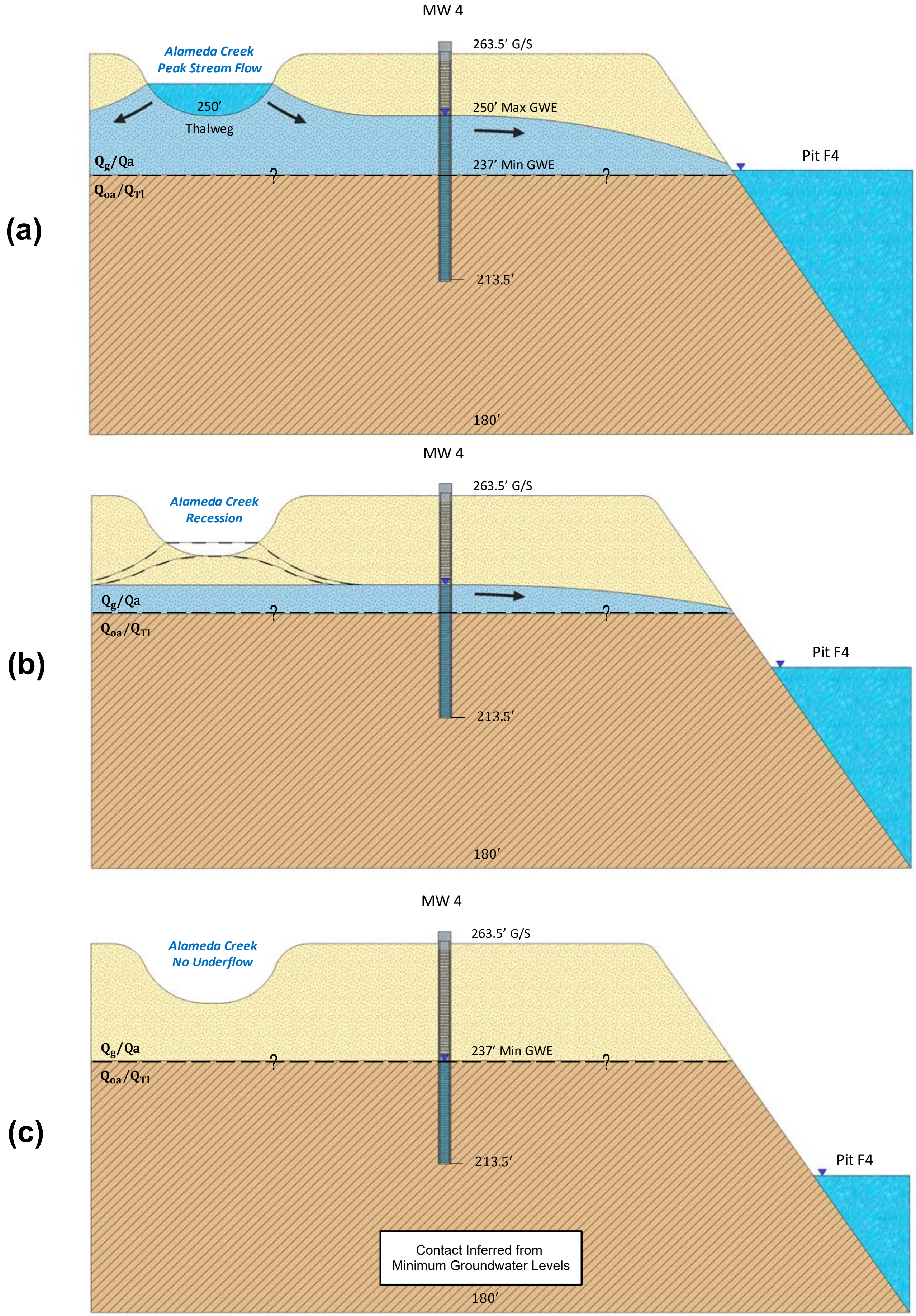

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Figure 7-2
Groundwater Conditions at MW 4
Peak Flow (a), Groundwater Recession (b) and Historic Minimum (c)

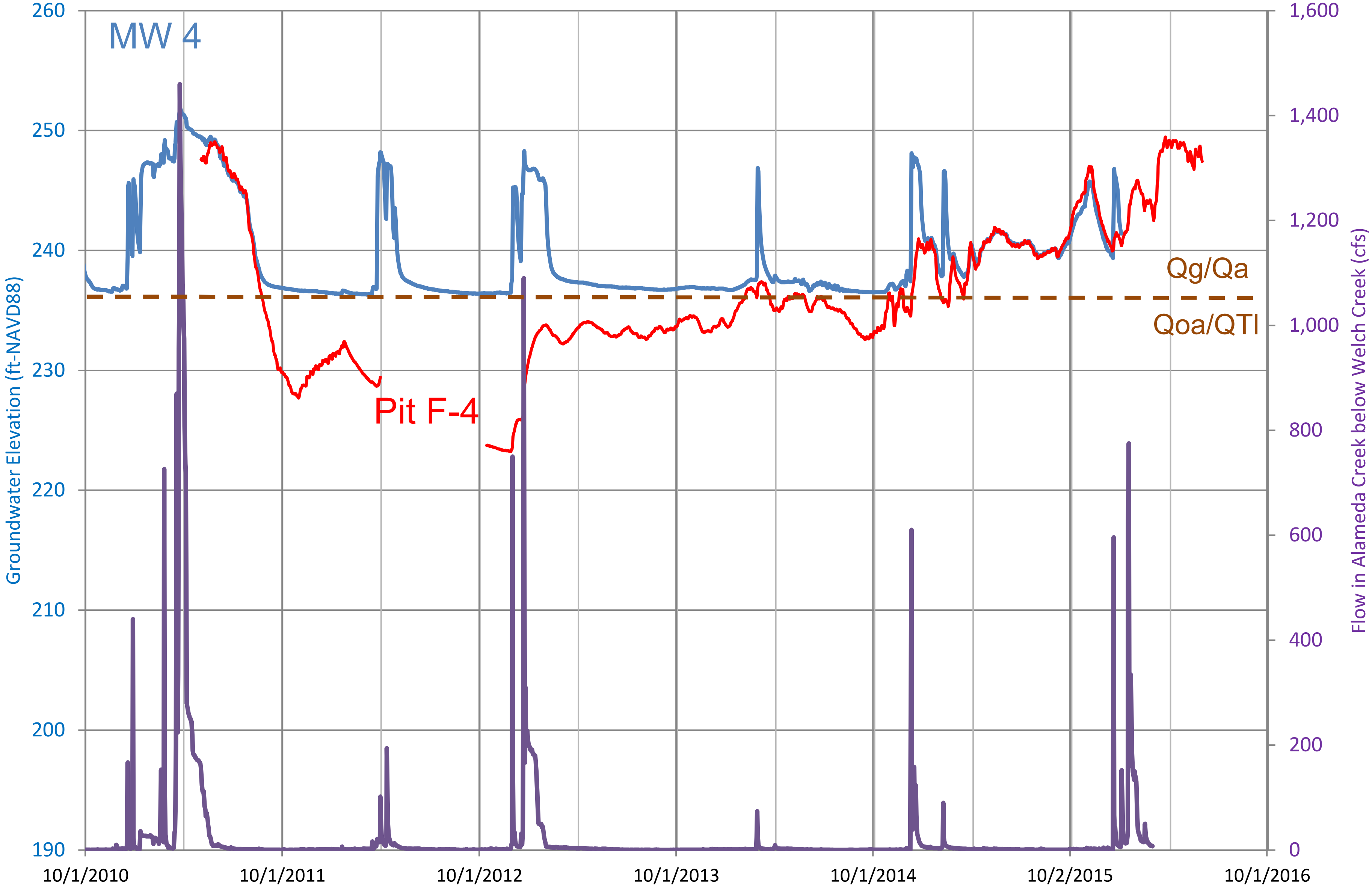

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Figure 7-3
Hydraulic Connection Between MW 4 and Pit F-4

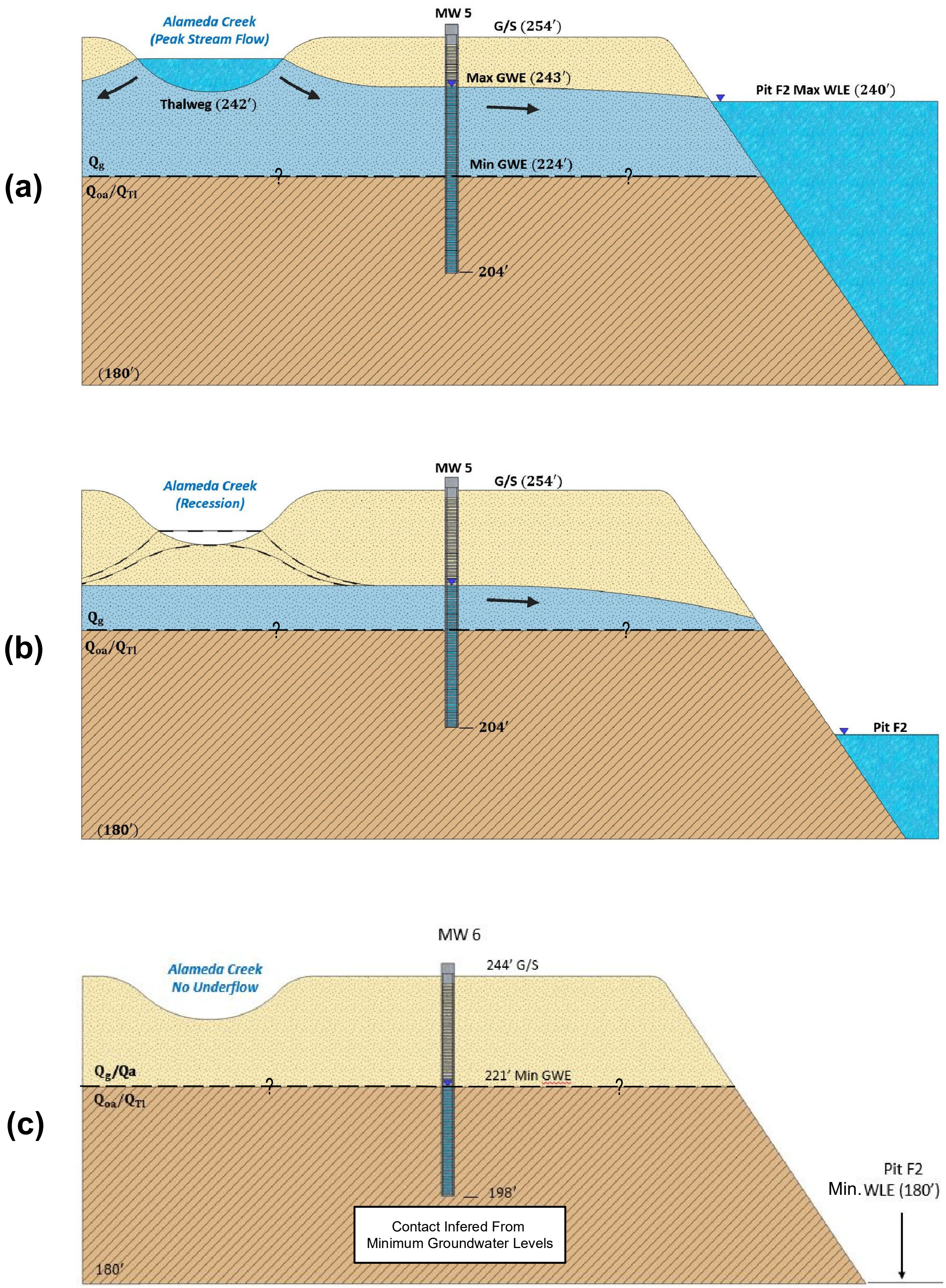

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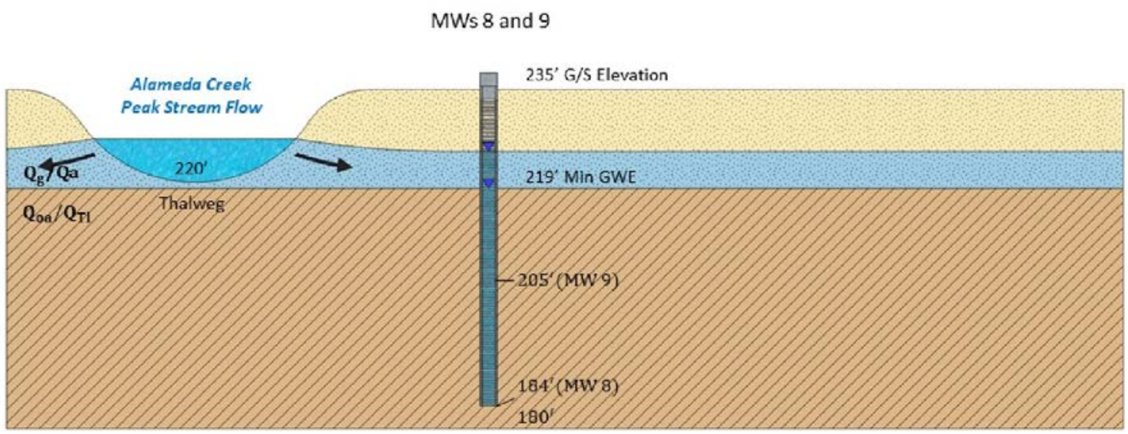
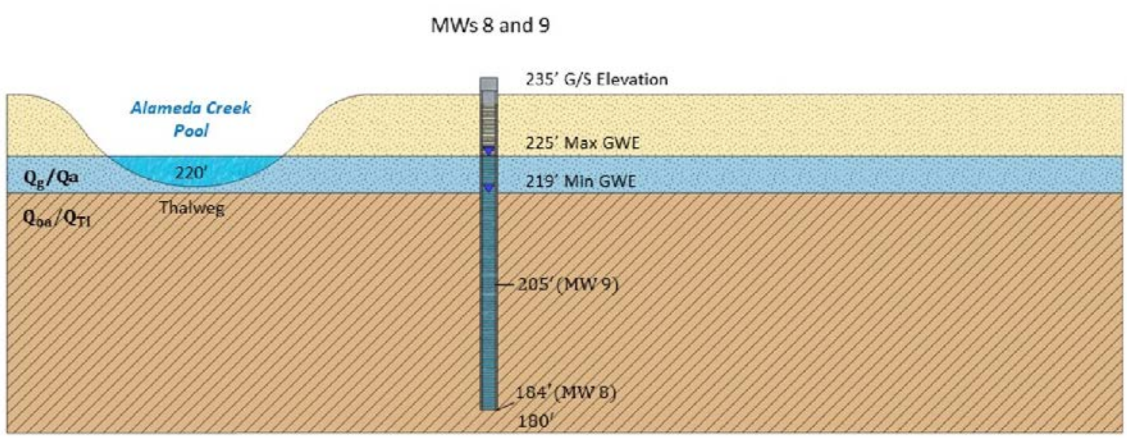
Figure 7-4
Groundwater Conditions at MW 5 and MW 6
Peak Flow (a), Groundwater Recession (b) and Historic Minimum (c)

(a)



(b)



Contact Inferred From
Minimum Groundwater Levels

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Figure 7-5
MW 8 and 9 and Peak Flow (a) and Pool (b)

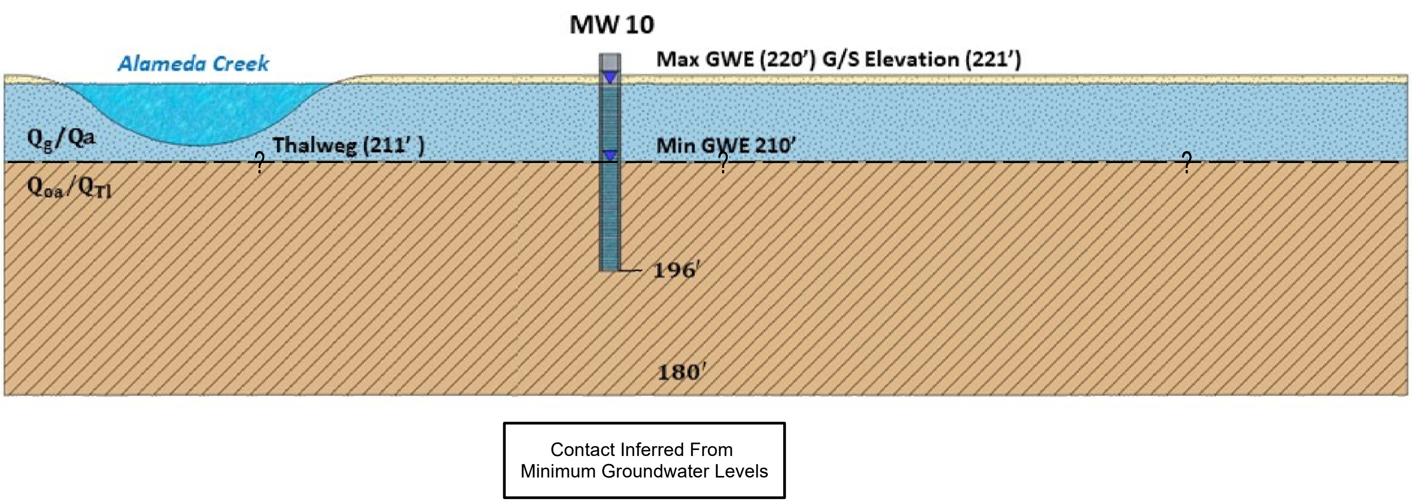

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Figure 7-6
Groundwater Conditions at MW 10

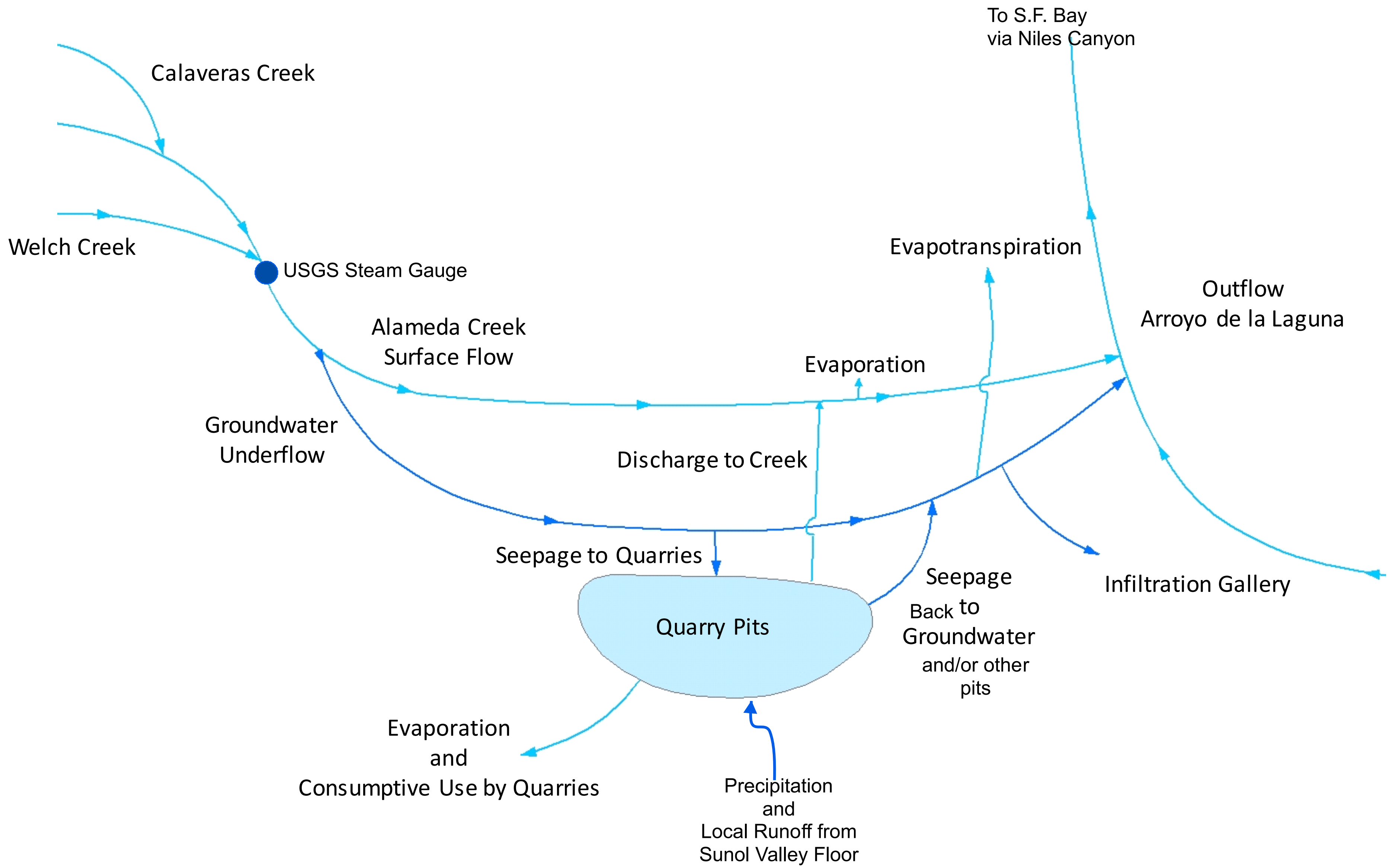

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Figure 8-1
Flow Pathways for
Groundwater - Surface Water Interactions

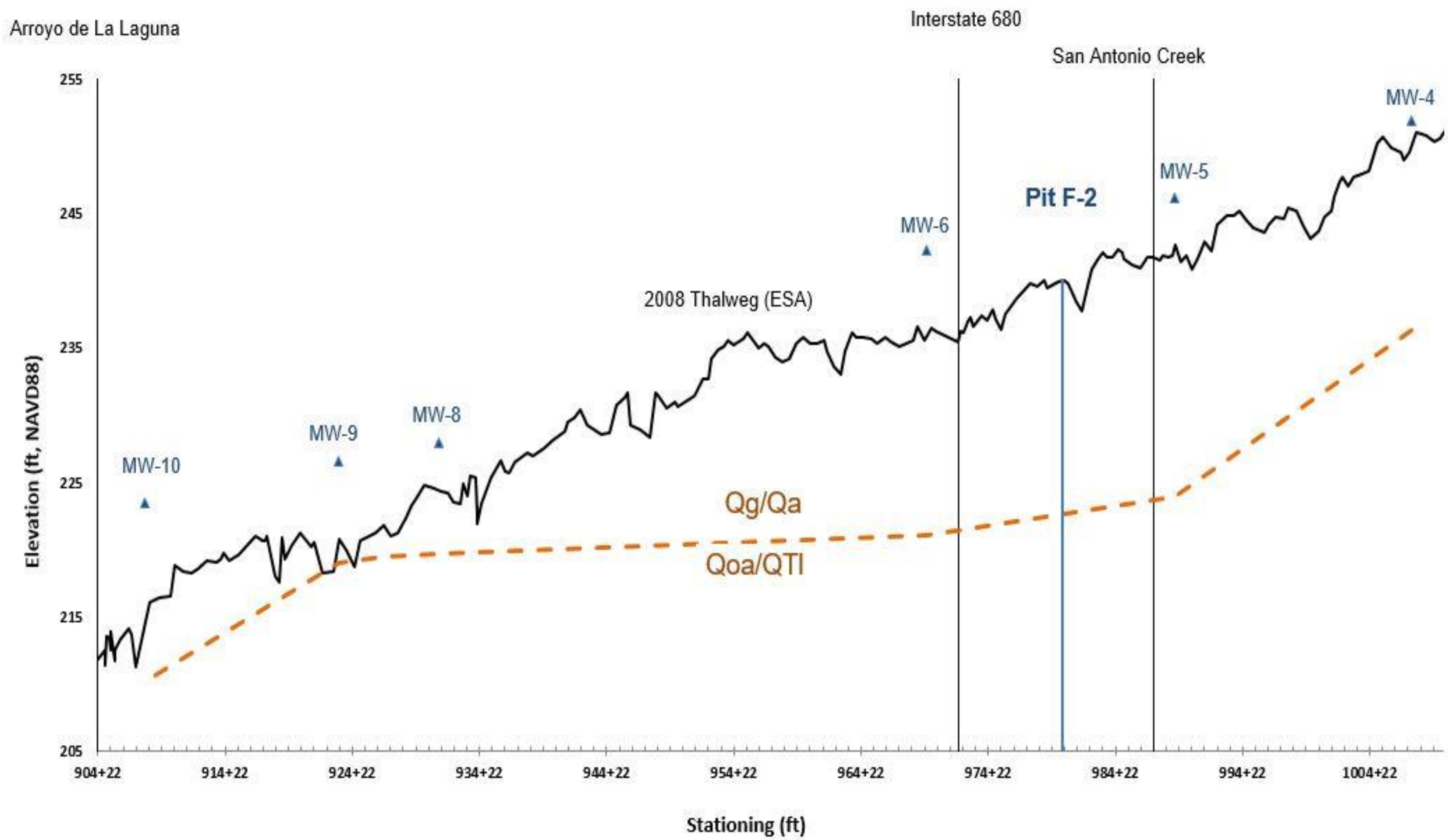

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Figure 8-2

Profiles of Thalweg and Shallow Aquifer Base (Qg/Qa)

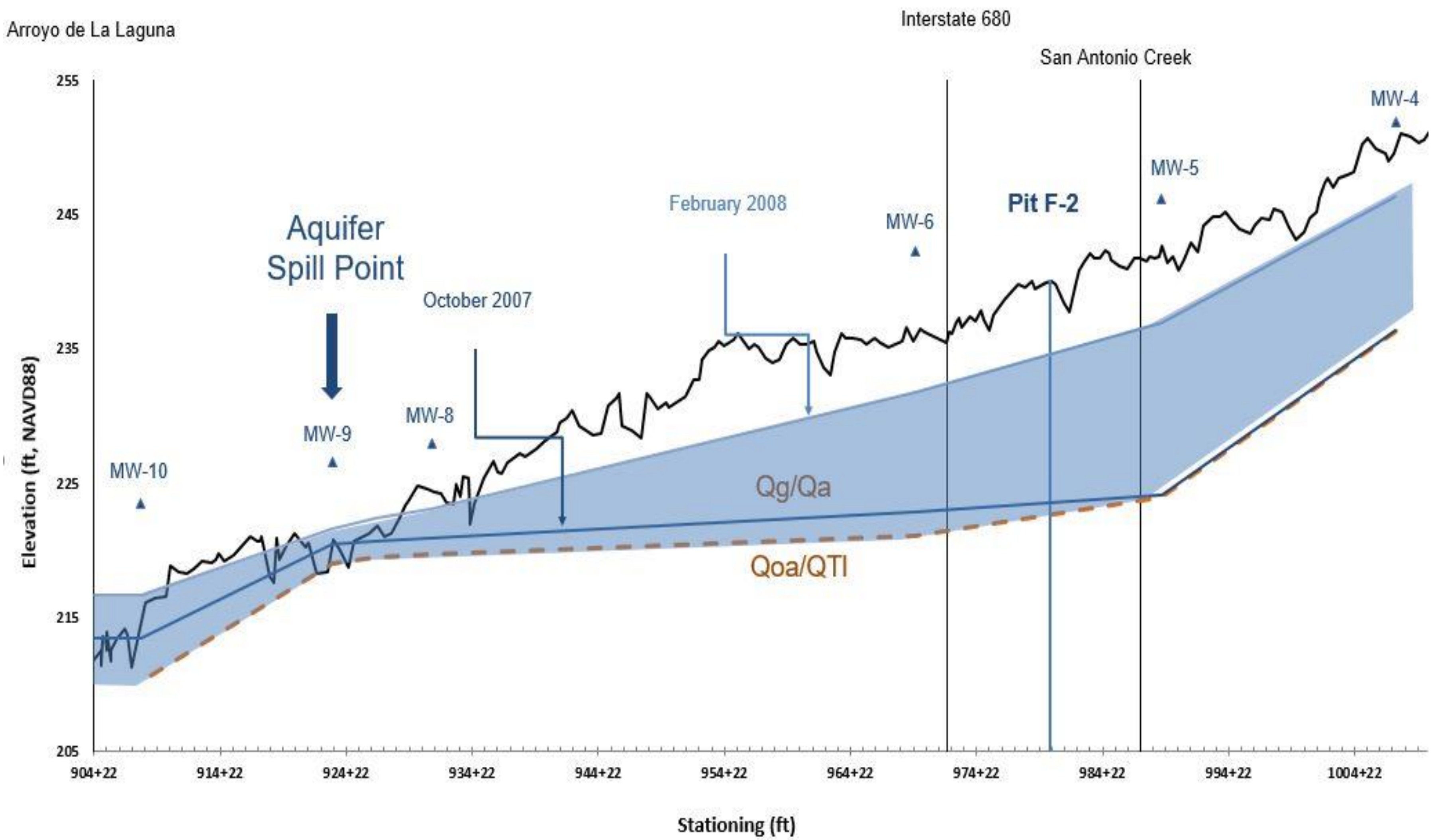

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Figure 8-3
Aquifer Spill Point - Groundwater Levels in February 2008 and October 2007

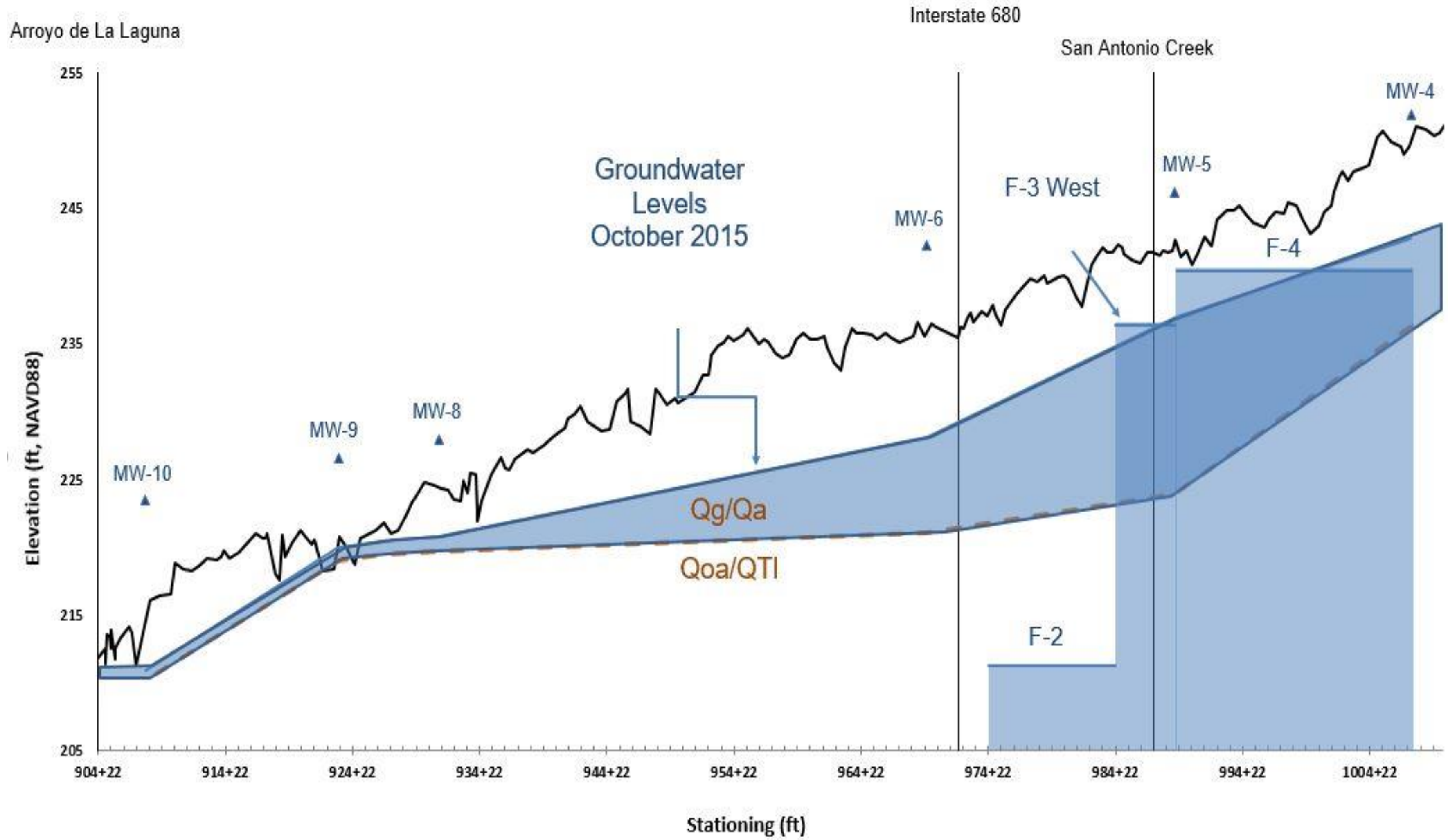

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Figure 8-4

Gradient from Pits to Groundwater - October 2015

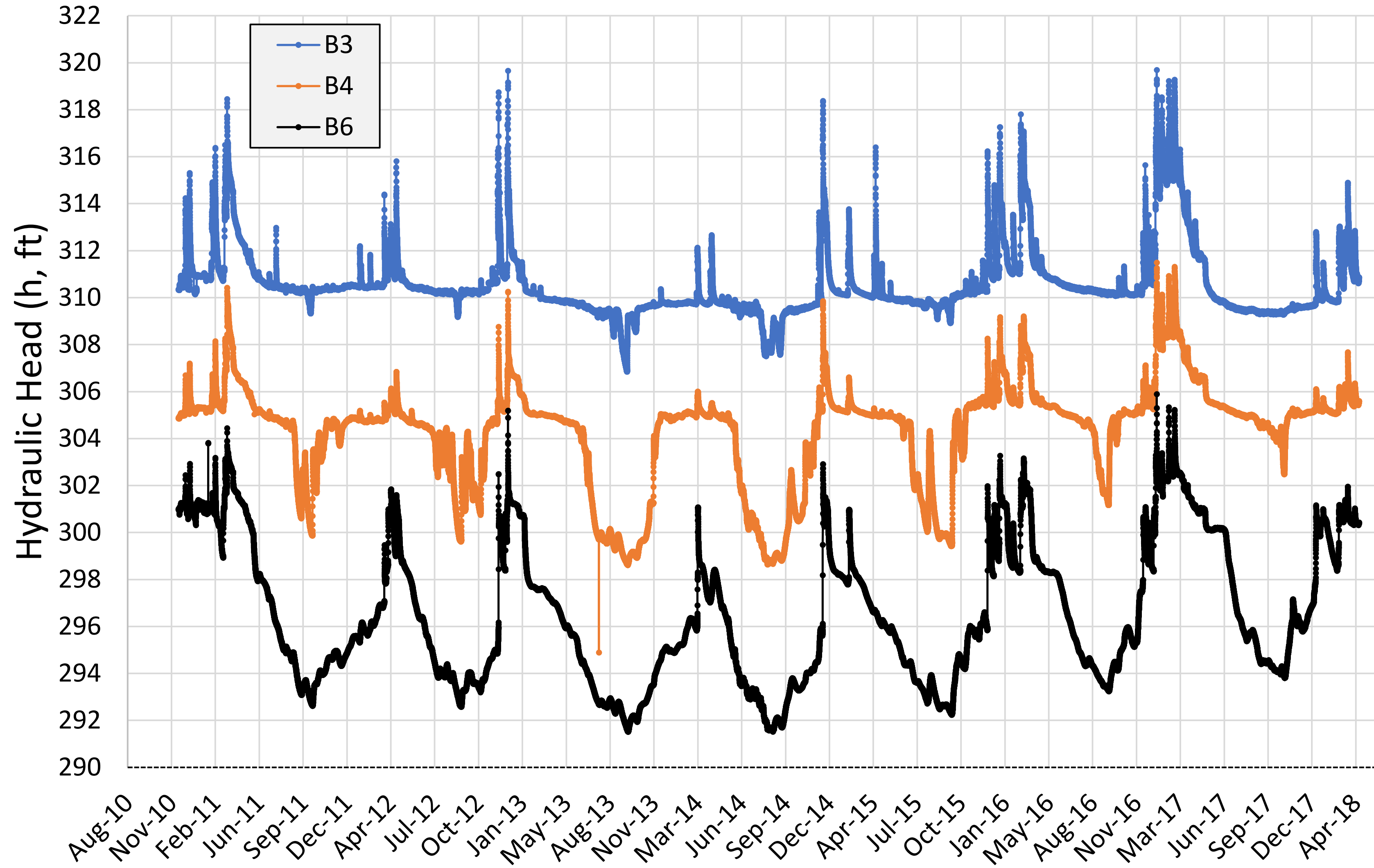

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Figure 9-1
Time series of hydraulic head measured
upstream of the quarry reach at piezometers B3, B4 and B6

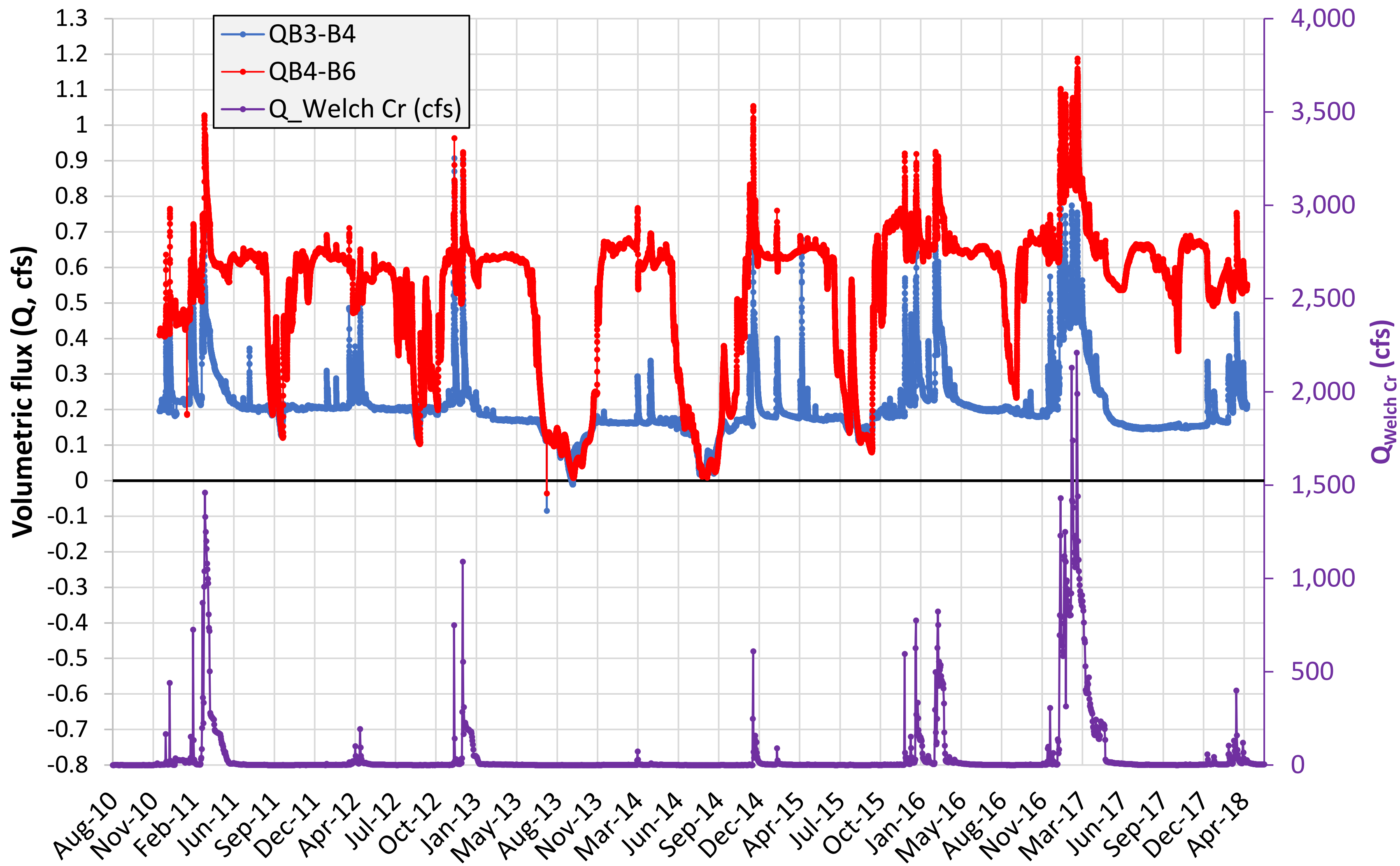

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Figure 9-2
Time series of aquifer volumetric flux estimated between B3-B4 and B4-B6 and creek flux below Welch Creek

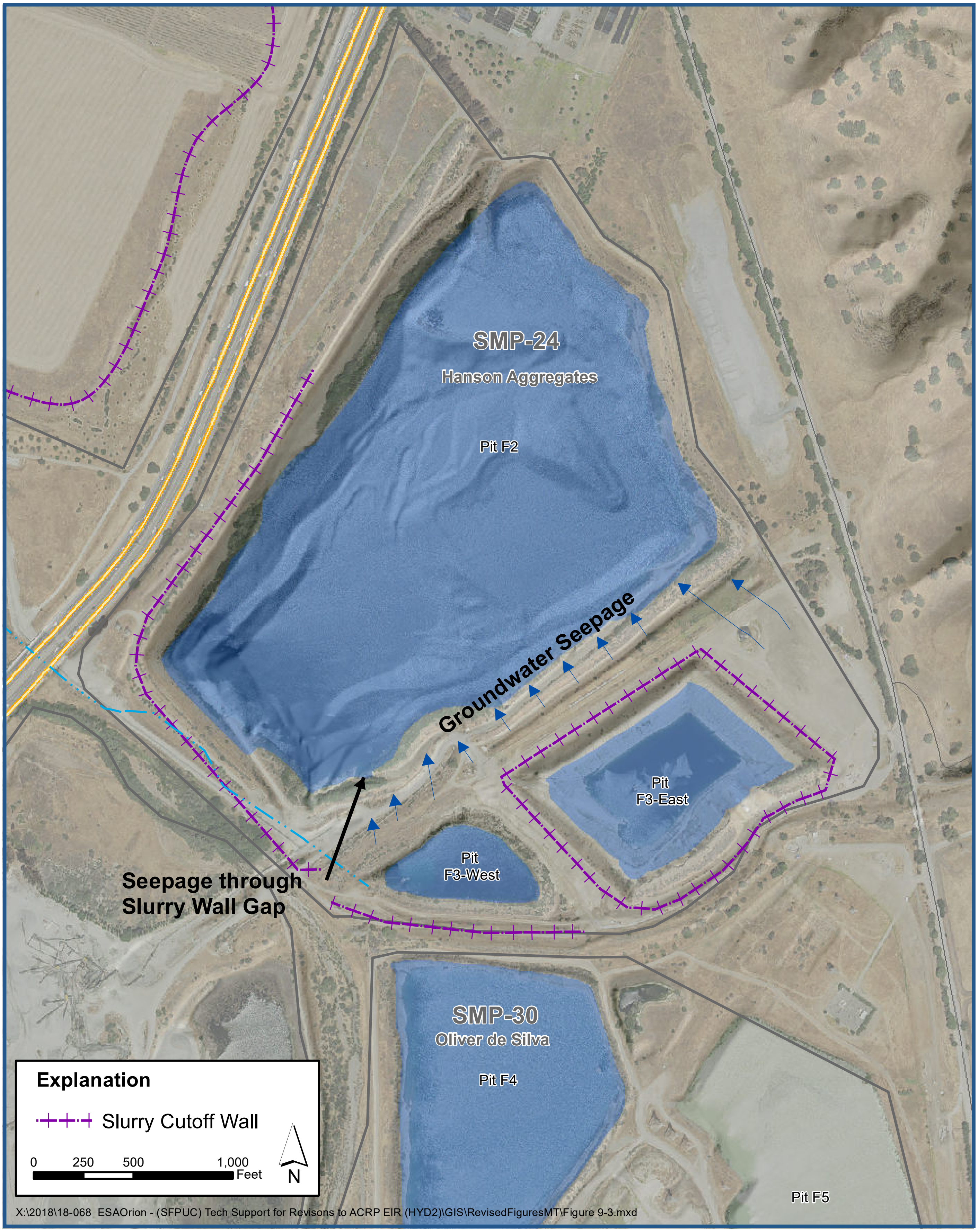

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Figure 9-3
Flow Paths for Seepage into Pit F-2

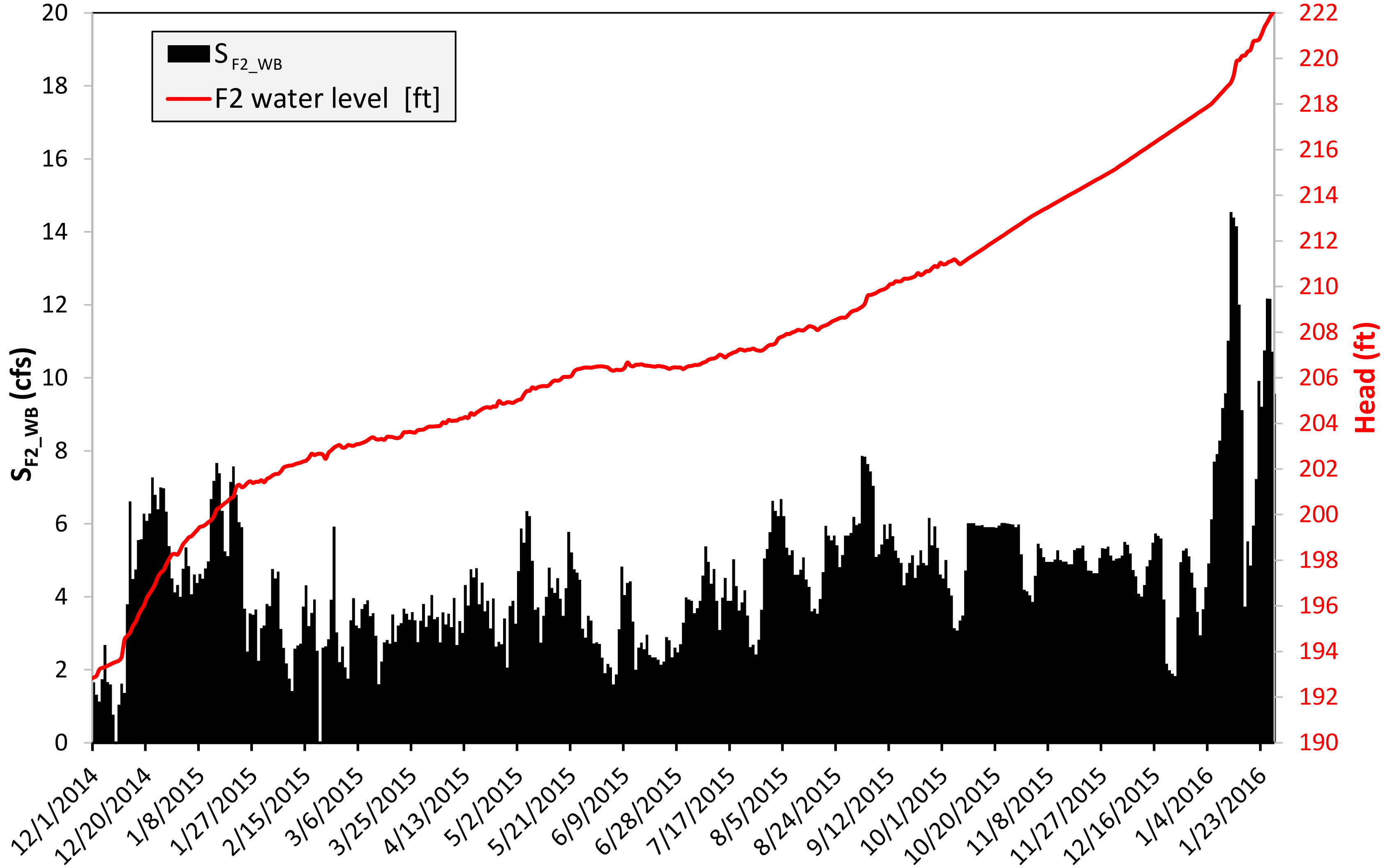

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Figure 9-4
Time series of estimated seepage rate into Pit F-2 from water budget S_{F2_WB} (y-primary axis) and F-2 water level (y-secondary axis)

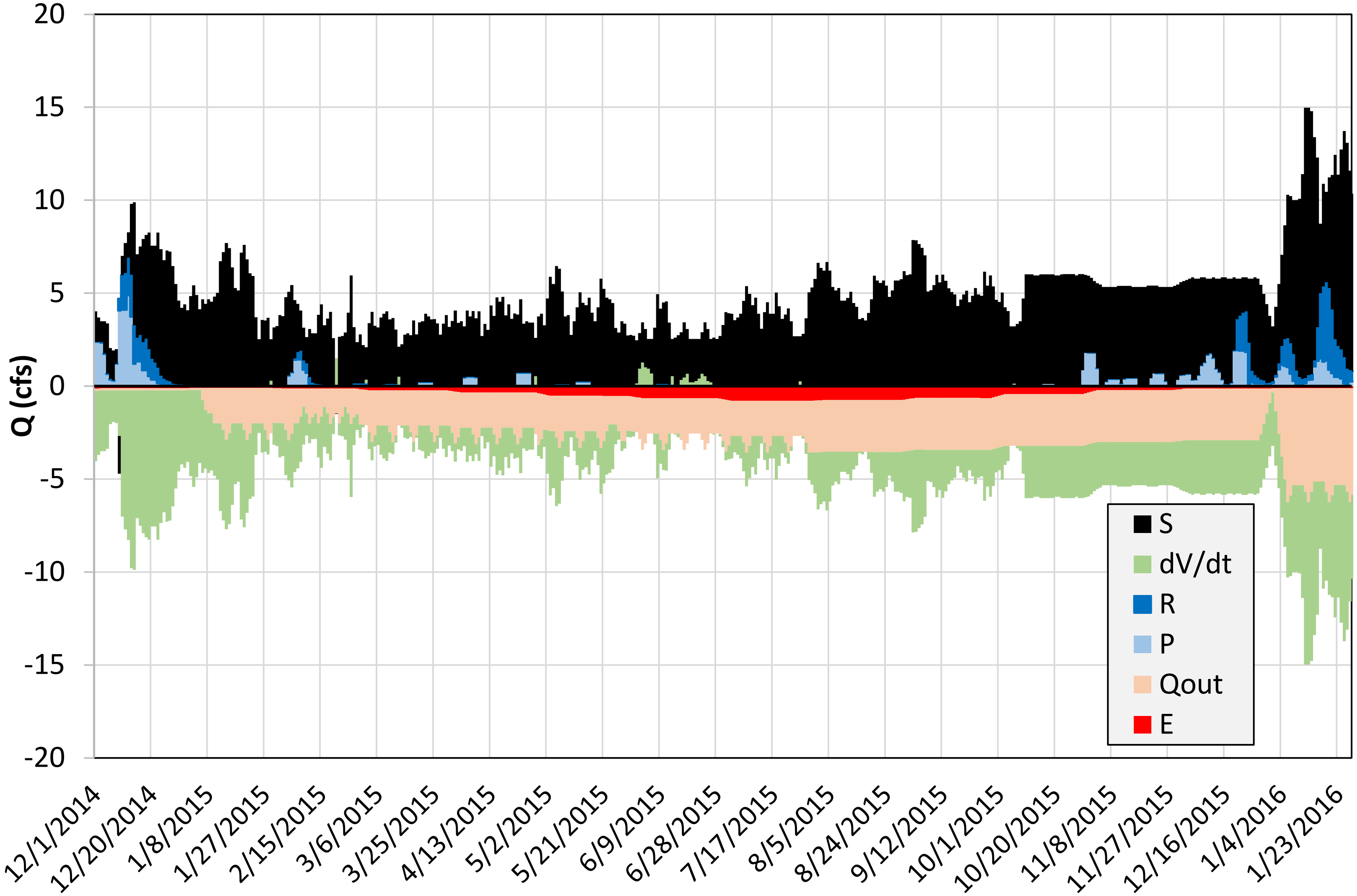

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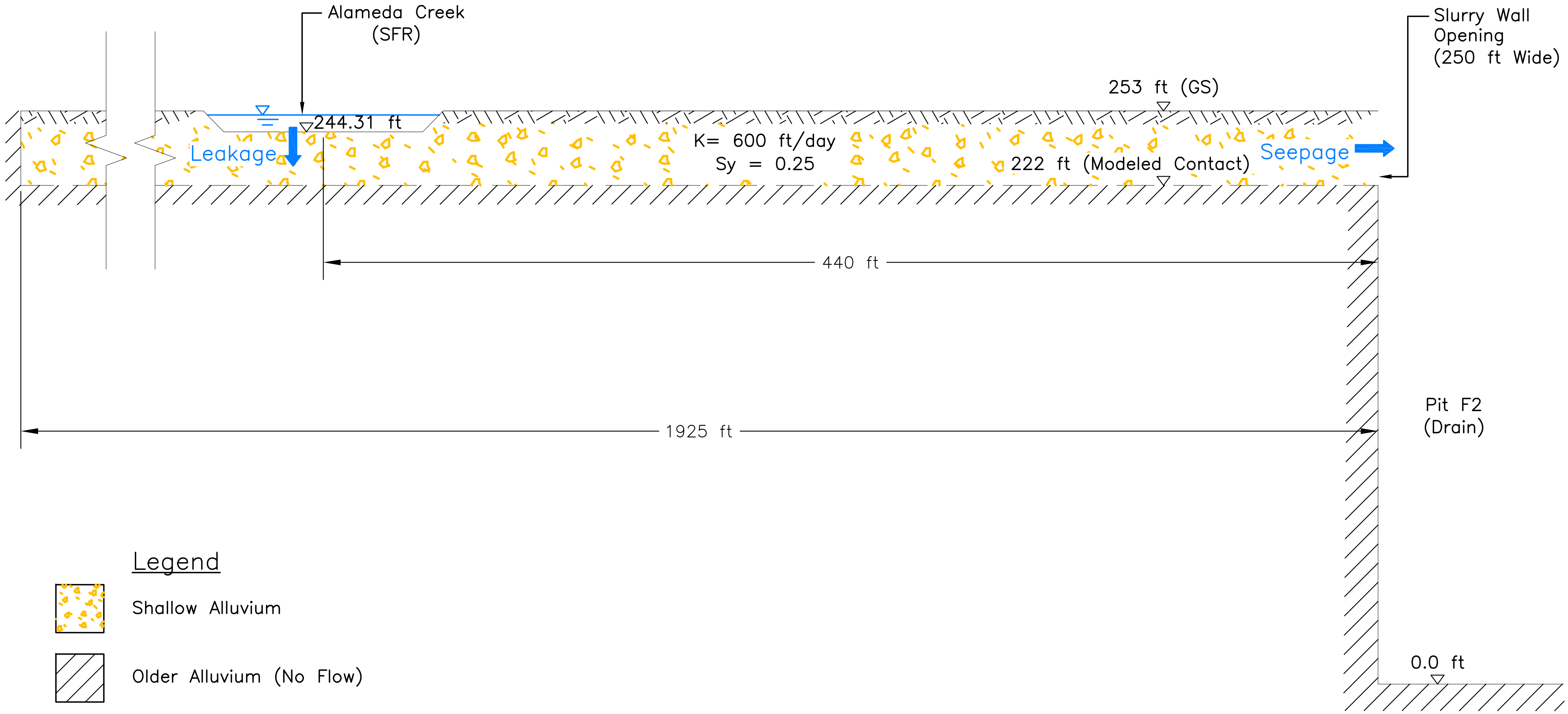
Figure 9-5
Time series of water budget components of Pit F-2



CAD FILE: G:\Projects\San Francisco PUC\18-1-068\Alameda Creek Drawing.dwg DATE: 7/3/2019 1:27 PM

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Figure 9-6
Schematic Diagram of Numerical Model for Creek Seepage into Pit F2

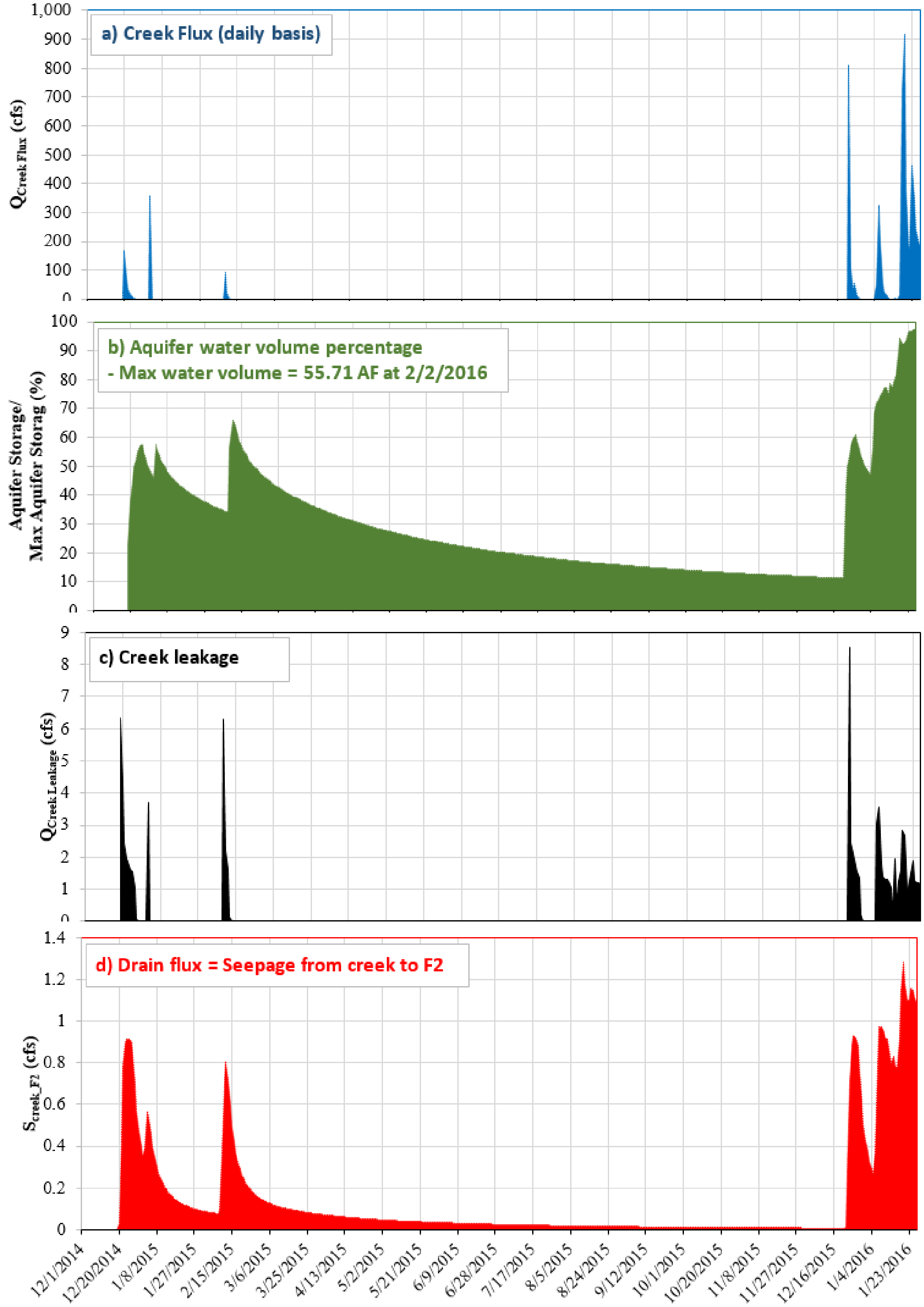

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Figure 9-7
Time series of a) creek flux b) modeled aquifer volume, c) modeled creek leakage and d) modeled drain flux ($S_{creek-F2}$)

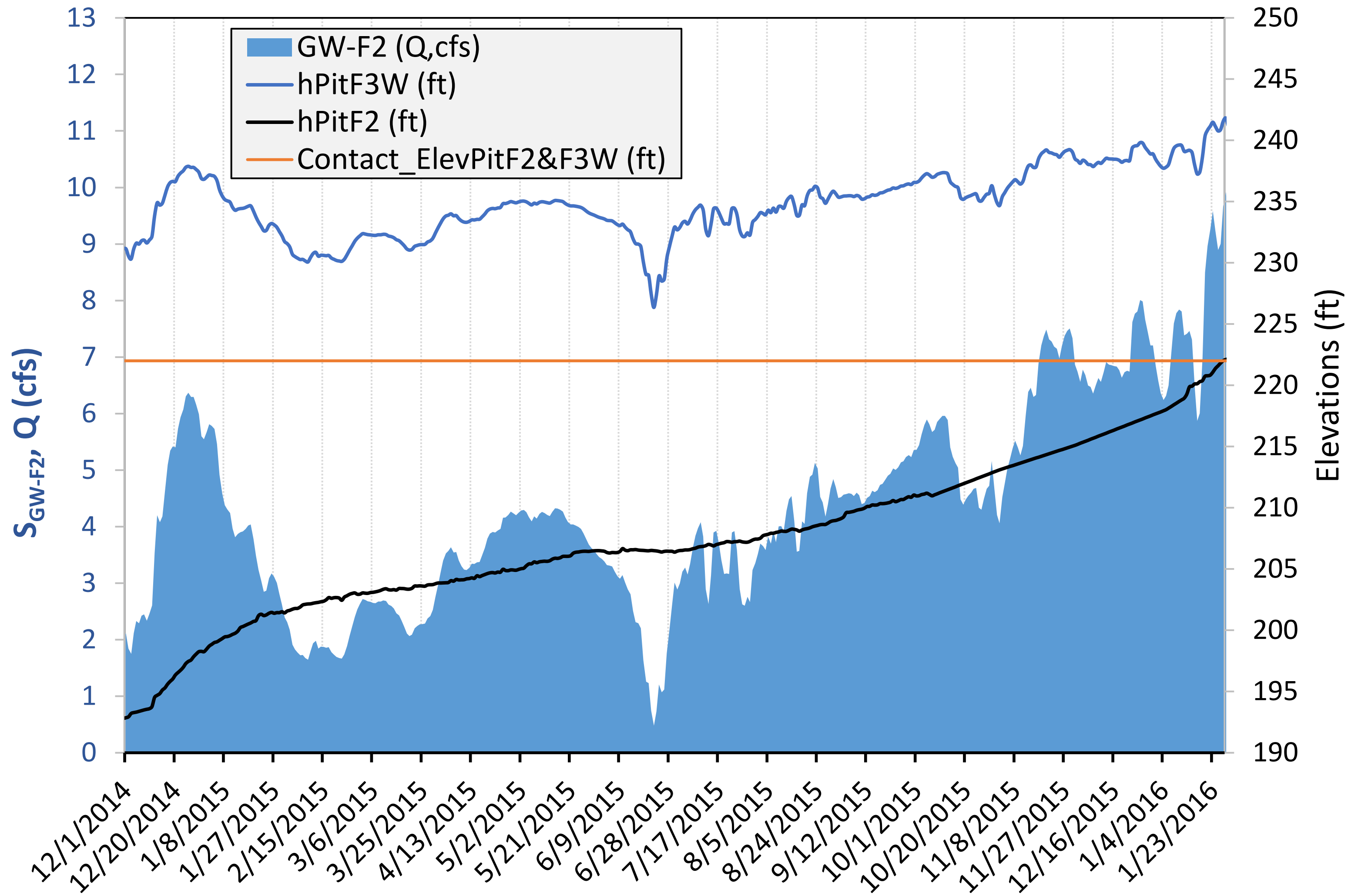

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Figure 9-8
Time series of seepage rate "S_{GW-F2}" (y-primary axis) and
F-3 West and F-2 water levels and contact elevations (y-secondary axis)

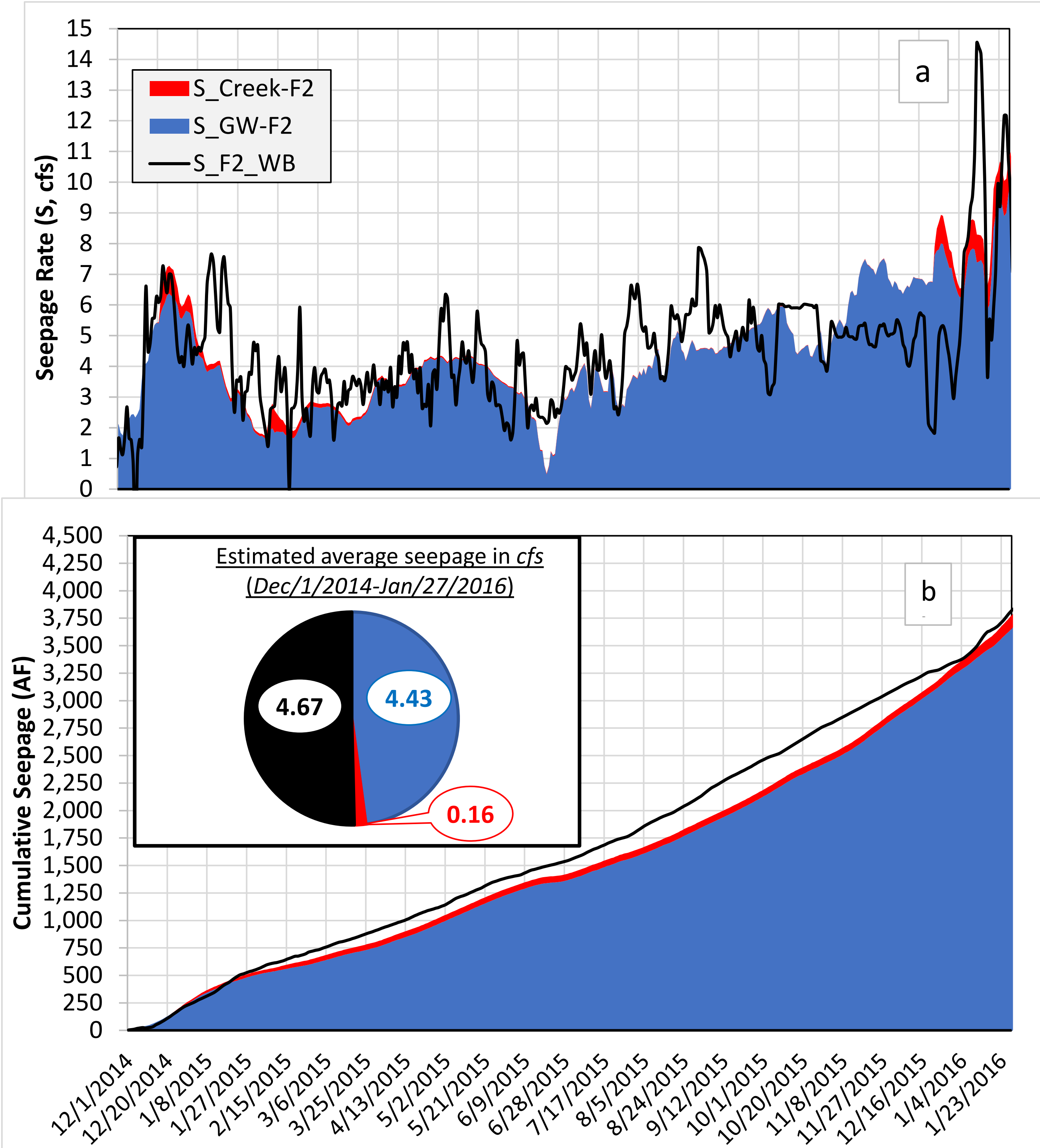

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Figure 9-9
a) Seepage rate from F-2 mass balance compared with model estimates of seepage from creek and groundwater and b) cumulative seepage (x-y plot) with average seepage (pie chart)

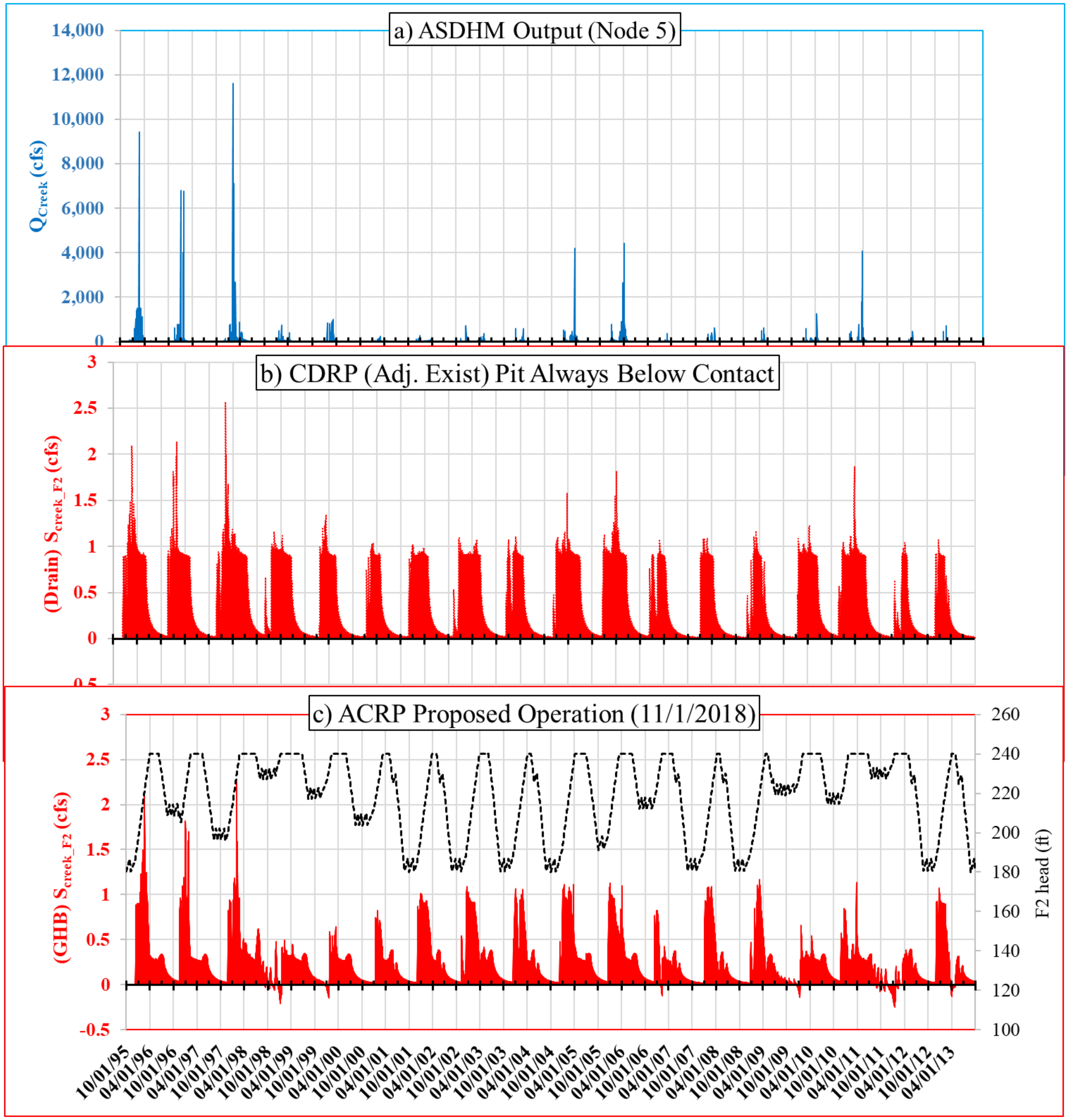

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Figure 9-10
a) ASDHM creek flux (1995-2013) at Node 5,
b) modeled seepage flux, $S_{creek\text{-}F2}$ for with-CDRP, and
c) modeled seepage flux, $S_{creek\text{-}F2}$ for with-ACRP

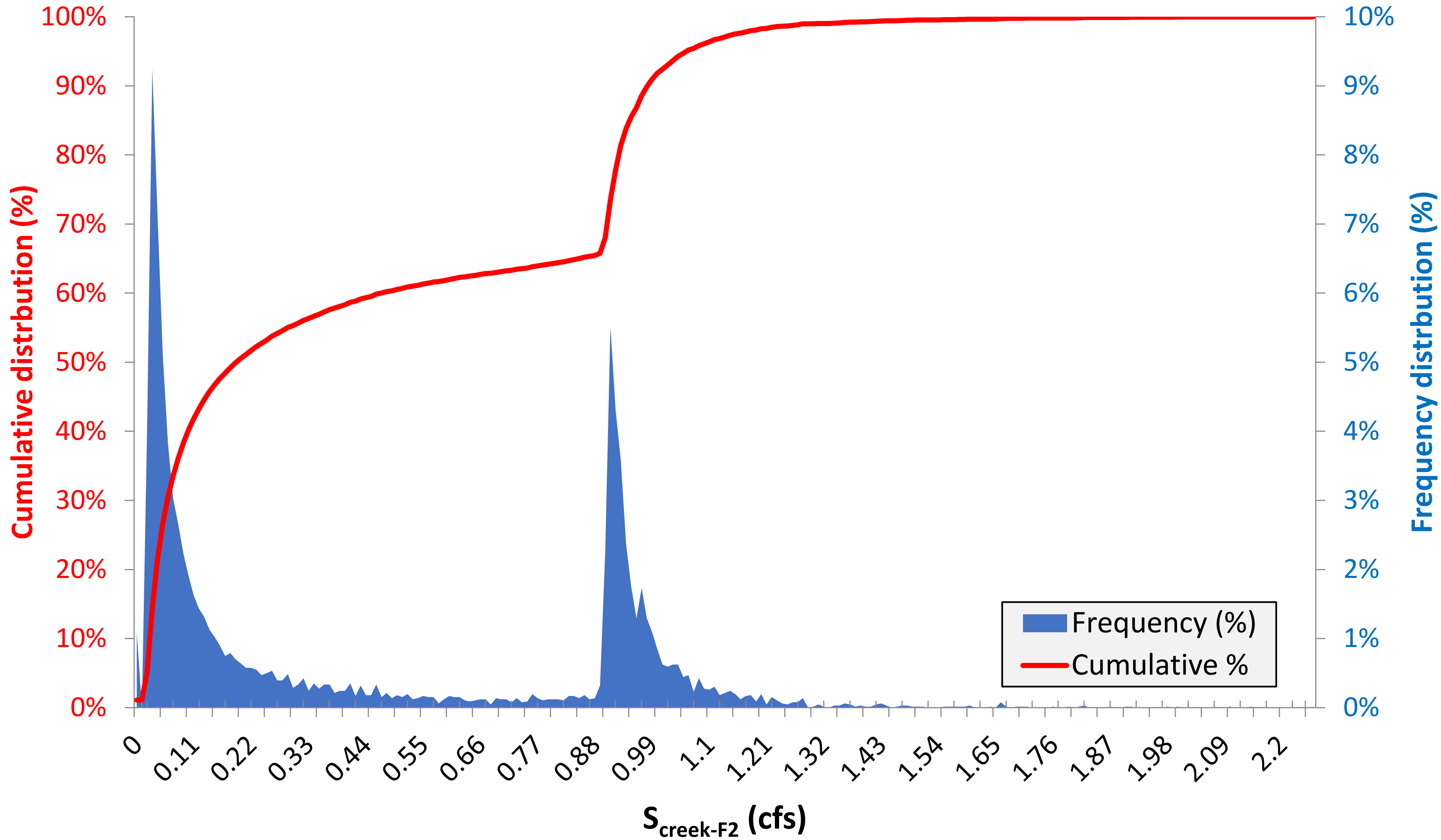

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Figure 9-11a
With-CDRP frequency and cumulative distribution of seepage rate, S_{creek}-F2,
for ASDHM base period (1995 to 2013) [6575 days]

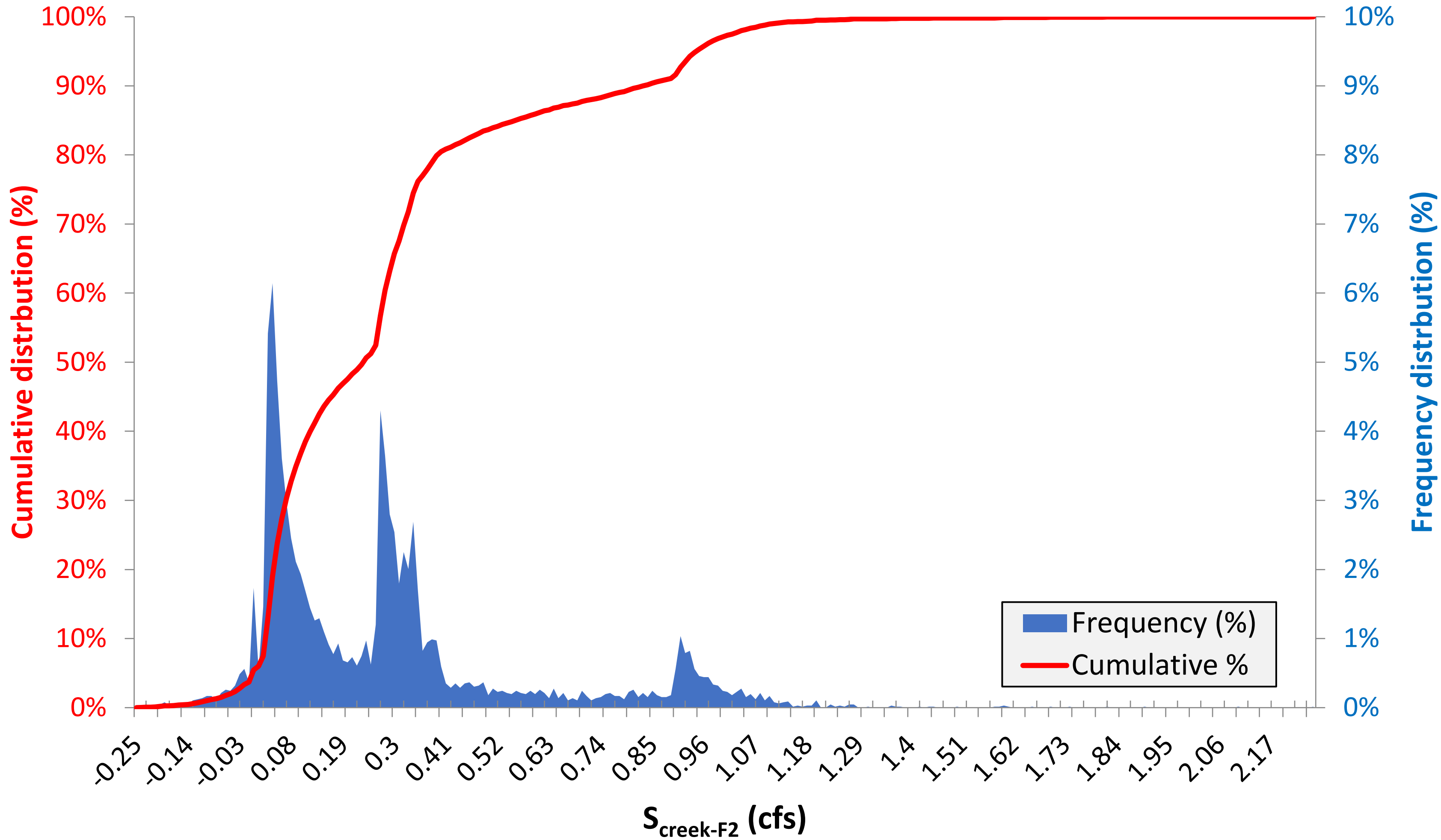

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Figure 9-11b
With-ACRP frequency and cumulative distribution seepage rate, $S_{creek\text{-}F2}$, over ASDHM base period (1995 to 2013) [6575 days]

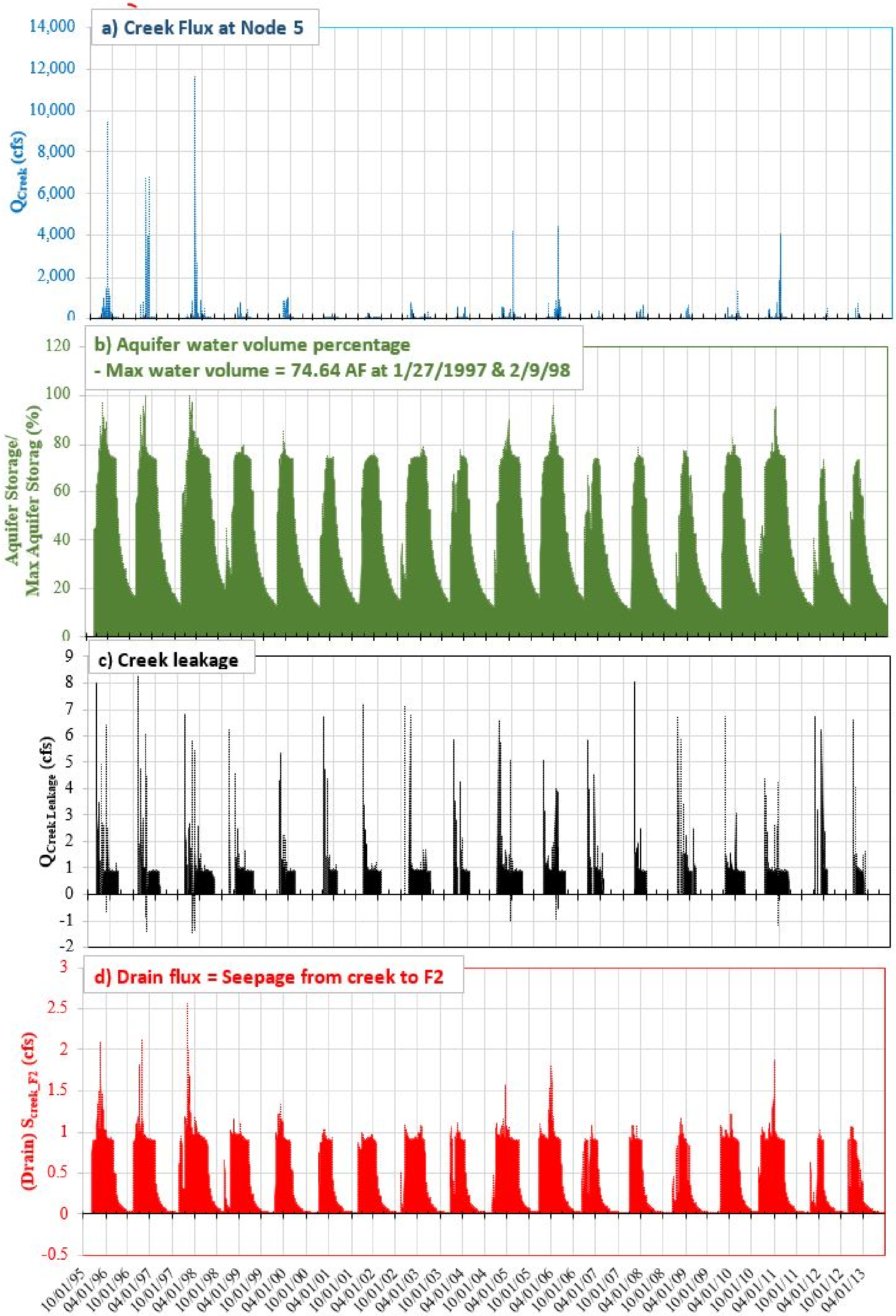

Figure 9-12
With-CDRP a) ASDHM creek flux (1995-2013) at Node 5
b) modeled aquifer volume c) modeled creek leakage and
d) modeled drain flux ($S_{creek\text{-}F2}$)

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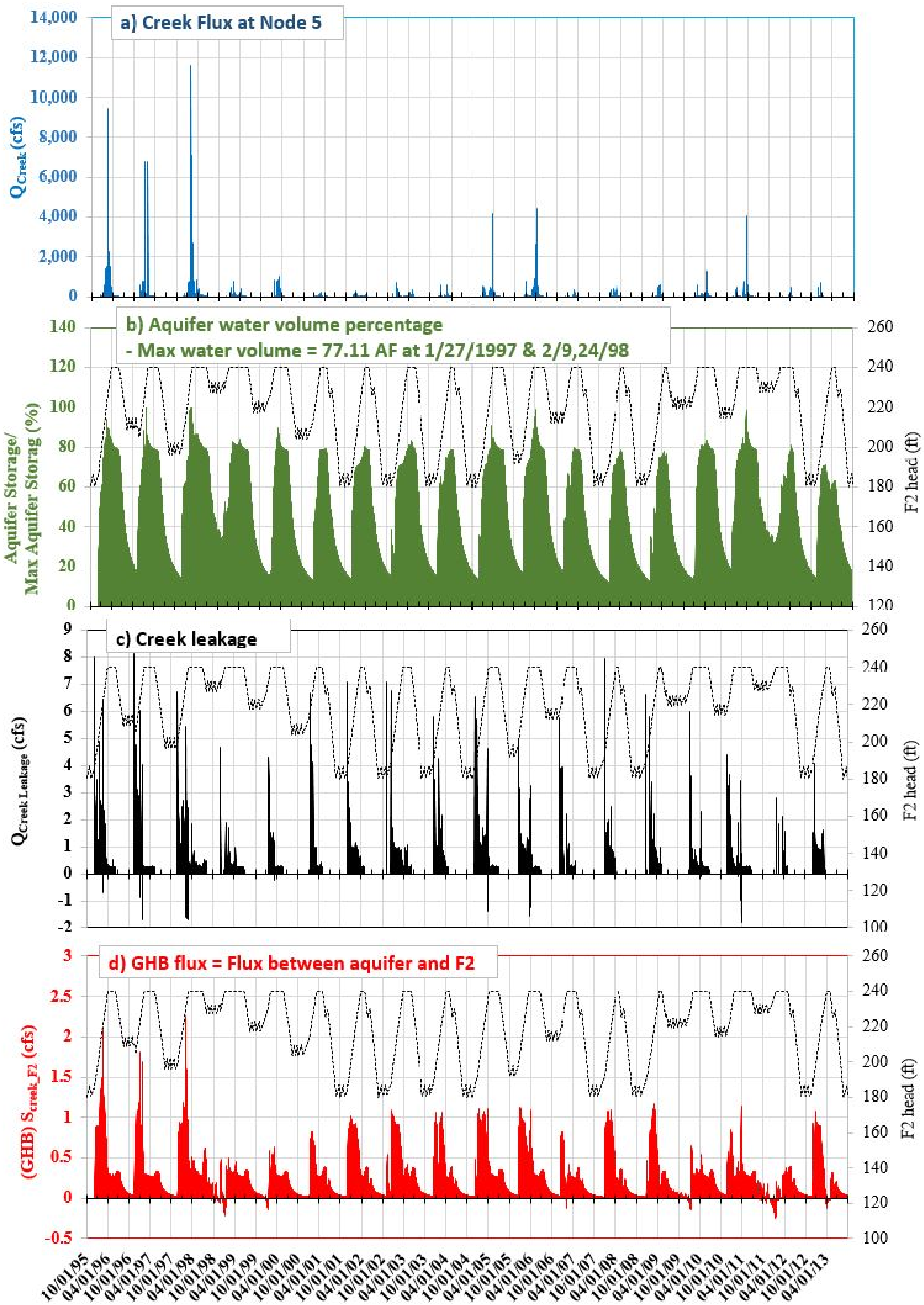

Figure 9-13
With-ACRP a) ASDHM creek flux (1995-2013) at Node 5
b) modeled aquifer volume, c) creek leakage and
d) flux between aquifer and F2 pit "$S_{creek\text{-}F2}$"

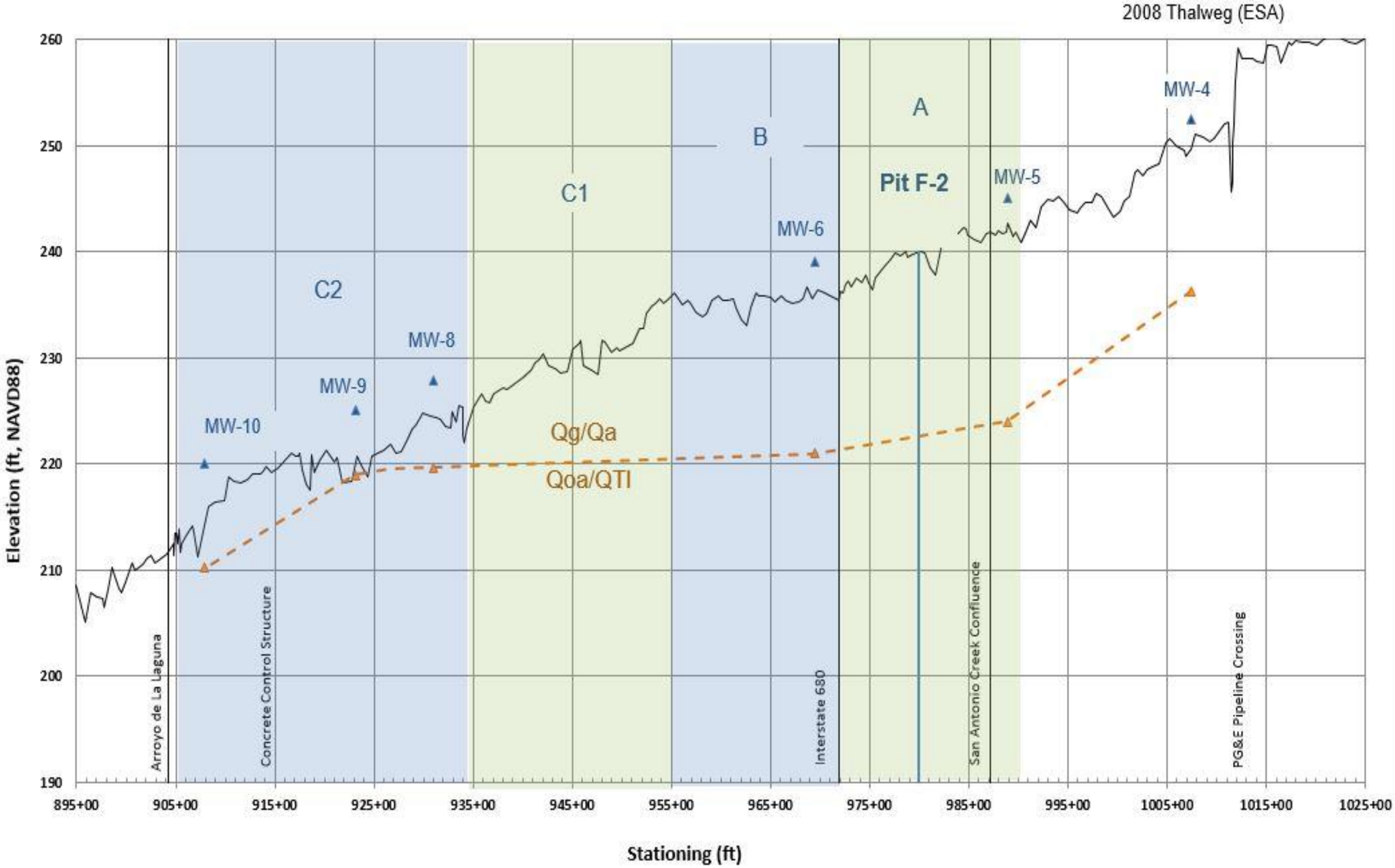

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Figure 11-1
Subreaches for Impact Analysis Based on Aquifer Geometry

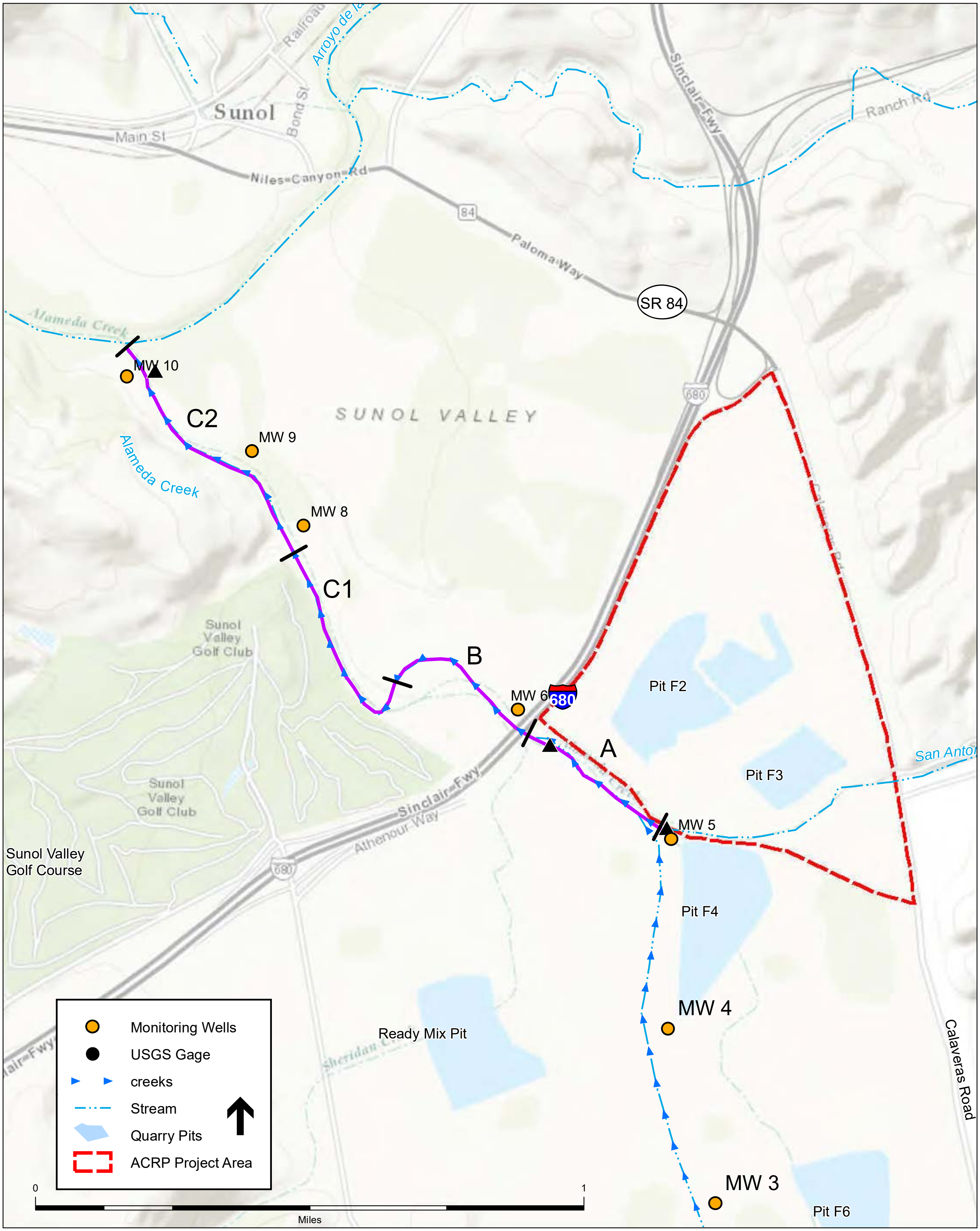

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Figure 11-2
Study Area Subreaches

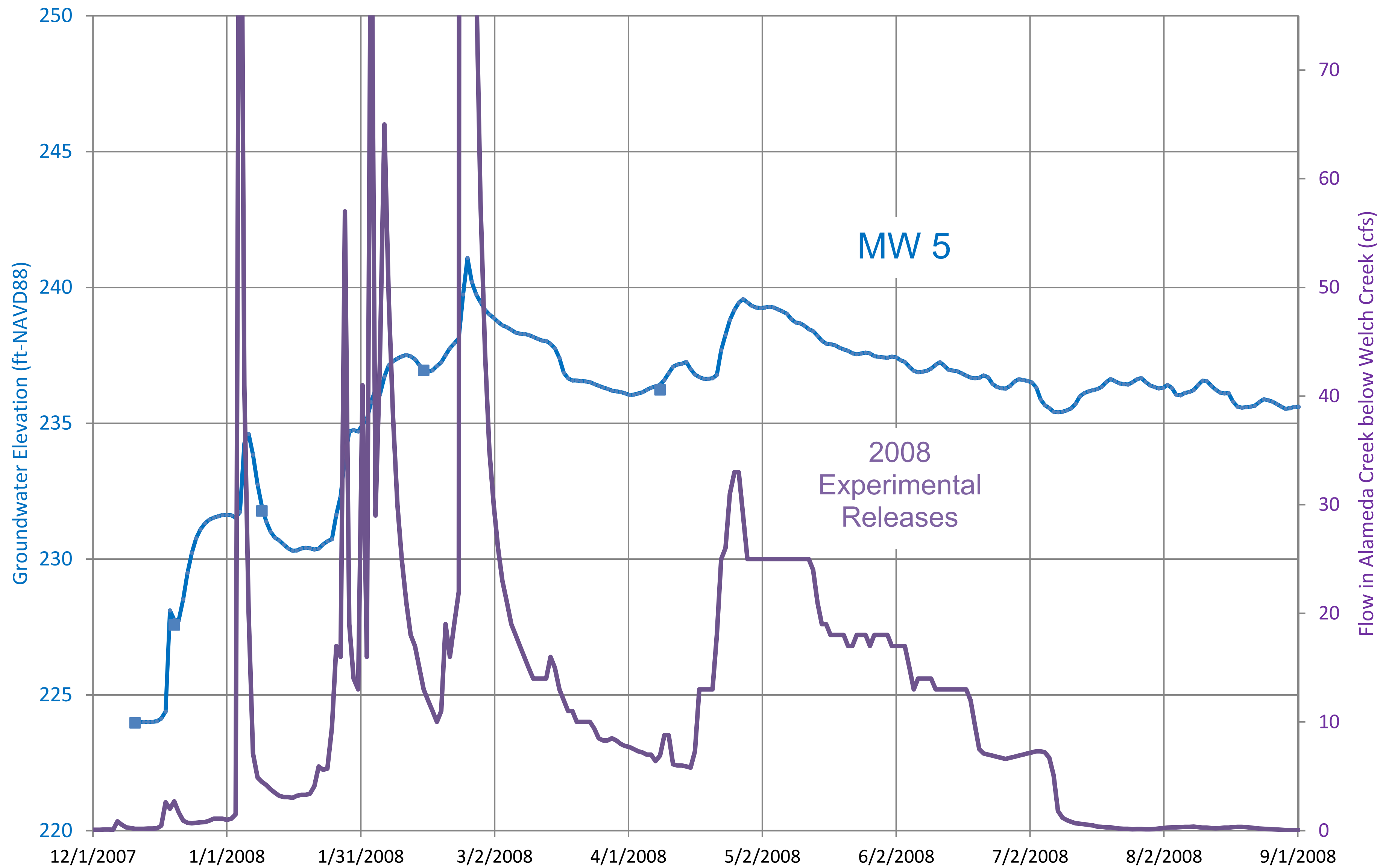

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Figure 11-3
Groundwater Levels during Calaveras Experimental Releases

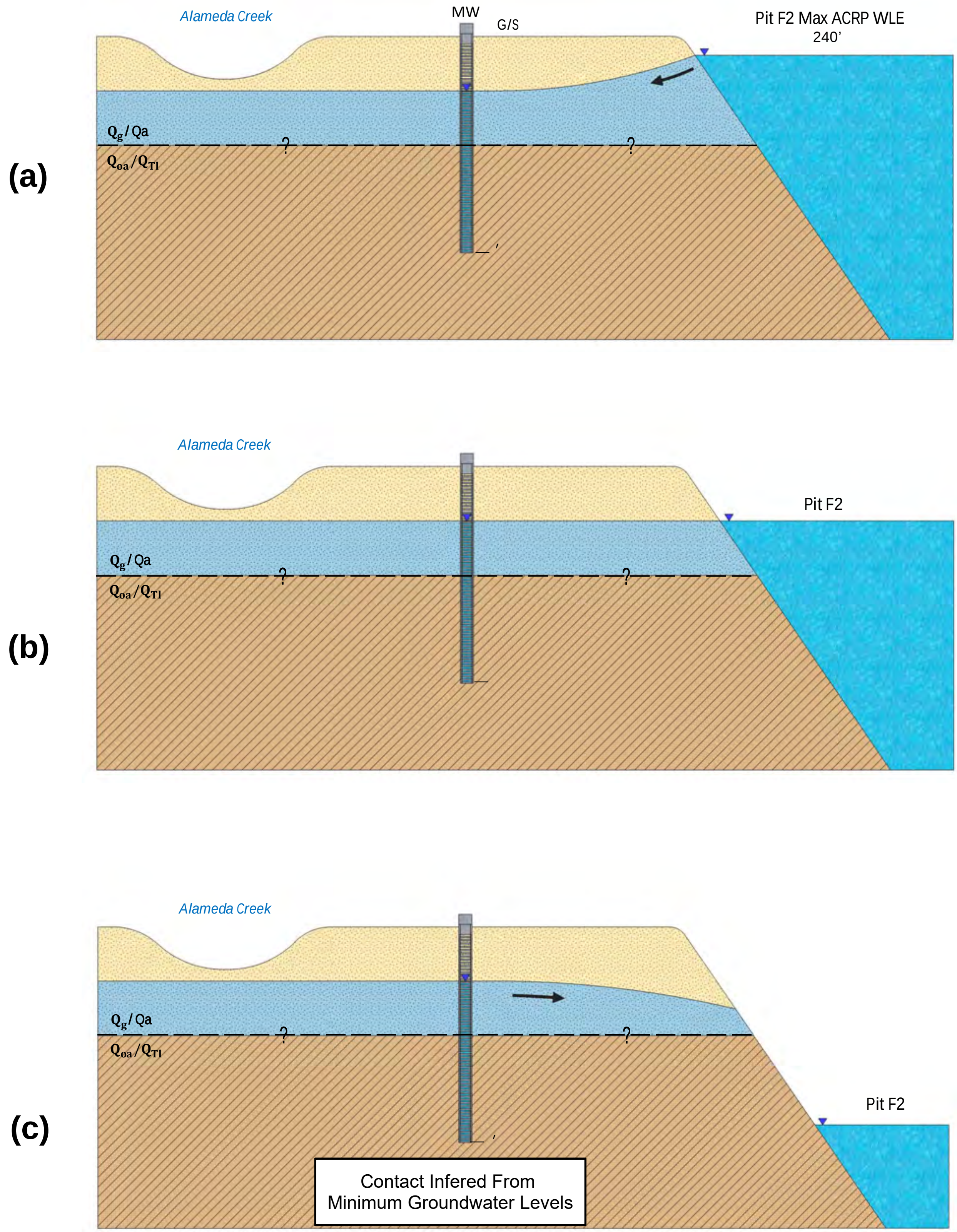

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Figure 11-4
ACRP Maximum Storage (a), Storage same as Groundwater (b) and Storage Disconnected (c)

Appendix 1

Volumetric Calculations of Alluvium (Qa and Qg) in the ACRP Study Area

	A Upstream of Alameda Siphons to Welch Creek			B Alameda Siphons to San Antonio Creek			C San Antonio Creek to Arroyo de la Laguna			A + B + C Entire Aquifer from Welch Creek to Arroyo de la Laguna		
	Qg	Qa	Total	Qg	Qa	Total	Qg	Qa	Total	Qg	Qa	Total
Surface area (acres)[1]	160	162	322	418	249	666	126	624	750	703	1,035	1,738
Gross volumes (ac-ft)	1,665	1,309	2,974	5,773	2,982	8,755	1,171	10,452	11,623	8,609	14,742	23,351
Volume of mined pits (ac-ft)	0	0	0	4,336	1,725	6,061	148	4,916	5,064	4,483	6,641	11,125
Remaining gross volume (ac-ft)	1,665	1,309	2,974	1,437	1,256	2,693	1,023	5,535	6,559	4,125	8,101	12,227

Volumes of Saturated Thickness (acre-feet)

	Upstream of Alameda Siphons to Welch Creek			Alameda Siphons to San Antonio Creek			San Antonio Creek to Arroyo de la Laguna			Entire Aquifer from Welch Creek to Arroyo de la Laguna		
	Qg	Qa	Total	Qg	Qa	Total	Qg	Qa	Total	Qg	Qa	Total
Gross volumes (ac-ft)[2]	1,498	1,152	2,650	4,772	2,377	7,149	475	4,383	4,858	6,745	7,912	14,657
Volume of mined pits (ac-ft)	0	0	0	3,743	1,529	5,272	111	2,260	2,371	3,854	3,789	7,643
Remaining gross volume (ac-ft)	1,498	1,152	2,650	1,029	848	1,877	364	2,123	2,487	2,891	4,123	7,014

Effective Storage Volumes using Specific Yield (acre-feet)[3]

	Upstream of Alameda Siphons to Welch Creek			Alameda Siphons to San Antonio Creek			San Antonio Creek to Arroyo de la Laguna			Entire Aquifer from Welch Creek to Arroyo de la Laguna		
	Qg	Qa	Total	Qg	Qa	Total	Qg	Qa	Total	Qg	Qa	Total
Storage Volume (ac-ft)	375	115	490	257	85	342	91	212	303	723	412	1,135

[1] Areas determined from GIS calculations (see **Figure 6-2a**)
[2] Volumes and excluded mine areas determined from GIS calculations (see **Figure 6-2b**)
[3] Specific Yield for Stream Channel Gravels (Qg) = 0.25; Specific Yield for Younger Alluvium (Qa) = 0.10

Appendix 2

SMP-24

A Report Prepared for

Mission Valley Rock Company
699 Virginia Street
Berkeley, California 94710

FINAL REPORT
CUTOFF WALL CONSTRUCTION OBSERVATION
MISSION VALLEY GRAVEL QUARRY
SUNOL, CALIFORNIA

HLA Job No. 18081,005.04

by

Russell C. Thompson
Project Engineer

Frank L. Rollo
Geotechnical Engineer

REGISTERED PROFESSIONAL ENGINEER
FRANK L. ROLLO
GE733
Exp. 6/30/89
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Harding Lawson Associates
666 Howard Street
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415/543-8422

January 28, 1988

INTRODUCTION

This report presents the results of our construction observation during installation of the soil/bentonite wall (cutoff wall) at the Mission Valley Rock Quarry in Sunol, California. Our work was performed under a service agreement with Mission Valley Rock Company. Our scope of services is outlined in detail in our September 18, 1987 proposal; in summary, it included: 1) analysis of borrow sites for cutoff wall backfill, 2) preparation of plans and specifications, and 3) observation during construction.

We presented the concept of a cutoff wall in a report titled "Ground-Water Investigation for Dewatering," dated August 11, 1987. The plans and specifications were presented on September 24, 1987. Modifications that became necessary during construction are detailed later in this report.

The cutoff wall is 36 inches wide and approximately 48 feet deep. The cutoff wall creates a relatively impervious barrier between the planned quarry and the surrounding water-bearing alluvial, thus reducing the quantity of water that enters, and that must be pumped from, the quarry.

The cutoff wall was constructed using the soil-bentonite slurry trench technique. This technique consists of excavating a trench that is kept open with bentonite slurry. Outside of the trench, soil is mixed with the slurry and additional dry bentonite to form the soil-bentonite backfill. The backfill is then pushed into the trench, displacing the slurry and forming a relatively impervious cutoff wall.

DISCUSSION AND CONCLUSIONS

The cutoff wall was constructed by Slurry Walls, Inc., with the cooperation of Mission Valley Rock personnel and equipment.

The approximate cutoff wall alignment is shown on Plate 1. It should be noted that contours shown on the plate are design cut limits and are not "as-built" contours. The cutoff wall alignment was staked in the field prior to construction by Bissell & Karn, Inc.

The top of the cutoff varies between Elevation 240 and 253 feet, Mean Sea Level datum.

Construction began on October 26, 1987, and it was complete, except for cleanup work, on January 7, 1988. We were on the site full-time during construction.

Initially, the cutoff wall was designed to be continuous and to bound the east, west, and south limits of the planned quarry. The State of California later denied a request to construct the cutoff wall through the 84-inch South Bay Aqueduct easement. To reduce ground-water flow through the easement and into the planned quarry, two additions were made to the original cutoff wall design. On the south side of the easement, the cutoff wall was extended 125 feet to the west (parallel to the easement). On the north side of the easement, parallel to and between the easement and an existing conveyor belt, 180 linear feet of cutoff wall was constructed.

Trench Excavation

The trench was excavated using FMC Linkbelt LS7400A and Koehring 1266D backhoes with modified sticks (lengthened arm) to facilitate deep excavation. The Linkbelt backhoe had several major breakdowns at the beginning of construction and was replaced by the Koehring backhoe for the remainder of the work.

Excavation began along Alameda Creek, proceeded west to Highway 680, and then continued north (parallel to Highway 680). Excavation parallel to Highway 680 was temporarily stopped approximately 650 feet short of design limits because of a very soft subgrade caused by rain. The excavation work was completed along San Antonio Creek, while the soft subgrade parallel to Highway 680 was overexcavated and replaced with drier material. The excavation parallel to Highway 680 resumed, but ultimately it stopped 110 feet short of design limits because of a soft subgrade and the possibility of damaging an existing 12-inch water line near the ground surface.

The plans and specifications call for the trench to be keyed into the dense, impervious gravels (Livermore formation) below. Generally, this required a 45- to 48-foot-deep cut, measured from the existing ground surface. To facilitate excavation, and to help confine the slurry, a 2- to 3-foot-deep "slot" was cut along the cutoff wall alignment. This slot was used as a depressed working pad by the backhoe. We observed the excavated material from the trench to confirm that the soil encountered was as anticipated.

The trench was measured to be 5038 feet long, 45 feet deep (measured from the working grade), and 36 inches wide. The depth of the trench was measured by dropping a weight on the end of a rope that was marked in feet to the bottom of the trench. The depth was generally measured every 20 feet along the alignment of the trench.

Slurry

The bentonite used to produce the slurry was Slurry Mud 90, manufactured by Federal Bentonite. The bentonite was delivered to the site in bulk form and was mixed with water in a Venturi mixer (flash mixer). The bentonite was hydrated in a holding pond prior to being pumped into the trench. Whenever slurry from the pond was being pumped into the trench, its viscosity and unit weight were measured twice daily. Viscosity was measured with a Marsh funnel and unit weight was determined with a mud balance. The viscosity and unit weight are summarized in Table 1.

Backfill

The backfill placed in the cutoff wall trench consisted of select soil (overburden), excavated from the upper 2 to 3 feet of future mining areas, mixed with dry bentonite and bentonite slurry.

The backfill typically consisted of a silty sand with some gravel, enriched with at least 2 percent bentonite by dry weight. Generally, the dry bentonite was added and mixed during stockpiling operations. The backfill was stockpiled along the cutoff wall alignment before the trench was excavated.

The bentonite slurry was taken from the trench or the pond and mixed into the stockpiled material using a dozer. When the backfill was at the desired consistency, it was placed in the trench.

Slump tests were performed on the backfill to check its consistency. Particle size and Atterberg limits tests were performed on backfill samples. The results of these tests are shown on Plates 2 through 8.

Permeability tests were performed on backfill samples obtained just before the material was placed in the trench. The permeability tests were performed in a triaxial cell using falling-head procedures. The confining (consolidation) pressure that was placed on the samples was generally 10 pounds per square inch (psi), with an average pressure gradient equal to 20. The permeability test results are summarized in Table 2. Based on these permeability results, we believe that the cutoff wall has an overall permeability of less than 10^{-6} centimeters per second (cm/sec).

SUMMARY

On the basis of our observations and laboratory testing, we believe that the cutoff wall was constructed in general accordance with the project plans and specifications, except as modified in the field during construction.

A gap in the cutoff wall was created when the State of California denied a request to construct the wall through the 84-inch South Bay Aqueduct easement.

In a letter dated November 16, 1987, we suggested that the flow of water through this gap be monitored this winter, and that if the quantity of water is substantial, the installation of a grout curtain in the spring be considered.

PLATES

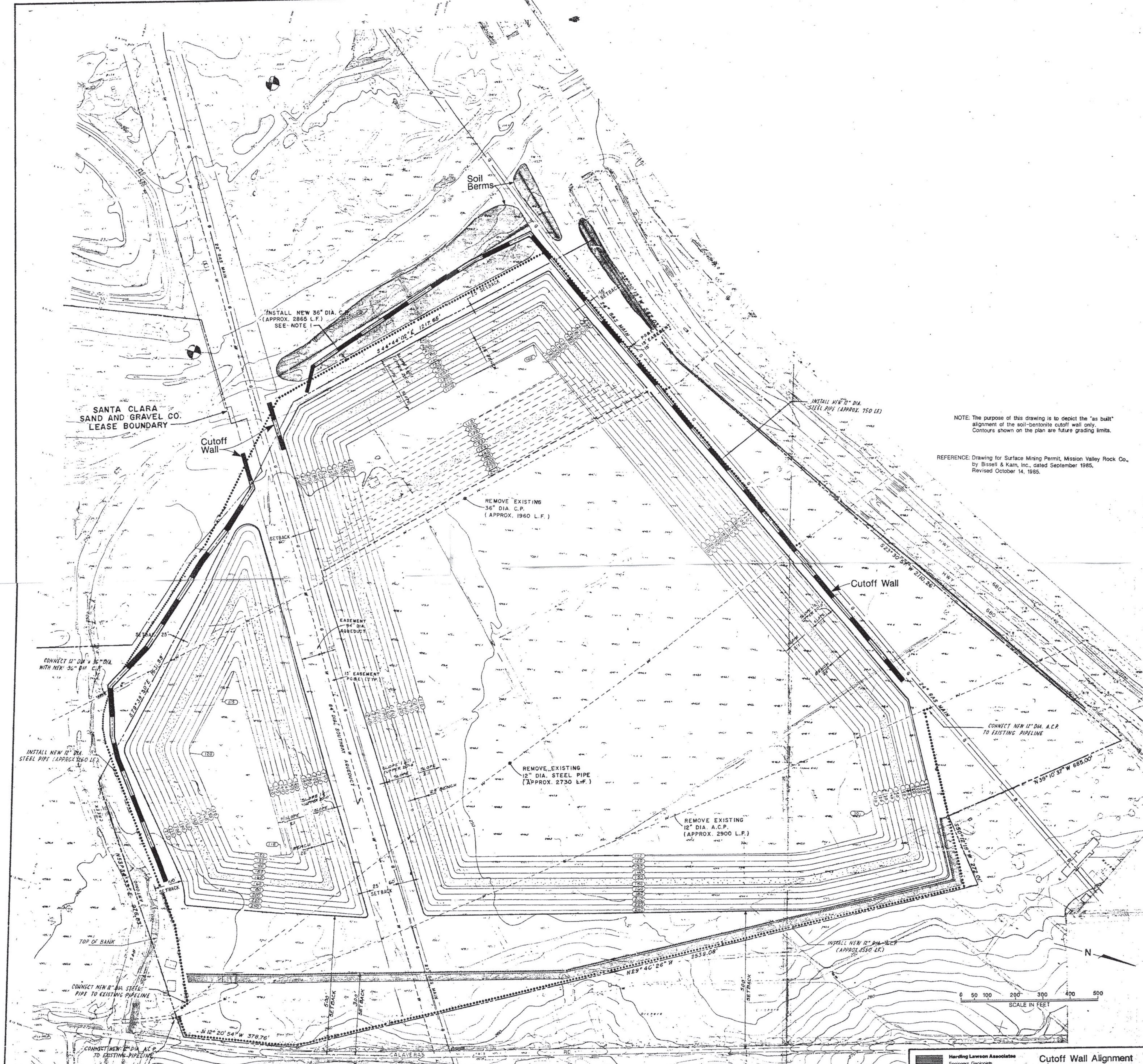
Table 1. Summary of Field Test Results

Date	Pond Slurry Viscosity (seconds)	Pond Slurry Unit Weight (lbs. per cu. ft.)	Trench Slurry Viscosity (seconds)	Trench Slurry Unit Weight (lbs. per cu. ft.)
10/26/87	44	65.5	--	----
10/28/87	50	65.5	55	71.0
10/29/87	71	65.0	64	67.0
10/29/87	54	65.5	51	66.5
10/30/87	56	65.2	54	66.2
10/30/87	48	65.5	54	66.5
11/9/87	48	65.5	60	68.0
11/10/87	--	----	46	66.0
11/10/87	50	65.0	52	67.8
11/11/87	45	65.0	45	66.2
11/11/87	45	65.0	52	67.0
11/12/87	48	65.5	49	68.2
11/12/87	42	65.0	43	65.0
11/13/87	43	65.0	43	68.0
11/13/87	41	65.0	46	69.0
11/14/87	41	65.5	40	65.2
11/14/87	43	65.0	41	66.2
11/16/87	40	65.5	37	65.5
11/16/87	--	----	36	66.2
11/17/87	40	65.5	36	66.2
11/17/87	41	65.2	42	66.5
11/18/87	41	65.2	45	67.2
11/18/87	41	65.0	37	68.3
11/19/87	42	65.5	42	65.5
11/19/87	35	66.0	--	----
11/19/87	43	66.0	--	----
11/24/87	--	----	43	67.4
11/25/87	41	65.2	43	67.4
11/25/87	41	65.5	42	67.0
11/30/87	41	65.2	42	67.1
11/30/87	--	----	42	67.0
12/1/87	41	65.3	41	66.8
12/1/87	--	----	42	67.1
12/2/87	--	----	49	72.1
12/2/87	--	----	47	72.3
12/3/87	--	----	48	71.8
12/3/87	--	----	46	72.5
12/4/87	--	----	46	72.2
12/4/87	--	----	48	72.0

Continued

Table 2. Summary of Cutoff Wall Backfill Test Results

Date	Location	Permeability (centimeters per second)
10/31/87	Trial Batch	4.00×10^{-8}
11/16/87	Sta. 26+50	6.40×10^{-8}
11/24/87	Sta. 22+75	1.10×10^{-7}
12/4/87	Sta. 11+25	1.39×10^{-8}
12/30/87	Sta. 36+50	3.70×10^{-8}
1/7/88	Sta. 3+00	3.01×10^{-8}



NOTE: The purpose of this drawing is to depict the "as built" alignment of the soil-bentonite cutoff wall only. Contours shown on the plan are future grading limits.

REFERENCE: Drawing for Surface Mining Permit, Mission Valley Rock Co., by Bissell & Karn, Inc., dated September 1985, Revised October 14, 1985.

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Engineers, Geologists & Geophysicists

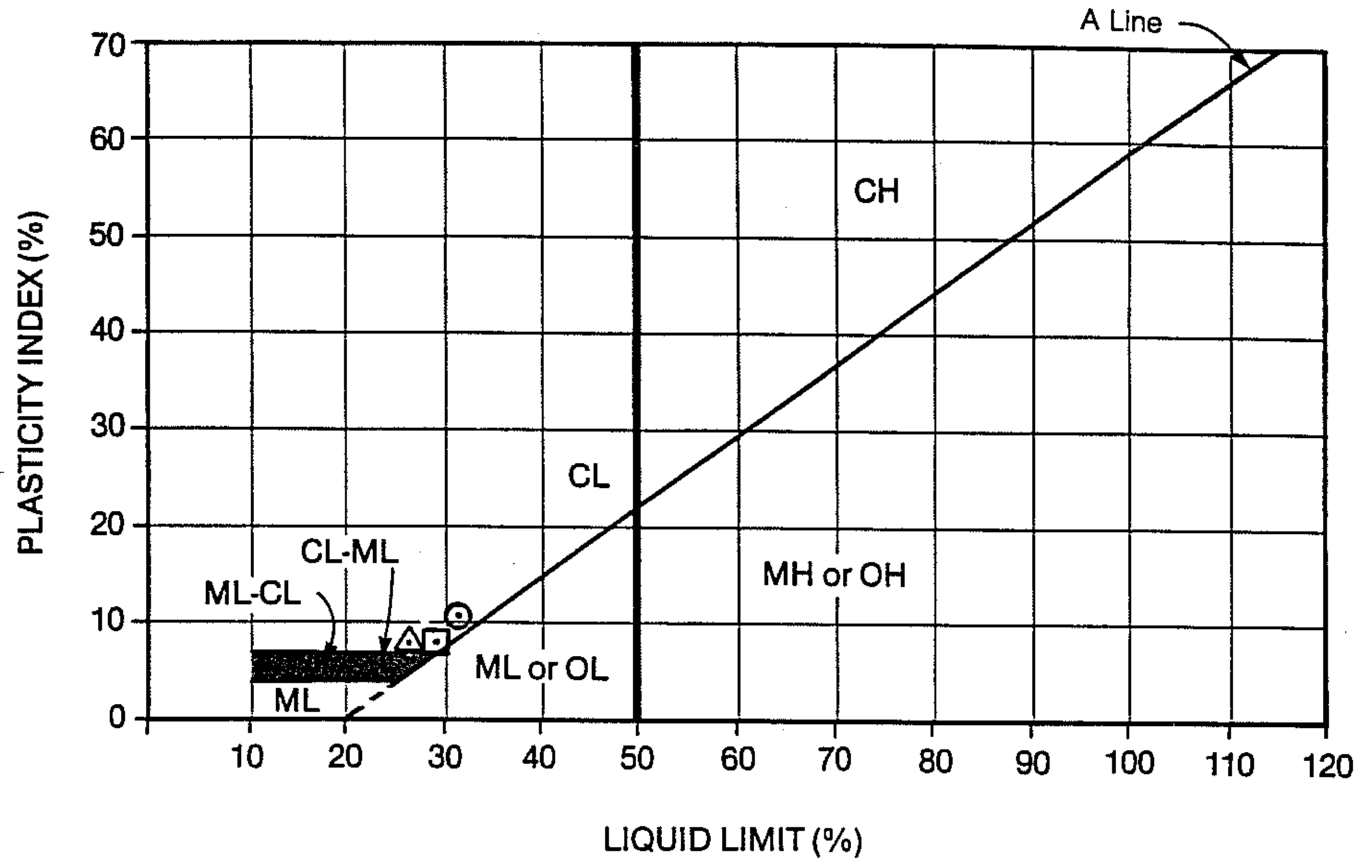
Cutoff Wall Alignment

Mission Valley Rock Slurry Wall
Sunol, Alameda County, California

PLATE 1

DRAWN	JOB NUMBER	APPROVED	DATE
RS	18081,005.04		1/88
REVISED	DATE	REVISED	DATE

Reference: ASTM D 423, 424



Symbol	Source	Classification	Natural M.C. (%)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
⊙	Sta. 26+50	BROWN CLAYEY SAND	—	31	11	24
△	Sta. 22+75	BROWN CLAYEY SAND	—	27	8	8
⊡	Sta. 11+25	BROWN CLAYEY SAND	—	29	8	38

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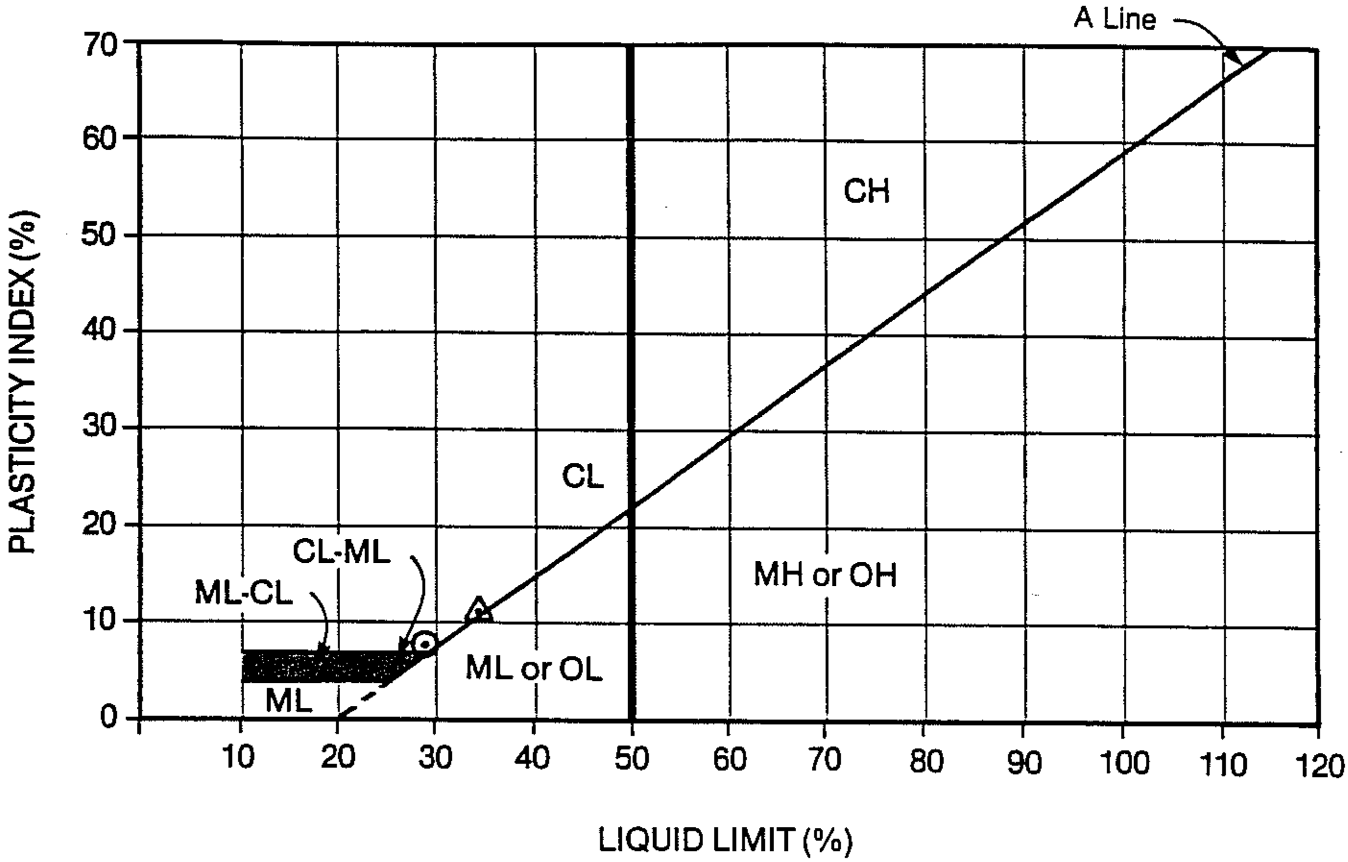
Plasticity Chart
Mission Valley Rock Slurry Wall
Sunol, Alameda County, California

PLATE
2

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
RS	18081,005.04	RCT	1/88		

Reference: ASTM D 423, 424



Symbol	Source	Classification	Natural M.C. (%)	Liquid Limit (%)	Plasticity Index (%)	% Passing #200 Sieve
⊙	Sta. 36+50	BROWN CLAYEY SAND	—	28	8	37
△	Sta. 3+00	GRAY SANDY SILT	—	35	11	77

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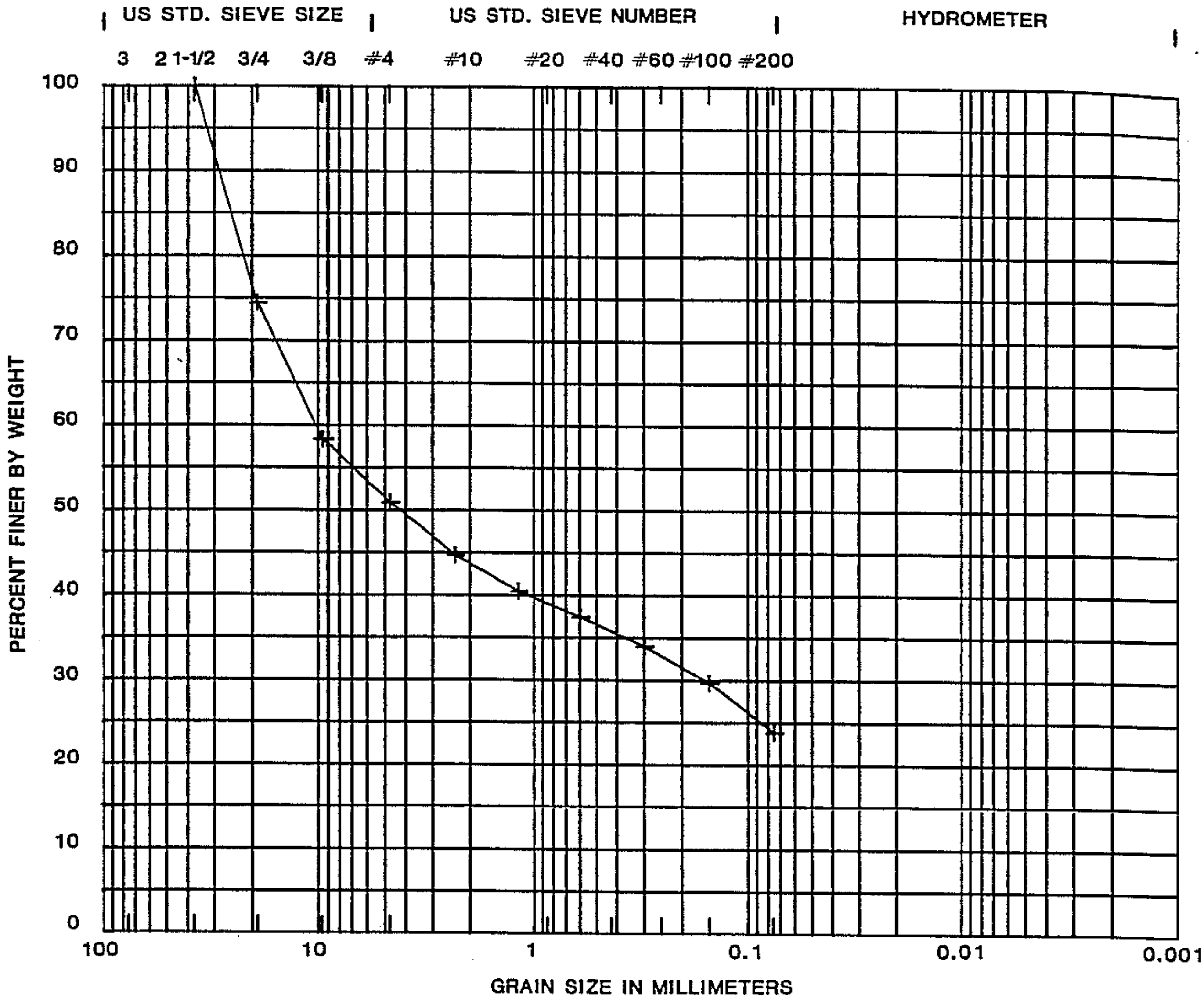
Plasticity Chart

Mission Valley Rock Slurry Wall
Sunol, Alameda County, California

PLATE
3

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
RS	18081,005.04	RCT	1/88		



COBBLES	GRAVEL		SAND			SILT or CLAY
	COARSE	FINE	COARSE	MEDIUM	FINE	

SYMBOL	BORING NUMBER	DEPTH (feet)	CLASSIFICATION
+	26+50	0.00	BROWN CLAYEY GRAVEL W/ SAND (GC*)

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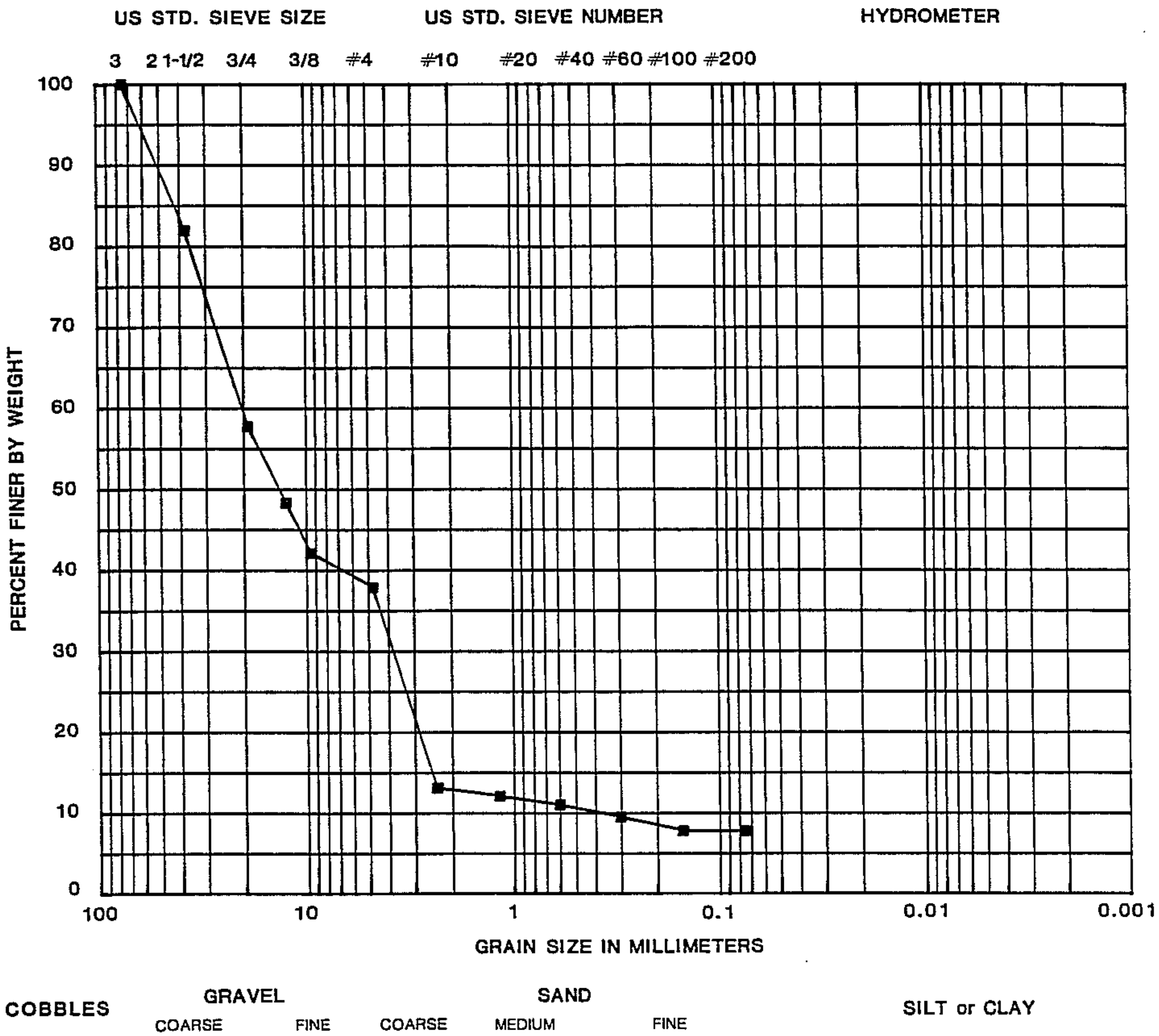
Particle Size Analysis

Mission Valley Rock Slurry Wall
Sunol, Alameda County, California

PLATE
4

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	18081.005.01	AG	1/88		



SYMBOL	BORING NUMBER	DEPTH (feet)	CLASSIFICATION
■	22+75	0.0	BRN. GRAVEL W/CLAY AND SAND (GW-GC)

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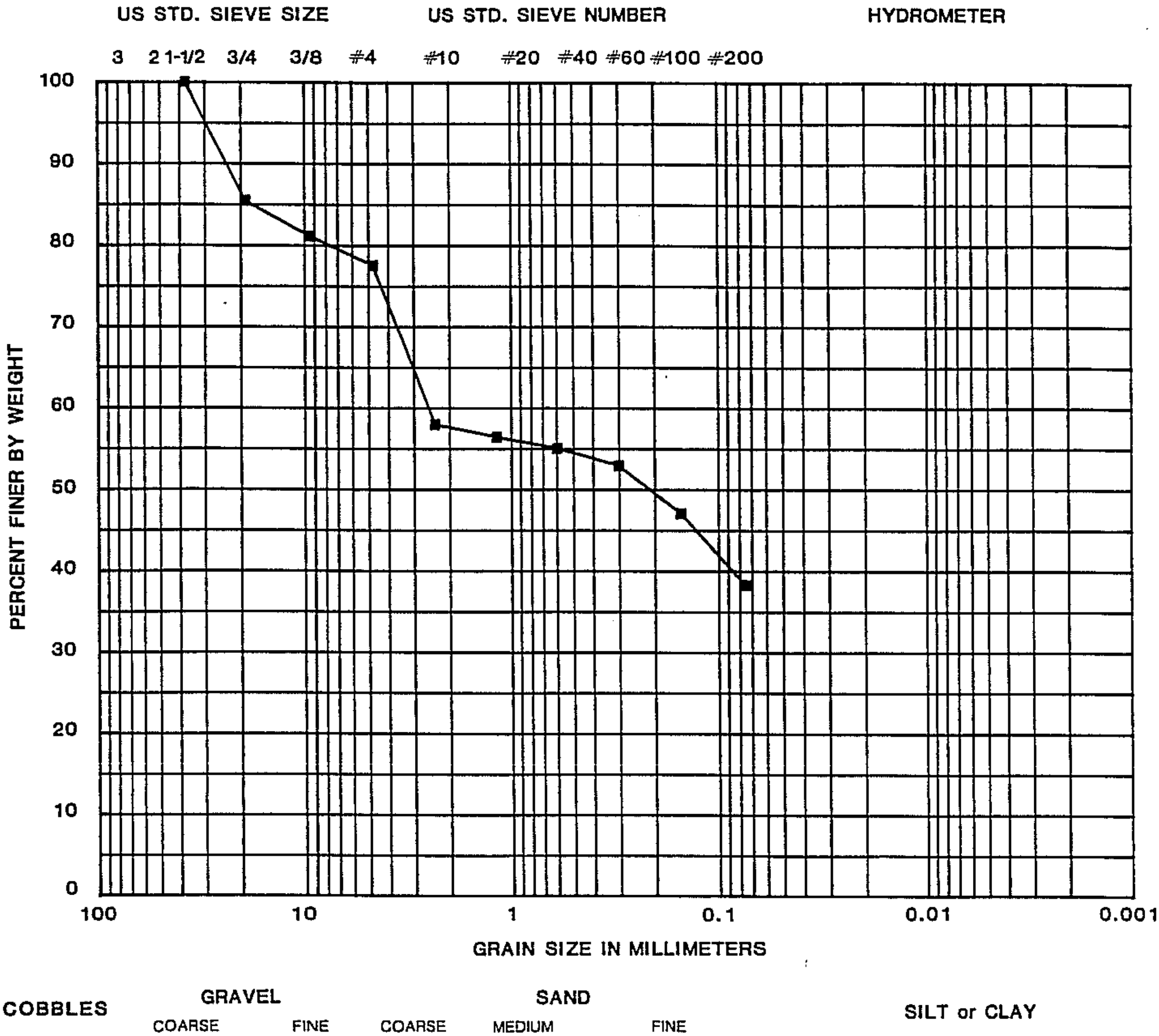
Particle Size Analysis

Mission Valley Rock Slurry Wall
Sunol, Alameda County, California

PLATE
5

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	18081,005.04	AG	1/88		



SYMBOL	BORING NUMBER	DEPTH (feet)	CLASSIFICATION
■	11+25	0.0	BRN. CLAYEY SAND W/GRAVEL (SC)

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Particle Size Analysis

Mission Valley Rock Slurry Wall
Sunol, Alameda County, California

PLATE 6

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
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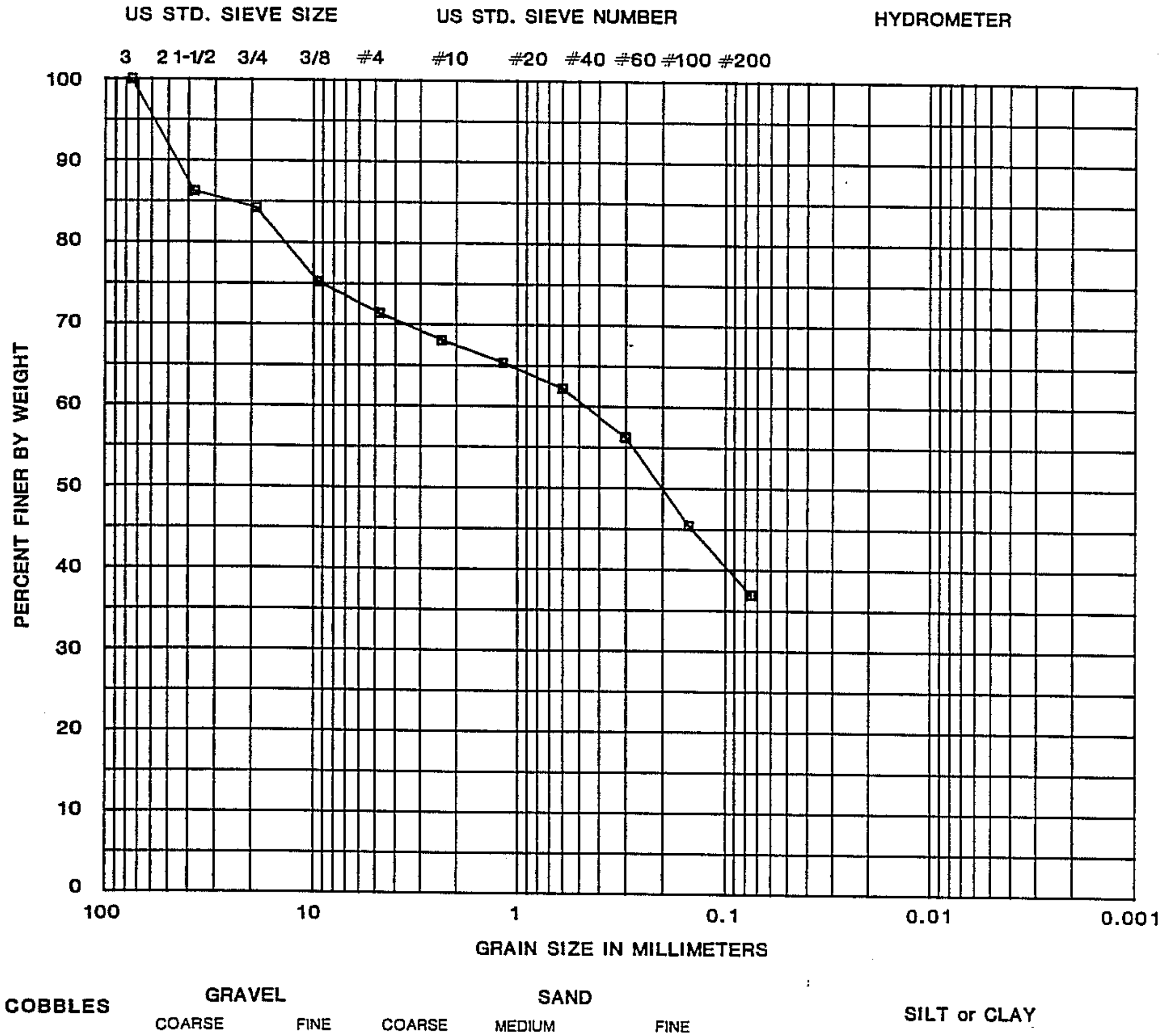

SYMBOL	BORING NUMBER	DEPTH (feet)	CLASSIFICATION
■	36+50	0.0	BROWN CLAYEY SAND W/GRAVEL (SC)

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Particle Size Analysis

Mission Valley Rock Slurry Wall
Sunol, Alameda County, California

PLATE
7

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
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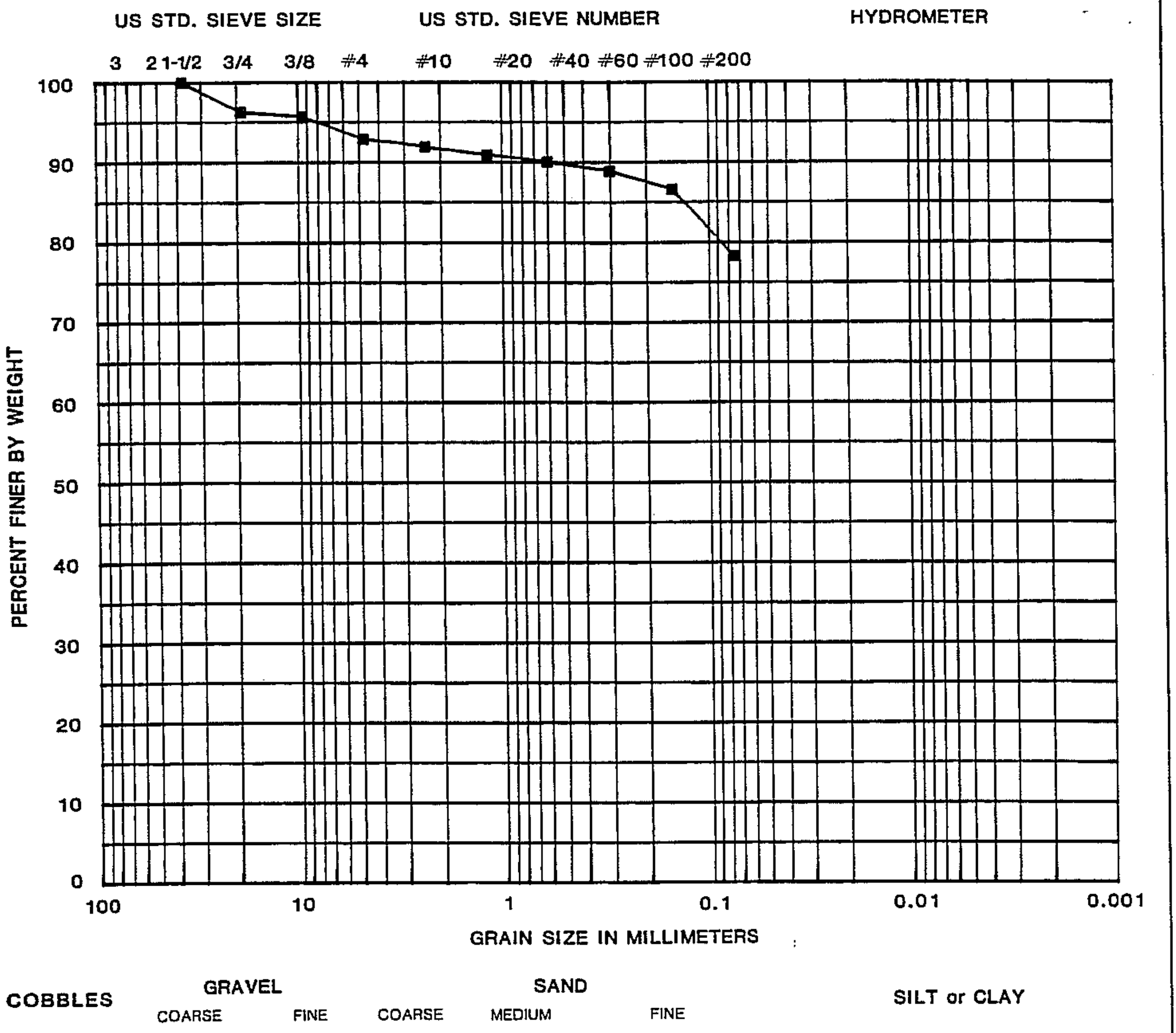

SYMBOL	BORING NUMBER	DEPTH (feet)	CLASSIFICATION
■	3+00	0.0	GREY SILT WITH SAND (ML*)

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& Geophysicists

Particle Size Analysis

Mission Valley Rock Slurry Wall
Sunol, Alameda County, California

PLATE
8

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
	18081.005.04		1/88		

DISTRIBUTION

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Mission Valley Rock Company
699 Virginia Street
Berkeley, California 94710
Attention: Mr. William Howard

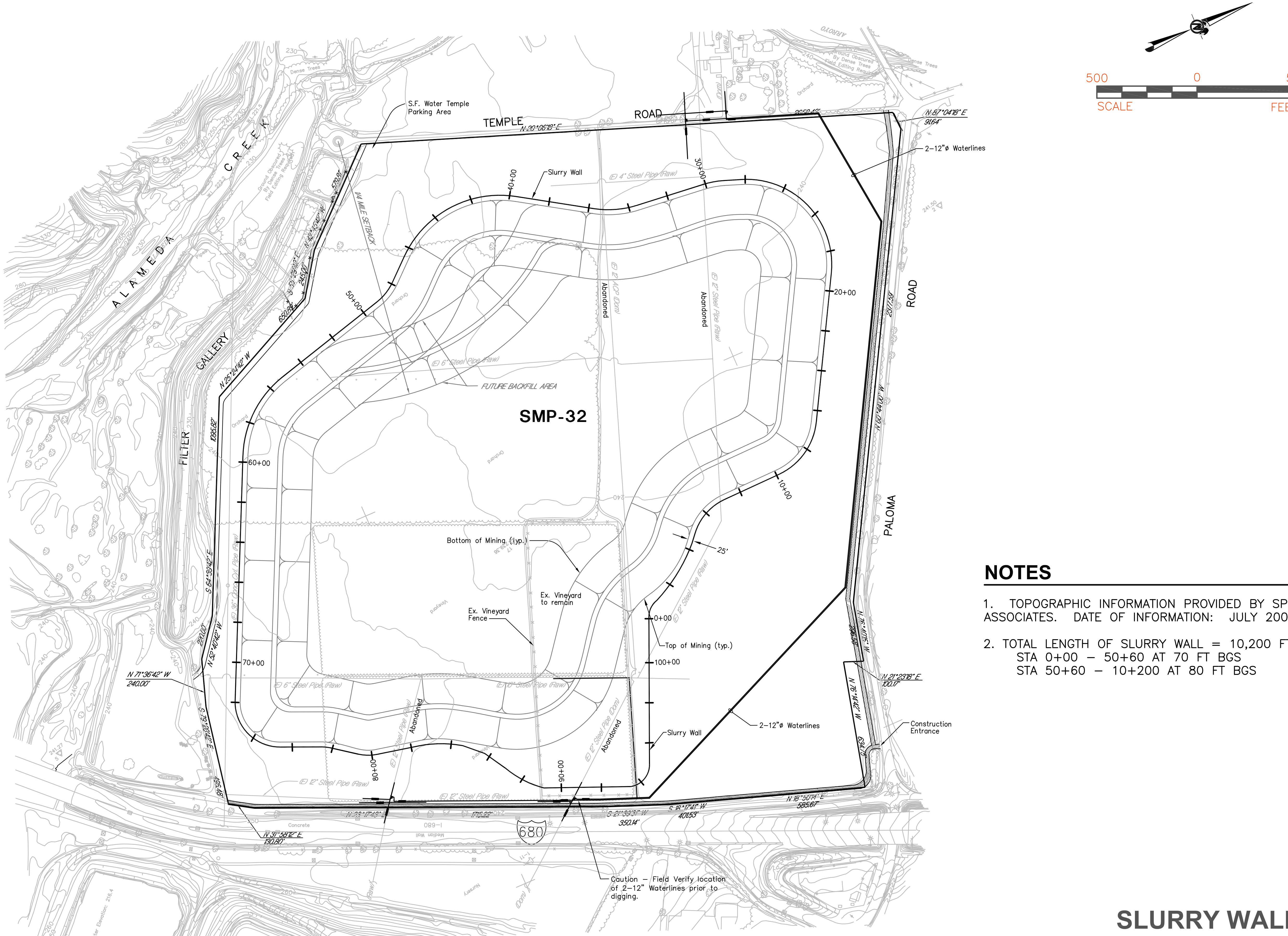
RCT/FLR/nlh

QUALITY CONTROL REVIEWER

Henry T. Taylor

Henry T. Taylor
Geotechnical Engineer

SMP-32



NOTES

1. TOPOGRAPHIC INFORMATION PROVIDED BY SPINARDI ASSOCIATES. DATE OF INFORMATION: JULY 2005.

2. TOTAL LENGTH OF SLURRY WALL = 10,200 FT
   STA 0+00 – 50+60 AT 70 FT BGS
   STA 50+60 – 10+200 AT 80 FT BGS

SLURRY WALL PLAN

FIGURE 1

Golder Associates
Sacramento, CA

PROJECT No. 053-7051 FILE No.Fig 1 – Slurr CADD JDR DATE 07/20/06