ENVIRONMENTAL ANALYSIS

for the

PROPOSED YUBA COUNTY WATER AGENCY ONE-YEAR WATER TRANSFER TO THE CALIFORNIA DEPARTMENT OF WATER RESOURCES AND 2006 PILOT PROGRAM LOWER YUBA RIVER ACCORD FISHERIES AGREEMENT

Prepared for

Yuba County Water Agency

Department of Water Resources, State of California

California Environmental Protection Agency
STATE WATER RESOURCES CONTROL BOARD

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List of Acronyms

ASIP	Action Specific Implementation Plan
Basin Plan	Central Valley Regional Water Quality Control Plan
Bay-Delta	San Francisco Bay/Sacramento-San Joaquin Delta Estuary
BVID	Browns Valley Irrigation District
BWD	Brophy Water District
CALFED	CALFED Bay-Delta Program
CCR	California Code of Regulations
CCWD	Contra Costa Water District
CDEC	California Data Exchange Center
CDFG	California Department of Fish and Game
CDPR	California Department of Parks and Recreation
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CID	Cordua Irrigation District
Corps	U.S. Army Corps of Engineers
CVP	Central Valley Project
CVPIA	Central Valley Project Improvement Act
CWUA	composite weighted usable area
D-1644	State Water Resources Control Board Water Right Decision 1644
DCMWC	Dry Creek Mutual Water Company
Delta	Sacramento-San Joaquin Delta
DWR	California Department of Water Resources
E/I	export-to-inflow ratio
EC	electrical conductivity
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
ESA	Endangered Species Act
ESUs	Evolutionarily Significant Units
EWA	Environmental Water Account
FERC	Federal Energy Regulatory Commission
FOR	Friends of the River
ft/s	feet per second
HIC	Hallwood Irrigation Company
HSC	habitat suitability criteria
Interior	U.S. Department of the Interior
mg/L	milligrams per liter
msl	mean sea level
MWD	Metropolitan Water District
NEPA	National Environmental Policy Act
NGOs	non-governmental organizations
NMFS	National Marine Fisheries Service
NYI	North Yuba Index
PEIS/EIR	Programmatic Environmental Impact Statement/Environmental Impact Report

PG&E	Pacific Gas and Electric Company
RD-1644	State Water Resources Control Board Revised Water Right Decision 1644
Reclamation	Bureau of Reclamation
RM	River Mile
RMF	River Management Fund
RMT	River Management Team
ROD	Record of Decision
RST	Rotary Screw Traps
RWD	Ramirez Water District
RWQCB	Regional Water Quality Control Board
SRA	State Recreation Area
SWP	State Water Project
SWRCB	State Water Resources Control Board
SYRCL	South Yuba River Citizens League
SYWD	South Yuba Water District
TBI	The Bay Institute
TDS	total dissolved solids
TU	Trout Unlimited
USFWS	U.S. Fish and Wildlife Service
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
VAKI	VAKI RiverWatcher System
WQCP	Water Quality Control Plan
WWD	Wheatland Water District
WUA	weighted useable area
YCWA	Yuba County Water Agency
YOY	young-of-year
YRI	Yuba River Index
Yuba Accord	Proposed Lower Yuba River Accord
Yuba Project	Yuba River Development Project

Chapter 1
Introduction

Temporary water transfers have been used as an important mechanism to distribute water throughout California and are considered an effective means of minimizing the overall environmental effects of and increasing the operational flexibility of the State Water Project (SWP) and the Central Valley Project (CVP) (SWRCB 1995). Over the past 16 years, the Yuba County Water Agency (YCWA) has conducted several water transfers to the California Department of Water Resources (DWR) and other water agencies to enhance water supply reliability, protect water quality in the Sacramento-San Joaquin Delta (Delta) (i.e., salinity control), and improve environmental conditions.

The proposed project involves YCWA transferring water from New Bullards Bar Reservoir via the Yuba River Development Project (Yuba Project) facilities to DWR via the lower Yuba River, lower Feather River, Sacramento River, and the Delta. Additionally, YCWA proposes to release water (including water transferred) according to instream flow schedules as described in the "Fisheries Agreement for the 2006 Lower Yuba River Pilot Program" (2006 Pilot Program Fisheries Agreement) (**Appendix A**). Water released by YCWA would be utilized by DWR: (1) in the Environmental Water Account (EWA) Program; (2) in the 2006 Dry Year Water Purchase Program; or (3) for salinity and water quality controls within the Delta. DWR's acquisition of transfer water for use in the EWA and Dry Year Water Purchase programs also may involve the export of this water to state or federal water contractors as authorized by those existing programs. Water exported from the Delta would be pumped to state water contractors via the SWP Harvey O. Banks Pumping Plant or to federal water contractors via the Tracy Pumping Plant, both located in the southern Delta.

YCWA is requesting State Water Resources Control Board (SWRCB) approval of a temporary change in its water-right permit to enable YCWA to operate the Yuba Project to provide minimum instream flows in the lower Yuba River between April 1, 2006 and February 28, 2007 consistent with the proposed 2006 Pilot Program Fisheries Agreement. These operations also would provide transfer water to DWR. Sources of water to meet the flow schedules and for the transfer potentially would include: (1) stored water from New Bullards Bar Reservoir; and/or (2) surface water made available through an increase in groundwater pumping (groundwater substitution program) by farmers within YCWA Member Units. Most of the stored reservoir water would remain in surface storage at New Bullards Bar Reservoir in the absence of the proposed transfer. The groundwater substitution program involves YCWA Member Units use of groundwater supplies in place of: (1) diverting surface water flows from the lower Yuba River; or (2) receiving surface water diversion allocations from YCWA. Member Units participating in groundwater substitution programs are anticipated to include Brophy Water District (BWD), Browns Valley Irrigation District (BVID), Cordua Irrigation District (CID), Dry Creek Mutual Water Company (DCMWC), Hallwood Irrigation Company (HIC), Ramirez Water District (RWD), and South Yuba Water District (SYWD).

DWR has preliminarily indicated that it will purchase a minimum of 62,000 acre-feet of water for use in the EWA Program, with an option to purchase up to an additional 63,000 acre-feet of water, depending upon the EWA and Dry Year Water Purchase Program needs for 2006. This Environmental Analysis presents the assessment required by California Water Code §1727 regarding the potential for unreasonable impacts upon fish, wildlife, or other instream beneficial uses and upon any legal user of the water.

YCWA has the ability to transfer up to 100,000 acre-feet of stored reservoir water and to transfer up to 85,000 acre-feet of water through groundwater substitution. The decisions regarding the ultimate sources and amounts of water for transfer will depend largely upon prevailing hydrologic conditions.

1.1 Background

The SWRCB conducted hearings in 1992 and 2000 that led to the adoption of Water Right Decision 1644 (Decision D-1644 or D-1644) on March 1, 2001. After considering new evidence presented by YCWA, several local water districts in Yuba County, and a coalition of conservation non-governmental organizations (NGOs), the court remanded D-1644 to the SWRCB for reconsideration. Following a two-day hearing, the SWRCB issued RD-1644 on July 16, 2003. RD-1644 contained only minor changes from D-1644.

Since D-1644 was issued, YCWA has been engaged in a set of separate but related negotiations with the parties to the D-1644 litigation, state and federal fisheries agencies, water supply agencies, and other parties to try to resolve flow and other fisheries issues on the lower Yuba River. These collaborative interest-based initiatives led to the development of three interrelated proposed agreements: (1) *"Principles of Agreement for Lower Yuba River Fisheries Agreement"* (Fisheries Agreement); (2) *"Outline of Proposed Principles of Agreements with YCWA Member Units in Connection with Proposed Settlement of SWRCB D-1644"* (Conjunctive Use Agreements); and (3) *"Agreement for the Long-term Purchase of Water from Yuba County Water Agency by the Department of Water Resources and the Bureau of Reclamation"* (Water Purchase Agreement), and related actions. These agreements collectively are known as the Proposed Lower Yuba River Accord (Proposed Yuba Accord).

The Parties to the Proposed Yuba Accord drafted the 2006 Pilot Program Fisheries Agreement, which contains the minimum flow requirements and other key elements of the Proposed Yuba Accord Fisheries Agreement. The 2006 Pilot Program Fisheries Agreement specifies instream flows in the lower Yuba River for the period of April 1, 2006 through February 28, 2007. Additionally, YCWA and DWR entered into the *"Amendment No. 1 to Agreement for the Temporary Transfer of Water from Yuba County Water Agency to the Department of Water Resources"* which incorporates certain accounting practices that are specific to, and necessary for, calculating the volume of water transferred by release of the flows specified in the 2006 Pilot Program Fisheries Agreement. In almost all respects, the transfer of water from YCWA to DWR as described in this Environmental Analysis is a pilot program, which will serve not only the intent of a water transfer between the parties, but also as a test and validation of several key elements of the proposed settlement agreement that is the Proposed Yuba Accord.

1.2 Project Location, Agencies, and Related Facilities

1.2.1 Yuba County Water Agency and Yuba River Development Project

YCWA is a public agency created and existing pursuant to the provisions of the Yuba County Water Agency Act (California Statutes 1959, Chapter 2788, as amended). YCWA owns the Yuba

Project, which is a multi-purpose project and includes features that are operated by YCWA and other entities for water supply, irrigation, flood control, hydropower generation, fisheries protection and enhancement, and recreational activities. Yuba Project facilities include: Our House Diversion Dam on the Middle Yuba River; Log Cabin Diversion Dam on Oregon Creek; Lohman Ridge Tunnel between the Middle Yuba River and Oregon Creek; Camptonville Tunnel between Oregon Creek and New Bullards Bar Reservoir; New Bullards Bar Dam, Reservoir and Fish Release Power facility on the North Yuba River; New Colgate Powerhouse below New Bullards Bar Dam on the Yuba River; and Narrows II Powerhouse below Englebright Reservoir. Other facilities on the lower Yuba River that are owned and operated by Pacific Gas and Electric Company (PG&E) and the U.S. Army Corps of Engineers (Corps) include the Narrows I Powerhouse and Englebright and Daguerre Point dams, respectively. The locations of these facilities are shown on **Figure 1-1.**

1.2.2 California Department of Water Resources State Water Project

The SWP includes 29 storage facilities, 18 pumping plants, four pumping-generating plants, five hydroelectric power plants, and approximately 660 miles of canals and pipelines. Its main purpose is water supply, that is, to divert and store surplus water during wet periods and distribute it to areas of need in northern California, the San Francisco Bay area, the San Joaquin Valley, the Central Coast, and southern California. Other SWP purposes include flood control, power generation, recreation, fish and wildlife enhancement, and water quality improvements in the Delta. Twenty-nine urban and agricultural water agencies have long-term contracts for a total of just over 4 million acre-feet of water per year from the SWP. DWR operates the SWP.

1.2.3 Bureau of Reclamation Central Valley Project

The CVP is a multi-purpose project operated by the Bureau of Reclamation (Reclamation) that stores and transfers water from the Sacramento, San Joaquin, and Trinity River basins to the Sacramento and San Joaquin valleys. Congress authorized the CVP in 1937 for water supply, hydropower generation, flood control, navigation, fish and wildlife, recreation, and water quality control purposes. The CVP service area extends about 430 miles through much of California’s Central Valley, from Trinity and Shasta reservoirs in the north to Bakersfield in the south.

1.3 Purpose and Need for the Proposed Project

The proposed project would enable a one-year water transfer of up to 125,000 acre-feet of water from YCWA to DWR, which would provide YCWA a source of revenue and assist DWR in meeting a substantial portion of the EWA Program asset acquisition goal for 2006. DWR is a Project Agency responsible for administering the EWA Program, including banking, borrowing, transferring, selling, and arranging for the conveyance of EWA water supply and EWA assets. DWR and Reclamation are responsible for seeking to acquire approximately 200,000 acre-feet of water on behalf of the EWA Program annually. DWR also acquires water for its annual Dry Year Water Purchase Program for use in the state and federal water contractors’ service areas. If a portion of the YCWA transfer water is not needed for the EWA Program, then DWR may elect to use the water for the 2006 Dry Year Water Purchase Program. These programs are described in the following sections.

Figure 1-1. Location of Yuba Project Area

1.3.1 Environmental Water Account

The EWA Program provides for environmentally beneficial changes to the operation of the SWP and the CVP, at no water cost to the SWP/CVP water users. This approach to fish protection requires the acquisition of alternative sources of water supply, called "EWA assets", which are used to: (1) augment instream flows and Delta outflows; (2) modify the timing Delta exports to protect sensitive fish species in the Delta during critical life history periods; and (3) compensate for reductions in deliveries of SWP/CVP water supplies because of changes to SWP/CVP operations. Because of the flexible nature of the EWA Program, water transferred to DWR for the EWA Program can be used for a variety of purposes to enhance fisheries and water supply conditions.

The EWA Management Agencies (California Department of Fish and Game [CDFG], National Marine Fisheries Service [NMFS], and U.S. Fish and Wildlife Service [USFWS]) have primary responsibility for managing the EWA assets and exercising their biological judgments to determine what SWP/CVP operational changes are beneficial to the Bay-Delta ecosystem and/or the long-term survival of fish species, including those listed under the federal and state Endangered Species Acts (ESA). The EWA Project Agencies (DWR and Reclamation) cooperate with the Management Agencies in the administration of the EWA Program, including banking, borrowing, transferring, selling, and arranging for the conveyance of EWA assets. The Project Agencies implement the operational changes proposed by the Management Agencies, when feasible.

The EWA Program initially was established as a four-year program to test its viability. Over those years, the EWA agencies developed the EWA Program into a flexible water and fisheries resources management tool toward achievement of the EWA Program objectives. In September 2004, the EWA agencies signed a memorandum of understanding extending the EWA Program through 2007 in accordance with the EWA Operating Principles Agreement (2000). The EWA EIS/EIR Flexible Purchase Alternative included potential asset acquisitions from the Yuba River Basin in the amounts of: (1) up to 100,000 acre-feet of stored reservoir water; and (2) up to 85,000 acre-feet of groundwater, both of which could be provided to the EWA Program by YCWA (Reclamation *et al.* 2003).

1.3.2 California Department of Water Resources - Dry Year Water Purchase Program

The SWP and CVP use a common water supply in the Central Valley. DWR and Reclamation have built water conservation and delivery facilities throughout the Central Valley to deliver water supplies to affected water-rights holders and SWP/CVP contractors. DWR and Reclamation water rights are conditioned by the SWRCB to protect beneficial uses of the water within the Sacramento Valley and Delta regions.

DWR operates water acquisition programs to provide water to environmental programs and to supplement SWP contractors, CVP contractors, and other parties' water supplies. DWR's Dry Year Water Purchase Program allows water agencies to purchase water provided by willing sellers to help offset water shortage conditions. The program is intended to reduce the possibility of adverse economic impacts and hardships associated with water shortages, and is open to all water agencies within the state. By purchasing water from YCWA and other willing sellers through the Dry Year Water Purchase Program, DWR can assist other agencies throughout California in meeting water supply needs for a number of uses including irrigation, domestic use, industrial use, recreation, fish mitigation and enhancement, municipal use, salinity control, and water quality control (YCWA 2004).

During 2001 to 2004, some areas of California experienced water supply deficiencies. DWR responded by implementing the Dry Water Year Purchase Program in each of these years. In 2001, DWR obtained 138,800 acre-feet of water from willing sellers in northern California and provided it to eight water agencies throughout California to help offset their water shortage conditions. In 2002, DWR obtained 22,000 acre-feet of water and provided it to four water agencies throughout California (YCWA 2004). In 2003 and 2004, DWR obtained and provided a total of 11,355 acre-feet and 487 acre-feet of water, respectively. In the 2005, the Dry Water Year Purchase Program was not implemented because there was abundant runoff and reservoirs were filled to capacity in the spring of 2005.

DWR may implement a Dry Year Water Purchase Program in 2006. However, at this time it is unknown whether there will be a need for this program in 2006. If a Dry Year Water Purchase Program is implemented in 2006, then it is possible that DWR may provide some of the YCWA proposed project transfer water to SWP or CVP water contractors.

1.4 Purpose of This Environmental Analysis

This Environmental Analysis provides detailed results of the environmental assessment conducted to evaluate whether implementation of the proposed project would result in any unreasonable impacts on fish, wildlife, or other instream beneficial uses, in accordance with Water Code §1727. SWRCB RD-1644 specifies the current flow requirements in the lower Yuba River. In this analysis, the long-term flow requirements identified in RD-1644 are used as the regulatory baseline of comparison to evaluate potential impacts of the proposed project.

The following sections provide information related to YCWA's petition to the SWRCB regarding temporary changes to YCWA's water right permits in order to implement the proposed project; the SWRCB's statutory provisions under the California Water Code; and exemption of the proposed temporary water transfer from the California Environmental Quality Act (CEQA) under Water Code §1729.

Guidance on the proper scope of the environmental analysis necessary to comply with Water Code §1727 has been provided by past SWRCB decisions associated with temporary water transfers. The following analysis has been prepared consistent with that guidance. Although this analysis is specific to the proposed 2006 Pilot Program, past water transfer analyses were reviewed and used as appropriate. Information presented in this document builds upon YCWA's environmental analyses of recent temporary water transfers (YCWA 2004; YCWA *et al.* 2005; YCWA and SWRCB 2002; YCWA and SWRCB 2003).

1.4.1 Petitions to State Water Resources Control Board

YCWA has filed a petition with the SWRCB under the provisions of Water Code §1725 *et. seq.*, and in conformance with the specific requirements of the California Code of Regulations (CCR) §794 for temporary changes to YCWA's water right permit 15026 to add, during the term of proposed project, the SWP and CVP points diversion/rediversion and place of use that are necessary for water transfers between YCWA and DWR. In addition to the proposed changes in point of diversion, place of use and purpose of use, YCWA has filed a separate petition with the SWRCB to modify the terms of YCWA's water right permits to change the effective date of RD-1644 long-term instream flow requirements from April 21, 2006 to March 1, 2007. An Initial Study/Mitigated Negative Declaration (IS/MND), pursuant to CEQA, will be submitted to the SWRCB to analyze the potential environmental effects of the second petition.

1.4.1.1 Change in Point of Rediversion

YCWA's current petition includes a request to change the authorized points of rediversion in YCWA's permit to add the Clifton Court Forebay (SWP facility) and the Tracy Pumping Plant (CVP facility).

1.4.1.2 Change in Place of Use

YCWA's petition includes a request to expand the place of use in YCWA's permit from the YCWA service area in Yuba County (YCWA Permit No. 15026) for DWR to include the SWP and CVP service areas in the California Central Valley: SWP (as shown on map 1878-1, 2, 3, and 4 on file with Application No. 5629); and CVP (as shown on map 214-208-12581 on file with Application No. 5626).

1.4.1.3 Change in Purpose of Use

YCWA's petition includes a proposed change in the purpose of use in YCWA's permit to include the additional uses of municipal supply, salinity control, and water quality control to the present authorized uses of irrigation, domestic, industrial, recreational, and fish mitigation and enhancement.

1.4.2 State Water Resources Control Board's Statutory Provisions

Pursuant to Water Code §1725 *et. seq.*, the SWRCB Division of Water Rights is authorized to approve temporary changes in YCWA's permits, allowing the transfer or exchange of water, or water rights if the proposed temporary changes:

- Would not injure any other legal user of the water; and
- Would not unreasonably affect fish, wildlife, or other instream beneficial uses.

This Environmental Analysis provides an evaluation of the potential impacts on fish, wildlife, and other instream beneficial uses [Water Code §1727(b)(2)].

1.4.3 California Environmental Quality Act Exemption

As described in CCR §15282 (v), and Water Code §1729, temporary water transfers of up to one year in duration are statutorily exempt from CEQA. The proposed water transfer meets these requirements and definitions within the CCR and Water Code and, therefore, is exempt from CEQA.

Chapter 2
Description of 2006 Pilot Program

YCWA has completed several short-term water transfers in recent years to enhance statewide water supply, Delta water quality, and environmental conditions in the Delta. Water transfers in 2001 through 2004 were to DWR for the EWA; in 2002 and 2004 transfers were made to the DWR Dry Year Water Purchase Program, and in 2002, 2003, and 2004 transfers also were made to Contra Costa Water District (CCWD). In 2005, YCWA planned to conduct a one-year water transfer to DWR for the EWA and the SWRCB approved the transfer; however, due to hydrologic conditions, the 2005 water transfer was not implemented.

Over the course of the past two years, YCWA in collaboration with CDFG, NMFS, USFWS, Reclamation, DWR, several NGOs, and YCWA Member Units, has developed a set of interrelated agreements intended to settle pending litigation regarding SWRCB RD-1644. These proposed agreements include fisheries, conjunctive use and water purchase elements and are collectively known as the Proposed Lower Yuba River Accord (Proposed Yuba Accord). The term of the Proposed Yuba Accord is through 2016, when FERC is scheduled to issue a new long-term license for the Yuba Project. Additionally, the Water Purchase Agreement element of the Proposed Yuba Accord would include provisions for the continued YCWA delivery of water and DWR and Reclamation purchase of water until December 31, 2025, based upon certain conditions to be specified in the agreement.

The Proposed Yuba Accord Fisheries Agreement includes provisions to implement instream flow schedules to enhance the fisheries conditions of the lower Yuba River. The NGOs participating in the Fisheries Agreement are South Yuba River Citizens League (SYRCL), Friends of the River (FOR), Trout Unlimited (TU), and the Bay Institute (TBI). The Conjunctive Use Agreements involve several YCWA Member Units' commitments to conjunctively manage and utilize surface and groundwater resources to meet local water supply needs. Participating YCWA Member Units include BWD, BVID, CID, DCMWC, HIC, RWD, SYWD, and Wheatland Water District (WWD). The Water Purchase Agreement would provide for Reclamation and DWR purchase of water made available through implementation of the instream flow schedules, and compensation to YCWA from Reclamation and DWR. YCWA would utilize some of the Proposed Yuba Accord revenue to implement lower Yuba River fisheries studies, the conjunctive use program, and other related elements of the Proposed Yuba Accord. All of the agreements of the Proposed Yuba Accord must be in place to enable the various project components to proceed.

YCWA, as a CEQA lead agency, and Reclamation, as a National Environmental Policy Act (NEPA) lead agency, currently are preparing an Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the Proposed Yuba Accord. The lead agencies anticipate completion of the EIR/EIS and related environmental compliance processes by early 2007. Should the agencies' decision-making bodies decide to implement the Proposed Yuba Accord, then YCWA, Reclamation, and the other stakeholders and signatories to the agreements would commence implementation of the Proposed Yuba Accord in 2007.

YCWA and DWR propose to conduct a one-year water transfer for 2006 in a manner that would serve as a "pilot program" for the Proposed Yuba Accord. To that end, YCWA also proposes to implement a short-term Fisheries Agreement. YCWA has worked with CDFG, NMFS, USFWS, and the NGOs to develop the 2006 Pilot Program Fisheries Agreement (Appendix A). The 2006 Pilot Program Fisheries Agreement specifies the minimum instream flows based on the Proposed Yuba Accord for the lower Yuba River from April 1, 2006 through February 28, 2007. These instream flow schedules are proposed as an alternative to implementation of RD-1644 long-term instream flow requirements, which currently are scheduled to become effective on April 21, 2006.

YCWA and DWR would complete the proposed one-year water transfer by implementing water accounting methods designed to determine the amount of water released under the 2006 Pilot Program Fisheries Agreement flow schedules that also could provide DWR with transfer water. In essence, the one-year water transfer volume is embedded within the fisheries flow schedules. Depending on the hydrologic conditions in the Delta and in the Yuba River watershed in 2006, the amount of water transferred to DWR via implementing the 2006 Pilot Program Fisheries Agreement flow schedules could be as little as 62,000 acre-feet (or less), or as much as 125,000 acre-feet. If it appears that the flow schedules would make less than the full 125,000 acre-feet available to DWR, then DWR may request YCWA to release additional transfer water. YCWA then would determine if additional water could be made available for transfer to DWR by evaluating potential supplemental surface water transfers and/or groundwater substitution transfer options.

YCWA's policy for past water transfers has been to determine annually if hydrologic and hydrogeologic conditions provide water, under YCWA water rights, that is surplus to the needs of its customers and Yuba County demands. In 2006, if YCWA determines that water may be available for supplemental surface water or groundwater substitution transfer, then YCWA will work with DWR to implement the transfer of additional water above the amount provided through implementing the 2006 Pilot Program Fisheries Agreement flow schedules. These practices would be consistent with California policy as set forth in Water Code §109 and §475. Delivery of the water to DWR would be conducted in a manner that satisfies Water Code §1725 *et. seq*. In 2006, YCWA water transfers therefore primarily will involve water that would otherwise remain in storage at New Bullards Bar Reservoir and/or water made available by implementation of a YCWA Member Unit groundwater substitution program. Some additional transfer water would be made available by the change requested in YCWA's petition to modify the terms of its water-rights permits.

The current petition to the SWRCB is for the temporary change in place of use, point of rediversion, and purpose of use in YCWA's water right permits to facilitate a one-year water transfer associated with the re-operation of YCWA facilities to implement the proposed project. No releases of water pursuant to the agreements between YCWA and DWR will confer any appropriative, public trust, or other right to water on any person or entity.

Implementation of the proposed project would result in YCWA's operation of the Yuba Project to meet the instream flow requirements of the 2006 Pilot Program Fisheries Agreement, resulting in the potential for DWR to acquire a minimum of 62,000 acre-feet and a maximum of 125,000 acre-feet of transfer water. Water released by YCWA would pass through Englebright Reservoir and over Daguerre Point Dam. New Bullards Bar Reservoir storage levels during the proposed project would remain within normal operating limits for the Yuba Project. YCWA would not change its historical practices of providing irrigation water to its Member Units, potentially including implementation of a groundwater substitution program. YCWA releases would flow from the lower Yuba River into the Feather River, and the Sacramento River, and downstream to the Delta. DWR would use the transfer water for environmental purposes in the Delta or would convey the water via the pumping plants at Clifton Court Forebay into SWP conveyance channels. The acquired transfer water would then either be stored in San Luis Reservoir or transported through the California Aqueduct directly to groundwater storage banks or to state or federal water contractors pursuant to the provisions of the EWA or Dry Year Water Purchase programs.

2.1 2006 Proposed Project Hydrology

Hydrologic changes to lower Yuba River flows, New Bullards Bar Reservoir storage and water surface elevations, Feather River flows and Sacramento River flows that would be anticipated under the proposed project are described in the Hydrologic Analysis (**Appendix B**) and in the following sections. The Yuba River Basin, including the Yuba Groundwater Basin features, is described first followed by discussion of the Feather River and Oroville Reservoir, the Sacramento River, the Delta, and facilities south of the Delta.

2.1.1 Yuba River

The current instream flow requirements for the Yuba River are RD-1644 interim requirements established in RD-1644 (SWRCB 2003). The RD-1644 long-term instream flow requirements are scheduled to become effective on April 21, 2006 (**Table 2-1**). The RD-1644 long-term instream flow requirements are used as the basis of comparison in this Environmental Analysis because these flow requirements otherwise would be in effect if the proposed project is not implemented.

Table 2-1. Long-term Instream Flow Requirements - Revised Water Right Decision 1644.

Period	Wet, Above Normal, and Below Normal Years (cfs)		Dry Years (cfs)	
	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage
Sep 15-Oct 14	700	250	500	250
Oct 15-Apr 20	700	500	600	400
Apr 21-Apr 30	--	1,000	--	1,000
May 1-May31	--	1,500	--	1,500
Jun 1	--	1,050	--	1,050
Jun 2	--	800	--	800
Jun 3-Jun 30	--	800	--	800
Jul 1	--	560	--	560
Jul 2	--	390	--	390
Jul 3	--	280	--	280
Jul 4-Sep 14	--	250		250
Period	**Critical Years (cfs)**		**Extreme Critical Years (cfs)**	
Sep 15-Oct 14	400	250	400	250
Oct 15-Apr 20	600	400	600	400
Apr 21-Apr 30	--	1,000	--	500
May 1-May31	--	1,100	--	500
Jun 1	--	800	--	500
Jun 2	--	800	--	500
Jun 3-Jun 30	--	800	--	500
Jul 1	--	560	--	500
Jul 2	--	390	--	390
Jul 3	--	280	--	280
Jul 4-Sep 14	--	250	--	250

RD-1644 long-term minimum instream flow requirements vary by water year type as defined by the Yuba River Index (YRI). The YRI is a water year hydrologic classification index that is based on the unimpaired runoff of the Yuba River for the period of record from 1921 to 1994 and is defined by: (1) the current year's April through July Yuba River unimpaired runoff (50 percent proportional weighting); (2) the current year's October through March Yuba River unimpaired runoff (30 percent proportional weighting); and (3) the previous year's YRI (20 percent proportional weighting).

Yuba River flows are measured at Smartville near Englebright Reservoir at the upper end of the lower Yuba River (Smartville Gage – U.S. Geological Survey (USGS) Station No. 11418000) and at Marysville, about 6 miles upstream of the mouth of the Yuba River (Marysville Gage - USGS Station No. 11421500).

The following sections provide a description of proposed project elements including the 2006 Pilot Program Fisheries Agreement flow schedules, groundwater substitution operations, and potential supplemental surface water and groundwater transfer operations.

2.1.1.1 2006 Pilot Program Fisheries Agreement

Flow Schedules

The NYI is an indicator of the amount of water available in the North Yuba River at New Bullards Bar Reservoir that could be utilized to achieve proposed project flow schedules on the lower Yuba River through operations of the reservoir **(Figure 2-1)**. The NYI is comprised of two components: (1) active storage in New Bullards Bar Reservoir at the commencement of the current water year; and (2) total inflow to New Bullards Bar Reservoir for the current water year, including diversions from the Middle Yuba River and Oregon Creek to New Bullards Bar Reservoir.

The water year hydrologic classification for the Yuba River to determine the flow requirements of Yuba County Water Agency's water right permits shall be based on the North Yuba Index. Determinations of a year's flow schedule year type shall be made in February, March, April, and May and for any subsequent updates.

Flow Schedule Year Type	North Yuba Index Thousand Acre-Feet (TAF)
Schedule 1	Equal to or greater than 1,400
Schedule 2	Equal to or greater than 1,040 and less than 1,400
Schedule 3	Equal to or greater than 920 and less than 1,040
Schedule 4	Equal to or greater than 820 and less than 920
Schedule 5	Equal to or greater than 693 and less than 820
Schedule 6	Equal to or greater than 500 and less than 693

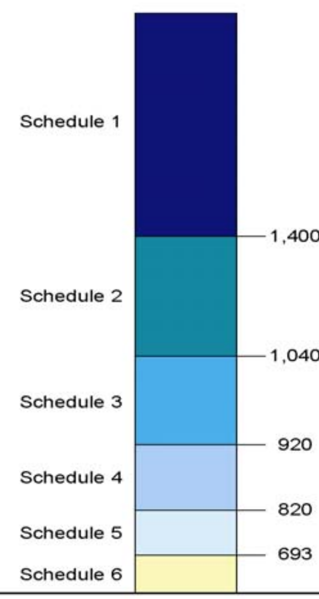

Figure 2-1. Flow Schedule Year Types Based on the North Yuba Index for Establishing Required Flows During the 2006 Pilot Program.

As noted, RD-1644 long-term instream flow requirements are determined by the YRI, whereas instream flows to be met under the proposed project are determined by the NYI. The YRI includes five water year types (wet, above normal, below normal, dry, and critical). The NYI has six water year types, which approximately correspond to the 2006 Pilot Program Fisheries Agreement flow schedules 1 through 6.

The proposed project flow schedules primarily were developed to achieve maximum benefit to lower Yuba River anadromous salmonid fisheries resources under a range of hydrologic conditions that potentially could occur in the Yuba River Basin. These flow schedules were developed in consultation with jurisdictional fisheries agencies (CDFG, NMFS, USFWS), and with NGO participation. The combination of the six flow schedules in conjunction with the NYI for determining which flow schedule would be used during a particular hydrologic year is intended to provide a more tailored set of flows for the lower Yuba River than the flows that would be achieved under RD-1644 flow requirements. The flow schedule numbers increase as hydrologic water years become drier. During wetter years (schedules 1 and 2), minimum flow requirements under the proposed project represent the range of optimum conditions in the lower Yuba River for all salmonid life stages. Schedules 3 through 6 would occur during drier years (mostly dry and critical water years). These flow schedules were developed to provide instream flow ranges that would protect fisheries resources by maintaining sufficient flows during key life stages such as adult immigration and holding, spawning and embryo incubation, and juvenile rearing and smolt emigration. For some species of salmonids, these life stages occur during the summer and late fall when seasonal water temperatures typically reach peak levels.

Peak flows in the Yuba River during wetter year classes under unimpaired flow conditions generally would occur during the month of April. During drier year classes, peak flows tend to be skewed from May to April (**Figure 2-2**). Consistent with this trend, the proposed project flow schedules were developed to provide peak flows earlier in the spring during drier water years. These flow patterns could facilitate the emigration of juvenile salmonids before water temperatures reach their seasonal peaks during the summer months and also could provide lower water temperatures during the late summer and fall for juvenile rearing and adult immigration life stages.

Except as otherwise stated in the 2006 Pilot Program Fisheries Agreement, YCWA would comply with the flow schedule requirements in **Table 2-2** during the period of the proposed project. Schedules 1-6 in Table 2-2 specify the minimum instream flow requirements measured at the Marysville Gage, and Schedules A and B specifies minimum instream flow requirements at the Smartville Gage. The Smartville Gage flows may control at certain times of the year depending on diversion patterns from the lower Yuba River; at other times of the year, the Marysville Gage flow requirements would control. Smartville Gage flow schedules (A and B) were developed only for months when those flows might control (i.e., in the fall and winter months). During the late spring and summer months, the irrigation demands at the Daguerre Point Dam, added to the minimum flow requirements at the downstream Marysville Gage, will always control the required releases; thus, no Smartville Gage requirements were developed for those months.

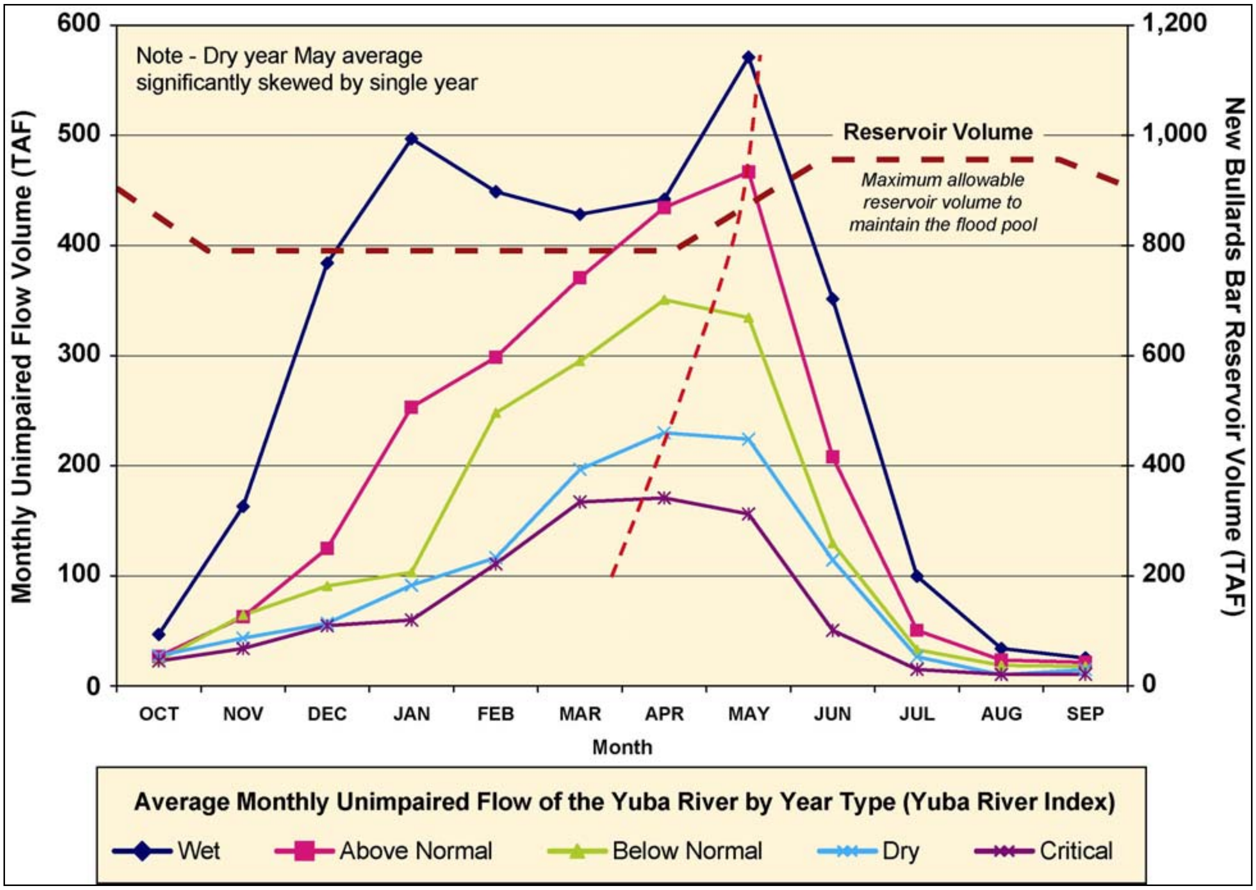

Figure 2-2. **Average Monthly Unimpaired Flow Volumes at the Smartville Gage from 1922 through 2004.**

Table 2-2. 2006 Pilot Program Fisheries Agreement Lower Yuba River Instream Flow Schedules.

MARYSVILLE GAGE (cfs)															
	APR		MAY		JUN		JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	Total Volume (AF)
Schedule	1-15	16-30	1-15	16-31	1-15	16-30	1-31	1-31	1-30	1-31	1-30	1-31	1-31	1-29	
1	1,000	1,000	2,000	2,000	1,500	1,500	700	600	500	500	500	500	500	500	531,178
2	700	800	1,000	1,000	800	500	500	500	500	500	500	500	500	500	385,788
3	700	700	900	900	500	500	500	500	500	500	500	500	500	500	367,738
4	600	900	900	600	400	400	400	400	400	400	500	500	500	500	330,846
5	500	600	600	400	400	400	400	400	400	400	500	500	500	500	303,672
6	350	500	500	400	300	150	150	150	350	350	350	350	350	350	210,349
* Indicated flows represent average volumes for the specified time period. Actual flows may vary from the indicated flows according to established criteria. * Indicated Schedule 6 flows do not include an additional 30 TAF available from groundwater substitution to be allocated according to established criteria.															
SMARTVILLE GAGE (cfs)															
A	700	-	-	-	-	-	-	-	700	700	700	700	700	700	-
B	600	-	-	-	-	-	-	-	500	600	600	550	550	550	-
* Schedule A used with Schedules 1, 2, 3 and 4 at Marysville Gage. * Schedule B used with Schedules 5 and 6 at Marysville Gage.															

The specific flow schedule that would be implemented during the 2006 Pilot Program would be determined by the value of the NYI illustrated in Figure 2-1, with potential adjustments for dry year storage.

2.1.1.2 Surface Water Supplemental Transfers

Hydrologic conditions prevented completion of a surface water transfer by YCWA during 2005. As a result, the NYI was approximately 62,000 acre-feet higher as of October 1, 2005 than it would have been if a water transfer had taken place in 2005. If hydrologic conditions permit, if a transfer of at least 62,000 acre-feet would be completed in the course of implementing the appropriate flow schedule under the 2006 Pilot Program Fisheries Agreement, and if DWR requests an additional transfer volume, then YCWA may make a Surface Water Supplemental Transfer of up to 63,000 acre-feet (or the amount required to complete a total transfer of 125,000 acre-feet). If YCWA decides to make any Supplemental Surface Water Transfer, then the following conditions would apply:

- The flow schedule for the water involved in the Supplemental Surface Water Transfer would be set to achieve maximum fisheries benefit during the transfer period, as determined by YCWA in consultation with the River Management Team (RMT);
- The minimum flow at the Marysville Gage after May 31, 2006 and before any increase of flows above the flow schedule as a result of the Surface Water Supplemental Transfer would remain within 300 cfs (or greater than 300 cfs upon consent of the RMT) of the maximum flow above the flow schedule as a result of the Surface Water Supplemental Transfer;
- Any change in flows would (within YCWA's operational ability) be gradual and would not exceed 300 cfs per day, and will be as close as possible to 100 cfs in any four-hour period as is operationally feasible, although a buffer of 50 cfs (resulting in a potential flow change of up to 150 cfs per four-hour period) is allowable provided that all reasonable efforts are made to adhere to a limit of 100 cfs change per four-hour period; and
- Any ramp-down of flows would be gradual and not exceed 400 cfs per day, would be as close as possible to 100 cfs in any four-hour period as is operationally feasible, and would include the 50 cfs operational buffer as described in this section.

If it appears that hydrologic conditions would allow YCWA to make a Supplemental Surface Water Transfer, then on April 10, 2006, YCWA would provide DWR and the RMT with a preliminary indication of the supplemental transfer. On May 1, 2006, YCWA would provide a refinement of the preliminary transfer indication. The May 1 refinement would include a draft implementation schedule, after consultation with the RMT, for the Supplemental Surface Water Transfer. Unless otherwise indicated by YCWA, the implementation schedule for the transfer would become final no later than May 15, 2006, according to the provision of the 2006 Pilot Program Fisheries Agreement.

Given the low probability of a surface water supplemental transfer or groundwater substitution transfer, the analysis essentially addressed potential effects on the system. The result of this transfer would be a slight shift (increase) in the probability of occurrence of mid-range flows occurring over the range of flows analyzed. The result of this shift would be cooler summer water temperatures providing a potential beneficial effect.

2.1.1.3 River Management Team

During the course of the proposed 2006 transfer, and in accordance with the 2006 Pilot Program Fisheries Agreement, a RMT will be convened to provide input for lower Yuba River operations. The RMT would consist of a Planning Group and an Operations Group. The Planning Group would include representatives of the parties to the 2006 Pilot Program Fisheries Agreement, which are YCWA, NMFS, USFWS, CDFG, DWR, Reclamation, PG&E, and the NGOs. The Operations Group would include one representative each of: (1) YCWA; (2) PG&E; (3) CDFG, NMFS, and USFWS, where the one representative would rotate between these three agencies; (4) the NGOs; and (5) DWR.

Actions that could be undertaken by the Planning Group include the following:

- Setting the flow schedule for any surface water or groundwater substitution operations;
- Altering instream flow requirements as appropriate (within specified limits) to achieve maximum fisheries resource benefits;
- Developing and implementing fisheries monitoring studies on the lower Yuba River; and
- Allocating expenditures from the River Management Fund (RMF).

The Operations Group would meet and hold conference calls as necessary to carry out the actions identified above. If necessary to carry out its functions, the Planning Group may convene a Technical Working Group, which would include such members as the Planning Group may appoint. Each Planning Group principal representative may designate one or more secondary representative(s) who may participate in the Planning Group discussion of a given issue. The Operations Group would provide YCWA with guidance in the implementation and alteration of flow schedules, as well as other actions agreed upon by the Planning Group. Each Operations Group member may designate in its discretion additional technical experts to participate in the Operations Group's discussions of issues (Appendix A, 2006 Pilot Program Fisheries Agreement).

Temporary Alteration of Flow Schedule

The RMT, through a decision by its Planning Group, could decide to temporarily alter applicable instream flow requirements in the 2006 Pilot Program Fisheries Agreement (within specified limits) at any time during the proposed project, so long as the agreed-to instream flows would comply with the applicable requirements of YCWA's FERC license and YCWA's water right permits.

Alterations to the 2006 Pilot Program Fisheries Agreement's instream flow schedules could occur only during March through October of the proposed project. Any alterations to the instream flows would not: (1) cause decreases from the minimum instream flows specified under the proposed project of more than 20 percent; (2) shift the timing of flows released from New Bullards Bar Reservoir specified under the proposed project by more than six weeks; (3) reduce the amount of stored water remaining in New Bullards Bar Reservoir at the end of the calendar year during which the temporary alteration occurs below the amount that would result without the temporary alteration; or (4) result in a net decrease in the total amount of water released for the applicable minimum instream flow requirements for the calendar year. Absent RMT consensus, changes to applicable instream flow requirements in 2006 Pilot Program Fisheries Agreement flows would not occur (Appendix A).

Any alterations to the 2006 Pilot Program Fisheries Agreement's instream flow schedules approved by the RMT would have to result in flows that were equal to or greater than the minimum flows required by applicable regulatory requirements.

2.1.1.4 River Management Fund

The RMF is established as an element of the Proposed Yuba Accord with the purpose of funding studies and research on the lower Yuba River to investigate the impacts and effects of the Proposed Yuba Accord flow schedules. During the term of the proposed project, YCWA will make payments to the RMF in accordance with the terms of the 2006 Pilot Program Fisheries Agreement. Disbursement of RMF funds will be directed by the RMT. The RMT would adopt a structure for fund allocation based on specific prioritized goals for monitoring, studies, actions and activities. Money from the RMF may be spent for any of the following actions:

- Monitoring and evaluating the effectiveness of the implementation of the 2006 Pilot Program Fisheries Agreement, including flow schedules, and the 2006 water transfer agreement;
- Evaluating the condition of fisheries resources in the lower Yuba River;
- Evaluating the viability of lower Yuba River fall-run Chinook salmon and any subpopulations of the Central Valley steelhead and spring-run Chinook salmon Evolutionarily Significant Units (ESUs) that may exist in the lower Yuba River;
- Implementing habitat improvement and non-flow enhancement actions and activities;
- Purchasing water for augmentation of instream flows in the lower Yuba River above the minimum flow requirements specified by the flow schedules (Table 2-2);
- Retaining expert advice for specific technical questions;
- Retaining an expert or experts for dispute resolution processes; or
- Paying local shares of grant-funded projects for fish or fish habitat in the lower Yuba River, specifically to facilitate unique grant matching opportunities.

YCWA would continue to directly fund certain data collection activities and studies on the lower Yuba River. Specifically, YCWA would continue to fund the collection of flow and water temperature data including daily instream flows at the Smartville and Marysville gages, and hourly records of water temperatures at Marysville, Smartville, and Daguerre Point Dam. Additionally, YCWA will continue to fund and conduct the redd dewatering and fry stranding studies through the completion of the study plan that has been submitted to the SWRCB (see Appendix B for a more detailed discussion of carryover storage).

2.1.1.5 New Bullards Bar and Englebright Reservoirs

YCWA would temporarily modify normal storage and water release operations of its Yuba Project facilities, including New Bullards Bar Reservoir, to implement the 2006 Pilot Program Fisheries Agreement that would allow for the provision of water for DWR acquisition. YCWA's operational target storage level for the end of September is 705,000 acre-feet for New Bullards Bar Reservoir without the proposed project. This storage amount is the target storage specified in YCWA's power purchase contract with PG&E for the Yuba Project.

Under the proposed project, YCWA would draw down New Bullards Bar Reservoir by up to 125,000 acre-feet by the end of the proposed project, resulting in a potential reservoir storage level of 594,865 acre-feet at the end of September 2006 and potential reservoir storage of 684,344 acre-feet at the end of February 2007 (end of proposed project period). The corresponding reservoir surface water elevations would be 1,866 feet above mean sea level (msl) in September 2006 and 1,902 feet msl in February 2007 under the proposed project.

The water transfer amount would be limited so that the drawdown in New Bullards Bar Reservoir required for all releases would not reduce carryover storage below a level sufficient to meet local and instream requirements in 2006 and 2007 (Appendix B).

Englebright Reservoir is a re-regulating reservoir subject to frequent small storage changes. As a result, Englebright Reservoir storage would remain relatively unaffected by the proposed project and would remain within normal historical operation limits (MWH 2005).

New Bullards Bar Reservoir Refill Conditions/Procedures

YCWA would refill New Bullards Bar Reservoir from North Yuba River flows under a schedule mutually agreed upon by DWR and YCWA titled "*New Bullards Bar Reservoir Refilling Conditions and Procedures for Water Transfer from Yuba to the Department*" (Refill Agreement). The Refill Agreement is intended to ensure that future refill of water released from storage (i.e., the transfer total minus the total excess groundwater pumped) in New Bullards Bar Reservoir resulting in purchases of water from YCWA by DWR would not adversely impact the SWP or CVP. The procedures included in the Refill Agreement provide for an accounting of refill of New Bullards Bar Reservoir resulting from the proposed project during balanced conditions in the Delta.

2.1.1.6 Yuba Groundwater Basin

Under the proposed project, YCWA would operate a groundwater substitution program with participating Member Units in lieu of surface water deliveries during a Schedule 6 water year, which would correspond to the driest 2 to 3 percent of water years. These operations would result in an additional 30,000 acre-feet of water flowing in the lower Yuba River at the Marysville Gage. The total volume of the groundwater substitution component would be determined by May 1, 2006.

Subject to the requirement of transferability (per the 2006 Pilot Program Fisheries Agreement), the RMT, through a decision by its Planning Group, would determine the flow schedule for the 30,000 acre-feet if a Schedule 6 water year were in effect during the proposed project. This flow schedule would be set to achieve a maximum fisheries resource benefit during the proposed project transfer period (as stated in the 2006 Pilot Program Fisheries Agreement).

YCWA would sell water to its Member Units under existing contracts, consistent with historical and recent practices and would comply with Water Code §1732 to protect groundwater resources. Groundwater substitution operations would involve the YCWA Member Units' agreement to temporarily pump groundwater rather than divert surface flows near Daguerre Point Dam. The surface water flows that otherwise would be diverted thus instead would be allowed to flow down the lower Yuba River, the Feather River, and the Sacramento River and into the Delta.

YCWA would manage the groundwater resources of the Yuba Groundwater Basin to avoid impacts related to its use, including subsidence and water quality impacts. YCWA, in cooperation with DWR, would investigate any claim of adverse impact due to groundwater pumping conducted for the proposed project water transfer, and would adjust operations, as necessary, to address any such impact.

Water Code §1745.10 and §1745.11 require the water supplier from whose service area the water is to be transferred (if a groundwater management plan has not been adopted pursuant to state law) to determine that groundwater use (in lieu of surface water) would not create or contribute to long-term overdraft in the affected groundwater basin.

YCWA, in cooperation with DWR, has agreed to continue implementation of a Groundwater Program. The Groundwater Program would identify wells within the Yuba groundwater subbasins that could be affected by the proposed groundwater substitution operations. Implementation of monitoring elements of the plan would include recording measurements of groundwater levels both before and after pumping begins. Monitoring of groundwater levels in the groundwater subbasins below the levels that would have occurred in the absence of the transfer would continue on a monthly basis until the groundwater level has returned to its pre-pumping level. Additionally, to ensure that salt intrusion into the groundwater wells is minimized, electrical conductivity (EC) measurements would be taken before and after pumping begins, along with an intermediate measurement at two months into the proposed project. DWR and YCWA would cooperate in obtaining these measurements. In addition to assessment of pumping effects upon the groundwater subbasins, monitoring and reporting would be performed to evaluate and avoid potential effects upon surface waters.

2.2 Feather River and Oroville Reservoir

Flows in the Feather River primarily would be influenced by operation and management of the Oroville Facilities associated with coordinated and integrated SWP/CVP operations related to water supply and environmental requirements. Generally, average flows in the Feather River downstream of the Yuba River under the proposed project would not be expected to vary substantially from flows that would occur under RD-1644 long-term requirements (without the proposed project). Although the specific operational scenario associated with the proposed project is uncertain, it is anticipated that Feather River flows would remain within the normal flow ranges and fluctuations resulting from normal SWP operations.

Water levels in Oroville Reservoir could be affected by the proposed project only if DWR decided to release water to compensate for reduced flows to the Delta during the period when New Bullards Bar Reservoir is being refilled. As in past water transfers, YCWA would take measures noted in the Refill Agreement to prevent adverse impacts on the SWP and CVP due to the refilling of New Bullards Bar Reservoir following the release of water under the proposed project.

2.3 Sacramento River

As stated earlier, flows in the Sacramento River primarily are influenced or controlled by Reclamation's operation of Shasta Reservoir as required for management of the CVP system, including coordinated operations with the SWP for water supply and environmental purposes. Although the specific operational scenario associated with the proposed project is uncertain, projected Sacramento River flows are anticipated to remain within the normal flow ranges and fluctuations resulting from SWP and CVP operations.

2.4 Sacramento-San Joaquin Delta

The proposed project would become part of the overall SWP and/or CVP water supply with related environmental and water quality protection limitations for exporting water from the Delta. The water released from the Yuba Project reaching the Delta would move through the Delta in summer and fall months and provide DWR with flexibility regarding export pumping in a manner that would avoid significant impacts upon fisheries resources and SWP and CVP water supplies. If it becomes necessary, DWR would install temporary portable pumps in the south Delta at Old River and at Tom Paine Slough diversion structure to avoid impacts on water diverters due to potential water level drawdown effects associated with rediversion of the water transfer water from the Clifton Court Forebay and the Tracy Pumping Plant (pers. comm., Brown 2005a; pers. comm., Brown 2005b)

2.4.1 South of Delta Water Conveyance Storage

DWR could elect to store some of the acquired water in groundwater banks south of the Delta, or as surface water storage in San Luis Reservoir. Water levels in groundwater banks or in San Luis Reservoir could increase during April through February, by the volume of any transfer water stored in them, and then subsequently decrease by the same amount as the amount of water used.

South-of-Delta storage and conveyance facilities include:

> California Aqueduct. The California Aqueduct is California's largest and longest water conveyance system, stretching from the Delta in the north to Lake Perris in the south (DWR 2001b). The aqueduct and its branches supply water for two-thirds of California's population and irrigate approximately 1 million acres of farmland (DWR 2001b). The California Aqueduct conveys water to southern California, and provides an irrigation supply to the Central (San Joaquin) Valley as part of the SWP. The aqueduct is approximately 444 miles long, most of which is a wide, concrete-lined ditch.

> San Luis Reservoir. San Luis Reservoir is an off-stream storage reservoir operated jointly by the SWP and CVP with a capacity of 2,041,000 acre-feet. San Luis Reservoir is located 12 miles west of the city of Los Banos on San Luis Creek, between the eastern foothills of the Diablo Range and the western foothills of the San Joaquin Valley in Merced County (DWR 2001b). This major off-stream reservoir of the joint-use San Luis Complex stores excess winter and spring flows from the Delta and supplies water to service areas for both state and federal water contractors (DWR 2001b).

> Groundwater Banks South of the Delta. DWR may elect to store some or all of the transfer water in groundwater banks south of the Delta (South San Joaquin Groundwater Basin). The extracted transfer water may be conveyed directly to water contractors via the California Aqueduct to supplement SWP supplies or it may be used by local districts for domestic and agricultural uses in exchange for an equivalent amount of their SWP entitlement water. Their entitlement water would then be added to the amount of SWP water available for delivery to other SWP contractors.

If DWR uses groundwater basins south of the Delta, then the amount of water that would be extracted from them would be equivalent to the amount that is deposited in them. Water extracted from the groundwater banks for delivery in the California Aqueduct would be subject to certain conditions, particularly regarding water quality, and approval by DWR would be required before such delivery could begin (YCWA 2004). In particular, DWR has developed acceptance criteria to govern the water quality of non-project water that may be conveyed through the California Aqueduct. Water that is transported through the California Aqueduct facilities has to meet the DWR water quality regulatory standards before it can enter into the California Aqueduct. DWR monitors SWP water quality to ensure that SWP water quality meets California Department of Health Services drinking water standards and Article 19 Water Quality Objectives for long-term SWP contracts[1].

The SWP and CVP conveyance and storage facilities discussed above will be operated in accordance with applicable state and federal regulations, as well as the established plans, policies, and agreements identified in Chapter 7 of this Environmental Analysis.

It is presently uncertain how DWR would operate the water conveyance and storage facilities south of the Delta as a result of this proposed project. The proposed project is not expected to change the overall operations of the SWP and CVP facilities outside of normal operations.

[1] Article 19 Objectives are included as standard provisions in DWR's water supply contracts. They require the collection and analysis of water quality samples in the SWP and the compilation of records. Article 19 (a) states: "*It shall be the objective of the State and the State shall take all reasonable measures to make available, at all delivery structures for delivery of Project water to the District, Project water of such quality that the following constituents do not exceed the concentrations stated*."

Chapter 3
Project Setting

The water storage and conveyance systems that could be affected by the proposed project include YCWA's Yuba Project New Bullards Bar Reservoir, the lower Yuba River, Oroville Reservoir (SWP), the lower Feather River, and the Delta. This chapter provides a description of these features and facilities.

3.1 Project Location

YCWA will release water to implement the 2006 Pilot Program Fisheries Agreement instream flow schedules from New Bullards Bar Reservoir into the lower Yuba River in Yuba County. DWR will receive and convey YCWA transfer water in the Sacramento River and Delta and potentially may store a portion of the transfer water in San Luis Reservoir or groundwater banks south of the Delta.

3.1.1 Yuba River

3.1.1.1 Surface Water Features and Management

The Yuba River Basin drains approximately 1,339 square miles of the western Sierra Nevada slope, including portions of Yuba, Sierra, Placer, and Nevada counties. The primary watercourses of the upper watershed are the South, Middle and North Yuba rivers. Both the upper and lower watersheds (above and below Englebright Dam, respectively) have been extensively developed for water supply, hydropower production, and flood control. Operators of upper watershed projects include PG&E, Nevada Irrigation District, and South Feather Water and Power Agency. The Yuba Project, which is operated by YCWA, includes water project operations in both the upper and lower watersheds. The Yuba Project, completed in 1969, includes New Bullards Bar Dam and Reservoir, New Colgate Powerhouse, Englebright Reservoir, and the Narrows II Powerhouse. Additional features of the Yuba Project are identified in Section 1.2.1, Yuba County Water Agency and Yuba River Development Project.

The flow in the Yuba River is partially controlled by New Bullards Bar Reservoir, the largest reservoir in the watershed. It stores approximately 966,000 acre-feet of water, has a surface area of approximately 4,800 acres when full, and regulates winter and spring drainage from approximately 489 square miles of watershed on the Yuba River. YCWA stores water in New Bullards Bar Reservoir to provide for instream flows for fisheries protection, flood control, power generation, recreation, and to provide irrigation water to Member Units that have both water rights and water service contracts. YCWA also has supplied water from New Bullards Bar Reservoir for municipal, industrial, and fish and wildlife purposes through several temporary water transfers, each lasting less than one year.

Englebright Reservoir is located approximately 6 miles downstream of New Bullards Bar Dam. Water that is released from New Bullards Bar Reservoir generally passes through Englebright Reservoir without significantly modifying Englebright Reservoir water surface elevations. Recent historical flows in the Yuba River below Englebright Dam during July and August have been between approximately 1,700 and 2,200 cfs during wet years and as low as 700 cfs during dry years, or when snowpack water content was low. Daguerre Point Dam is located approximately 12 miles downstream of Englebright Dam. During July and August, flows above Daguerre Point Dam are about 600 to 1,100 cfs higher than flows below the dam because of diversions at Daguerre Point Dam to meet irrigation demands. Specific anticipated lower Yuba River flows without the proposed project are difficult to predict at this time because the majority of the rainy season has yet to occur and, therefore, hydrologic conditions remain uncertain. As described in greater detail in Chapter 4, Environmental Setting and Impacts, RD-1644 long-term provisions would be the minimum instream flow requirements without the proposed project. RD-1644 long-term requirements are used as the basis of comparison for the evaluation of potential impacts.

Within Yuba County, the Yuba River provides the majority of the region's surface water supply. YCWA is a major water right holder on the Yuba River. Various water districts, irrigation districts, mutual water companies, and individuals contract with YCWA for delivery of water. These entities are BWD, BVID, CID, DCMWC, HID, RWD, SYWD, and other smaller contractors. Some of the entities that receive water from YCWA have their own appropriative or riparian rights for diversion of water. Other agencies and districts providing surface water for irrigation in Yuba County include the Yuba County Water District, Camp Far West Irrigation District, and Plumas Mutual Water Company.

3.1.1.2 Groundwater Features and Management

The YCWA groundwater substitution component of the proposed project would draw from the Yuba Groundwater Basin, which lies within the Sacramento Valley Groundwater Basin. The Yuba Groundwater extends from the Sierra Nevada foothills on the east to the Feather River on the west. The southern boundary is the Bear River and the northern boundary is Honcut Creek. The Yuba Groundwater Basin encompasses an area of approximately 270 square miles. The Yuba Groundwater Basin area is bounded on the east by impermeable rocks of the Sierra Nevada. These same rocks and younger consolidated rocks extend beneath the basin at a gradually increasing depth toward the Feather River and beyond to the trough of the Sacramento Valley. Fresh groundwater is stored in this wedge-shaped body of alluvial material to depths of 1,000 feet. Groundwater occurs generally under water table or unconfined conditions throughout most of the Yuba Groundwater Basin. Confinement probably occurs at depths in excess of 300 to 400 feet.

The Yuba River hydraulically divides the Yuba groundwater basin into the North Yuba Subbasin and the South Yuba Subbasin. The total groundwater storage capacity of the Yuba Groundwater Basin is 1,710,000 acre-feet, 40 percent of which is in the North Yuba Subbasin and 60 percent of which is in the South Yuba Subbasin. The portion of the Yuba Groundwater Basin from 50 to 100 feet in depth is estimated to have a total storage capacity of 540,000 acre-feet, and the portion between 20 and 50-feet-in-depth is estimated to have a total storage capacity of 340,000 acre-feet. Although these numbers do not represent the operational characteristics (e.g., recharge rate, recharge origin, pumping effects), they do demonstrate that a substantial water source is available within the Yuba Groundwater Basin.

Groundwater accounts for about 31 percent, or 130,000 acre-feet per year of irrigation water use in Yuba County. At least 385 wells, which provide water for irrigation, are located in the YCWA service area. In recent years, YCWA has provided surface water to areas previously served by groundwater, thereby decreasing demands on the groundwater basin. Over the past decade, YCWA and its Member Units have taken an active and progressive role in managing the groundwater resources of the Yuba Groundwater Basin. YCWA also works with DWR in monitoring the Yuba Groundwater Basin. YCWA and several of the districts in Yuba County have adopted groundwater management plans. As part of basin management, YCWA, DWR, and the Member Units have instituted a Groundwater Monitoring and Reporting Program to record in detail the water levels and water quality of the Yuba Groundwater Basin. Additional information regarding the Groundwater Monitoring and Reporting Program is included in Section 4.3.3, Groundwater Resources.

3.1.2 Feather River

The Feather River flows south for 67 miles from Oroville Reservoir and empties into the Sacramento River near Verona. Flows in the Feather River are controlled primarily by DWR's Oroville Reservoir, which stores 3.5 million acre-feet of water. A minimum flow of 600 cfs is maintained in the 8-mile low-flow section of the Feather River between the Fish Barrier Dam and the Thermalito Afterbay Outlet. A minimum flow of approximately 1,700 cfs is maintained in the 59-mile high flow section of the Feather River below the Thermalito Afterbay Outlet. Average flows in the Feather River during July and August are 7,600 cfs during wet years, 5,750 cfs during above-normal years, 4,700 cfs during below normal years, 4,050 cfs during dry years, and 2,950 cfs during critically dry years (YCWA 1998). Average monthly flows for all water year types in the lower Feather River at the Gridley Gage (39.3670ºN, 121.6460ºW) are stated in **Table 3-1**.

Table 3-1. Average Monthly Flow (cfs) for the Feather River at Gridley During the April through February period (1993 through 2003).

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Average Monthly Flow (cfs)	4,896	4,896	4,099	4,847	3,945	2,790	2,223	2,792	4,586	6,923	7,803
Source: California Data Exchange Center (CDEC)											

3.1.3 Sacramento River

The Sacramento River, which originates in the Cascade and Siskiyou Mountains of northern California and terminates in the Delta, is the largest river in California. Flows in the Sacramento River are controlled primarily by Reclamation's operation of Shasta Reservoir. In addition, release flows from both Oroville and Shasta reservoirs are coordinated by DWR and Reclamation, respectively, to meet water supply and environmental needs downstream and in the Delta. Flows on the Sacramento River at Keswick in July and August average approximately 12,500 cfs during wet years, 9,200 cfs during above-normal years, 7,600 cfs during below-normal years, 7,300 cfs during dry years, and 6,100 cfs during critically dry years (YCWA 1998). NMFS requires that Reclamation maintain a minimum release from Keswick Dam of 3,250 cfs from October 1 to March 31. No additional specific flow requirements have been identified for fish in the lower Sacramento River. Available average daily flow records for the Sacramento River recorded at the Freeport gaging station (FPT) were obtained from the DWR California Data Exchange Center (CDEC) website (*http://cdec.water.ca.gov*) as reported in PCWA and State Water Resources Control Board (2003) and are presented in (**Table 3-2**). These values generally are consistent with the reported estimated average operational flows on the Sacramento River at Freeport at or above 15,000 cfs for the June through September period, as reported in EDAW (2004).

Table 3-2. Average Monthly Flow (cfs) for the Sacramento River at Freeport During the April through February Period (1965 through 2003).

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Average Monthly Flow (cfs)	22,935	21,211	16,892	16,776	16,479	14,917	12,499	23,401	28,975	40,905	41,054
Source: CDEC											

3.1.4 Sacramento-San Joaquin Delta

The Delta, located at the confluence of the Sacramento and San Joaquin rivers, serves as the major hub for the operations of both the SWP and CVP. DWR operates its Harvey O. Banks Pumping Plant in the southern Delta to lift water into the California Aqueduct for delivery to SWP customers in the San Joaquin Valley and to southern California. Reclamation operates the Tracy Pumping Plant to lift water from the southern Delta into the Delta-Mendota Canal to serve CVP water contractors in the San Joaquin Valley and the Tulare Basin. Current SWP and CVP operations in the Delta are governed by a series of regulations and agreements with SWRCB, USFWS, NMFS, and CDFG. These regulations and agreements limit the volumes of water that may be exported from the Delta, based on Delta hydrodynamics, water quality, and potential impacts on fisheries as determined by fish population monitoring at the pumps and in the Delta system.

Water conditions in the south Delta are influenced to varying degrees by natural tidal fluctuations, San Joaquin River flow and quality, local agricultural drainage water, SWP and CVP export pumping, local diversions, operation of the Delta Cross Channel and tidal barrier facilities, channel capacity, and regulatory constraints. These factors affect water levels and availability at some local diversion points. When the SWP and CVP are exporting water, water levels in local channels can be drawn down. Also, flows can diverge and converge in some channels. If local agricultural drainage water is pumped into the channels where circulation is poor, water quality can be affected. The South Delta Temporary Barriers Project, initiated in 1991, has been used to provide short-term improvement of water conditions for the south Delta. The South Delta Temporary Barriers Project involves the seasonal installation of four barriers—one in Middle River, two in Old River, and one in Grant Line Canal. Three of the barriers are designed to improve water levels and circulation for agricultural diversions. These barriers are installed by DWR and Reclamation on a seasonal basis, as needed, to improve water levels and water quality.

3.1.5 South of Delta Water Conveyance and Storage

South-of-Delta storage and conveyance facilities, including the California Aqueduct, San Luis Reservoir, and groundwater banks are described in Section 2.1.4.4, South of Delta Water Conveyance and Storage.

Chapter 4
Environmental Setting and Impacts

4.1 Introduction

This section describes the environmental setting and evaluates the potential for unreasonable impacts on environmental resources due to implementation of the proposed project. The evaluation of potential impacts on fish, wildlife, or other instream beneficial uses (Water Code §1727) is based upon a comparison of the instream flows, and reservoir storage and water surface elevations that could occur with implementation of the proposed project relative to the conditions that could occur with implementation of the long-term instream flow requirements of RD-1644 (i.e., the basis of comparison).

The proposed project does not include any new construction of water facilities, infrastructure, or any other type of construction or land disturbance and, therefore, will not have any construction-related effects. In accordance with Water Code §1727, this Environmental Analysis draws conclusions regarding whether the proposed project "*would unreasonably affect fish, wildlife, or other instream beneficial uses*." Instream beneficial uses analyzed in this document include surface water supply availability, surface water quality, groundwater resources, fisheries and aquatic resources, terrestrial resources (wildlife and vegetation), recreation, and carryover storage. Because of the mitigation commitments required of water districts selling water under the EWA (EWA Final EIS/EIR and Record of Decision for the Short-Term Environmental Water Account Final EIS/EIR (Reclamation *et al.* 2004b), additional environmental topics are discussed in this section, including air quality and cultural resources.

4.2 Yuba County Water Agency's Water Rights

YCWA's water-right permits authorize diversion of water to storage at New Bullards Bar Reservoir and allow direct diversion of water downstream for consumptive uses. YCWA's permits authorize direct diversion at a total rate of 1,550 cfs from the lower Yuba River for irrigation and other uses from September 1 to June 1, and the diversion of 961,300 acre-feet per year to storage in New Bullards Bar Reservoir from October 1 to June 1 (SWRCB 2003). The points of diversion to storage and rediversion for Permit 15026 are located at the New Bullards Bar Dam and the Daguerre Point Dam. The water is used for irrigation, industrial, recreational, fish mitigation and enhancement, and domestic purposes within the authorized place of use as shown on map EI-05-08-RS on file with the SWRCB under Application 5632. In addition to providing water for consumptive use, water is released for power generation at the New Colgate Powerhouse below New Bullards Bar Dam, and at the Narrows II Powerhouse (and Narrows I Powerhouse operated by PG&E) below Englebright Dam. Hydroelectric power is generated at those locations under authorization from FERC and water right licenses issued by the SWRCB.

Based on evidentiary hearings held in 1992 and 2000, and a supplemental hearing held in 2003 regarding fishery resources and water right issues of the lower Yuba River, the SWRCB adopted RD-1644 instream flow requirements measured at the Marysville Gage (located about 6 miles upstream of the confluence of the Feather and Yuba rivers) and the Smartville Gage (located just below Englebright Reservoir). While these requirements are subject to pending legal challenges, long-term RD-1644 requirements are scheduled to be in effect during the period of this transfer, and therefore are used as the basis of comparison for this Environmental Analysis.

4.3 Water Resources

4.3.1 Water Supply Availability

4.3.1.1 Environmental Setting

The surface waterbodies potentially affected by the proposed project include New Bullards Bar Reservoir, the lower Yuba River, Oroville Reservoir and the lower Feather River, the Sacramento River, the Delta, and San Luis Reservoir. For a further description of each of these waterbodies and facilities, please refer to Section 3.0, Project Setting.

4.3.1.2 Impact Assessment Methodology

The analysis of the potential for unreasonable impacts on surface water supply availability associated with the proposed project within the affected waterbodies, listed above, was based on the following criterion:

- Reductions in reservoir storage or river flows, relative to RD-1644 long-term instream flow requirements, of sufficient frequency and duration, to unreasonably impact the water supply availability to customers and/or contractors.

Increases in reservoir water surface elevation or river flows were considered to have no unreasonable impact upon water supply availability.

4.3.1.3 Impact Assessment

Yuba River

The proposed project would result in a change in the hydrologic pattern of the Yuba River below New Bullards Bar Reservoir, although flows within the lower Yuba River would remain within normal operational ranges. In general, flow exceedance plots indicate that simulated monthly mean flows at Smartville and Marysville under the proposed project would be greater than under the basis of comparison approximately 60 percent to 80 percent of the time between April 1, 2006 and February 28, 2007.

The annual supply of water would not decrease and there would not be unreasonable impacts upon water supply availability. Additionally, YCWA would continue historic practices of providing surface water supply deliveries to its Member Units and/or implementation of groundwater substitution practices, thereby avoiding unreasonable impacts on agricultural water supplies within the YCWA service area. Therefore, no unreasonable impacts to surface water supply availability would be expected for water agencies and their customers or contractors that utilize the Yuba River, under the proposed project, relative to the basis of comparison.

New Bullards Bar Reservoir

Implementation of the proposed project would alter the hydrologic pattern relative to the basis of comparison; however, reservoir storage and water surface elevations at New Bullards Bar

Reservoir would remain within normal operational parameters. During most months, simulated end-of-month reservoir storage under the proposed project would be less than storage under the basis of comparison over approximately 80 percent to 100 percent of the cumulative distribution. Depending on hydrological conditions, average end of September storage in New Bullards Bar Reservoir under the proposed project would be approximately 594,865 acre-feet, and average end-of-September storage under the basis of comparison would be approximately 655,432 acre-feet. The decrease in reservoir storage under the proposed project, relative to the basis of comparison, is not expected to be of sufficient magnitude or duration to adversely impact water supply availability from New Bullards Bar Reservoir. YCWA would ensure that sufficient carryover water is available in New Bullards Bar Reservoir in 2007 to meet all contractual, regulatory, and environmental needs. However, please refer to **Appendix B** for additional discussion of carryover storage and the need for change in the effective date of the RD-1644 long-term flow requirements. Therefore, no unreasonable impacts to surface water supply availability are anticipated at New Bullards Bar Reservoir under the proposed project.

Feather River and Oroville Reservoir

Because the proposed project would not be expected to result in Feather River flows or Oroville Reservoir storage levels outside of normal operational parameters, instream flow and reservoir storage would not be expected to differ substantially under the proposed project, relative to the basis of comparison. Average differences in simulated monthly mean Yuba River flows at Marysville and the percentage of these flows to Feather River flows at Gridley under the proposed project, relative to the basis of comparison (RD-1644 long-term), over the 83-year simulation period are presented in **Table 4-1**.

Table 4-1. Average Difference in Simulated Monthly Mean Flows for the Lower Yuba River (Marysville) Between the Proposed Project and the Basis of Comparison (RD-1644 long-term), Compared to the Total Volume of Average Feather River Flows (Gridley) During the April through February Period.

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Average Difference in Monthly Mean Flows (cfs)	342	-192*	262	35	281	165	100	-89*	-300*	-285*	9
**Feather River Average Monthly Flow (cfs)	4,896	4,896	4,099	4,847	3,945	2,790	2,223	2,792	4,586	6,923	7,803
Percent of Feather River Flows (cfs)	6.9	3.9	6.4	0.7	7.1	5.9	4.4	3.2	6.5	4.1	0.1

*Average monthly flow less than RD-1644 long-term
**Source: CDEC, period of record 1993 through 2003

As described in the Hydrologic Analysis (Appendix B), Feather River flows for 2006/2007 are anticipated to range from four to five times higher than the Yuba River flows; therefore, the influence of Yuba River flows on total Feather River flows is not likely to be substantial. Overall, potential changes to Feather River flows would not be expected to result in unreasonable impacts upon surface water availability for water supply purposes.

Although the specific operational scenario for Oroville Reservoir is unknown, reservoir storage changes (due to subsequent refill of New Bullards Bar Reservoir) that would occur as a result of the proposed project would be expected to remain within historic operational ranges and, thus, would not adversely or unreasonably affect water supply availability to water customers, including SWP and CVP contractors, relative to the basis of comparison. Further, the Refill Agreement between YCWA and DWR would ensure that future refill of water transferred from storage in New Bullards Bar Reservoir resulting from purchases of water from YCWA by DWR would not adversely impact the SWP or CVP.

Sacramento River

Flows in the Sacramento River are anticipated to remain within normal flow ranges and fluctuations resulting from SWP and CVP operations and, thus, would not be expected to differ substantially under the proposed project, relative to the basis of comparison. Average differences in simulated monthly mean Yuba River flows at Marysville and the percentage of these flows compared to Sacramento River flows at Freeport occurring under the proposed project, relative to the basis of comparison (RD-1644 long-term), over the 83-year simulation period are presented in **Table 4-2**.

Table 4-2. Average Difference in Simulated Monthly Mean Flows for the Lower Yuba River (Marysville) Between the Proposed Project and the Basis of Comparison (RD-1644 long-term), Compared to the Total Volume of Average Sacramento River Flows (Freeport) During the April through February Period.

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb
Average Difference in Monthly Mean Flows (cfs)	342	-192*	262	35	281	165	100	-89*	-300*	-285*	9
**Sacramento River Average Monthly Flow (cfs)	22,935	21,211	16,892	16,776	16,479	14,917	12,499	23,401	28,975	40,905	41,054
Percent of Sacramento River Flows	1.4	1.0	1.5	0.2	1.7	1.1	0.8	0.4	1.0	0.7	0

*Average monthly flow less than RD-1644 long-term
**Source: CDEC, period of record 1993 through 2003

Although implementation of the proposed project potentially could alter Sacramento River flows slightly, these changes would be comparable to, or less than, the range described above for the Feather River. Therefore, potential flow changes due to the proposed project would be a relatively small proportion of total Sacramento River flows during the April 1, 2006 through February 28, 2007 period, and are not expected to unreasonably affect water supply availability to water customers, including CVP and SWP contractors, relative to the basis of comparison.

Sacramento-San Joaquin Delta

Although the patterns of outflow from the Yuba River into the Feather River, to the Sacramento River and eventually into the Delta may be slightly altered with the implementation of the proposed project, Delta conditions are anticipated to remain within the normal ranges and fluctuations resulting from SWP and CVP operations, which were previously evaluated in the

EWA EIS/EIR (Reclamation *et al.* 2003). Because the water would be used in the EWA and/or DWR Dry Year Water programs, the effect should be to provide a beneficial effect upon SWP and/or CVP contractor water supply conditions in 2006. Because the proposed project would supply water to EWA, water supply would not be affected by pumping reductions by the SWP and CVP because EWA assets are used to repay the SWP and CVP for the loss of supply caused by reduced pumping. The proposed project should provide a more reliable water source, which would benefit all water users, including agricultural, environmental, and urban interests. The SWP and CVP annual supply would be equal to or greater than it would be without the EWA, therefore ensuring greater reliability. Although the specific operational scenario associated with the proposed project is uncertain, the projected changes to Delta conditions are not expected to unreasonably impact water supply availability to SWP and CVP customers, relative to the basis of comparison.

The proposed project would be used for environmental purposes in the Delta or be conveyed through the pumping plants at Clifton Court Forebay into conveyance channels, and either stored in San Luis Reservoir or transported through the California Aqueduct directly to groundwater storage banks or SWP or CVP contractors. Because DWR and Reclamation are the entities responsible for operating the SWP and CVP systems and, likewise, for determining how best to address system-wide needs as environmental conditions change, YCWA would not be a participant in the operational decisions that may occur with respect to how transferred water would be managed once it leaves the Yuba River Basin. However, it is anticipated that conveyance of these EWA assets through the SWP/CVP system and into the Delta would be consistent with the procedures established by Reclamation in its 2004 OCAP, and according to the operating principles established by Reclamation and DWR as part of the EWA Program.

Further, coordination with numerous agencies (YCWA, DWR, Reclamation, USFWS, NMFS, and CDFG) has been initiated and would continue to take place to ensure that water supply impacts would not occur, and that water in the Delta would be pumped within the most environmentally protective "windows" that exist when conveyance capacity is available. DWR could elect to store some portion of acquired transfer water associated with the proposed project in San Luis Reservoir.

San Luis Reservoir

DWR likely will store some portion of water acquired from the proposed project in San Luis Reservoir. Because the water is intended for use in the EWA and DWR Dry Year Water programs, it is intended to potentially provide a beneficial effect upon state and/or federal water contractor supply conditions in 2006. There would be no unreasonable impact upon water supply at San Luis Reservoir.

4.3.2 Surface Water Quality

4.3.2.1 Environmental Setting

The following section provides a discussion of the water quality setting for the Yuba River, New Bullards Bar Reservoir, Feather River, Oroville Reservoir, Sacramento River, the Delta, and San Luis Reservoir.

Yuba River and New Bullards Bar Reservoir

The Yuba River is the largest tributary to the Feather River. Forest land is the primary land use and land cover for the Yuba River Basin, comprising about 85 percent of the land cover (USGS 2002). The forestland in the Yuba River Basin is located in the foothills of the Sierra Nevada, which experienced a substantial amount of gold mining, including placer and hard rock mining. Mercury was used in the basin to recover gold from both placer deposits and ore-bearing minerals. Residual mercury from those operations has been detected in invertebrate and fish communities nearby and downstream from the gold mining operations (May *et al.* 2000; Slotton *et al.* 1997).

The general water quality of the lower Yuba River is considered good and has improved in recent decades due to control of hydraulic and dredge mining operations, and the establishment of minimum instream flows (Beak Consultants, Inc. 1989). Dissolved oxygen concentrations, total dissolved solids, pH, hardness, alkalinity, and turbidity are well within acceptable or preferred ranges for salmonids and other key freshwater biota (Reclamation *et al.* 2003).

YCWA currently supplies raw water exclusively for agricultural purposes in YCWA's service area. YCWA is proposing to sell and deliver water to DWR, which has contracting agencies that have water treatment plants that would make YCWA water available for municipal supply.

Feather River

The Feather River is a large tributary to the Sacramento River. Flows in the lower Feather River are controlled mainly by releases from Oroville Reservoir, the second largest reservoir within the Sacramento River Basin, and by flow from the Yuba River, a major tributary. Forest land is the major (about 78 percent of total) land use or land cover for the Feather River Basin. Gold mining also was an important land use in the Sierra Nevada foothills that are part of the Feather River Basin. The Yuba and the Bear rivers both flow into the lower Feather River. Both the Yuba River and the Bear River basins have been affected by past gold mining and contribute mercury to the lower Feather and Sacramento rivers (May *et al.* 2000). Constituents of concern for the Feather River, according to the Clean Water Act Section 303(d) list, include diazinon, Group A pesticides, mercury and unknown toxicity. Potential sources of these constituents include agriculture, urban runoff, storm sewers, resource extraction and other unknown sources (Reclamation *et al.* 2003).

Oroville Reservoir

Oroville Reservoir primarily is used for water supply, power generation, flood control, fish and wildlife enhancement, and recreational purposes (DWR 2001b). Water quality in Oroville Reservoir is influenced by tributary streams, of which the Middle Fork Feather River, North Fork Feather River, and South Fork Feather River contribute the bulk of the inflow to the reservoir. Water quality in Oroville Reservoir generally is more influenced by recreation activities and other historical land-based activities (i.e., mining) than by SWP operations. Overall, based on preliminary on-going investigations being conducted under the Oroville Facilities FERC Relicensing studies (DWR 2005c), Oroville Reservoir water quality typically meets Central Valley Regional Water Quality Control Plan (Basin Plan) objectives for intended beneficial uses. Preliminary information indicates infrequent and minor exceedances for some constituents (DO, pH and nutrients) and more frequent exceedances of some metals (arsenic, aluminum and iron). Elevated metals concentrations potentially are related to wind disturbances and movement of bottom sediments, as well as from storm runoff events.

Sacramento River

The lower Sacramento River receives urban runoff, either directly or indirectly (through tributary inflow), from the cities of Sacramento, Roseville, Folsom, and their surrounding communities. The Natomas East Main Drainage Canal discharges to the Sacramento River immediately upstream of the confluence with the American River. This canal transfers both agricultural discharges and urban runoff into the Sacramento River.

Sacramento River water quality monitoring studies indicate that the river's water is generally of high quality (Brown and Caldwell *et al.* 1995; Larry Walker Associates 1996; Larry Walker Associates 1991). Concentrations of some trace elements (particularly copper and zinc) frequently approach limits established by regulatory agencies while other metals such as lead, cadmium, mercury, and silver also may approach these limits. Much of the trace element loadings in the Sacramento River are from non-permitted sources. Acid mine drainage contributes cadmium, copper, and zinc, while agricultural return flows typically contribute chromium and nickel. Discharges of urban runoff and seasonal agricultural runoff are the principal sources of water quality problems in the Sacramento River near its confluence with the American River (Corps 1991). Water quality of the Sacramento River near its confluence with the American River ranges from medium to good for numerous beneficial uses (SWRCB 1994).

Sacramento-San Joaquin Delta

Water quality in the Delta is influenced by a combination of environmental and institutional variables, including upstream pollutant loading, water export and diversions within and upstream of the Delta, and agricultural activities in the Delta. The tidal currents carry large volumes of seawater back and forth through the Bay-Delta Estuary with each tide cycle. The mixing zone of saltwater and freshwater can shift 2 to 6 miles depending on the tides, and may reach far into the Delta during periods of low inflow. Thus, the inflow of the tributaries into the Delta is essential in maintaining Delta water quality.

Metals, pesticides and petroleum hydrocarbons enter the Delta through several means, including agricultural runoff, municipal and industrial wastewater discharge, urban runoff, recreational uses, river inflow, and atmospheric deposition (SFEP 1992). The concentrations of these pollutants in the Delta vary geographically and seasonally. The toxic effects of pollutants on aquatic life can vary with flow levels.

In January 2005, DWR biologists identified and reported an unexpected decline of pelagic (i.e., open-water) organisms in the Delta. A draft white paper titled, *Interagency Ecological Program 2005 Workplan to Evaluate the Decline of Pelagic Species in the Upper San Francisco Estuary,* discussed the findings and was distributed among Interagency Ecological Program (IEP) agencies. Subsequently, a study plan was developed to begin intensive data analysis and technical studies into the causes of the decline. The IEP agencies provided approximately $2 million to support the initial studies, and a study plan was designed to continue to explore historical data and to clarify the nature of the decline and preliminarily screen possible explanations for the decline from among three broad categories: (1) ecological effects of non-indigenous species introductions, (2) unexpected effects of recent changes in water project operations, and (3) toxic effects of agricultural chemicals and blue-green algae. The correct explanation involves one, or a combination of these factors.

The IEP currently is in the process of finalizing its 2006/2007 work plan, which is being developed to expand on the efforts conducted as part of the initial 2005 studies focusing on pelagic organism declines. Because this work has yet to be conducted, it would be speculative to include a more detailed discussion of potential water quality impacts associated with these pelagic organism issues, as they relate to the proposed project, at this time. Due to the short-term nature (i.e., one year) of the proposed project, it is unlikely that new information will become available prior to completion of the proposed project. However, the proposed project would be operated pursuant to the constraints identified in the biological opinions that were issued for the CVP and SWP OCAP, which represent the best available science and management direction to date.

San Luis Reservoir

In general, the natural inflow from the San Luis Reservoir watershed is insignificant relative to the reservoir's capacity (DWR 2001b). Most of the reservoir's water is pumped from the California Aqueduct and the Delta-Mendota Canal via the O'Neill Forebay through the Gianelli Pumping-Generating Plant during the winter and spring (DWR 2001b). Water enters and exits San Luis Reservoir from a common inlet/outlet tower (DWR 2001b). In addition, Reclamation pumps water out of San Luis Reservoir in a westerly direction to San Felipe Division Water contractors through the Pacheco Pumping Plant and the Santa Clara Tunnel (DWR 2001b). San Luis Reservoir water is delivered to the San Joaquin Valley, the Santa Clara Valley, and Southern California when water supply in the California Aqueduct and the Delta Mendota Canal is insufficient (DWR 2001b).

In San Luis Reservoir, the low-point problem and associated algal growth is the primary water quality concern. In San Luis Reservoir, the low point refers to a range of minimum reservoir levels that occur in late summer and fall. The low-point problem is produced by a combination of warm-season algae growth and decreasing summer water levels (Reclamation *et al.* 2003). High algae content reduces the effectiveness of water treatment and can affect the quality and taste of treated water. As the reservoir is progressively drawn down below 300,000 acre-feet, increasing amounts of algae may enter the intake, and water quality problems can arise. Typically, taste and odor concerns associated with algal growth in the reservoir are more serious water quality concerns during drought years (DWR 2001b). In the fall, especially during drought years, a greater demand by SWP contractors creates lower water levels in the reservoir (DWR 2001b). Because of the improved light penetration and greater likelihood of establishment of a thermocline in the reservoir, algal blooms, consisting primarily of the blue-green algae *Aphanizomenon flosaquae*, are more likely to occur (DWR 2001b). During fall months, winds blow accumulated blue-green algae toward the intake, and taste and odor concerns may result (DWR 2001b). The EWA EIS/EIR (Reclamation *et al.* 2003) presents a detailed description of the San Luis Reservoir low-point topic.

4.3.2.2 Impact Assessment Methodology

The analysis of potential impacts on surface water quality associated with the proposed project within potentially affected waterbodies was based on the following criteria:

- Decrease in reservoir storage, of sufficient magnitude or duration relative to the basis of comparison, to result in an increase in the concentration of contaminants.
- Decrease in river flow, of sufficient magnitude or duration relative to the basis of comparison, to result in an increase in the concentration of contaminants.

Increases in reservoir storage or river flows under the proposed project, relative to the basis of comparison, were considered to have a slightly beneficial, or no effect, upon surface water quality due to the potential for increased dilution of contaminants.

Consultation with the Central Valley Regional Water Quality Control Board (RWQCB) related to the proposed YCWA water transfer to DWR in 2005 led to the identification of potential concerns regarding the possibility of a shift in hardness levels of the waterbodies receiving the proposed project water inflow. Therefore, a discussion of this topic is provided following the waterbody specific analyses presented in this section. Determination of the potential for an unreasonable impact is based on the following criterion:

- Increased potential for a substantial shift in hardness levels of the waterbodies receiving the proposed project source water, relative to the basis of comparison, of sufficient magnitude that the potential for increased bioavailability of metals would occur (e.g., substantially lower hardness level in the source water than in the receiving water).

4.3.2.3 Impact Assessment

Yuba River

The proposed project could result in increased or decreased instream flows in the Yuba River, relative to the basis of comparison. Overall, simulated monthly mean flows under the proposed project would be greater than or equal to flows under the basis of comparison approximately 60 percent to 80 percent of the time during the April 1, 2006 and February 28, 2007 period (see **Appendix D**, Monthly Exceedance Plots of Average Flows). During the remainder of the cumulative flow distribution, proposed project flows would be lower than the basis of comparison during certain months. However, the flow reductions of greatest magnitude generally range between 500 cfs and 700 cfs (during July and November) under the proposed project, relative to the basis of comparison, but occur when flows range from 1,000 cfs to 3,000 cfs. Therefore, reductions in lower Yuba River flows under the proposed project, relative to the basis of comparison, are not expected to be of sufficient magnitude or duration to result in an increase in the concentration of contaminants. Flow increases expected to occur under the proposed project, relative to the basis of comparison, may provide a beneficial effect to the water quality in the lower Yuba River by increasing the dilution of contaminants. Therefore, unreasonable impacts on the surface water quality of the Yuba River are not expected to result from implementation of the proposed project.

New Bullards Bar Reservoir

Implementation of the proposed project would alter the hydrologic pattern relative to the basis of comparison; however, reservoir storage and water surface elevations at New Bullards Bar Reservoir would remain within normal operational parameters. During April, average end of month reservoir storage under the proposed project would be 827,965 acre-feet, compared to 853,327 acre-feet under the basis of comparison. Depending on hydrological conditions, average end of September storage in New Bullards Bar Reservoir under the proposed project would be approximately 594,865 acre-feet, and average reservoir storage under the basis of comparison would be approximately 655,432 acre-feet. Therefore, monthly decreases in reservoir storage under the proposed project, relative to the basis of comparison, would not be of substantial magnitude or duration to adversely impact New Bullards Bar Reservoir water quality. YCWA would ensure that sufficient carryover water is available in New Bullards Bar

Reservoir in 2007 to meet all contractual, regulatory, and environmental needs (refer to Appendix B for additional discussion). Therefore, unreasonable impacts to water quality are not anticipated at New Bullards Bar Reservoir.

Feather River

The proposed project could result in increased or decreased instream flows in the Feather River, relative to the basis of comparison. As presented in Table 4-1, the proposed project could alter monthly mean Feather River flows between 0.5 percent (July) and 7.8 percent (November and December), relative to the basis of comparison. Because these values represent the total change in flow on a month-to-month basis, individual flow reductions that could occur in the in Feather River under the proposed project, relative to the basis of comparison, are not expected to be of sufficient magnitude or duration to result in an increase in the concentration of contaminants. The increases in flows expected under the proposed project, relative to the basis of comparison, may provide a beneficial effect to the water quality in the Feather River by increasing the dilution of contaminants. Therefore, unreasonable impacts on the surface water quality of the Feather River are not expected to result from implementation of the proposed project.

Oroville Reservoir

Oroville Reservoir water levels would not be anticipated to be substantially affected by the proposed project, relative to the basis of comparison and, thus, would not result in unreasonable impacts on Oroville Reservoir water quality.

Sacramento River

The proposed project could result in increased or decreased instream flows in the Sacramento River, relative to the basis of comparison. As presented in Table 4-2, the proposed project could alter monthly mean Sacramento River flows between 0.1 percent (July) and 1.2 percent (December), relative to the basis of comparison. Because these values represent the total change in flow on a month-to-month basis, individual flow reductions that could occur in the Sacramento River under the proposed project, relative to the basis of comparison, are not expected to be of sufficient magnitude or duration to result in an increase in the concentration of contaminants. The increases in flows expected under the proposed project, relative to the basis of comparison, may provide a beneficial effect to the water quality in the Sacramento River by increasing the dilution of contaminants. Therefore, unreasonable impacts on the surface water quality of the Yuba River are not expected to result from implementation of the proposed project.

Sacramento-San Joaquin Delta

DWR is responsible for mitigating its water quality impacts as required under the 1995 Delta Water Quality Control Plan (SWRCB 1995). Some operational changes may have to be made to meet these standards, but DWR's ability to meet these standards will not be compromised under the proposed project, relative to the basis of comparison.

If implemented in 2006, provision of the transfer water would occur through either the EWA and/or Dry Year Water Purchase programs. Under EWA, carriage water is used as a mechanism to maintain Delta water quality standards (Reclamation *et al.* 2003) by increasing Delta outflows to protect Delta water quality by either maintaining or preventing increases in chloride and bromide concentrations within the Delta during periods of increased pumping.

Because bromide is primarily present as a result of seawater intrusion, the use of carriage water to increase Delta outflow and hold ocean salts at the same point they were before pumping was increased would result in no increase in bromide concentrations. Water quality, including salinity, bromide, and the potential for THM and bromate formation, would not be altered in a way that would result in adverse effects to designated beneficial uses, exceedance of existing regulatory standards, or substantial degradation of water quality (Reclamation *et al.* 2003). Therefore, no unreasonable impacts to Delta water quality are expected to occur as a result of the proposed project.

Additionally, DWR monitors SWP water quality to ensure that SWP water supplies meet the Department of Health Services drinking water standards and Article 19 Water Quality Objectives for long-term SWP contracts. The objective of the SWP water quality monitoring program is to maintain project water at a quality acceptable for recreation, agriculture, and public water supply for the present and future under a policy of multiple uses of SWP facilities. These uses include fishing, boating, and water contact sports. DWR analyzes the water for physical parameters such as water temperature, specific conductance, and turbidity and more than 60 different chemical constituents, including inorganic chemicals, pesticides, and organic carbon potential. The monitoring program has stations throughout the SWP, including the O'Neill Forebay in San Luis Reservoir, the California Aqueduct, and terminal reservoirs such as Silverwood Lake, Lake Perris, Pyramid Lake, and Castaic Lake.

San Luis Reservoir

To the extent that proposed project transfer water is stored in San Luis Reservoir during summer and fall months when potential concerns related to the low point occur, the transfer of this water potentially could provide a beneficial effect. Although the SWP operations related to the proposed project transfer are unknown, it is expected that DWR would operate according to prevailing regulatory water quality and environmental protection requirements and that San Luis Reservoir water elevations would remain within normal operating ranges. Therefore, the proposed project would not be expected to result in unreasonable impacts upon San Luis Reservoir water quality.

Discussion of Potential Water Quality Concerns Related to Hardness Levels

The RWQCB requested that the 2005 Water Code Environmental Analysis provide information regarding hardness levels of the waterbodies potentially affected by the proposed 2005 water transfer. The RWQCB had determined that water transfers have the potential to impact water quality when the waterbodies are of substantially different hardness levels. In particular, if the transfer source water has a lower water hardness level than the receiving water, there is the potential for the transfer to cause a shift (reduction) in hardness levels in the receiving water, thereby causing metals in the water to become more bioavailable than they were previously (pers. comm., McHenry 2005b; pers. comm., McHenry 2005a). The potential for water quality impacts depends upon the dilution potential and on the concentrations of metals in the affected waterbodies. The following provides a discussion of hardness levels in the affected water systems, as provided by the RWQCB (pers. comm., McHenry 2005a; pers. comm., Niiya 2005) and an assessment of the potential impacts of the proposed project.

The RWQCB indicated that the hardness levels for the Yuba and Feather rivers are generally in the range of 40 milligrams per liter (mg/L) $CaCO_3$. Data for the Feather River for the period of March through November 2002 indicated a low value of 37 mg/L $CaCO_3$ and a high of 40 mg/L

$CaCO_3$ (pers. comm., McHenry 2005a). Sacramento River (near Freeport) hardness levels were reported to range from a low of 26 mg/L $CaCO_3$ to a high of 160 mg/L $CaCO_3$ for the period of January 1998 through November 2002 (pers. comm., Niiya 2005). Hardness levels for the Delta are reported to be in the range of 90 to 100 mg/L $CaCO_3$ (CCWD 2005). According to the RWQCB, these ranges of hardness levels between the affected water systems do not represent a significant water quality issue for the proposed project.

Additionally, because the Feather River and Sacramento River flows are substantially higher than the Yuba River flows under implementation of the proposed project, there is adequate dilution potential (of Yuba River water) to reduce the possibility of a shift in hardness levels that would result in a water quality concern in any of the receiving waterbodies.

4.3.3 Groundwater Resources

Groundwater resources are described and evaluated in detail in the Groundwater Analysis (MWH 2005) and in the EWA EIS/EIR (Reclamation *et al.* 2003). Information presented below is based upon these documents.

4.3.3.1 Environmental Setting

Groundwater

Yuba Groundwater Subbasin

The 2006 YCWA groundwater substitution component of the proposed project would utilize the Yuba County groundwater subbasin. The subbasin is described in Section 3.1.1.2, Groundwater Features and Management.

South-of-the-Delta Groundwater Banks

DWR potentially would store a portion of the proposed project transfer water in groundwater banks south of the Delta within the San Joaquin Groundwater Basin. The specific groundwater banking operations associated with the proposed project are unknown. The EWA EIS/EIR (Reclamation *et al.* 2003) provides detailed information regarding South-of-Delta Groundwater Banks, including participating agencies in Kern County that could be utilized as part of the EWA. Groundwater in the South San Joaquin Groundwater Basin historically has been heavily used, and excessive groundwater withdrawals have caused substantial declines in groundwater levels. However, as reported in the EWA EIS/EIR (Reclamation *et al.* 2003), groundwater levels have substantially increased relative to pre-project groundwater levels in several groundwater banks.

4.3.3.2 Impact Assessment Methodology

As part of the Pilot Program, YCWA potentially could transfer up to a total of 125,000 acre-feet of water into the Yuba River between April 2006 and February 2007. Under the proposed project, water will be supplied from surface water storage in New Bullards Bar Reservoir and a portion may be from substitution of groundwater for surface water deliveries by several Member Units. The maximum amount of water that could be derived from groundwater substitution is 85,000 acre-feet.

The evaluation of potential groundwater resources impacts due to the proposed project is based upon the assessments provided in the Groundwater Analysis (MWH 2005) and the analyses in the EWA EIS/EIR (Reclamation *et al.* 2003). In these assessments, the groundwater recharge rate of the Yuba County groundwater subbasin first was determined. Then, historic groundwater level data were critically reviewed to evaluate the rate of aquifer recovery associated with historic water transfers (i.e., transfers that utilized groundwater quantities no greater than 85,000 acre-feet). To evaluate the potential effects on non-Member Unit groundwater well users, available documentation of mitigation measures performed in support of the historic transfers also were reviewed.

4.3.3.3 Impact Assessment

Groundwater substitution was used by YCWA and its Member Units to support water transfers in 1991, 2001 and 2002 (MWH 2005). Based on the experience gained from these water transfers, extracted quantities are to be well within the aquifer's ability to recharge in a reasonable amount of time (MWH 2005). Further, although groundwater substitution may result in temporary localized declines in groundwater levels, programmatic monitoring and mitigation measures exist to address this potential consideration (MWH 2005).

For the proposed project, the maximum amount of water that would be derived from groundwater substitution is 85,000 acre-feet. Based on the information presented in the Groundwater Analysis (MWH 2005), the extraction of this amount of water will result in conditions that are within an acceptable range for the groundwater basin. Operation of the 2006 groundwater substitution program and the projected post-transfer basin conditions would not cause significant or unreasonable impacts to the environment. These expected conditions along with the basin management procedures implemented by YCWA and Member Units would result in no significant unmitigated third-party impacts to other groundwater users within the basin. The water transferred during the proposed project would not strain the water supply and overall conditions of the Yuba North or Yuba South subbasins, and would not contribute to, or result in conditions of overdraft.

Yuba Groundwater Subbasin

Currently, groundwater is the primary source of drinking water and surface water is the primary source of irrigation water in the Yuba River Basin. Historically, however, groundwater also was a primary source of irrigation water, and signs of overdraft were apparent by the 1980s. As a result of these overdraft considerations, actions were taken to replace groundwater with surface water for irrigation purposes. Subsequent to the development of the Yuba River Operating Program, deliveries of surface water began with the completion of the initial phase of the South Yuba Canal in 1983. Extension of the canal continues to this day with increasing areas of the South Yuba subbasin receiving surface water with a concomitant reduction in groundwater use. Groundwater storage has recovered to the extent that current groundwater storage in the South Yuba subbasin is nearing the levels of the pre-development era.

Groundwater Recharge Rates

Since construction of the South Yuba Canal, the estimated increase in groundwater storage for the Yuba South Basin has ranged from 15,100 acre-feet to 21,200 acre-feet per year, depending on hydrologic conditions (MWH 2005). Recharge is faster adjacent to the river, as all of the stream channels and floodplain deposits along the Yuba River act as a large water intake area for recharge of the subbasin (MWH 2005).

Groundwater Levels

Increased groundwater pumping in support of water transfers could cause localized declines of groundwater levels, or the development of cones of depression near pumping wells. For example, the 2001 transfer operations affected wells in the Las Quintas area (lower groundwater levels). Because of the lower levels, either reduced well pumping capacity or loss of pumping capacity occurred. In response, the Cordua Irrigation District (the member district for this area) lowered the pumps and/or deepened the wells for five residences. Ultimately, no significant long-term or unmitigated impacts to the residents of this area occurred.

In order to address these potential local declines in future transfers involving groundwater substitution, DWR, YCWA and the Member Units have implemented a cooperative monitoring program that will ensure immediate remedial action would be taken to mitigate any identified impacts from a groundwater substitution (see Groundwater Management, below).

Interaction with Surface Water

All of the stream channels and floodplain deposits along the Yuba River act as a large water intake area for recharge of the groundwater subbasin (MWH 2005). Since groundwater substitution would be used to support higher riverine flows during dry years, effects to riparian and aquatic habitats along the Feather and Yuba Rivers would be unlikely. Any loss from the river that would occurs in response to transfer pumping is accounted for by the required instream flow rate. Large flows would be maintained in these rivers that would continue to support aquatic and riparian resources at levels that would exist in the absence of the proposed water transfers.

The portion of the Bear River that most likely could be affected by the proposed project has only limited connection with adjacent groundwater that would be pumped. Wetlands, primarily irrigated rice cultures, exist in the area and pumping activities could reduce groundwater availability as a source of the wetlands' water supply. However, the amount of water applied for irrigation and the resulting return flows would be largely unchanged under the proposed project, relative to the basis of comparison and would continue to support wetlands (Reclamation *et al.* 2003).

In addition to the Groundwater Management tasks that YCWA employs to protect groundwater resources (see below), as part of the EWA, DWR implements a Well Review process to reduce potential effects upon surface waters. The Well Review may determine that pumping activities should be limited to certain wells, or to a specified depth in some areas, in order to avoid hydraulic interaction between pumping and overlying surface water systems.

Groundwater Quality

Potential groundwater quality effects associated with increased groundwater withdrawals in the North Yuba and South Yuba subbasins include the migration of reduced quality water. Groundwater underlying Beale Air Force Base on the eastern boundary of the South Yuba subbasin is contaminated and being remediated. In addition, high nitrate levels are present in the boundaries of Dry Creek Mutual Water Company (Reclamation *et al.* 2003), and the upward migration of saline water from the deeper aquifers is of concern near Wheatland in the southeastern portion of the South Yuba subbasin. Although plans to supply surface water to this area are in the preliminary planning phase, this area currently relies on groundwater, which may cause the upward migration of saline water.

With the exception of these areas, groundwater is of good quality with a median total dissolved solids (TDS) concentration of 277 mg/L and 224 mg/L for the North and South Yuba subbasins, respectively. Groundwater extraction associated with past transfers was a sufficient distance from these potential problem areas, thus avoiding any adverse groundwater quality impacts.

Groundwater Management

YCWA has a number of water transfer policies that help guide agency operations. These policies specify that groundwater transfers should not result in unmitigated third party impacts, or cause overdraft. BVID also has a set of principles and policies addressing groundwater substitution transfers (Reclamation *et al.* 2003).

Through previous transfers, YCWA has learned that conjunctive use operations can cause isolated and site-specific effects. If an immediate response is provided, significant short-term or long-term impacts normally can be avoided completely.

Over the past decade, YCWA and its Member Units have taken an active and progressive role in managing the groundwater resources of the subbasin. YCWA also works with DWR in monitoring the basin and has been instrumental in extending the monitoring network of wells in the basin. Several of the districts in Yuba County have adopted groundwater management plans and YCWA adopted a groundwater management plan (compliant with AB 3030 SB 1938) during February 2005. YCWA and the districts participating in water transfers meet regularly to discuss the management of the basins. As part of basin management, YCWA, DWR, and the Member Units have instituted a monitoring plan to record in detail the water levels and water quality of the basins. The monitoring plan will be included in the water transfer contract with DWR.

The groundwater management approach for groundwater substitution transfers in Yuba County is embodied in three principles, as follows:

- Closely monitor conditions to watch for any potential significant impacts and to gain a better understanding of the groundwater resource;
- Immediately respond to any significant impacts that occur and mitigate those impacts with appropriate measures; and
- Utilize the transfer and associated activities to further the goal of effective management of the water resources of Yuba County through conjunctive use of groundwater and surface water.

YCWA and DWR coordinated implementation of the Groundwater Program for the Yuba Basin will protect Yuba County's groundwater resources. Overall, no unreasonable impacts upon local groundwater resources would occur related to the proposed project.

South-of-the-Delta Groundwater Banks

DWR may store a portion of the proposed project transfer water in groundwater banks located in the San Joaquin Groundwater Basin, south of the Delta. It is likely that groundwater banks would be utilized in 2006 if the water supplied to EWA and requested by SWP contractors does not require delivery of the full proposed project transfer amount. Storing excess transfer water in groundwater banks would make storage space available in San Luis Reservoir available for 2007. The water that is stored as groundwater likely would be extracted for use later as part of

DWR's entitlement or could be conveyed to the California Aqueduct to supplement SWP water supply.

If groundwater basins south of the Delta were used, the amount of water that would be extracted from them would be equivalent to the amount that is deposited. Storage of the proposed project transfer water potentially could result in beneficial effects upon the groundwater basin by increasing groundwater levels, if only temporarily. Eventual extraction of the water potentially could result in groundwater declines, subsidence, or groundwater quality degradation. However, transfer water utilized in the EWA Program is subject to certain mitigation provisions. Groundwater banking participants have signed MOUs or other agreements that ensure mitigation of potential adverse impacts through monitoring and regulation of groundwater declines, subsidence and water quality conditions. Therefore, the proposed project would not be expected to result in unreasonable impacts to south-of-Delta groundwater banks.

4.4 Fisheries and Aquatic Resources

The evaluation of potential impacts on fisheries and aquatic resources due to the proposed project focuses on reservoirs where operational changes are anticipated (New Bullards Bar and Oroville), the rivers used for the conveyance of the transfer water (Yuba, Feather, and Sacramento), and the Delta.

4.4.1 Environmental Setting

4.4.1.1 New Bullards Bar Reservoir

New Bullards Bar Reservoir has steeply sloped sides created from the flooding of a deep canyon. New Bullards Bar Reservoir supports both coldwater and warmwater fisheries including rainbow trout, kokanee salmon, brown trout, largemouth bass, smallmouth bass, crappie, sunfish, and bullhead (Jones and Pack 2004). Although warmwater fish species are known to occur in New Bullards Bar Reservoir (crappie, largemouth and smallmouth bass, and sunfish), limited recreational fisheries exist for these warmwater fish species. New Bullards Bar Reservoir supports an important salmonid fishery and is reported as having some of the best kokanee salmon fishing throughout the State of California (Jones and Pack 2004).

4.4.1.2 Yuba River

Based on general differences in hydraulic conditions, channel morphology, geology, water conditions, and fish species distribution, Beak (1989) divided the lower Yuba River into the following four reaches:

- **Narrows Reach** – extends from Englebright Reservoir to the downstream terminus of the Narrows (River Mile [RM] 23.9 to RM 21.9); topography is characterized by steep canyon walls;
- **Garcia Gravel Pit Reach** – extends from the Narrows downstream to Daguerre Point Dam (RM 21.9 to RM 11.5);
- **Daguerre Point Dam Reach** – extends from Daguerre Point Dam downstream to the upstream area of Feather River backwater influence (just east of Marysville) (RM 11.5 to RM 3.5); and

- **Simpson Lane Reach** – begins at the upstream area of Feather River backwater influence and extends to the confluence with the Feather River (RM 3.5 to RM 0).

The lower Yuba River consists of the approximately 24-mile section extending from Englebright Dam, the first impassable fish barrier along the river, downstream to the confluence with the Feather River near Marysville.

The Yuba River provides habitat for anadromous fish species such as Central Valley steelhead (federally listed threatened species), Central Valley fall-run Chinook salmon (federal species of concern), Central Valley spring-run Chinook salmon (state and federally listed threatened species), southern distinct population segment of green sturgeon (proposed federally threatened), and American shad. Resident fish in the lower Yuba River include rainbow trout, smallmouth bass, largemouth bass, Sacramento sucker, Sacramento pikeminnow, common carp, stickleback, and sculpin (YCWA 2004).

Water temperatures are colder upstream of Daguerre Point Dam than downstream of Daguerre Point Dam during the warmer months of the year. Water diversions occur in the vicinity of Daguerre Point Dam, which result in lower flows downstream, primarily during the summer and fall months. Also, during summer months, Yuba River water temperatures progressively warm from the release point downstream of Englebright Dam to the confluence with the Feather River. Yuba River water temperatures generally are cooler than those in the Feather River around the Yuba-Feather river confluence (YCWA 2003b).

The differences in habitat characteristics (e.g., substrates, flows, water temperatures) of the 24 miles of the lower Yuba River suggests a gradient of potential use by Chinook salmon and juvenile steelhead. The upper reaches represent the best habitat for spawning and rearing, and the lower-most reach represents the poorest habitat and serves primarily as a corridor for Chinook salmon and steelhead migration.

Species Occurrence, Status, and Life Stage Habitat Requirements

The timing of the life history events of each fish varies. Therefore, at any given time, water operations associated with the proposed project potentially could affect different life stages and associated habitat requirements (e.g., adult immigration and holding, spawning and embryo incubation, and juvenile rearing and downstream movement) of the various species.

Steelhead

Central Valley steelhead is federally listed as "threatened" under the ESA. Historical information on Central Valley steelhead populations is limited. Steelhead ranged throughout accessible tributaries and headwaters of the Sacramento and San Joaquin rivers before major dam construction, water development, and other watershed disturbances. Historical declines in steelhead abundance have been attributed largely to dams that eliminated access to most of their historic spawning and rearing habitat, and restricted steelhead to less suitable habitat below the dams. Other factors that have contributed to the decline of steelhead and other salmonids include habitat modification, over-fishing, disease and predation, inadequate regulatory mechanisms, climate variation, and artificial propagation (NMFS 1996).

CDFG estimated that only approximately 200 steelhead spawned in the lower Yuba River before New Bullards Bar Reservoir was completed in 1969. From 1970 to 1979, CDFG annually stocked 27,270 to 217,378 fingerlings, yearlings, and sub-catchables from Coleman National Fish Hatchery into the lower Yuba River (McEwan and Nelson 1991; NMFS 1996). Based on angling data, CDFG estimated a run size of 2,000 steelhead in the lower Yuba River in 1975. The current status of this population is unknown, but it appears to be stable and able to support a significant sport fishery (McEwan and Jackson 1996). The Yuba River is currently managed for natural steelhead production.

Immigration and Holding

The immigration of adult steelhead in the lower Yuba River has been reported to occur from August through March, with peak immigration from October through February (McEwan and Nelson 1991). For this Environmental Analysis, the adult immigration and holding life stages will be evaluated together, because it is difficult to determine the thermal regime that steelhead have been exposed to in the river prior to spawning and, in order be sufficiently protective of pre-spawning fish, water temperatures that provide high adult survival and high egg viability must be available throughout the entire freshwater immigration and holding period. Water temperatures can affect the timing of adult spawning and migrations, and can affect the egg viability of holding females. Few studies have been published that examine the effects of water temperature on either immigration or holding, and none have been recent (Bruin and Waldsdorf 1975; McCullough *et al.* 2001). The available studies suggest that adverse effects could occur to immigrating and holding steelhead at water temperatures that exceed the mid 50°F range, and that immigration could be delayed if water temperatures approach approximately 70°F (Bruin and Waldsdorf 1975; McCullough *et al.* 2001).

Spawning and Embryo Incubation

Steelhead spawning and embryo incubation generally occurs from January through May in the Yuba River (SWRI 2002). Salmonids typically deposit eggs within a range of depths and velocities that minimize the risk of desiccation as seasonal water levels recede, and that maintain high oxygen levels and remove metabolic wastes from the redd (Spence *et al.* 1996). Water depth range preference for spawning steelhead has been most frequently observed between 0.3 and 4.9 feet (Moyle 2002). The reported preferred water velocity for steelhead spawning is 1.5 feet per second (ft/s) to 2.0 ft/s (USFWS 1995b). Few studies have been published regarding the effects of water temperature on steelhead spawning and embryo incubation (Redding and Schreck 1979; Rombough 1988). From the available literature, water temperatures in the low 50°F range appear to support high embryo survival, with substantial mortality to eggs reportedly occurring at water temperatures in the high 50°F range and above 60°F (Redding and Schreck 1979; Velsen 1987).

Juvenile Rearing

Juvenile steelhead often rear in the lower Yuba River for one year or more (SWRI 2002). Both seasonal and anthropogenic fluctuations in river flows affect juvenile steelhead habitat quantity and quality. Within freshwater environments, juvenile salmonids select specific microhabitats where water depth and velocity fall within a specific range or where certain hydraulic properties occur. Juvenile steelhead prefer water depths and velocities that provide adequate cover and foraging opportunities. The reported optimal water velocity for juvenile steelhead is 0.9 ft/s (USFWS 1995b). Juvenile steelhead reportedly most often utilize water depths of approximately 15 inches (McEwan 2001). Like other salmonids, growth, survival, and successful smoltification of juvenile steelhead are affected by water temperature. The duration of steelhead residence in freshwater is long relative to that of fall-run Chinook salmon, making the juvenile life stage of steelhead more susceptible to the influences of water temperature, particularly during the over-summer rearing period. The preferred range of water temperatures for juvenile steelhead is reportedly 62.6°F to 68.0°F (Cech and Myrick 1999).

Smolt Emigration

Juvenile steelhead smolt emigration can occur in the Yuba River from October through May (SWRI 2002). River flow may be important in facilitating downstream movement of steelhead smolts. Smolt emigration is prompted by factors (e.g., photoperiod, instream flow, and water temperature), that induce the fish to emigrate once a physiological state of readiness has been achieved (Groot and Margolis 1991). The reported optimum water temperature range for successful smoltification of juvenile steelhead is 44.0°F to 52.3°F (Myrick and Cech 2001; Rich 1987). River flows may be an important factor influencing the rate at which steelhead smolts migrate downstream, although factors influencing the actual speed of migration remain poorly understood. Steelhead smolts that emigrate later (e.g., May) during the emigration period may undergo a more rapid parr-smolt transformation as seasonal water temperatures increase (Spence *et al.* 1996).

Spring-run and Fall-run Chinook Salmon

Specific information on the life history and habitat requirements of spring-run Chinook salmon in the lower Yuba River was not located during an extensive literature search. Spring-run Chinook salmon cannot reliably be distinguished from fall-run Chinook salmon during spawning, rearing and emigration periods because of overlapping spawning periods, juvenile sizes, and other life history traits (YCWA 2000). Reported information on the life history and habitat requirements of Central Valley spring-run Chinook salmon can be found in the *Report to the Fish and Game Commission: A Status Review of the Spring-Run Chinook Salmon* (CDFG 1998) and *Habitat Restoration Actions to Double Natural Production of Anadromous Fish in the Central Valley of California* (USFWS 1995b).

The Central Valley spring-run Chinook salmon is listed as a threatened ESU under both the federal and state ESAs. Critical habitat for this ESU, which includes the lower Yuba River, was designated on September 2, 2005, which includes the lower Yuba River. Several factors have contributed to the state and federally "threatened' status of Central Valley spring-run Chinook salmon in the lower Yuba River. Major in-basin factors contributing to the decline were migration barriers, hydraulic mining, and water diversions. Hydraulic mining in the Yuba River watershed from 1850 to 1885 caused extensive habitat destruction. Between 1900 and 1941, debris dams constructed by the California Debris Commission, now owned and operated by the Corps on the lower Yuba River to retain hydraulic mining debris, completely or partially blocked the migration of Chinook salmon and steelhead to historic spawning and rearing habitats (CDFG 1991b; Wooster and Wickwire 1970; Yoshiyama *et al.* 1996). Water diversions also contributed to poor habitat conditions below the dams, especially in dry years. Today, Englebright Dam, completed in 1941 by the California Debris Commission and now owned and operated by the Corps, completely blocks spawning runs of Chinook salmon and steelhead, and is the upstream limit of fish migration.

Since the completion of New Bullards Bar Reservoir in 1970 by YCWA, higher, colder flows in the lower Yuba River have improved conditions for over-summering and spawning of spring-run Chinook salmon in the lower Yuba River. Relatively small numbers of Chinook salmon that exhibit spring-run phenotypic characteristics have been observed (CDFG 1998). Although precise escapement estimates are not available, the USFWS testified at the 1992 SWRCB lower

Yuba River hearing that *"…a population of about 1,000 adult spring-run Chinook salmon now exists in the lower Yuba River"* (SWRCB 2005). During March 1 through July 31 in 2001, 108 adult spring-run Chinook salmon were estimated to pass the fish ladders at Daguerre Point Dam on the lower Yuba River, possibly representing the early portion of the run. During September 2001, 288 Chinook salmon redds were observed. Historically, September is the peak month of spring-run Chinook salmon spawning, although some temporal overlap with fall-run Chinook salmon occurs (CDFG 2002b; Myrick and Cech 2001; Rich 1987; SWRCB 2005). Neither of these estimates was used to attempt to estimate the total spring-run Chinook salmon escapement in the lower Yuba River. The origin of these fish and their genetic relationship with fall-run Chinook salmon are unknown. The run may have originated from plants of hatchery-reared spring-run Chinook salmon in the lower Yuba River during the 1970s.

For this Environmental Analysis, the life stage habitat requirements for both the spring and fall runs of Chinook salmon are discussed concurrently.

Adult Immigration and Holding

Adult spring-run Chinook salmon immigration and holding occurs in the Yuba River from February through September; upstream migration generally peaks in May (SWRI 2002). Adult fall-run Chinook salmon immigration and holding occurs August through September, typically peaking in October and November (SWRI 2002). The adult immigration and holding life stages are evaluated together, because it is difficult to determine the thermal regime that Chinook salmon have been exposed to in the river prior to spawning. Elevated water temperatures and increased adult holding habitat densities can influence the number and virulence of common microparisites affecting immigrating adult salmonids (Spence *et al.* 1996). Water temperatures also can influence the timing of adult spawning and the egg viability of holding females. Adult Chinook salmon prefer to hold in run and pool habitats during their upstream migration to spawning areas. Preferred holding water depths for these habitats are usually greater than 6.2 feet (Moyle 2002). The acceptable water temperature range for adults immigrating upstream and holding is 57°F to 67°F (NMFS 1997). However, water temperatures above 64°F reportedly could cause the many diseases that commonly affect immigrating and holding Chinook salmon to become virulent (EPA 2001).

Spawning and Embryo Incubation

Spring-run Chinook salmon spawning and embryo incubation occurs in the lower Yuba River from September through December. Fall-run Chinook salmon spawning and embryo incubation occurs generally from October through March. Approximately 60 percent of the Chinook salmon population in the lower Yuba River spawn above Daguerre Point Dam (SWRCB 2003). In the lower Yuba River, early Chinook salmon redds have been observed in the Garcia Gravel Pit Reach (primarily above Parks Bar) by mid-September (CDFG 2000). Characteristics of spawning habitats that are directly related to flow include water depth and velocity. Chinook salmon spawning reportedly occurs in water velocities ranging from 1.2 ft/s to 3.5 ft/s. Chinook salmon redd construction and spawning typically occurs at water depths greater than 0.5 feet. Maximum Chinook salmon embryo survival reportedly occurs in water temperatures ranging from 41°F to 56°F (USFWS 1995b).

Juvenile Rearing and Smolt Emigration

Spring-run Chinook salmon juvenile rearing is believed to extend year-round (Moyle 2002), and smolt emigration generally occurs from November through June in the lower Yuba River (SWRI

2002). Fall-run juvenile rearing and emigration occurs from December through June (SWRI 2002). Fall-run Chinook salmon emigration generally occurs within several weeks of emergence from gravels. Juvenile salmonid growth, survival, and successful smoltification are influenced by various environmental and physiological factors, including photoperiod and water temperature. During juvenile rearing and smolt emigration, salmonids prefer stream margin habitats with sufficient depths and velocities to provide suitable cover and foraging opportunities. Chinook salmon reportedly utilize river channel depths ranging from 0.9 feet to 2.0 feet (Raleigh *et al.* 1986). Water velocities observed being utilized most frequently by juvenile Chinook salmon range from 0 ft/s to 1.3 ft/s (Raleigh *et al.* 1986). Water temperatures reported for optimal growth and survival of Central Valley Chinook salmon range from 53°F to 64°F (Raleigh *et al.* 1986).

Southern Distinct Population Segment of Green Sturgeon

The green sturgeon is the most widely distributed member of the sturgeon family *Acipenseridae* (68 FR 4433 (2003)). In California, historical spawning populations existed only in the Sacramento, Eel, and Klamath-Trinity river systems. A number of presumed spawning populations (Eel River, South Fork Trinity River, San Joaquin River) have been lost, and the only known spawning in California now occurs in the Sacramento and Klamath river systems (Moyle 2002; NMFS 2002). Green sturgeon are reported to spawn in the Feather River, though this claim is not substantiated (NMFS 2002). Green sturgeon reportedly still regularly occur in the Bear and Yuba rivers (CDFG 2002a). Daguerre Point Dam restricts the upstream migration of green sturgeon in the lower Yuba River. Although green sturgeon have been known to utilize fish ladders (Peake *et al.* 1997), the fish ladders on Daguerre Point Dam are not adequately designed to allow passage by sturgeon. The Daguerre Point Dam fish ladders are pool and weir type structures that require fish to jump from step to step as they ascend weirs located on each side of the dam (NMFS 2001). This type of swimming behavior would not be expected to commonly occur due to the benthic nature of sturgeon. Therefore, Daguerre Point Dam is considered a barrier to the upstream migration of green sturgeon in the lower Yuba River.

Specific life history requirements have not been developed for green sturgeon populations within tributaries of the Sacramento River; therefore, for the purpose of this environmental assessment, life history requirements for green sturgeon in the Sacramento River are assumed to be the same in the lower Yuba River.

Green sturgeon are anadromous and are the most marine-oriented of the Pacific Coast sturgeon species (68 FR 4433 (2003)). Green sturgeon are thought to spawn every three to five years (68 FR 4433 (2003)), and may spawn as frequently as every two years (70 FR 17386 (2005)). In the Sacramento River, green sturgeon spawning occurs during late spring and early summer above Hamilton City, and perhaps as far upstream as Keswick Dam (CDFG 2000). Adults begin their inland migration in late-February (Moyle *et al.* 1995), and enter the Sacramento River between February and late July. The water temperature tolerance of immigrating adult green sturgeon reportedly ranges from 44.4°F to 60.8°F (USFWS 1995b). The spawning period generally extends from March through July, with peak spawning occurring between April and June (Moyle *et al.* 1995). Green sturgeon reportedly tolerate spawning water temperatures ranging from 50°F to 70°F (CDFG 2001). Water temperatures above 68°F are reportedly lethal to green sturgeon embryos (Cech *et al.* 2000). Green sturgeon larvae first feed at about 10 days post-hatch, and metamorphosis to the juvenile life stage is generally complete at 45 days. Juveniles spend one to three years in fresh water before they enter the ocean (68 FR 4433 (2003)). Growth of juvenile green sturgeon is reportedly optimal at a water temperature of 59°F and reduced at water temperatures exceeding 66.2°F (Cech *et al.* 2000). Juvenile green sturgeon are taken in traps at the Red Bluff Diversion Dam and the Glenn-Colusa Irrigation District pumping facility in Hamilton City, primarily in the months of May through August. Peak counts occur in the months of June and July (68 FR 4433 (2003)). Because the literature does not report on green sturgeon water temperature preferences during juvenile emigration, the water temperature requirement for juvenile rearing are considered to also be also applicable to juvenile emigration. Green sturgeon disperse widely in the ocean after their out-migration from freshwater (68 FR 4433 (2003)).

American Shad

American shad are native to the Atlantic coast and were introduced into the Sacramento River in the 1800s (Moyle 2002). In the Sacramento River and its tributaries, such as the Yuba River, homing behavior is generally assumed to guide American shad to their natal rivers to spawn, although there is some evidence to suggest that the numbers of shad spawning in major tributaries are proportional to flows of each river at the time the shad arrive. They also are capable of timing their migrations to river outflows (Quinn and Adams 1996). However, spawning fish tagged in one year are most likely to return to the same river in following years if they are repeat spawners (Johnson and Dropkin 1995). Water temperature is an important factor influencing the timing of American shad spawning, which takes place mostly in the main channels of rivers. Peak spawning reportedly occurs at water temperatures between 51.2°F and 62.6°F (Moyle 2002). Approximately 70 percent of the spawning run is composed of first time spawners (Moyle 2002). When suitable spawning conditions are found, American shad school and broadcast their eggs throughout the water column. Egg incubation and hatching are coincident with the primary spawning period in the lower Yuba River, which occurs from May through June (SWRI 2002).

Summary of Recent Water Transfer Fisheries Monitoring Studies and Findings

The Yuba River is one of many Central Valley rivers that has been utilized in water transfer projects for a number of years. The following discussion provides a summary of YCWA's recent water transfers and related monitoring studies and evaluations performed in 2001, 2002, and 2004. Monitoring studies were not conducted in 2003 because a research permit, authorizing take of federally listed species, as required for monitoring by Section 10 of the federal ESA, was not issued in that year.

In 2001, 2002, 2003 and 2004, YCWA and other local water agencies initiated water transfers from New Bullards Bar Reservoir through the Yuba River to satisfy a variety of downstream water needs. YCWA water transfer amounts and periods were as follows:

Year	Acre-feet	Transfer Period
2001	172,000 acre-feet	July 1 through mid-October 2001
2002	157,050 acre-feet	Mid-June through mid-September 2002
2003	65,000 acre-feet	Mid-July through mid-October 2003
2004	100,487 acre-feet	July 1 through September 28, 2004

The primary fisheries issues evaluated in recent water transfer monitoring and evaluation studies include issues associated with: (1) juvenile steelhead downstream movement; (2) adult

Chinook salmon immigration and the potential for increased straying of non-native fish into the lower Yuba River; and (3) water temperatures in the lower Yuba River and Feather River.

Juvenile steelhead and adult Chinook salmon were monitored during the 2001, 2002 and 2004 Yuba River water transfers utilizing rotary screw traps (RSTs) and adult ladder trapping. In June 2003, an automated fish detection system was installed at the Daguerre Point Dam fish ladders to improve the overall efficiency of adult Chinook salmon monitoring). Due to the differences in the characteristics of the water transfers (i.e., a distinct ramp-up period in 2001 but not in 2002 or 2004), patterns of juvenile steelhead downstream movement that were observed in 2001 were not similar to those observed in 2002 or 2004. Additionally, monitoring program complications and inherent natural variation between 2001, 2002, and 2004 (associated with water year type and the abundance, timing and distribution of juvenile steelhead, among other parameters) complicate the use of the observations to draw definitive conclusions regarding the effects of water transfers on juvenile steelhead in the lower Yuba River. However, the studies and evaluation undertaken in 2004 provide an assessment of potential short-term effects of the 2004 water transfers on lower Yuba River fisheries (specifically regarding juvenile steelhead movement and adult Chinook salmon immigration).

Discussions among YCWA and fisheries resources agencies (i.e., CDFG, USFWS and NMFS) resulted in modification of the operations associated with the 2004 water transfer. Specifically, CDFG suggested several measures to avoid potential adverse impacts upon anadromous fish resources of the lower Yuba River. In response to these discussions, YCWA maintained minimum instream flow levels to avoid substantial increases or decreases in lower Yuba River flow at the initiation of the 2004 water transfers. Additionally, YCWA operated the Yuba Project such that changes in flow were gradual. Also, as requested by CDFG, the monitoring and evaluation studies of lower Yuba River fisheries conducted in 2002 were continued in 2004.

The initial observations and reported findings of the monitoring and evaluation studies undertaken during 2001, 2002, and 2004 are summarized below, and provide insight to potential effects associated with the 2006 project.

Juvenile Steelhead Downstream Movement

Resource agencies involved in the management of fisheries resources in the lower Yuba River have indicated concern that YCWA water transfers potentially can induce the downstream movement of juvenile steelhead due to increases in instream flows associated with water transfer operations. The potential movement of juvenile steelhead over Daguerre Point Dam (RM 11) restricts subsequent rearing to those areas downstream of Daguerre Point Dam, because juvenile steelhead are not able to readily pass back upstream of Daguerre Point Dam. Conditions downstream of Daguerre Point Dam may be more or less suitable for juvenile steelhead rearing during the post-water transfer period, depending upon several factors, including post-water transfer water temperatures as influenced by ambient conditions.

This section summarizes the observations made based upon monitoring and evaluation studies conducted during the 2001, 2002 and 2004 YCWA water transfers. It is noted that due to differences in monitoring program implementation during these years of study, it is problematic to conclude definitive trends from the data. However, based upon the substantial differences in juvenile steelhead downstream movements (RST catch data) noted between the 2001 study, and the 2002 and 2004 studies, it does appear that the increases in juvenile steelhead downstream movement associated with the initiation of the 2001 water transfers were avoided due to a more gradual ramping-up of flows that occurred in 2002 and 2004.

The 2001 water transfer was characterized by a relatively large, rapid ramp-up period. Beginning approximately July 1, 2001, water transfers increased flows in the lower Yuba River over a few days by about 1,200 cfs and generally were sustained through late August when ramping down began. On July 8, 2001, a week subsequent to the start of the 2001 water transfers, the daily catch at the CDFG Hallwood Boulevard (RM 7) RST increased from less than ten young-of-the-year (YOY) steelhead juveniles per day, to more than 450 YOY per day (CDFG unpublished data). The next week, daily catches decreased to about 190 YOY per day. In the following weeks, while the transfers were continuing, daily catches decreased further, but still surpassed catches prior to the water transfers. Thus, potentially associated with the ramping-up of the 2001 water transfers, juvenile steelhead moved downstream from the upstream reaches of the lower Yuba River to areas downstream of Hallwood Boulevard. The relationship between a rapid increase in flow and a large peak in the number of juvenile steelhead captured at the RSTs may indicate that the water transfer affected downstream movement of juvenile steelhead, possibly over Daguerre Point Dam into the lower Yuba River, or into the lower Feather River.

In response to the 2001 water transfer observations, discussions regarding flow and water temperature patterns and coincident fish behavior, including juvenile steelhead downstream movement, YCWA, NMFS, USFWS, CDFG, and NGO representatives collaboratively developed a rigorous monitoring and evaluation plan for YCWA water transfers. Additionally, these entities created an instream flow release schedule for the water transfers to avoid a rapid increase in flow when the transfers begin to minimize or avoid impacts upon anadromous fish in the lower Yuba River.

During the 2002, 2003, and 2004 water transfers, YCWA operated the Yuba Project in a manner that maintained instream flows in the lower Yuba River at a relatively stable rate in the late spring, with gradual changes in flow rates through initiation of the water transfer. Maintenance of more stable and gradually changing flows during this period (June through July), rather than a large, rapid ramp-up such as occurred during the 2001 water transfer, appeared to minimize the potential for transfer-related inducement of juvenile salmonid downstream movement.

Monitoring data (RST catch data) for 2002 and 2004 water transfers indicate that the large peak in downstream movement of juvenile steelhead observed in 2001 did not occur in 2002 or 2004. During the 2002 water transfer evaluation, the abundances and the temporal distributions of juvenile steelhead passing Daguerre Point Dam and Hallwood Boulevard were estimated. In addition, several observations were made regarding the possible relationship between juvenile steelhead downstream movement and flow, water temperature, and the initiation, ramp-down and termination of the 2002 water transfers. The RST catch data from the 2002 water transfers do not suggest an association between the initiation of the water transfers and the downstream movement of juvenile steelhead. This information suggests that a large increase in the numbers of juvenile steelhead moving downstream such as that which occurred at the initiation of the 2001 transfers may be avoided by maintaining a more gradual increase in flows through the initiation of water transfers. Downstream movement of juvenile steelhead during the water transfers may be associated with the rate of flow increase from the water transfer, rather than the eventual maximum flow or a response to water temperature change. In 2004, neither the RST catch data nor the estimated abundances suggest an association between the initiation of the water transfers and the downstream movement of juvenile steelhead.

The juvenile steelhead catch data from the 2002 water transfers suggest a site-specific variation in the relationship between juvenile steelhead downstream movement (both timing and abundance), and the ramp-down of transfer flows. During the 2002 extended ramp-down period (31 days), the number of juvenile steelhead moving downstream from upstream of Daguerre Point Dam decreased considerably relative to the number of juvenile steelhead moving downstream during the preceding period of relatively high and stable flows. It appears that juvenile steelhead generally ceased movement past Daguerre Point Dam concurrently with the ramp-down of the water transfers. By contrast, the largest numbers of juvenile steelhead moved downstream past Hallwood Boulevard during the ramp-down period. However, this peak is not clearly associated with the flow ramp-down initiation, but may be more closely related to the subsequent increase in water temperatures. Hence, it appears that the juvenile steelhead responses to the ramp-down of flows associated with the 2002 water transfers may differ by river reach.

The 2004 Yuba River water transfers were characterized by a significantly shorter ramp-down period (5 days) than the 2002 water transfers. Unlike the 2002 observations, the 2004 data did not indicate a site-specific variation in the relationship between juvenile steelhead downstream movement (both timing and abundance) and the ramp-down of transfer flows. The number of juvenile steelhead moving past the three RST sites decreased during the ramp-down of flows.

During both 2002 and 2004, a greater number of steelhead juveniles moved past the Daguerre Point Dam RST relative to the Hallwood Boulevard RST location. Statistical evaluation of the 2002 and 2004 data indicate that the percentage of fish moving downstream past these locations was not significantly different between the two years of data (YCWA 2005). During the 2002 water transfers investigations, the estimated abundance of juvenile steelhead passing the Daguerre Point Dam RST significantly exceeded the estimated abundance of juvenile steelhead passing the Hallwood Boulevard RST (by approximately 80,000 fish), which may or may not have been associated with the water transfers and/or the presence of Daguerre Point Dam. However, the results of the 2002 water transfers study did not have sufficient resolution to determine the reasons for the significant difference in abundance estimates between monitoring sites, and the experimental design did not allow for determination of the fate of the fish that moved passed the Daguerre Point Dam RSTs. Potential losses of fish may be attributed to mortality encountered while passing the Daguerre Point Dam, diversion of fish through the Hallwood-Cordua diversion canal, or mortality or residualization within the Middle Yuba River study reach (between upstream and downstream RST locations) (YCWA 2005). Three potential factors may explain the large differences in the estimated total number of juvenile steelhead passing each of the three RST locations. First, juvenile steelhead moving from upstream of the Daguerre Point Dam may experience relatively high mortality rates at Daguerre Point Dam and in the river reaches between Daguerre Point Dam and Kibbe Road, as well as between Kibbe Road and Hallwood Boulevard. Although some proportion of the emigrating juvenile steelhead population likely suffered mortality from factors such as predation, disease, natural mortality, and entrainment, it is unlikely that factors such as these alone are able to explain the large observed difference in estimated total abundance between the Daguerre, Kibbe, and Hallwood RSTs.

Second, juvenile steelhead moving past the Daguerre RSTs may not have moved past the Kibbe and Hallwood RSTs before the end of the sampling period. The multi-modal temporal distributions of daily RST catches observed in 2002 and 2004 suggest a periodic variation in the magnitude of downstream moving steelhead in response to some environmental cue (e.g., out-migration prompted by changes in lunar cycles). Also, the habitats between the Daguerre RST and the Hallwood RST may be conducive to rearing, and juvenile steelhead may have temporarily taken up residence in this reach, thus potentially avoiding capture in the Kibbe or Hallwood RST during the study period.

Third, the difference in abundance estimates between the Daguerre and Hallwood Boulevard RST locations also may be partially explained by sampling and analytical error. Differences in RST operations and the placement of the RSTs within the hydraulic spectrum of the river potentially may have caused discrepancies in catch between the traps. For example, slight variations in the capture efficiency tests caused by dissimilarities in the local hydrology where the tests were conducted could produce large differences in capture efficiencies which, in turn, could affect the estimation of the total abundance at each trap location.

It is important to note that the above discussion does not attempt to describe direct causal relationships, and instead only discusses the potential relationships between selected abiotic and biotic factors in the lower Yuba River during the 2002 and 2004 water transfers. The analysis of only two years of quantifiable and calibrated RST capture data, in conjunction with one year of uncalibrated RST catch trends, is not sufficient to definitively determine specific biologic responses of juvenile steelhead to changes in flow and water temperature. The presentation of this data merely shows the potential correlation between the timing of such environmental factors with the spatial and temporal distribution of juvenile steelhead during water transfers in 2001, 2002, and 2004.

In summary, water transfer monitoring in 2001, 2002, and 2004 indicate that the character of the initiation of the water transfers potentially can affect juvenile steelhead downstream movement. In 2001, an increase in the number of downstream moving juvenile steelhead was observed coincident with the relatively rapid and large increase in streamflow at the onset of the water transfer. However, in 2002 and 2004, when increases in streamflow during the initiation of the water transfers were relatively small and gradual, increases in the numbers of downstream moving juvenile steelhead were not observed.

Adult Chinook Salmon Immigration

In the past, hypotheses have been suggested regarding the potential relationships between the water transfers and the relative abundance of adipose fin-clipped and non-adipose fin-clipped immigrating adult Chinook salmon. Specifically, concern has been raised regarding the potential for the Yuba River water transfers via decreased water temperatures and increased flow, relative to the Feather River, to encourage the straying of Feather River hatchery Chinook salmon into the Yuba River. YCWA and CDFG monitoring efforts in 2001, 2002, 2003, and 2004 water transfer years indicated that Chinook salmon of hatchery origin ascended the fish ladders at Daguerre Point Dam in the lower Yuba River during both the water transfer and non-transfer periods. Chinook salmon of hatchery origin also have been observed ascending the Yuba River in non-transfer years (CDFG unpublished data).

Adult Chinook salmon monitoring study results during the 2001 and 2002 water transfers potentially indicated some correspondence with water temperatures, suggesting that the cooler water temperatures potentially associated with the water transfers may have encouraged some straying of non-native adult Chinook salmon into the Yuba River. However, because only the 2002 data were statistically analyzed, the reliance upon only one year of data restricted the confidence in, and overall applicability of, such a tentative conclusion. Further, a number of unexpected procedural difficulties were encountered during the 2002 study implementation leading to unequal distribution of sampling effort at the fish ladders and low number of sampling days representing the water transfer study period (i.e., less than 15 percent of the study period). These issues, combined with the incorrect assumption that salmon counts before, during and after the water transfers were distributed as Poisson variables with constant but distinct rates[2], likely lead to underestimation of adult Chinook salmon abundance. However, despite the procedural difficulties and low reliability of the resulting abundance estimates, the 2002 study led to three general observations.

- The temporal distribution of the combined adult Chinook salmon catch, displaying a large increase in catch coincident with the decreases in flow and increases in water temperature associated with the ramp-down of the water transfers, was more likely a reflection of the adult immigration life stage periodicity expected for fall-run Chinook salmon. Fall-run Chinook salmon typically begin entering the upstream portions of the lower Yuba River in increasing numbers during the late-summer and early fall months (coinciding with the 2002 post-transfer period). Chinook salmon displaying spring-run Chinook salmon life history characteristics in the lower Yuba River generally begin entering the lower Yuba River, in much fewer numbers than fall-run Chinook salmon, at an earlier time that coincided with the 2002 pre-transfer and transfer periods.
- The 2002 immigration rates for non-adipose fin-clipped adult Chinook salmon suggested that the relatively high water transfer flows did not attract salmon immigrants because otherwise a greater immigration rate would have been observed during the transfer period relative to the pre- and post-transfer periods.
- The estimates of the proportions of adipose fin-clipped adult Chinook salmon to the total number of adult Chinook salmon immigrating into the lower Yuba River before, during and after the 2002 water transfers did not indicate the attraction of non-natal (adipose fin-clipped) adult Chinook salmon during the transfer period, because the calculated proportions were based on the abundance and immigration rate estimates for the periods under comparison that were not fully reliable, particularly for adipose fin-clipped adult Chinook salmon.

In June 2003, the VAKI RiverWatcher system (VAKI), an infrared and video graphic device used to classify and enumerate adult fish, was installed at the Daguerre Point Dam fish ladders. During the 2004 study period (May 1 through September 30, 2004), the VAKI was utilized to monitor migration pattern and abundance estimates of adipose fin-clipped and non-adipose fin-clipped adult Chinook salmon immigrating into the lower Yuba River before, during and after the 2004 water transfer. The use of the VAKI as a counting device, and CDFG's processing of the resulting VAKI counts, photographs, and silhouettes enabled a more efficient and reliable collection of data than in 2002. The data were used to obtain estimates of the immigration rates (fish/day), abundance estimates of adipose fin-clipped and non-adipose fin-clipped adult Chinook salmon, and proportions of adipose fin-clipped adult Chinook salmon. The resulting data set permitted intense statistical evaluation including Chi-square analysis, multiple regression analysis and multivariate time series analysis, providing a more thorough assessment of the potential effects of the 2004 water transfer on the immigration of Chinook

[2] A Chi-square analysis indicated that during the 2004 survey, neither the adipose fin-clipped or the non-adipose fin-clipped Chinook salmon migrated with constant but distinct rates for the pre-transfer, transfer, and post-transfer periods, suggesting that the assumption that salmon counts before, during and after the water transfers were distributed as Poisson variables with constant but distinct rates, that was used to estimate the 2002 abundance of adipose fin-clipped and non-adipose fin-clipped Chinook salmon, probably was incorrect.

salmon into the lower Yuba River, and of the relationship between Chinook salmon immigration and Yuba River flows and water temperatures, relative to the Feather River, than could be performed in previous years. The findings of these analyses led to the following general conclusions.

- The temporal distributions of the daily counts of adipose fin-clipped and non-adipose fin-clipped adult Chinook salmon likely were reflections of Chinook salmon adult immigration life stage periodicity, with the relatively abundant fall-run Chinook salmon mostly migrating during the post-transfer period.
- As the 2004 study period progressed, more adipose fin-clipped and non-adipose fin-clipped Chinook salmon were observed immigrating into the Yuba River, but not necessarily resulting from an attraction to the cooler waters of the lower Yuba River, or to a relative increase in Yuba River flows with respect to the Feather River flows. The 2004 abundance estimates and immigration rates for adipose fin-clipped and non-adipose fin-clipped adult Chinook salmon suggest that the relatively high flows and low water temperatures observed during the transfer period did not necessarily attract salmon immigrants; otherwise, greater abundances and immigration rates would have been observed during the transfer period relative to the pre- and post-transfer periods.
- The estimates of the proportions of clipped adult Chinook salmon to the total number of adult Chinook salmon immigrating into the lower Yuba River did not suggest the attraction of non-natal adult Chinook salmon during the 2004 transfer period, because the proportion calculated for the transfer period was not greater than the proportions for the pre-transfer and post-transfer periods.
- Multivariate time series analyses indicate that the immigration rates of non-adipose fin clipped and adipose-fin clipped Chinook salmon in 2004 are not significantly associated with: (1) attraction flows, defined as the difference between Yuba River and Feather River flows; or (2) attraction water temperatures, defined as the difference between Yuba River and Feather River water temperatures.
- Analyses of the 2002 and 2004 water transfers studies data indicate that water transfers that do not involve a large, rapid ramp-up and that are characterized by relatively high and stable flows (between 1,000 cfs (2004) and 1,400 cfs (2002) during July and August), do not appear to attract non-natal adult Chinook salmon into the Yuba River.

Water Temperatures

Water temperatures measured at the Smartville site (at RM 24, approximately 2 miles downstream of Englebright Dam) during the 2004 water transfers study period are representative of the relatively stable, low water temperatures associated with reservoir releases occurring during May through October. Smartville daily mean water temperatures did not display large fluctuations between consecutive days, but did show an overall increasing temporal trend in daily average water temperature from 51.6°F on May 1 to 55.9°F on October 1, 2004.

Daily mean water temperatures during the 2004 study period for monitoring sites farther downstream retained an overall increasing temporal trend from May 1 through October 1, which dissipated as distance from the dam increased, reflecting the progressive warming and increasing diurnal variation in downstream lower Yuba River water temperatures. Average daily water temperatures progressively increased as the site location approached the Yuba-Feather river confluence, and the daily water temperature ranges became progressively larger.

For example, at Parks Bar (RM 18) daily water temperature minimum and maximum differed, on average, by 4.5°F, while at Long Bar (RM 14), the daily water temperature minimum and maximum differed by 5.4°F. At Daguerre Point Dam (RM 11), the differences between the minimum and maximum daily water temperatures averaged 7.6°F, while at the Marysville (RM 6) and Simpson Lane (RM 3) water temperature monitoring locations, the average difference was approximately 9.4°F and 9.9°F, respectively.

From May 1 through October 1, 2004, Feather River water temperatures at monitoring locations upstream and downstream of the confluence with the lower Yuba River were consistently higher than those of the lower Yuba River. Downstream of the Yuba-Feather river confluence, daily average water temperatures were consistently lower on the left bank of the Feather River than on the right bank, suggesting that the cooling effect of lower Yuba River water temperatures predominantly affects the left bank of the Feather River. Moreover, based upon the regression analysis performed, the influence of lower Yuba River flows on Feather River water temperatures is reduced considerably within the first 2 miles of river occurring downstream of the confluence of the Yuba and Feather rivers.

4.4.1.3 Oroville Reservoir

Like many other California foothill reservoirs, Oroville Reservoir is steep-sided, has large water surface elevation fluctuations, and a low surface area-to-volume ratio. It is a warm, monomictic reservoir that thermally stratifies in the spring, destratifies in the fall, and remains destratified throughout the winter. Due to the stratification, Oroville Reservoir has been said to contain a "two-story" fishery, supporting both coldwater and warmwater fisheries that are thermally segregated for most of the year. The coldwater fish use the deeper, cooler, well-oxygenated hypolmnion, whereas the warmwater fish are found in the warmer, shallower, epilimnetic and littoral zones. Once Oroville Reservoir destratifies in the fall, the two fishery components mix in their habitat utilization.

Oroville Reservoir's coldwater fishery primarily is composed of coho salmon and brown trout, although rainbow trout and lake trout are periodically caught. The coldwater fisheries for coho salmon and brown trout are sustained by hatchery stocking because natural recruitment to the Oroville Reservoir coldwater fishery is very low. A "put-and-grow" hatchery program is currently in use, where salmonids are raised at CDFG hatcheries and stocked in the reservoir as juveniles, with the intent that these fish will grow in the reservoir before being caught by anglers (DWR 2001b).

The Oroville Reservoir warmwater fishery is a regionally important self-sustaining fishery. The black bass fishery is the most significant, both in terms of angler effort and economic influence on the area. Spotted bass are the most abundant bass species in Oroville Reservoir, followed by largemouth, redeye, and smallmouth bass, respectively. Catfish are the next most popular warmwater fish at Oroville Reservoir, with both channel and white catfish present in the lake. White and black crappies also are found in Oroville Reservoir, though populations fluctuate widely from year to year. Bluegill and green sunfish are the two primary sunfish species in Oroville Reservoir. Although common carp are considered by many to be a nuisance species, they are abundant in Oroville Reservoir (DWR 2001b). The primary forage fish in Oroville Reservoir are wakasagi and threadfin shad. Threadfin shad intentionally were introduced in 1967 to provide forage for game fish, whereas the wakasagi migrated down from an upstream reservoir in the mid-1970s.

4.4.1.4 Feather River

The lower Feather River begins at the Low Flow Channel, which extends 8 miles from the Fish Barrier Dam (RM 67) to the Thermalito Afterbay Outlet (RM 59). The lower Feather River from the Fish Barrier Dam to Honcut Creek supports a variety of anadromous and resident fish species. The most important fish species in terms of sport fishing is the fall-run Chinook salmon, although striped bass and American shad also are common targets for anglers. Fall-run Chinook salmon may enter the river as early as August and begin spawning in September. Spawning typically continues through December, with October and November constituting the peak spawning months in the lower Feather River.

Several other native and exotic fish species are found in the Feather River including spring-run Chinook salmon, steelhead, and Sacramento splittail. In the Feather River, the basic life history of spring-run Chinook salmon is similar to fall-run Chinook salmon. Spawning may occur a few weeks earlier for spring-run (as compared to fall-run), but there is no clear distinction between the two runs due to the elimination of spatial separation by Oroville Reservoir. Fish exhibiting the typical life history of spring-run Chinook salmon are found holding at the Thermalito Afterbay Outlet and the Fish Barrier Dam as early as March. At present, the genetic distinctness of Feather River spring-run Chinook salmon is undetermined.

Adult steelhead typically ascend the Feather River from September through January (YCWA *et al.* 2005). The residence time of adult steelhead in the Feather River after spawning, and adult steelhead post-spawning mortality, are currently unknown. It appears that most of the natural steelhead spawning in the Feather River occurs in the Low Flow Channel, particularly in the upper reaches near Hatchery Ditch. It is unknown whether steelhead spawn below the Thermalito Afterbay Outlet (YCWA *et al.* 2005). However, based on the spawning habitat available, it is very likely that at least some steelhead spawn below the Thermalito Afterbay Outlet. Soon after emerging from the gravel, a small percentage appears to emigrate. The remainder of the population rears in the river for at least six months to one year. Recent studies have confirmed that juvenile steelhead rearing (and probably adult steelhead spawning) is most concentrated in small secondary channels within the Low Flow Channel (YCWA *et al.* 2005). The smaller substrate size and greater amount of cover (compared to the main river channel) likely make these side channels more suitable for steelhead spawning.

4.4.1.5 Sacramento River

The upper Sacramento River is often defined as the portion of the river from Princeton (RM 163), the approximate downstream extent of salmonid spawning in the Sacramento River, to Keswick Dam (the upstream extent of anadromous fish migration and spawning). The lower Sacramento River is generally defined as that portion of the river from Princeton to the Delta, at approximately Chipps Island (near Pittsburg). The lower Sacramento River is predominantly channelized, leveed, and bordered by agricultural lands. The Sacramento River serves as an important migration corridor for anadromous fish moving between the Pacific Ocean and/or the Delta and upper river/tributary spawning and rearing habitats.

In excess of 30 fish species are known to use the Sacramento River. Of these, a number of both native and introduced species are anadromous. Anadromous species include Chinook salmon, steelhead, green and white sturgeon, striped bass, and American shad. The upper Sacramento River is of primary importance to native anadromous species, and is presently utilized for spawning and early life stage rearing, to some degree, by all four runs of Chinook salmon (i.e., fall, late-fall, winter, and spring runs) and steelhead. Consequently, various life stages of the four races of Chinook salmon, and steelhead, can be found in the upper Sacramento River throughout the year. Other Sacramento River fish are considered resident species, which complete their lifecycle entirely within freshwater, often in a localized area. Resident species include rainbow and brown trout, largemouth and smallmouth bass, channel catfish, sculpin, Sacramento pikeminnow, Sacramento sucker, hardhead, and common carp (Reclamation 1991).

Many of the fish species utilizing the upper Sacramento River also use the lower river to some degree, even if only as a migratory pathway to and from upstream spawning and rearing grounds. For example, adult Chinook salmon and steelhead primarily use the lower Sacramento River as an immigration route to upstream spawning habitats, and as an emigration route to the Delta. The lower river also is used by other fish species (e.g., Sacramento splittail and striped bass) that make little use of the upper river (i.e., upstream of RM 163). Overall, fish species composition in the lower portion of the Sacramento River is similar to that of the upper Sacramento River and includes resident and anadromous cold- and warmwater species. Many fish species that spawn in the Sacramento River and its tributaries depend on river flows to carry their larval and juvenile life stages to downstream nursery habitats. Native and introduced warmwater fish species primarily use the lower river for spawning and rearing, with juvenile anadromous fish species also using the lower river, to some degree, for rearing.

4.4.1.6 Sacramento-San Joaquin Delta

The Delta provides spawning and nursery habitat for more than 40 resident and anadromous fish species, including delta smelt, Sacramento splittail, American shad, and striped bass. The Delta also is a migratory corridor and seasonal rearing habitat for the various runs of Chinook salmon and steelhead.

Many factors have contributed to the decline of Delta species, including loss of habitat, contaminant input (water quality degradation), entrainment in diversions, and introduction of non-native fish species. The Delta is a network of channels through which water, nutrients, and aquatic food resources are moved and mixed by tidal action. Pumps and siphons divert water for Delta irrigation and municipal and industrial use or into CVP and SWP canals. River inflow, Delta Cross Channel operations, and diversions (including agricultural and municipal diversion and export pumping) affect Delta species through changes in habitat conditions (e.g., salinity intrusion) and mortality attributable to entrainment in diversions.

4.4.1.7 San Luis Reservoir

San Luis Reservoir provides habitat for both coldwater and warmwater fisheries. The game fish found in San Luis Reservoir include largemouth bass, crappie, sunfish, striped bass, and bullhead.

4.4.2 Impact Assessment Methodology

This Environmental Analysis considers the potential for unreasonable impacts upon fisheries resources in the waterbodies potentially influenced by the proposed project including the lower Yuba River, New Bullards Bar Reservoir, Feather River, Oroville Reservoir, Sacramento River, and the Delta. The impact assessment methodology utilized to conduct this Environmental Analysis is described below.

4.4.2.1 Reservoir Impact Assessment Methodology

The analysis of potential impacts on reservoir fisheries associated with the proposed project was based on consideration of anticipated seasonal changes in reservoir storage under the proposed project, relative to the basis of comparison. The potential changes in reservoir storage levels in New Bullards Bar Reservoir were based upon information provided in the Hydrologic Analysis (Appendix B). The analysis of reservoir storage for Oroville Reservoir was performed qualitatively based on anticipated potential changes in operations associated with the proposed project, to the extent that this information was available, and primarily from assessments conducted for recent water transfer years (YCWA 2004; YCWA and SWRCB 2002).

Potential changes in reservoir water surface elevations were considered for the analysis of potential increases in the frequency of warmwater fish nest-dewatering events, and decreases in coldwater pool volume that could occur under the proposed project, relative to the basis of comparison.

San Luis Reservoir

DWR may store a portion of the proposed project transfer water in San Luis Reservoir. To the extent that some of the transfer water (potentially up to 125,000 acre-feet by the end of the transfer period) is stored in San Luis Reservoir, the proposed transfer may have a potentially beneficial effect upon San Luis Reservoir fisheries resources. The storage volume associated with the proposed project transfer potentially would provide increased habitat for reservoir species. Water stored in San Luis Reservoir likely would be held only for a short period prior to delivery to water contractors. Generally, it is expected that operations of San Luis Reservoir would remain within normal operational parameters, and the proposed project water transfer would not result in unreasonable impacts on San Luis Reservoir fisheries. Therefore, San Luis Reservoir is not further discussed in the impact assessment.

Reservoir Coldwater Fisheries

Coldwater fish in the reservoirs reside primarily within the reservoir's metalimnion (middle of the reservoir) and hypolimnion (near the bottom) where water temperatures remain suitable during the period when reservoirs are thermally stratified (i.e., April through November). Reduced reservoir storage during this period could reduce the reservoir's coldwater pool volume, thereby reducing the quantity of habitat available to coldwater fish species during these months. The analysis of potential impacts on reservoir coldwater fisheries associated with the proposed project was based on the following criterion:

- A decrease in reservoir storage during April through November, which would reduce the coldwater pool, relative to the basis of comparison, of sufficient magnitude or duration to adversely affect long-term population levels of coldwater fish.

Reservoir Warmwater Fisheries

Warmwater fish species in reservoirs use the warm upper layer of the reservoir and nearshore littoral habitat throughout most of the year. Seasonal changes in reservoir storage, as it affects reservoir water surface elevation (feet msl) can directly affect the reservoir's warmwater fish resources. Decreases in reservoir water surface elevation during the primary spawning period for nest building warmwater fish (March into June) may result in reduced initial year-class strength through warmwater fish nest "dewatering."

To assess potential elevation-related impacts on warmwater fish in the evaluated reservoirs, the magnitude of change (feet msl) in reservoir water surface elevation occurring each month of the spawning period (i.e., March through June) for nest-building fish under the proposed project relative to the basis of comparison was considered, when available. Review of available literature suggests that, on average, self-sustaining black bass populations in North America experience a nest success (i.e., the nest produces swim-up fry) rate of 60 percent (Friesen 1998; Goff 1986; Hunt and Annett 2002; Hurley 1975; Knotek and Orth 1998; Kramer and Smith 1962; Latta 1956; Lukas and Orth 1995; Neves 1975; Philipp *et al.* 1997; Raffetto *et al.* 1990; Ridgway and Shuter 1994; Steinhart 2004; Turner and MacCrimmon 1970).

A study by CDFG, which examined the relationship between reservoir water surface elevation fluctuation rates and nesting success for black bass, suggests that a reduction rate of approximately 6 feet per month or greater would result in 60 percent nest success for largemouth bass and smallmouth bass (Lee and Jones-Lee 1999). Therefore, a decrease in reservoir water surface elevation of 6 feet or more per month was selected as the threshold beyond which spawning success of nest-building warmwater fish could potentially result in population effects. The analysis of potential effects on warmwater fisheries associated with the proposed water transfer was based on the following criterion:

- A decrease in reservoir water surface elevation of six feet or more per month, relative to the basis of comparison, of sufficient frequency to substantially affect population levels of warmwater fish during the extended spawning period (i.e., March through June).

4.4.2.2 Rivers Impact Assessment Methodology

Yuba River

Both qualitative and quantitative assessments were utilized to evaluate the potential operational impacts on fisheries resources. Qualitative analyses are conducted based on a combination of literature reviews, reference to previous monitoring studies and reports on the Yuba River fisheries, and best professional judgment. Hydrologic modeling was performed in order to provide a quantitative basis from which to assess potential impacts of the proposed project on fisheries resources and their associated aquatic habitats within the project area. Specifically, the hydrologic modeling methods used an 83-year simulation period of hydrology in the Yuba River watershed to simulate flows that would be expected under the proposed project and the basis of comparison given a storage volume of 708,000 acre-feet in New Bullards Bar Reservoir as of September 30, 2005. The simulation applied a set of rules and reservoir releases for both the proposed project and the basis of comparison in which the starting reservoir level was known, utilizing the hydrologic period of record extending from 1922 through 2004, to produce a set of flow exceedance plots for the April 1, 2006 through February 28, 2007 simulation period. The plots illustrate the distribution of flows under the proposed project and the basis of comparison. Flow exceedance curves represent the probability, as a percent of time that modeled flow volumes would be met or exceeded at a given location during a certain time period. Therefore, the plots demonstrate the cumulative probability distribution of flows that could occur for each month at a given river location over the simulation period. Flow exceedance curves were developed by ranking the simulated flows for each month from largest to smallest, and the probability of exceedance was then calculated for each flow value based on its rank (i.e., 1.0 to 99.0 percent).

Exceedance curves are particularly useful for examining flow changes that could occur at lower flow levels. Results from past instream flow studies indicate that Chinook salmon spawning habitat is most sensitive to changes in flow during lower flow conditions, during either dry year classes or the driest months of the year (CDFG 1994; USFWS 1985).

The potential impacts of simulated flows on the adult spawning life stage of Chinook salmon in the lower Yuba River were evaluated by examining the spawning habitat available for the months of September through December of the spawning season, as expressed as weighted usable area (WUA). The analysis included summing the WUAs that correspond to average monthly flows during the Chinook salmon spawning season within one reach for spring-run (above Daguerre Point Dam), and two reaches for the fall-run (above and below Daguerre Point Dam) (**Appendix C**).

For analytical purposes, September was assumed to represent a distinct period of spring-run Chinook salmon spawning and fall-run Chinook salmon spawning was assumed to occur from October through December, although considerable temporal and spatial overlap in spawning occurs between these two runs. Therefore, the spring-run Chinook salmon spawning habitat availability analysis emphasized the month of September, and the fall-run Chinook salmon spawning habitat availability analysis focused on the October through December time period. These time periods were used to compare the potential impacts of the proposed project on spring and fall-run Chinook salmon spawning habitat availability, relative to the basis of comparison.

Although CDFG (1991a) described spawning WUA-flow relationships for both fall-run Chinook salmon and steelhead, only the relationships for fall-run Chinook salmon were used in the present analysis. The steelhead WUA-flow relationships were not used because they were not based upon depth, velocity and substrate data collected on the lower Yuba River steelhead redds. Instead, steelhead WUA-flow relationships were developed from habitat suitability criteria (HSC) recommended by Bovee (1978). The comparison of Bovee's steelhead HSC curves with HSC curves developed for the species in the lower Feather River, lower American River, and Trinity River suggests that Bovee's criteria may not be representative of steelhead spawning in the Central Valley. Also, information describing the spatial and temporal distributions of steelhead spawning in the lower Yuba River is lacking.

Yuba River water temperature analyses were conducted for the months of May through October. During these months, solar radiation and ambient air temperature may cause water temperatures in the Yuba River below Englebright Reservoir to increase to levels that can be stressful to anadromous and resident salmonids, and other species of management concern. During November through April, water temperatures in the lower Yuba River are generally cool and, for this Environmental Analysis, are assumed not to cause thermal impacts on salmonids and other fish species in the river.

An evaluation of lower Yuba River water temperatures associated with the proposed project was conducted by assessing water temperature exceedance plots generated using simulated monthly flows from May through October. Simulated monthly water temperatures were used to assess potential impacts of the proposed project relative to the basis of comparison for the following species and life stages occurring from May through October:

- ❑ Steelhead
    - Adult Immigration and Holding
    - Juvenile Rearing

- Smolt Emigration

- Spring-run Chinook Salmon
  - Adult Immigration and Holding
  - Spawning and Embryo Incubation
  - Juvenile Rearing and Smolt Outmigration

- Fall-run Chinook Salmon
  - Adult Immigration and Holding
  - Spawning and Embryo Incubation
  - Juvenile Rearing and Smolt Outmigration

- Green Sturgeon (Southern Distinct Population Segment)
  - Adult Immigration and Holding
  - Spawning and Embryo Incubation
  - Juvenile Rearing and Outmigration

- American Shad
  - Adult Immigration and Spawning

The flow and water temperature exceedance analyses provided are based on modeled monthly mean flows, and linear regression analysis of water temperature parameters such as air temperature and flow volume. Monthly mean flows and water temperatures evaluated here do not describe daily variations that could occur in the river as a result of dynamic flow and climatic conditions. However, this modeling represents the best available information, and monthly modeling results are useful for comparative purposes where, in theory, the inherent limitations of the approach are embedded in both the proposed project and the baseline condition. Modeled water temperature and flow values were utilized to detect the frequency and magnitude of potential changes to flows and water temperatures under the proposed project and the basis of comparison (RD-1644 long-term).

The modeling method used for water temperatures has detection limits. The water temperature values depicted are predicted mean monthly values relative to changes in simulated mean monthly flows. These values are not representative of mean daily diurnal fluctuations in water temperatures occurring in the river. Therefore, the temperatures evaluated do not represent the entire range of temperatures occurring in the lower Yuba River on a daily basis within any given month.

Feather and Sacramento Rivers

An evaluation of the potential impacts from the proposed project on fisheries resources and aquatic habitats in the Feather and Sacramento rivers were evaluated by comparing the total contribution of monthly mean flows from New Bullards Bar Reservoir surface water releases under both the proposed project and basis of comparison. To evaluate the potential range of impacts to fisheries resources in the Sacramento and Feather rivers, the difference in simulated average monthly mean flows at the Marysville Gage between the proposed project and the basis of comparison were compared to average monthly mean flows in the Sacramento River at Freeport, and the lower Feather River at Gridley.

Although the specific release pattern associated with the proposed project is unknown at this time and will depend on SWP/CVP operational conditions as they develop, flow releases will be subject to certain operational constraints (e.g., ramping criteria) that are within normal operational ranges

Sacramento-San Joaquin Delta

The proposed project would provide water to DWR for use in the EWA and Dry Year Water Purchase programs in 2006. DWR personnel were consulted regarding the anticipated pumping, export, and delivery operations associated with the proposed project. The evaluation of potential impacts upon Delta fisheries resources considers whether DWR's acquisition of the YCWA transfer water would result in changes in SWP operations that could result in the following:

- Conflict with existing regulatory compliance requirements related to Delta export pumping
- Increased pumping at the Delta pumping facilities above levels authorized in existing permits

Regulatory documentation considered in the evaluation includes:

- 1995 SWRCB Delta Water Quality Control Plan
- 2004 NMFS Biological Opinion on OCAP
- 2004 USFWS Biological Opinion on OCAP

4.4.3 Impact Assessment

4.4.3.1 New Bullards Bar Reservoir

New Bullards Bar Reservoir Coldwater Fisheries

The proposed project could reduce New Bullards Bar Reservoir storage from an average of 827,965 acre-feet in April to an average of 594,865 acre-feet by the end of September, depending on hydrological conditions. This reduction corresponds to a change in average water surface elevation from approximately 1,959 feet-msl to 1,866 feet-msl. Under the basis of comparison, the end of September average storage in New Bullards Bar Reservoir could be 655,432 acre-feet with a corresponding average elevation of 1,890 feet-msl.

Anticipated reductions in reservoir storage associated with the proposed project would not be expected to adversely impact the New Bullard Bar Reservoir's coldwater fisheries because New Bullards Bar Reservoir is a deep, steep-sloped reservoir with ample coldwater pool reserves. Throughout the period of operations of New Bullards Bar Reservoir (1969 through present), which encompasses the most extreme critically dry year on record, the coldwater pool in New Bullards Bar Reservoir has not been depleted. In fact, since 1993, coldwater pool availability in New Bullards Bar Reservoir has been sufficient to accommodate year-round utilization of the lower river outlets, at the direction provided by CDFG, in order to provide the coldest water possible to the lower Yuba River. Therefore, potential reductions in coldwater pool storage would not be expected to adversely affect New Bullard Bar Reservoir's coldwater fisheries because: (1) coldwater habitat would remain available in the reservoir during all months of the proposed project; (2) physical habitat availability is not believed to be among the primary factors limiting coldwater reservoir fish populations; and (3) anticipated seasonal reductions in storage would not be expected to adversely affect the primary prey species utilized by coldwater fish. Therefore, changes in end-of-month storage at New Bullards Bar Reservoir under the proposed project would not result in unreasonable impacts to coldwater fisheries resources, relative to the basis of comparison.

New Bullards Bar Reservoir Warmwater Fisheries

The spawning period for warmwater fish is believed to generally extend from March through June. However, the majority of warmwater fish spawning occurs during the months of April and May. Decreases in the water surface elevation of New Bullards Bar Reservoir by more than 6 feet per month from March through June are 7 percent more likely to occur under the proposed project relative to the basis of comparison. Reductions in end-of-month water surface elevation in New Bullards Bar Reservoir under the proposed project would not be anticipated to result in substantial reductions in warmwater fish spawning success, because the results suggest that these potential decreases in water surface elevation would not be expected to occur during more than two months of any given spawning season. In addition, a 60 percent nest success rate or greater would be maintained throughout the spawning season, which would provide sufficient recruitment of individuals into the population in any given year. Therefore, potential reductions in water surface elevation under the proposed project would not be anticipated to result in unreasonable impacts upon warmwater fisheries that may be present in New Bullards Bar Reservoir.

Oroville Reservoir

Oroville Reservoir water levels would be affected by the proposed project only if DWR had to release additional flows to meet water quality standards in the Delta as a result of YCWA holding backwater to refill New Bullards Bar Reservoir after the completion of the proposed project. The potential drawdown of Oroville Reservoir would be minimal given the much larger size of Oroville Reservoir, and most likely would occur in winter or spring. The level of drawdown, if any, would be small and within normal operating conditions for Oroville Reservoir. Consequently, potential impacts to Oroville Reservoir fisheries are not considered unreasonable.

4.4.3.2 Rivers Impact Assessment

Yuba River

Anadromous Salmonid Utilization of the Lower Yuba River During the Proposed Project

Central Valley steelhead and two runs (i.e., fall-run and spring-run) of Chinook salmon utilize the lower Yuba River. Three life stages of these species/runs are present in the lower Yuba River at various times throughout the year: (1) adult immigration and holding; (2) spawning and embryo incubation; and (3) juvenile rearing and outmigration/smolt emigration. Most fall-run Chinook salmon migrate out of the lower Yuba River as post-emergent fry prior to reaching smolt size; spring-run Chinook salmon and steelhead typically rear in the river for extended periods of time, relative to fall-run Chinook salmon, migrating out as larger, smolt-sized individuals. The following sections describe the anadromous salmonid species and life stages occurring in the lower Yuba River, and the potential changes to instream flows and water temperatures that could occur during the proposed project, relative to the basis of comparison, on a month-to-month basis from April 1, 2006 through February 28, 2007.

Other Species of Primary Management Concern Utilization of the Lower Yuba River During the Proposed Project

USFWS photographic evidence of green sturgeon and captures of juveniles in rotary screw traps in the Feather River downstream of its confluence with the Yuba River (USFWS 1995a) provide evidence that suggests that tributaries to the Sacramento River may provide suitable spawning habitat for green sturgeon. Records of angler catches of green sturgeon in the Feather River coinciding with their spawning season further supports this theory. Based on this information, four life stages could potentially occur in the lower Yuba River at various times throughout the year: (1) adult immigration and holding; (2) spawning and embryo incubation; (3) juvenile rearing; and (4) juvenile emigration. The potential utilization of the lower Yuba River by green sturgeon warrants an evaluation of potential impacts to the species associated with potential changes in flow and water temperature under the proposed project, relative to the basis of comparison.

Despite being non-native, American shad are considered an important sport fish in the Central Valley, and are managed accordingly. Therefore, the American shad immigration and spawning life stage in the lower Yuba River will be evaluated for potential impacts associated with changes in flow and water temperature under the proposed project, relative to the basis of comparison.

Analysis Approach

The analysis of potential impacts to lower Yuba River anadromous salmonids and other species of management concern uses cumulative probability distributions to examine potential differences in flow that could occur under the proposed project and the basis of comparison (RD-1644 long-term) from April 1, 2006 through February 28, 2007. Of special concern are flow conditions that could potentially occur during dry and critical water years. These flows roughly correspond to the lowest 30 percent of flows simulated for the lower Yuba River for the analytical period extending from 1922 to 2004. Therefore, as an impact indicator of flow conditions, special emphasis is put on the lowest 30 percent of the cumulative flow distribution.

Results of the simulation period are presented in the following sections utilizing flow exceedance plots for the two control points for minimum instream flows on the Lower Yuba River (the Smartville Gage and the Marysville Gage). Each plot compares the proposed project (flow regime based on the flow schedules included in the 2006 Pilot Program Fisheries Agreement) versus the basis of comparison (flow regime based on RD-1644 long-term flow requirements).

All of the exceedance plots share certain characteristics. First, as is further described in the hydrological analysis (Appendix B) for the 2006 Pilot Program, different dispatch, reservoir, and operating rules govern the proposed project and the basis of comparison. In addition to different minimum flow release requirements, the proposed project and the basis of comparison utilize different indices (See Section 2.1.2), and have different reservoir dispatch rules based on those different flow schedules and indices.

Second, since the outlet capacity of the Narrows I and Narrows II powerhouses that release flow to the lower Yuba River totals 4,170 cfs, flows above that level are uncontrolled (spilling over the top of Englebright Dam). Differences in flows between the proposed project and the basis of comparison above that level therefore tend to be a function of river and reservoir operations in response to storm and flood control requirements.

Finally, in wetter year classes, annual Yuba River operations are primarily driven by flood control requirements. In the winter months of wetter year classes, maintenance of appropriate flood pool space may require releases well in excess of required minimums. During the summer months of wetter year classes, releases in excess of required minimum flows and delivery obligations are often required to draw down the reservoir to an appropriate level going into the succeeding fall and winter season. In drier year types, under both the proposed project and the basis of comparison, storm and flood operations cease to be a major influence in operations decisions early in the season, and the Yuba Project is operated to meet minimum flow requirements and consumptive demands. This can be observed in the exceedance plots, where in the driest 30 percent of years the plots of the Marysville Gage flows tend to correspond to the minimum requirements of the proposed project and the basis of comparison.

The following paragraphs and figures provide a summary of flow and water temperature exceedance plots under the proposed project and basis of comparison. Flow exceedance plots for April through November are shown below. In addition to these months, exceedance plots for the months of December through February are shown in **Appendix D**.

April

Species, Run and Life Stage Occurrence

- Steelhead (Spawning and Embryo Incubation; Juvenile Rearing; Smolt Emigration)
- Spring-run Chinook Salmon (Adult Immigration and Holding; Juvenile Rearing; Smolt Emigration)
- Fall-run Chinook Salmon (Juvenile Rearing and Outmigration)
- Green Sturgeon (Adult Immigration and Holding; Spawning and Embryo Incubation; Juvenile Rearing)

Simulated Actual Flows

Flows under the proposed project at both the Marysville (**Figure 4-1**) and Smartville (**Figure 4-2**) gages exceed (by up to about 670 cfs) flows under the basis of comparison, with up to approximately 90 percent probability. At the highest flow levels (about 10 percent probability) flows are essentially equivalent.

May

Species, Runs and Life Stages Occurring

- Steelhead (Spawning and Embryo Incubation; Juvenile Rearing; Smolt Emigration)
- Spring-run Chinook Salmon (Peak Adult Immigration and Holding; Juvenile Rearing; Smolt Emigration)
- Fall-run Chinook Salmon (Juvenile Rearing and Outmigration)
- Green Sturgeon (Adult Immigration and Holding; Spawning and Embryo Incubation; Juvenile Rearing; Juvenile Outmigration)
- American Shad (Adult Immigration and Spawning)

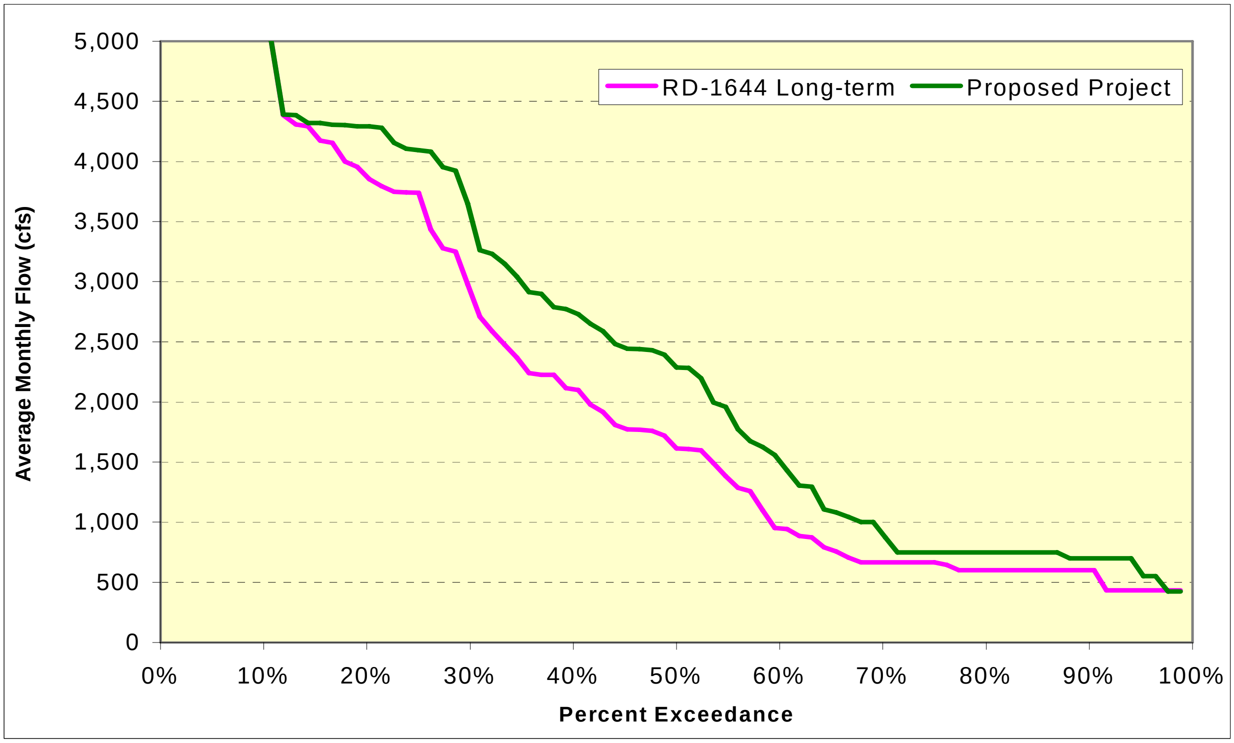

Figure 4-1. Exceedance Plot of Average Flows at the Marysville Gage During the Month of April Over the 83-Year Simulation Period.

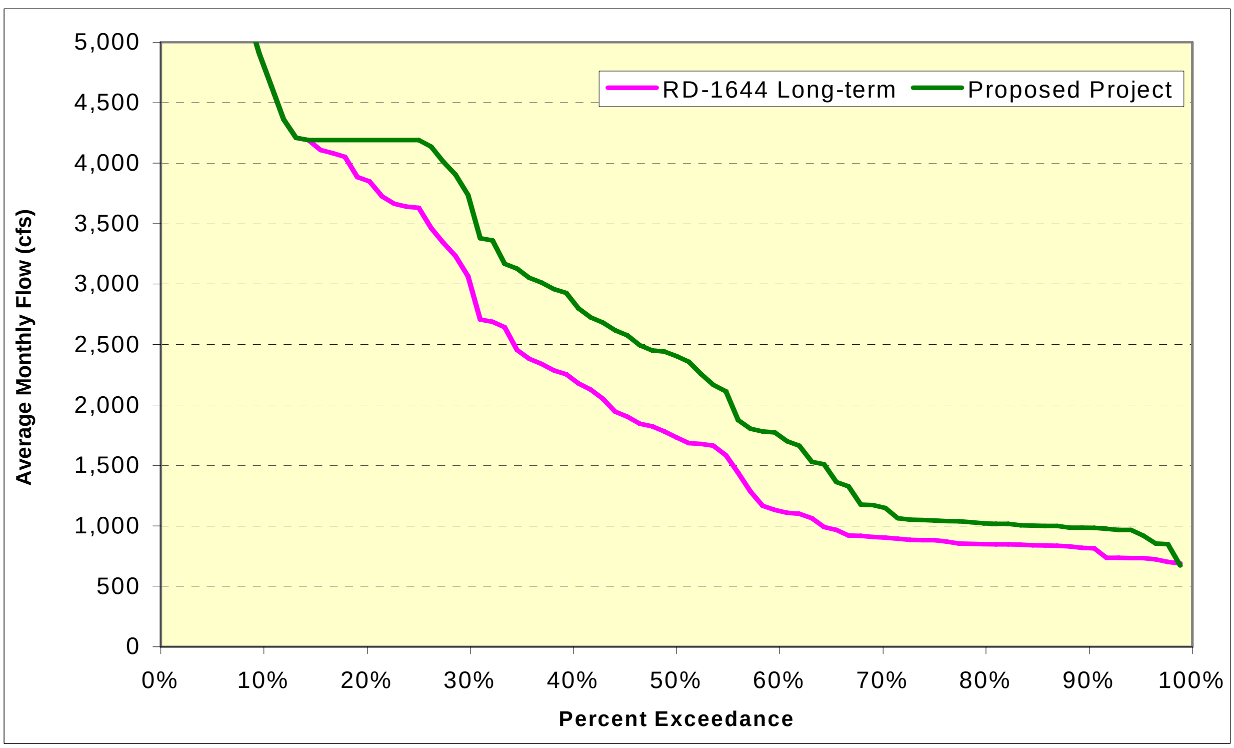

Figure 4-2. Exceedance Plot of Average Flows at the Smartville Gage During the Month of April Over the 83-Year Simulation Period.

Simulated Actual Flows

During a proportion of the lowest 30 percent of the cumulative flow distribution, flows under the proposed project at both the Marysville (**Figure 4-3)** and Smartville (**Figure 4-4**) gages are between 200 and 600 cfs lower than under the basis of comparison. However, the lower extent of the optimum flow range for lower Yuba River salmonids during the month of May is considered to be 1,000 cfs. The proposed project is expected to achieve flows of 1,000 cfs or higher at the Marysville Gage with about an 80 percent probability, and 900 cfs or higher with about a 90 percent probability. Also, lower flows in May under the proposed project than under the basis of comparison during these drier years occur due to an intentional operational shift in spring peak flows from late-spring to early-spring (e.g., late-May to April). This temporal shift in flows was designed to mimic Yuba River unimpaired flow patterns that would occur during drier year classes (Figure 2-3). During the lowest 8 percent of the cumulative flow distribution, flows under the proposed project at both gages are similar to or higher (up to 245 cfs) than under the basis of comparison.

Water Temperature

During May, average water temperatures simulated at Daguerre Point Dam (**Figure 4-5**) under the proposed project and under the basis of comparison are similar (always within 0.1°F of each other) and range from approximately 54.4°F to 55.2°F.

During May, average water temperatures simulated at Marysville (**Figure 4-6**) under the proposed project and under the basis of comparison are similar (within 0.2°F of each other) for most of the water temperature exceedance distribution, and range from approximately 54.0°F to 58.5°F. However, for 6 percent of the warmest 10 percent of the distribution, water temperatures under the proposed project are approximately 1.5°F lower than under the basis of comparison.

June

Species, Runs and Life Stages Occurring

- Steelhead (Juvenile Rearing)
- Spring-run Chinook Salmon (Peak Adult Immigration and Holding; Juvenile Rearing; Smolt Emigration)
- Fall-run Chinook Salmon (Juvenile Rearing and Outmigration)
- Green Sturgeon (Adult Immigration and Holding; Spawning and Embryo Incubation; Juvenile Rearing; Juvenile Outmigration)
- American Shad (Adult Immigration and Spawning)

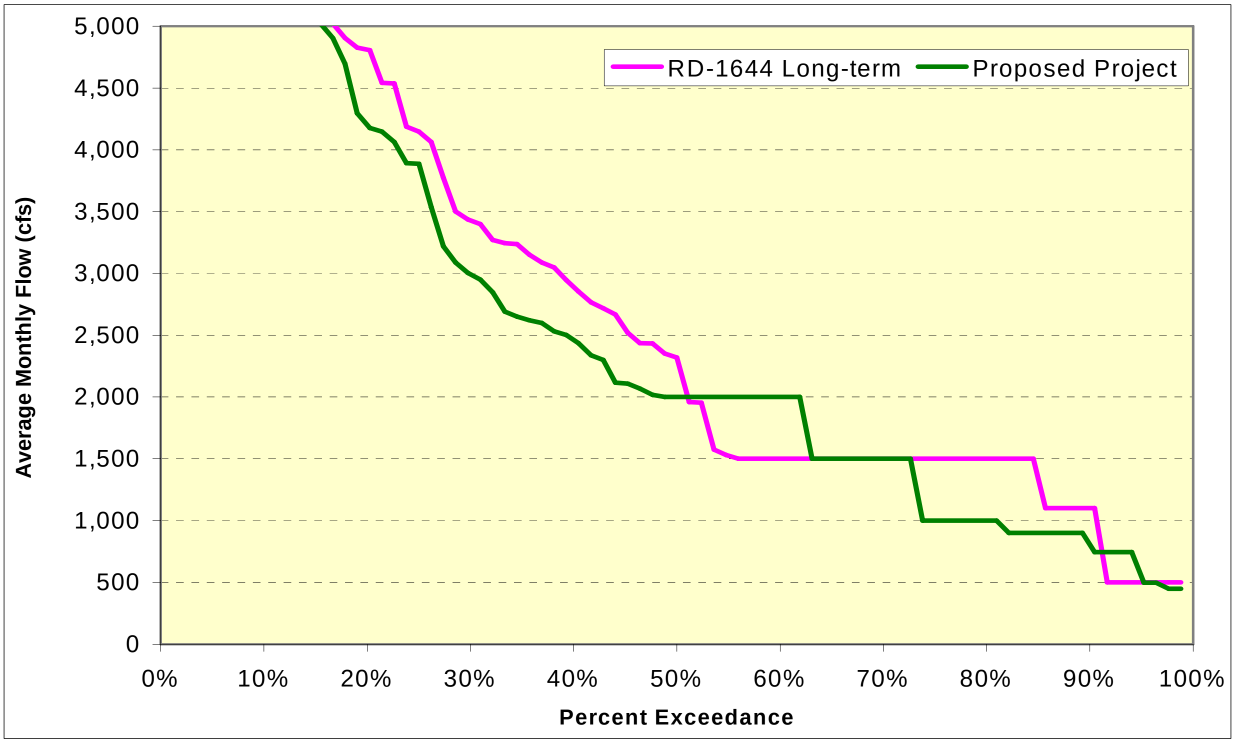

Figure 4-3. Exceedance Plot of Average Flows at the Marysville Gage During the Month of May Over the 83-Year Simulation Period.

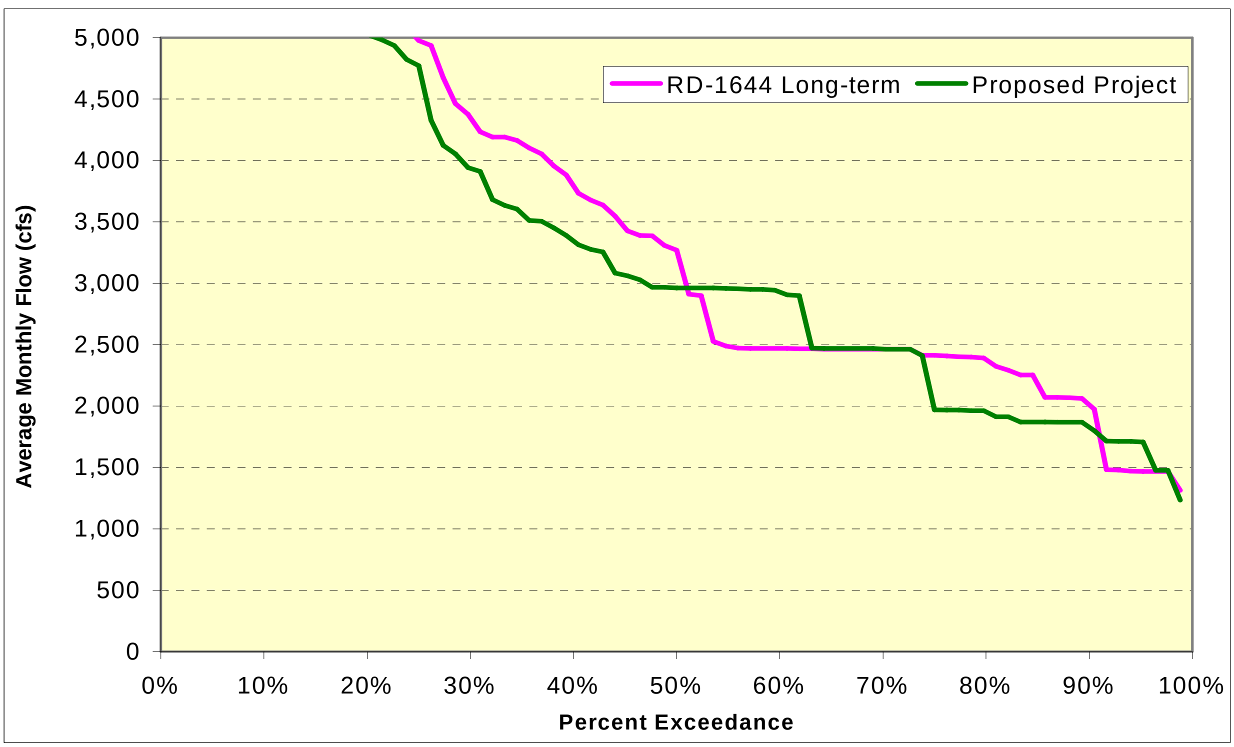

Figure 4-4. Exceedance Plot of Average Flows at the Smartville Gate During the Month of May Over the 83-Year Simulation Period.

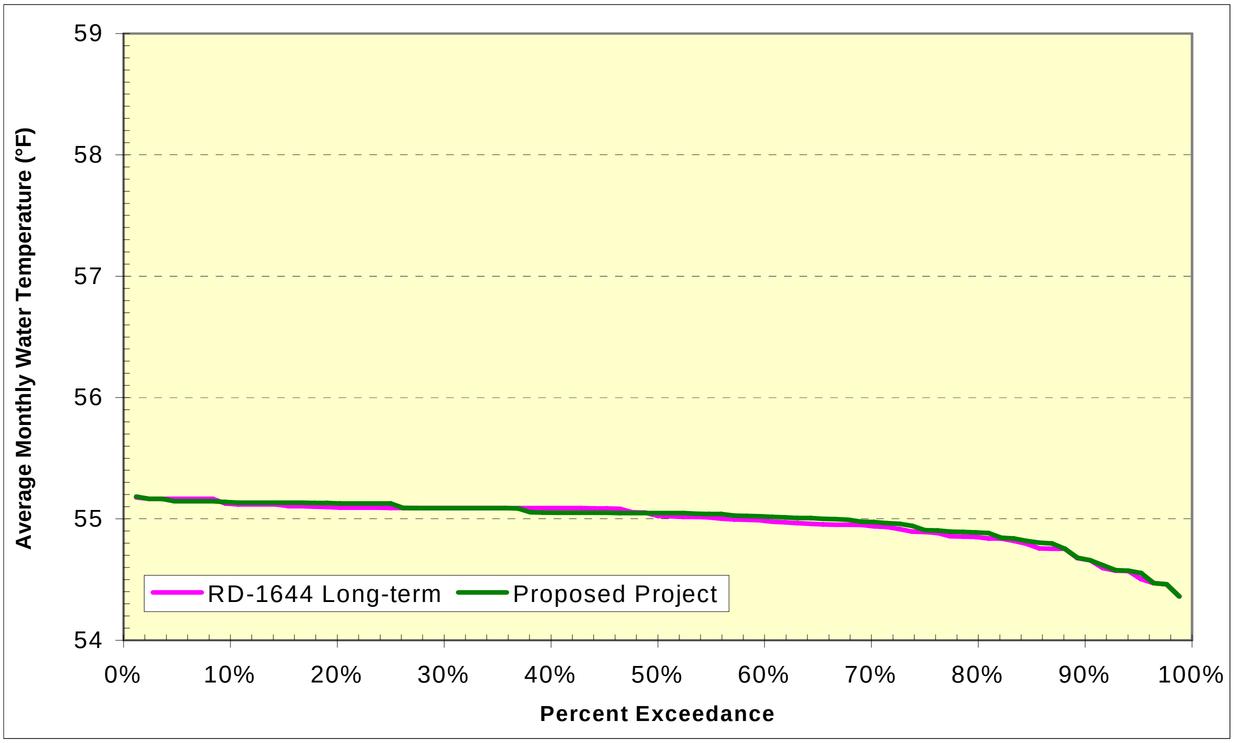

Figure 4-5. Exceedance Plot of Average Water Temperatures at Daguerre Point Dam During the Month of May Over the 83-Year Simulation Period.

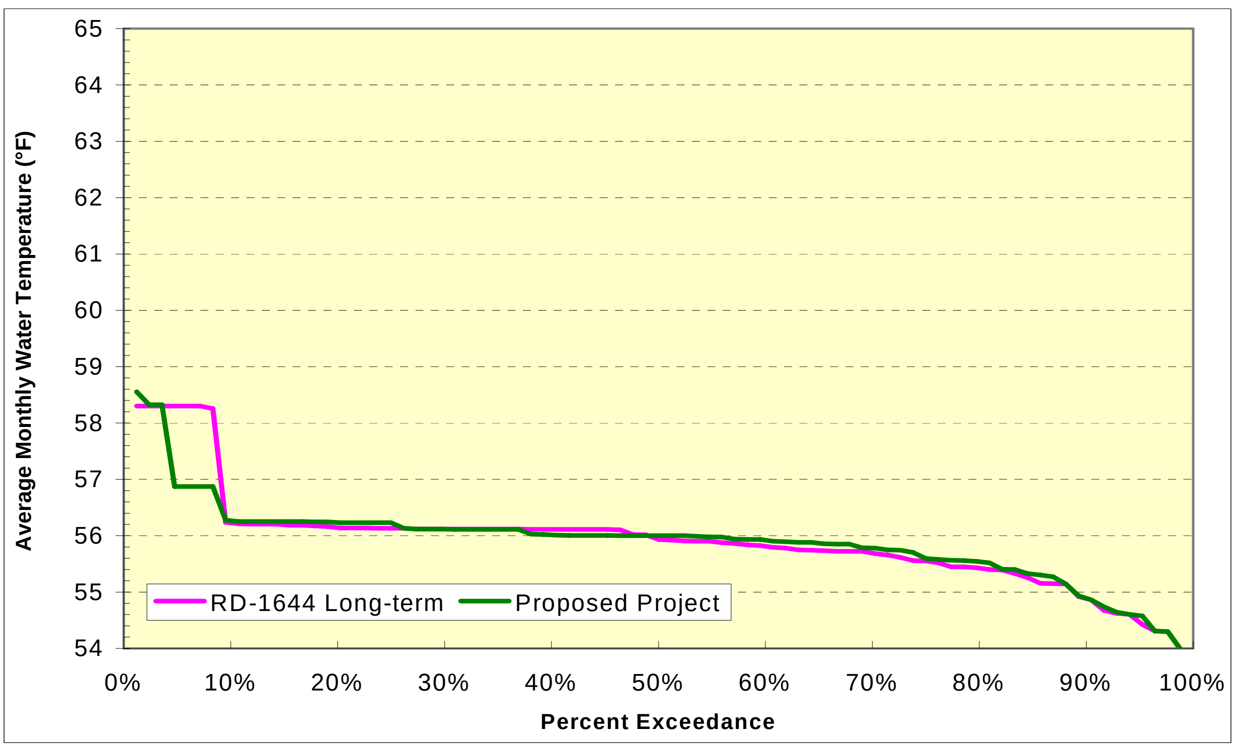

Figure 4-6. Exceedance Plot of Average Water Temperatures at Marysville During the Month of May Over the 83-Year Simulation Period.

Simulated Actual Flows

Simulated flows at the Marysville Gage (**Figure 4-7**) under the proposed project are lower (about 100 to 250 cfs) during the lowest 10 to 26 percent of the cumulative flow distribution, relative to the basis of comparison. However, flows under the proposed project generally remain within the reported optimum flow range (500 cfs to 800 cfs) for lower Yuba River salmonids at the Marysville Gage (see Section 2.1.3.1).

Simulated flows at the Smartville Gage (**Figure 4-8**) under the proposed project are equivalent or higher, relative to the basis of comparison, at the highest flow levels (which occur with about a 25 percent probability). Flows under the proposed project are slightly lower than the basis of comparison during the lowest 26 percent of the cumulative flow distribution, but remain higher than 1,000 cfs.

Water Temperature

During June, water temperatures simulated at Daguerre Point Dam (**Figure 4-9**) under the proposed project and under the basis of comparison are similar (always within 0.1°F of each other) and range from approximately 57.2°F to 57.9°F.

Water temperatures simulated at Marysville during June (**Figure 4-10**) range from 57.2°F to 62.6°F under the proposed project, and from 57.2°F to 61.8°F under the basis of comparison. During the warmest 26 percent of the water temperature exceedance distribution for June, water temperatures simulated at Marysville under the proposed project are similar to or higher (up to approximately 1.8°F) than those under the basis of comparison. For the remainder of the distribution, water temperatures under the proposed project are similar to or lower (up to 1°F) than those under the basis of comparison.

July

Species, Runs and Life Stages Occurring

- Steelhead (Juvenile Rearing)
- Spring-run Chinook Salmon (Adult Immigration and Holding; Juvenile Rearing)
- Green Sturgeon (Adult Immigration and Holding; Spawning and Embryo Incubation; Juvenile Rearing; Juvenile Outmigration)

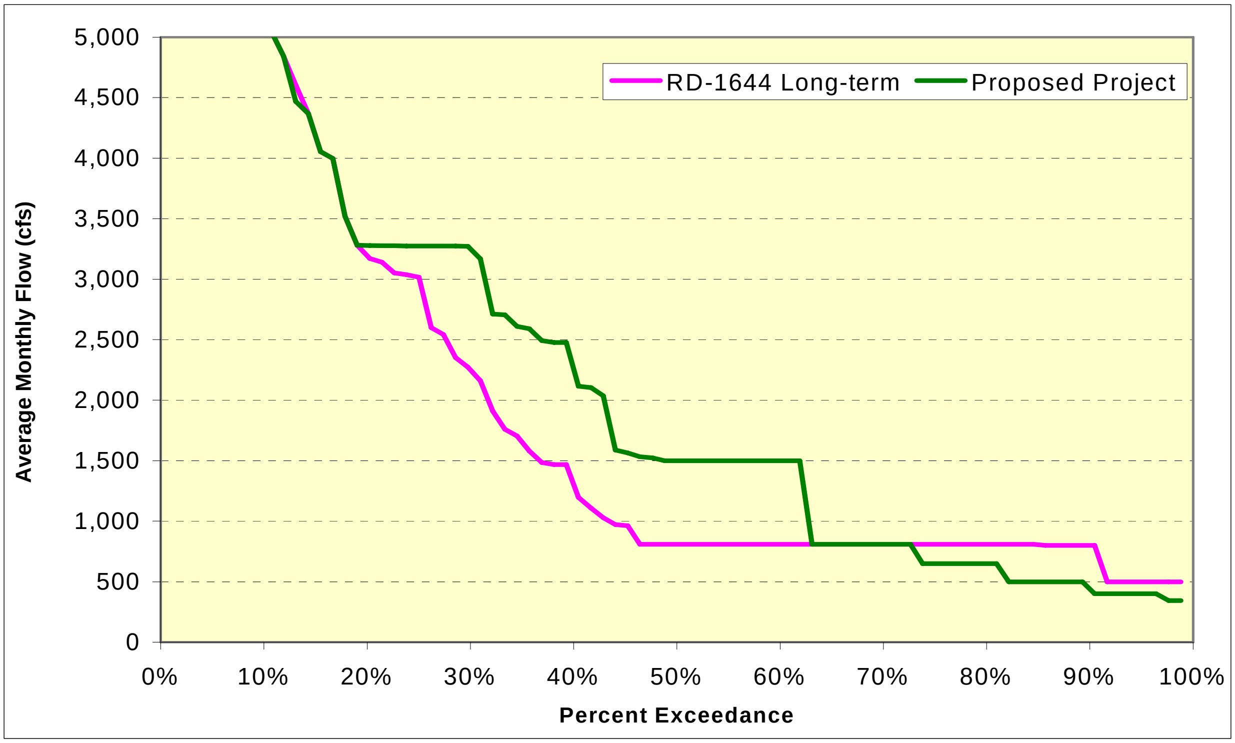

Figure 4-7. Exceedance Plot of Average Flows at the Marysville Gage During the Month of June Over the 83-Year Simulation Period.

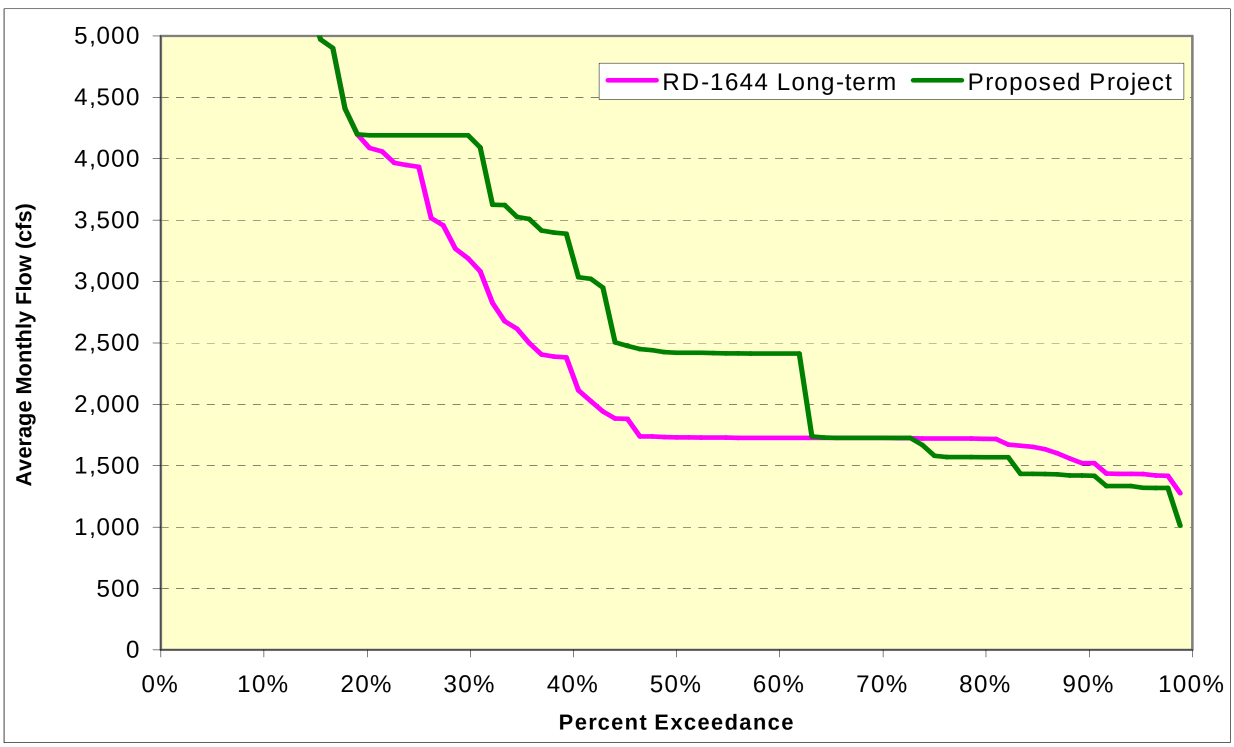

Figure 4-8. Exceedance Plot of Average Flows at the Smartville Gage During the Month of June Over the 83-Year Simulation Period.

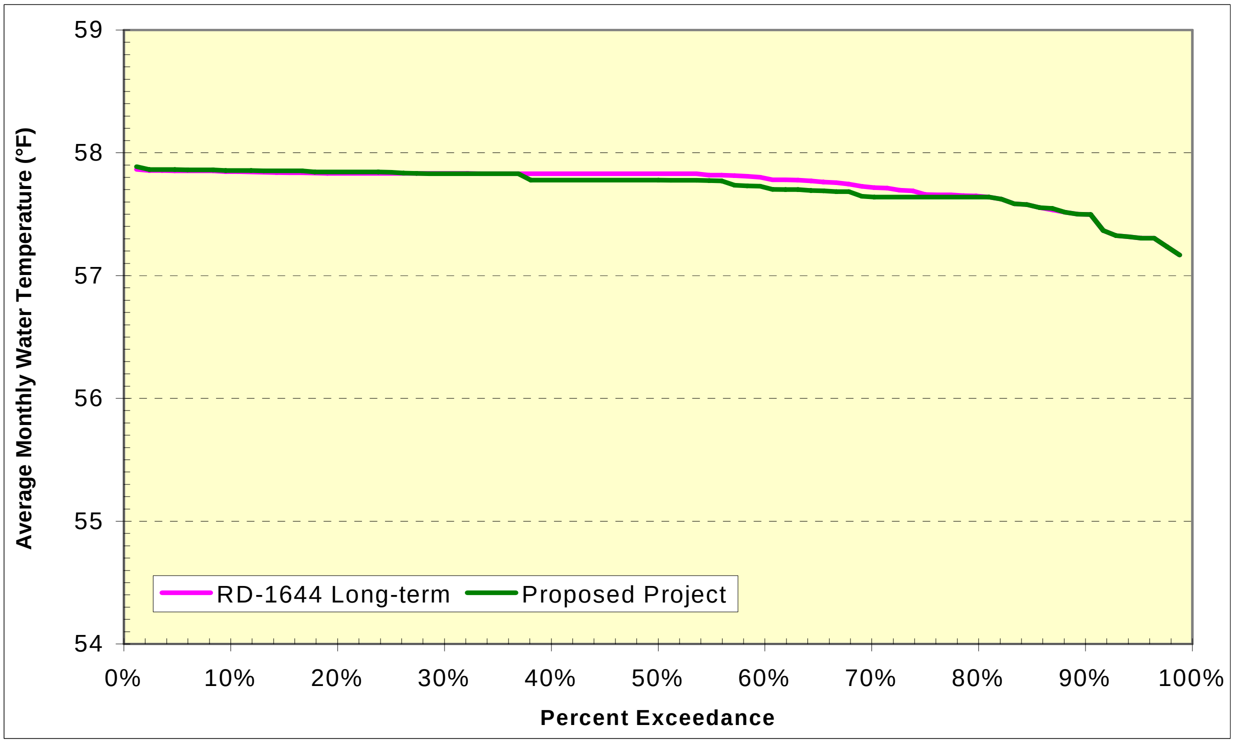

Figure 4-9. Exceedance Plot of Average Water Temperatures at Daguerre Point Dam During the Month of June Over the 83-Year Simulation Period.

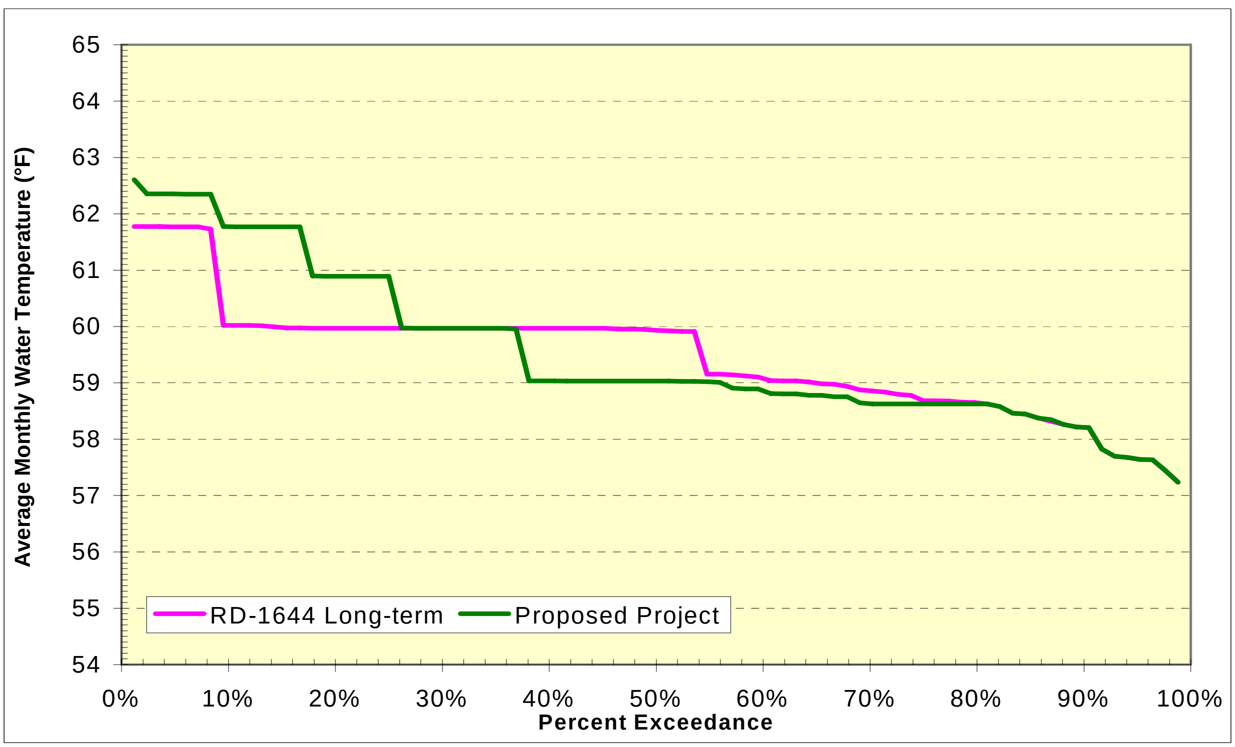

Figure 4-10. Exceedance Plot of Average Water Temperatures at Marysville During the Month of June Over the 83-Year Simulation Period.

Simulated Actual Flows

The lower and upper optimum flow range for lower Yuba River salmonids during the month of July is reportedly between 500 cfs and 700 cfs (see Section 2.1.3.1). Simulated flows under the proposed project at the Marysville Gage (**Figure 4-11**) that are lower under the proposed project, relative to the basis of comparison, occur during the highest flow conditions, and all exceed approximately 700 cfs.

By contrast, flows under the proposed project are higher (generally from about 200 to 400 cfs) than under the basis of comparison during drier conditions, which occur with up to about a 45 percent probability. Flows equal or exceed the lower optimum level (500 cfs) with about 90 percent probability under the proposed project, but with only about a 55 percent probability under the basis of comparison.

Simulated flows under the proposed project at the Smartville Gage (**Figure 4-12**) are lower than the basis of comparison during the highest 20 to 50 percent of the cumulative flow distribution, and all exceed approximately 1,700 cfs. During the lowest 30 percent of the cumulative flow distribution, flows under the proposed project remain between approximately 1,100 and 1,600 cfs, and are always higher than the basis of comparison.

Water Temperature

During July, water temperatures simulated at Daguerre Point Dam (**Figure 4-13**) under the proposed project and under the basis of comparison are similar (always within 0.1°F of each other) and range from approximately 58.0°F to 58.2°F.

During July, water temperatures simulated at Marysville (**Figure 4-14**) range from 59.1°F to 63.6°F under the proposed project, and from 59.1°F to 64.2°F under the basis of comparison. During the warmest 46 percent of the water temperature exceedance distribution for July, water temperatures simulated at Marysville under the proposed project are lower (up to 2.5°F) than those under the basis of comparison. For the remainder of the distribution, water temperatures under the proposed project are similar to or higher (up to 2.1°F) than those under the basis of comparison.

<u>August</u>

Species, Runs and Life Stages Occurring

- Steelhead (Adult Immigration and Holding; Juvenile Rearing)
- Spring-run Chinook Salmon (Adult Immigration and Holding; Juvenile Rearing)
- Fall-run Chinook Salmon (Adult Immigration and Holding)
- Green Sturgeon (Juvenile Rearing; Juvenile Outmigration)

Simulated Actual Flows

During the lowest 30 percent of the cumulative flow distribution, flows under the proposed project at the Marysville Gage (**Figure 4-15**) are expected to remain between 350 cfs and 500 cfs, whereas simulated flows under the basis of comparison (RD-1644 long-term) did not exceed 250 cfs. Flows under the proposed project at the Smartville Gage (**Figure 4-16**) during the lowest 30 percent of the cumulative flow distribution are always higher under the proposed project, than under the basis of comparison.

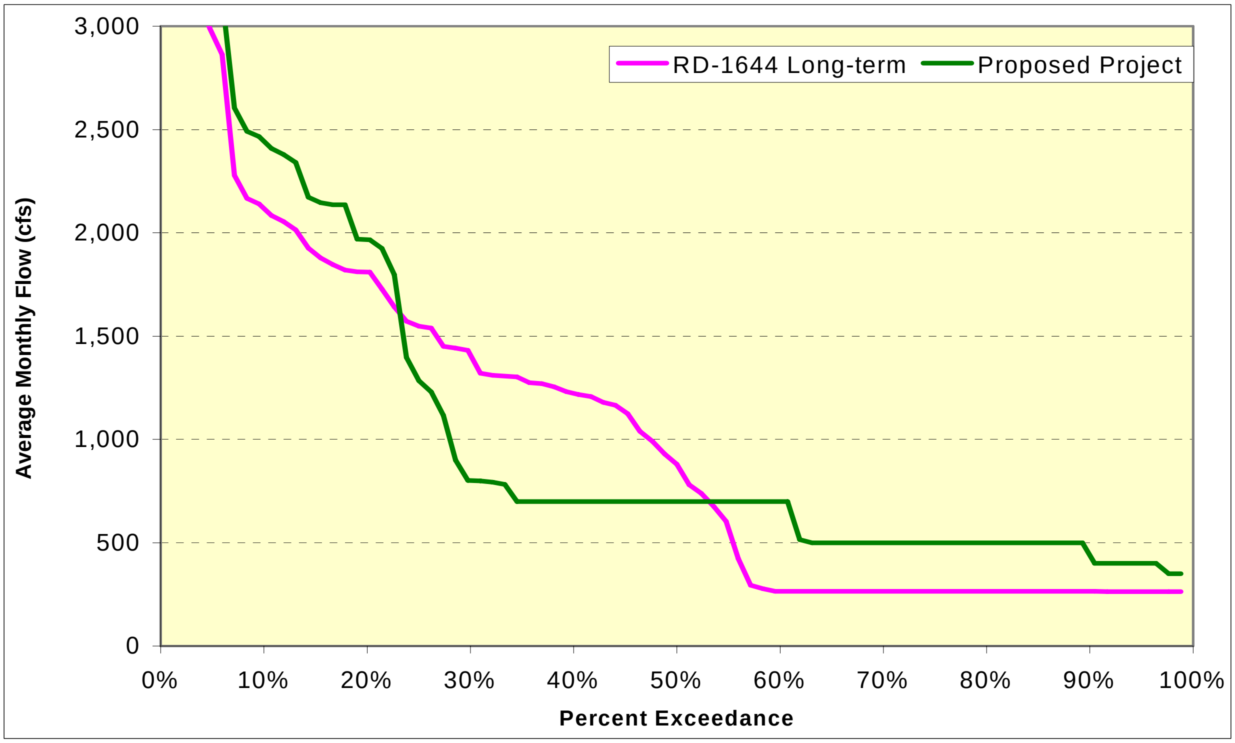

Figure 4-11. Exceedance Plot of Average Flows at the Marysville Gage During the Month of July Over the 83-Year Simulation Period.

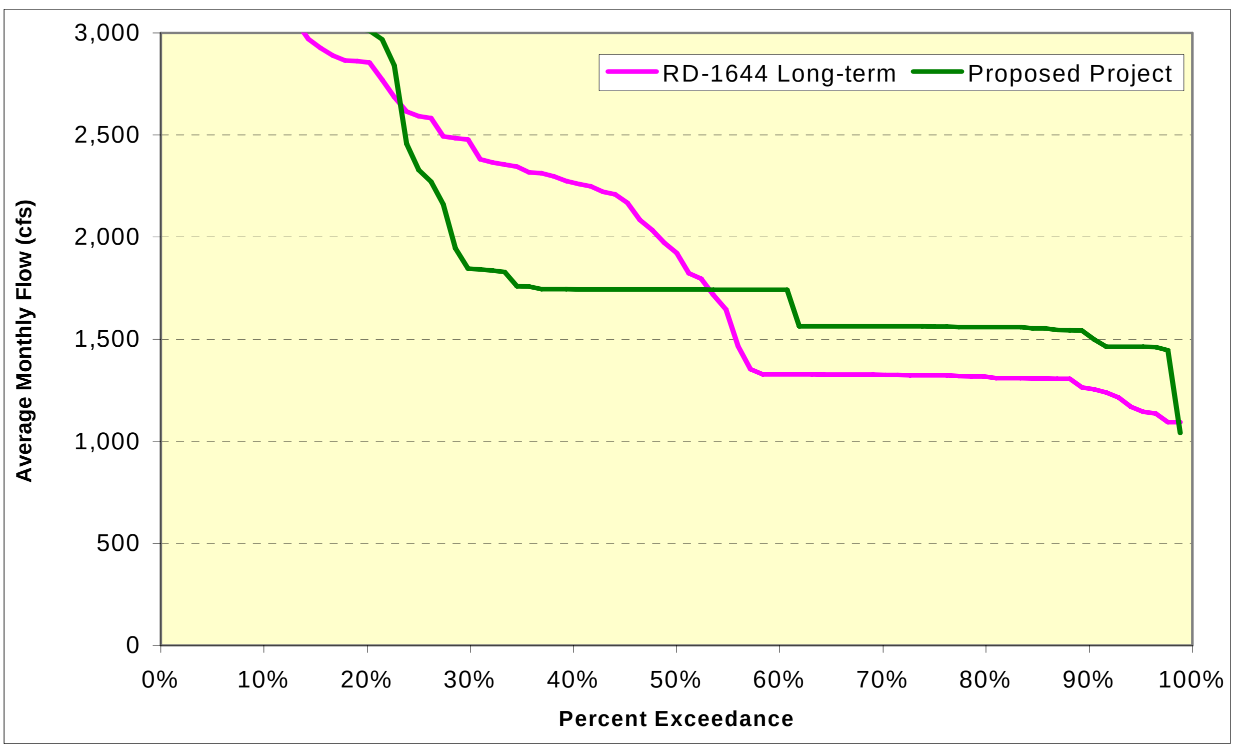

Figure 4-12. Exceedance Plot of Average Flows at the Smartville Gage During the Month of July Over the 83-Year Simulation Period.

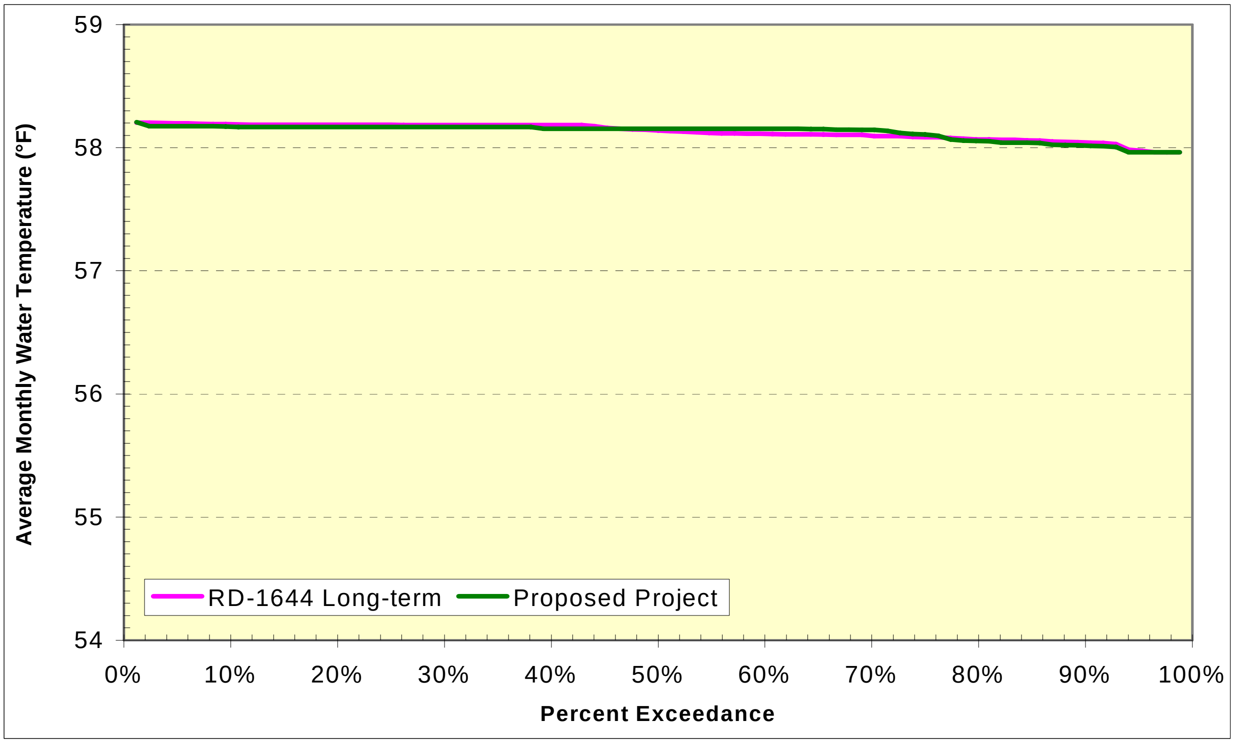

Figure 4-13. Exceedance Plot of Average Water Temperatures at Daguerre Point Dam During the Month of July Over the 83-Year Simulation Period.

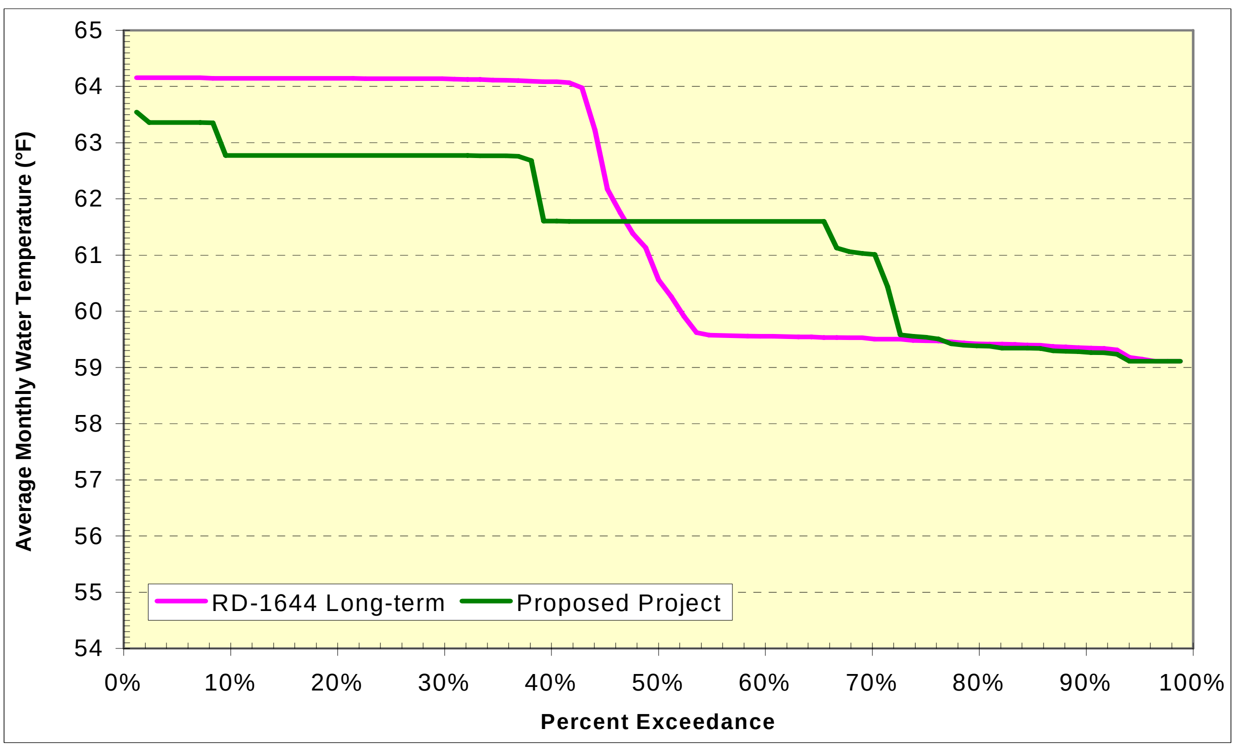

Figure 4-14. Exceedance Plot of Average Water Temperatures at Marysville During the Month of July Over the 83-Year Simulation Period.

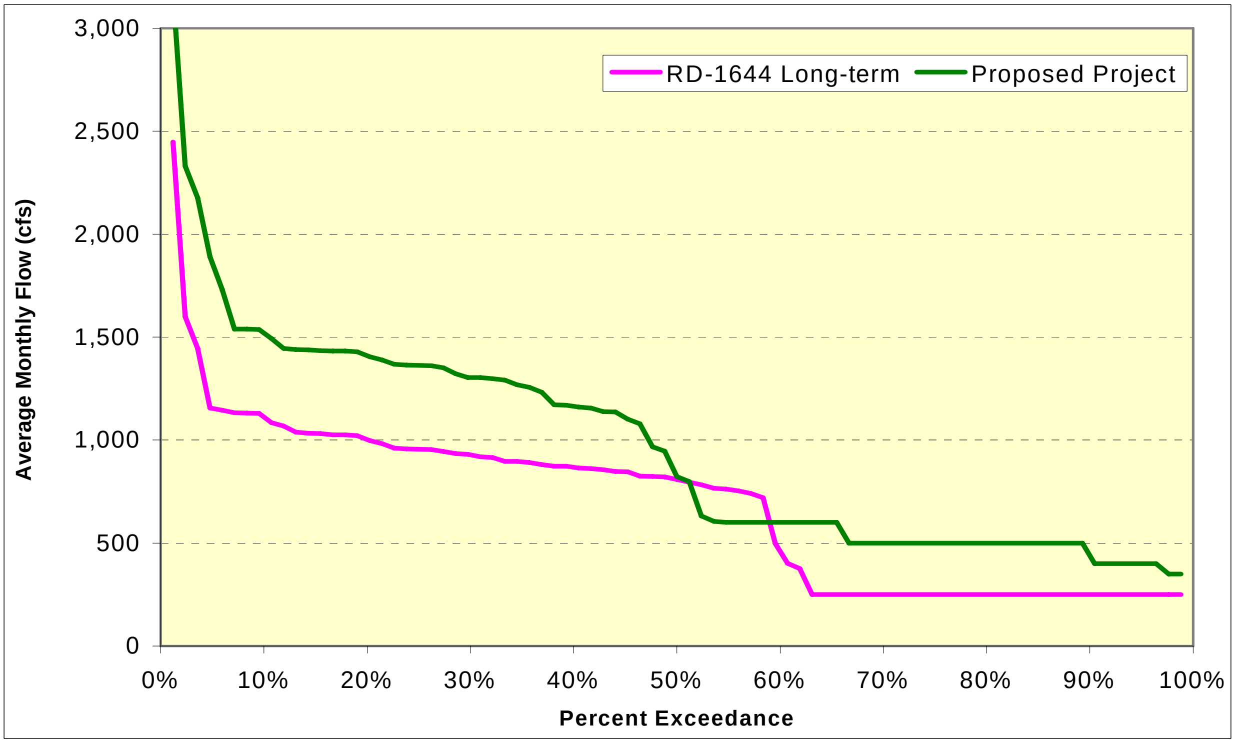

Figure 4-15. Exceedance Plot of Average Flows at the Marysville Gage During the Month of August Over the 83-Year Simulation Period.

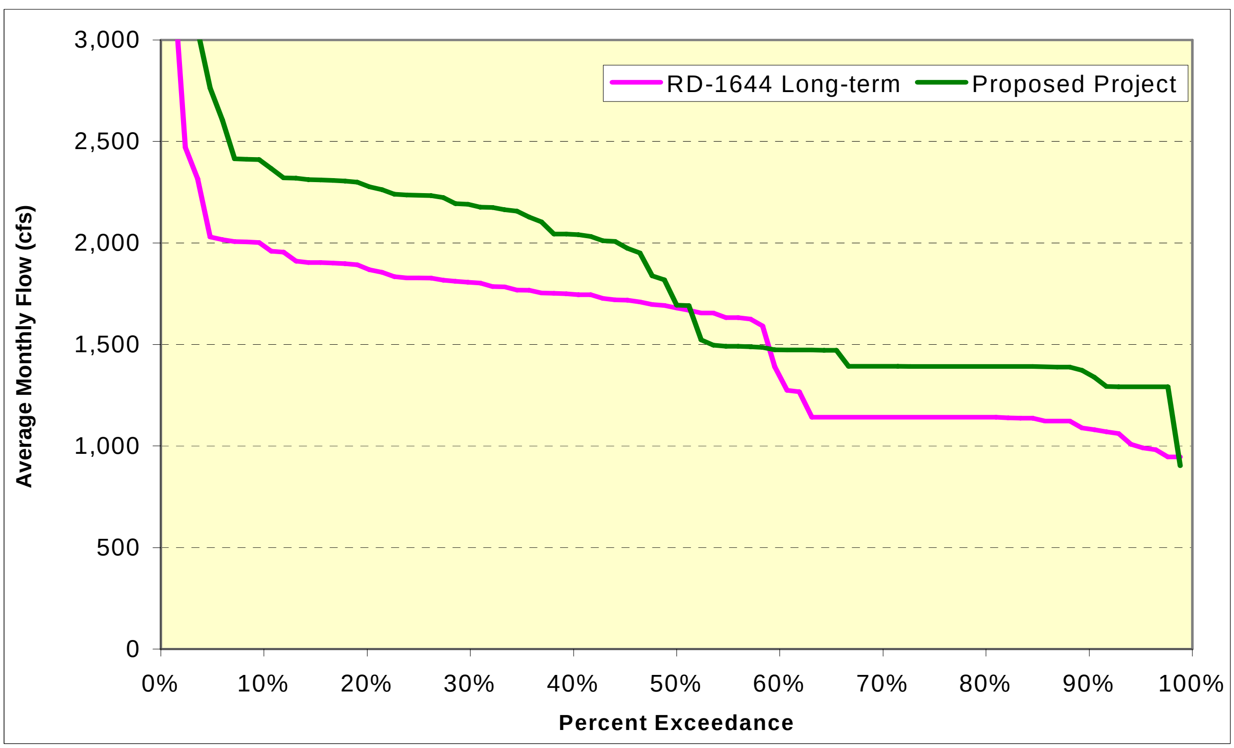

Figure 4-16. Exceedance Plot of Average Flows at the Smartville Gage During the Month of August Over the 83-Year Simulation Period.

Water Temperature

During August, water temperatures simulated at Daguerre Point Dam (**Figure 4-17**) under the proposed project and under the basis of comparison are similar (always within 0.1°F of each other) and range from approximately 57.2°F to 57.4°F.

During August, water temperatures simulated at Marysville (**Figure 4-18**) range from 59.1°F to 63.6°F under the proposed project, and from 59.1°F to 64.2°F under the basis of comparison. During the warmest 40 percent of the water temperature exceedance distribution for August, water temperatures simulated at Marysville under the proposed project are lower (up to 2.0°F) than those under the basis of comparison.

September

Species, Runs and Life Stages Occurring

- Steelhead (Adult Immigration and Holding; Juvenile Rearing)
- Spring-run Chinook Salmon (Adult Immigration and Holding; Spawning and Embryo Incubation; Juvenile Rearing)
- Fall-run Chinook Salmon (Adult Immigration and Holding)
- Green Sturgeon (Juvenile Rearing; Juvenile Outmigration)

Simulated Actual Flows

Flows under the proposed project at the Marysville Gage are higher than the basis of comparison 95 percent of the time during the 83-year simulation period (**Figure 4-19**). The lower optimum flow for lower Yuba River salmonids during the month of September at the Marysville Gage is reportedly 500 cfs (see Section 2.1.3.1). During the lowest 30 percent of the cumulative flow distribution, flows under the proposed project are higher than flows under the basis of comparison, and remain between 400 and 500 cfs 100 percent of the time, whereas flows under the basis of comparison (RD-1644 long-term) do not exceed 250 cfs.

The optimum flow for lower Yuba River salmonids during the month of September at the Smartville Gage is reportedly 700 cfs (see Section 2.1.3.1). During the lowest 30 percent of the cumulative flow distribution, flows at the Smartville Gage (**Figure 4-20**) under the proposed project are higher than the basis of comparison 100 percent of the time, and remain between approximately 600 and 800 cfs, whereas flows under the basis of comparison do not exceed 600 cfs.

Water Temperature

During September, water temperatures simulated at Daguerre Point Dam under the proposed project and under the basis of comparison are similar (always within 0.1°F of each other) and range from approximately 58.2°F to 58.3°F (**Figure 4-21)**.

During September, water temperatures simulated at Marysville generally range from about 59.2°F to 62.6°F under the proposed project, and from 59.3°F to 63.2°F under the basis of comparison. During the warmest 37 percent of the water temperature exceedance distribution for September, water temperatures simulated at Marysville under the proposed project are lower (up to 1.4°F) than those under the basis of comparison. For the coldest 56 percent of the distribution, water temperatures under the proposed project are lower (up to 1.0°F) than those under the basis of comparison **(Figure 4-22).**

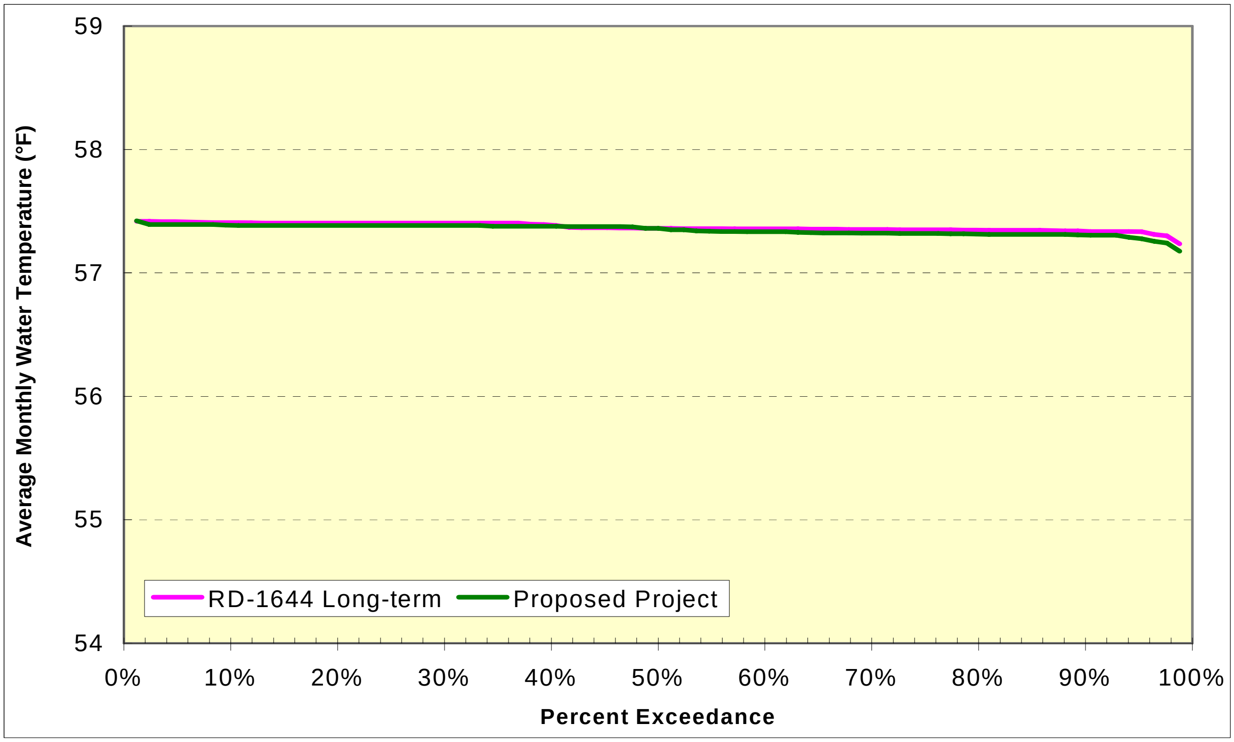

Figure 4-17. Exceedance Plot of Average Water Temperatures at Daguerre Point Dam During the Month of August Over the 83-Year Simulation Period.

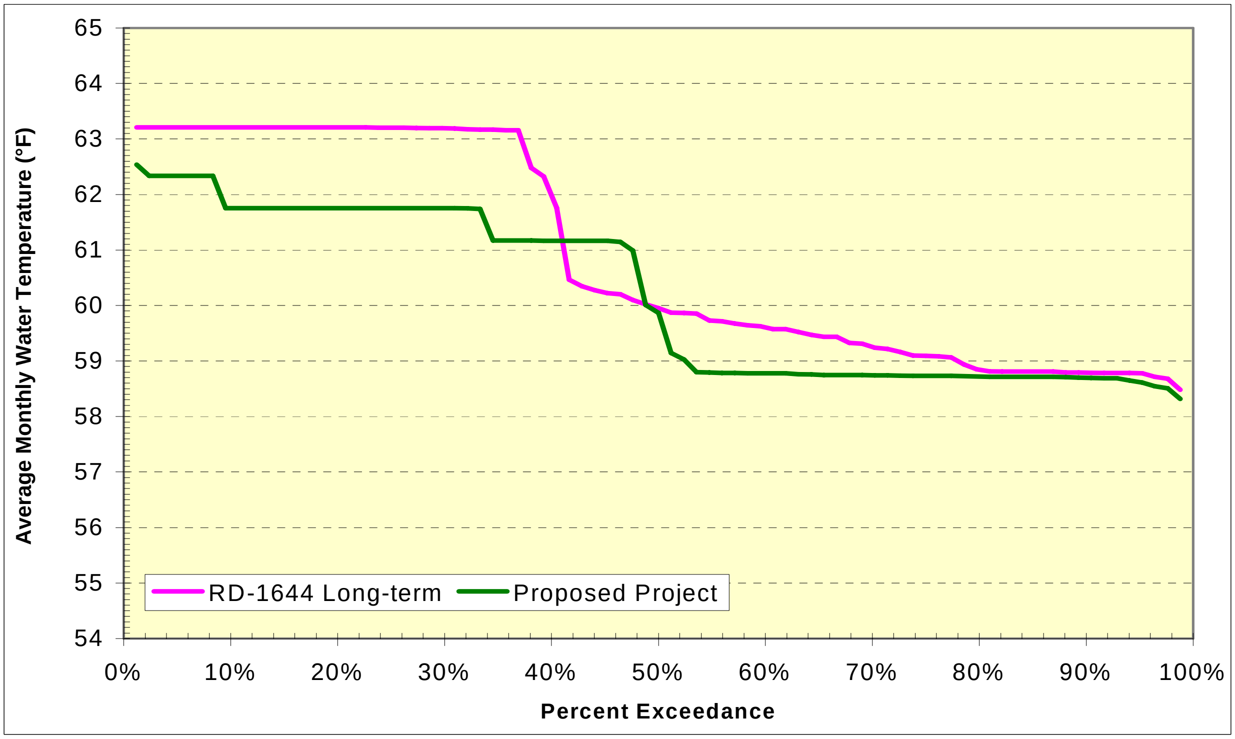

Figure 4-18. Exceedance Plot of Average Water Temperatures at Marysville During the Month of August Over the 83-Year Simulation Period.

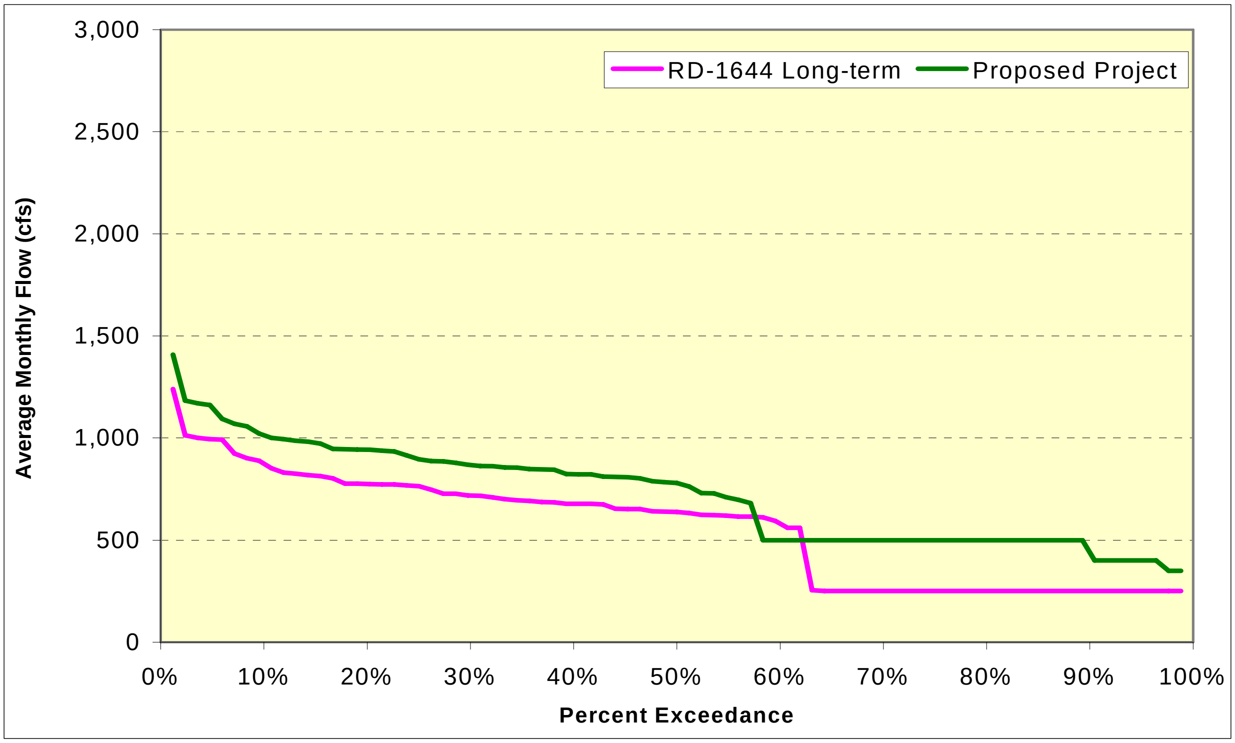

Figure 4-19. Exceedance Plot of Average Flows at the Marysville Gage During the Month of September Over the 83-Year Simulation Period.

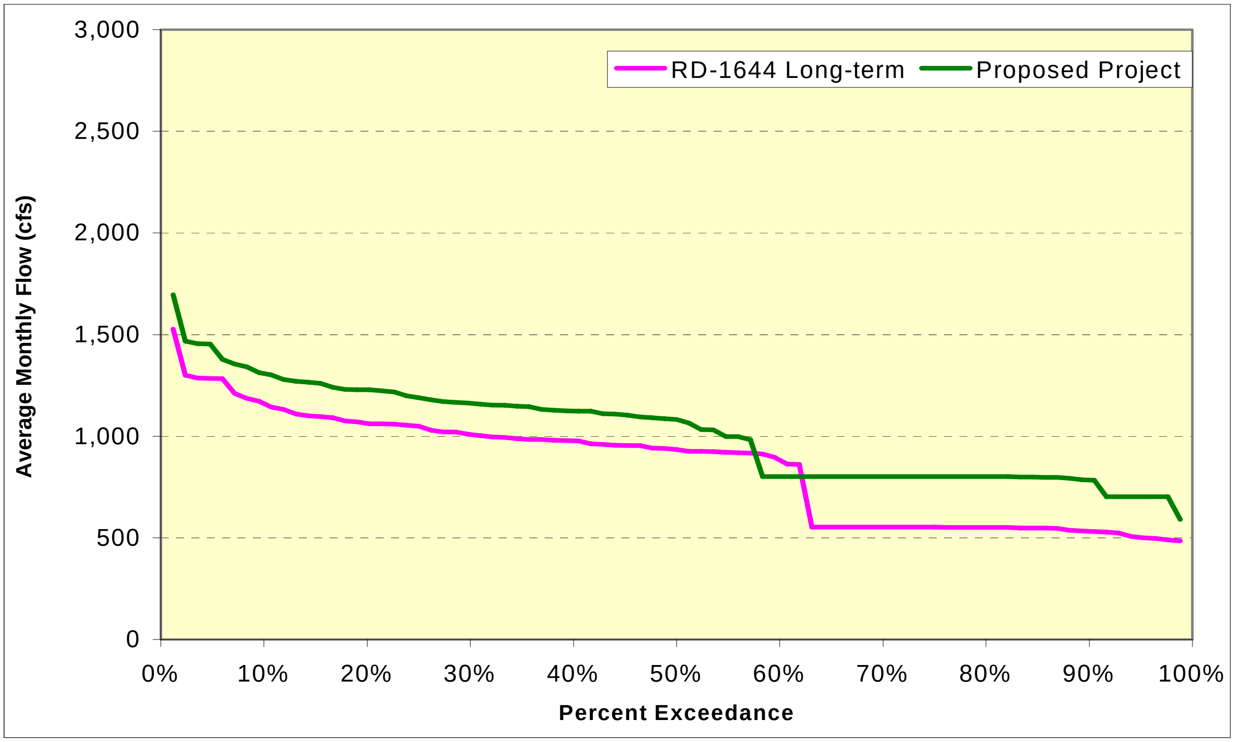

Figure 4-20. Exceedance Plot of Average Flows at the Smartville Gage During the Month of September Over the 83-Year Simulation Period.

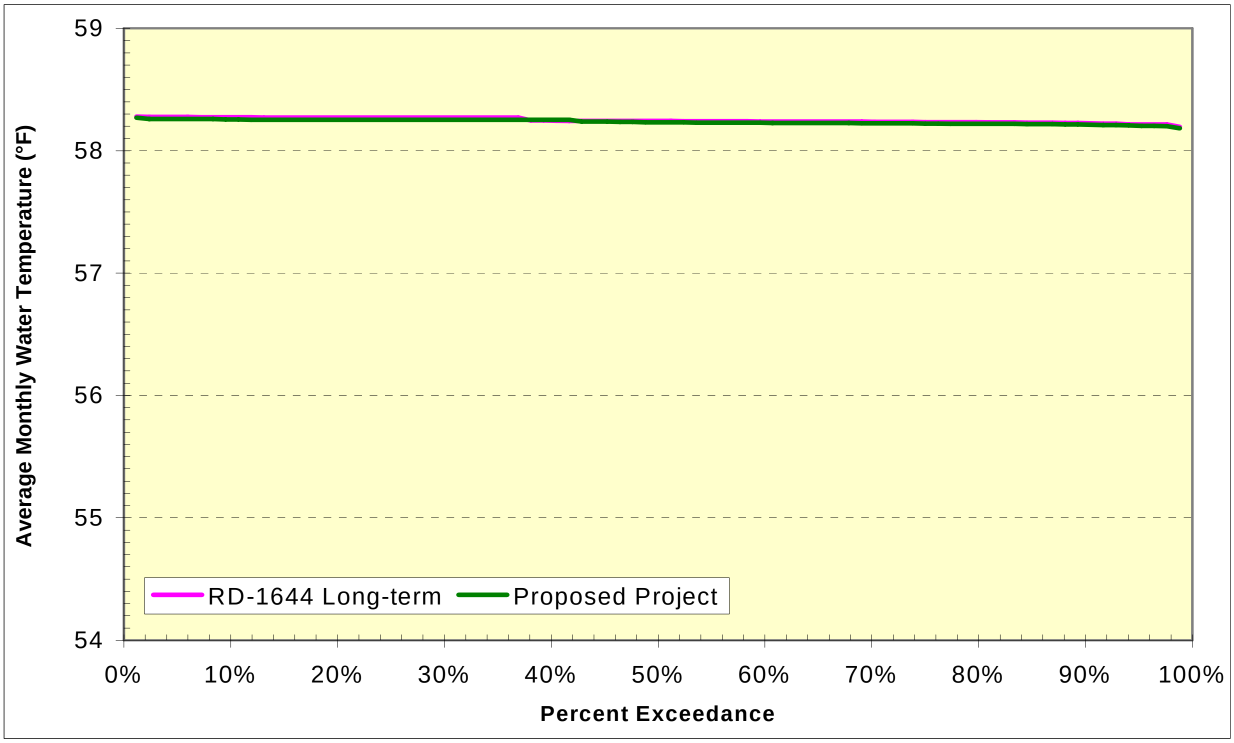

Figure 4-21. Exceedance Plot of Average Water Temperatures at Daguerre Point Dam During the Month of September Over the 83-Year Simulation Period.

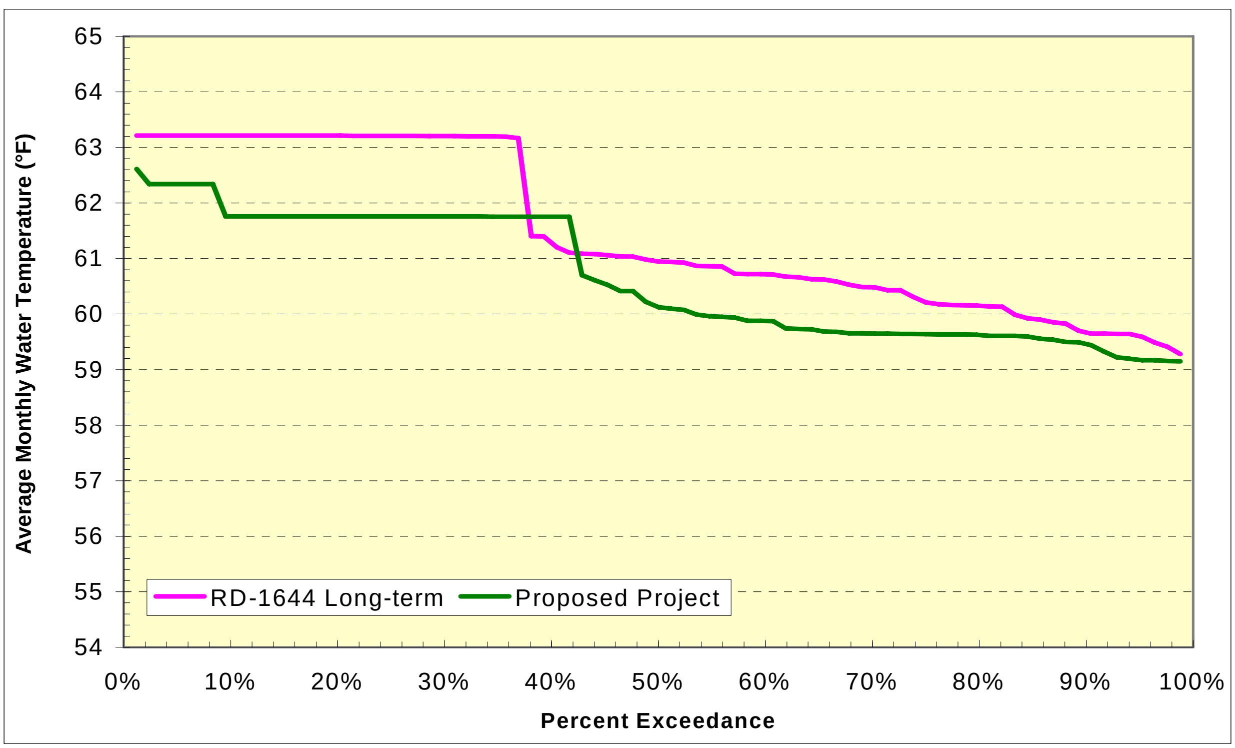

Figure 4-22. Exceedance Plot of Average Water Temperatures at Marysville During the Month of September Over the 83-Year Simulation Period.

October

Species, Runs and Life Stages Occurring

- Steelhead (Adult Immigration and Holding; Juvenile Rearing)
- Spring-run Chinook Salmon (Adult Immigration and Holding; Spawning and Embryo Incubation; Juvenile Rearing)
- Fall-run Chinook Salmon (Adult Immigration and Holding; Spawning and Embryo Incubation)
- Green Sturgeon (Juvenile Rearing)

Simulated Actual Flows

Flows at the Marysville Gage (**Figure 4-23)** and the Smartville Gage (**Figure 4-24**) under the proposed project are higher than the basis of comparison approximately 95 percent of the time for the 83-year simulation period.

A flow of 500 cfs at the Marysville Gage is considered to be optimal for lower Yuba River salmonids during October. Under the proposed project, 500 cfs is equaled or exceeded with about a 90 percent probability, but only with about a 5 percent probability under the basis of comparison.

Water Temperature

During October, water temperatures simulated at Daguerre Point Dam under the proposed project and under the basis of comparison are similar (always within 0.1°F of each other) and range from approximately 55.4°F to 55.7°F (**Figure 4-25**).

During October, water temperatures simulated at Marysville range from 56.2°F to 58.1°F under the proposed project, and from 56.2°F to 58.8°F under the basis of comparison (**Figure 4-26**).

November

Species, Runs and Life Stages Occurring

- Steelhead (Peak Adult Immigration and Holding; Juvenile Rearing; Smolt Emigration)
- Spring-run Chinook Salmon (Spawning and Embryo Incubation; Juvenile Rearing; Smolt Emigration)
- Fall-run Chinook Salmon (Peak Adult Immigration and Holding; Spawning and Embryo Incubation)
- Green Sturgeon (Juvenile Rearing)

Simulated Actual Flows

Flows at the Marysville Gage (**Figure 4-27)** and the Smartville Gage (**Figure 4-28**) under the proposed project are equivalent to or higher than the basis of comparison during lower flow conditions which occur with more than a 60 percent probability. At both gages, flows are expected to be nearly equal to or higher than the reported optimum (500 cfs at Marysville and 700 cfs at Smartville).

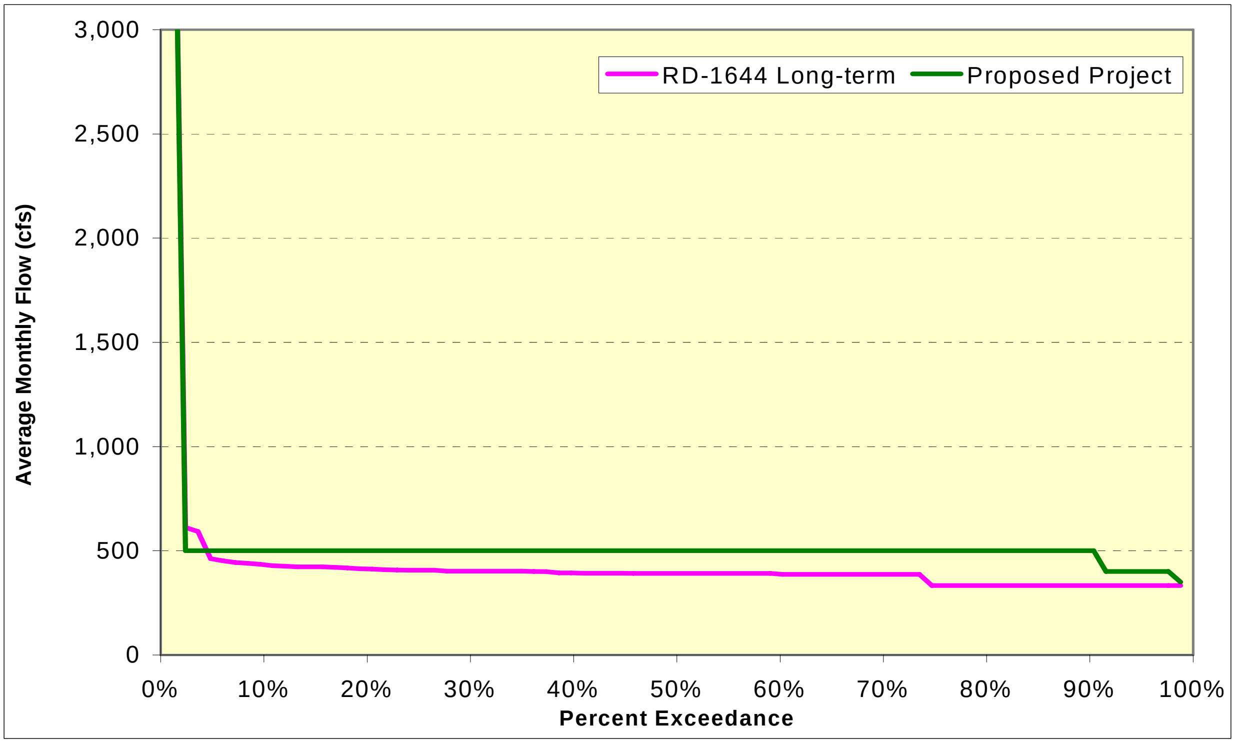

Figure 4-23. Exceedance Plot of Average Flows at the Marysville Gage During the Month of October Over the 83-Year Simulation Period.

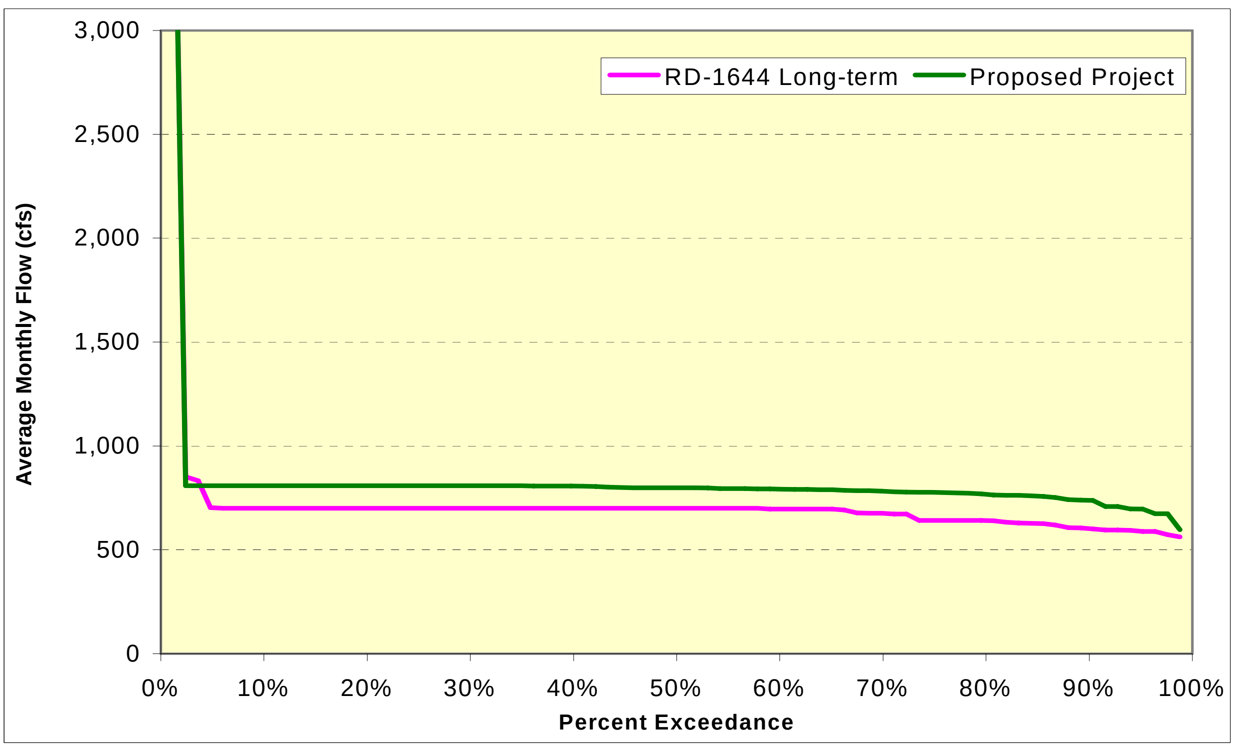

Figure 4-24. Exceedance Plot of Average Flows at the Smartville Gage During the Month of October Over the 83-Year Simulation Period.

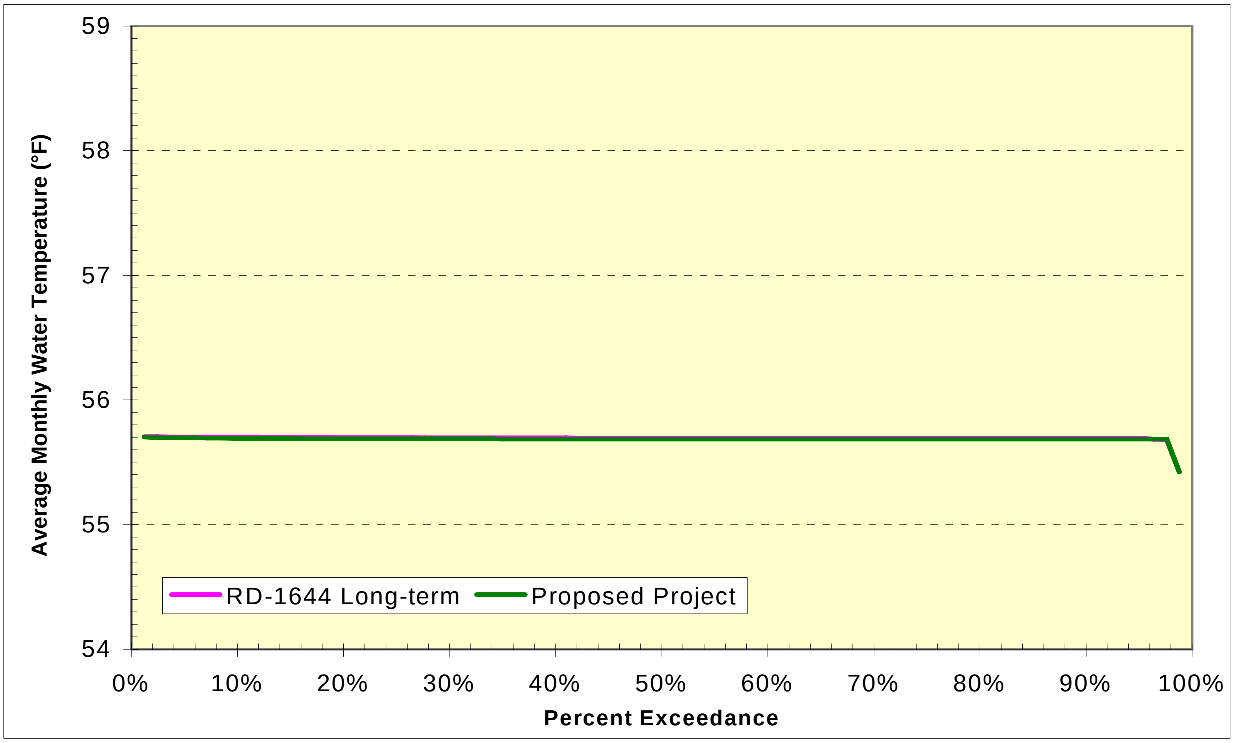

Figure 4-25. Exceedance Plot of Average Water Temperatures at Daguerre Point Dam During the Month of October Over the 83-Year Simulation Period.

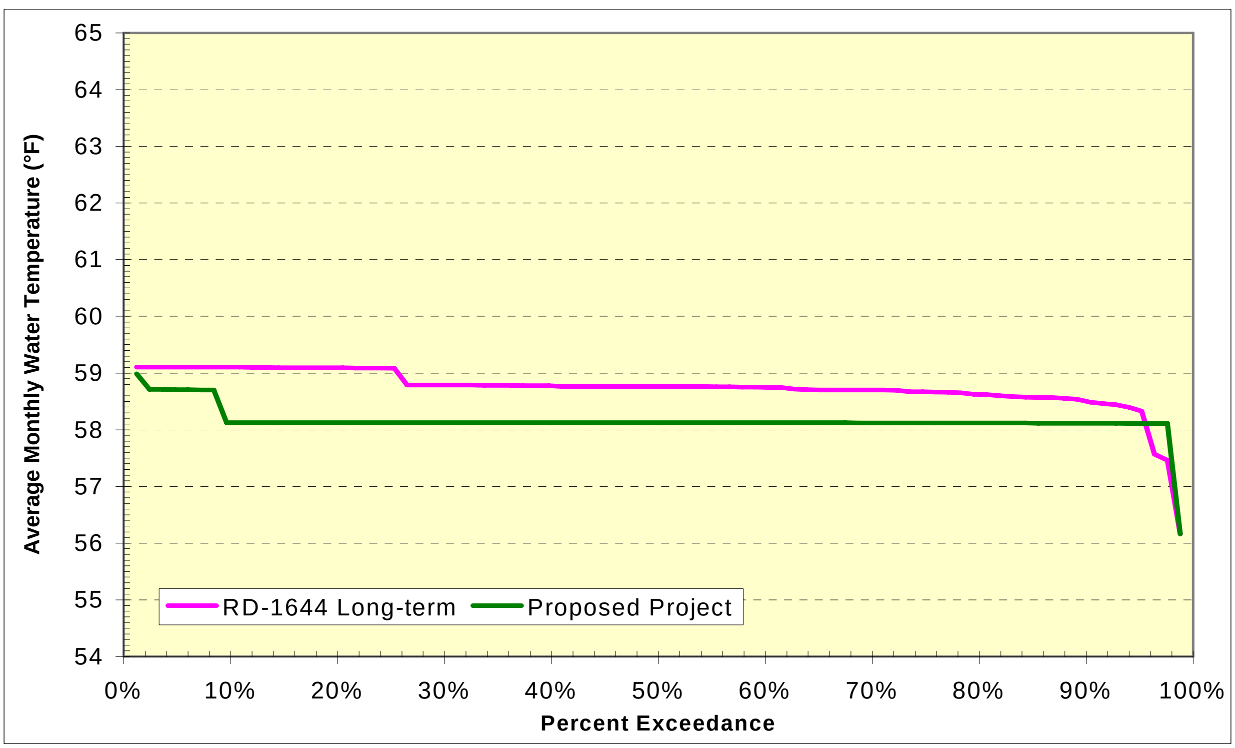

Figure 4-26. Exceedance Plot of Average Water Temperatures at Marysville During the Month of October Over the 83-Year Simulation Period.

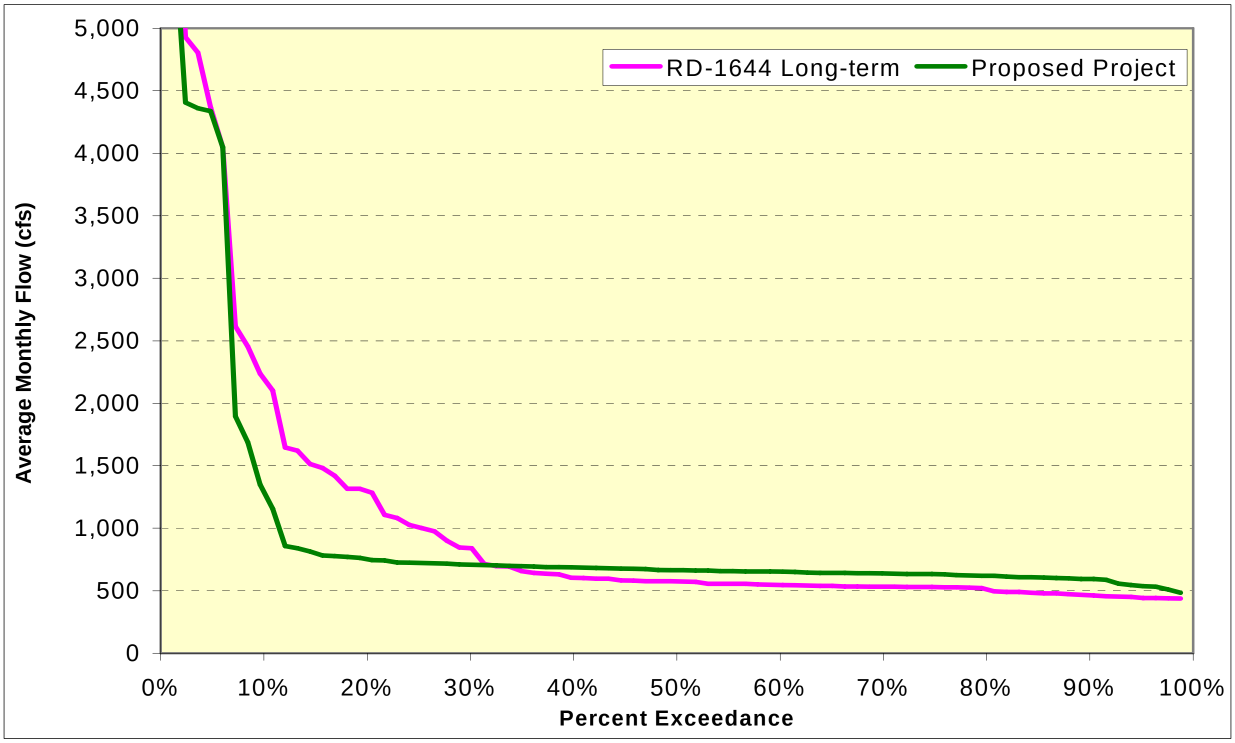

Figure 4-27. Exceedance Plot of Average Flows at the Marysville Gage During the Month of November Over the 83-Year Simulation Period.

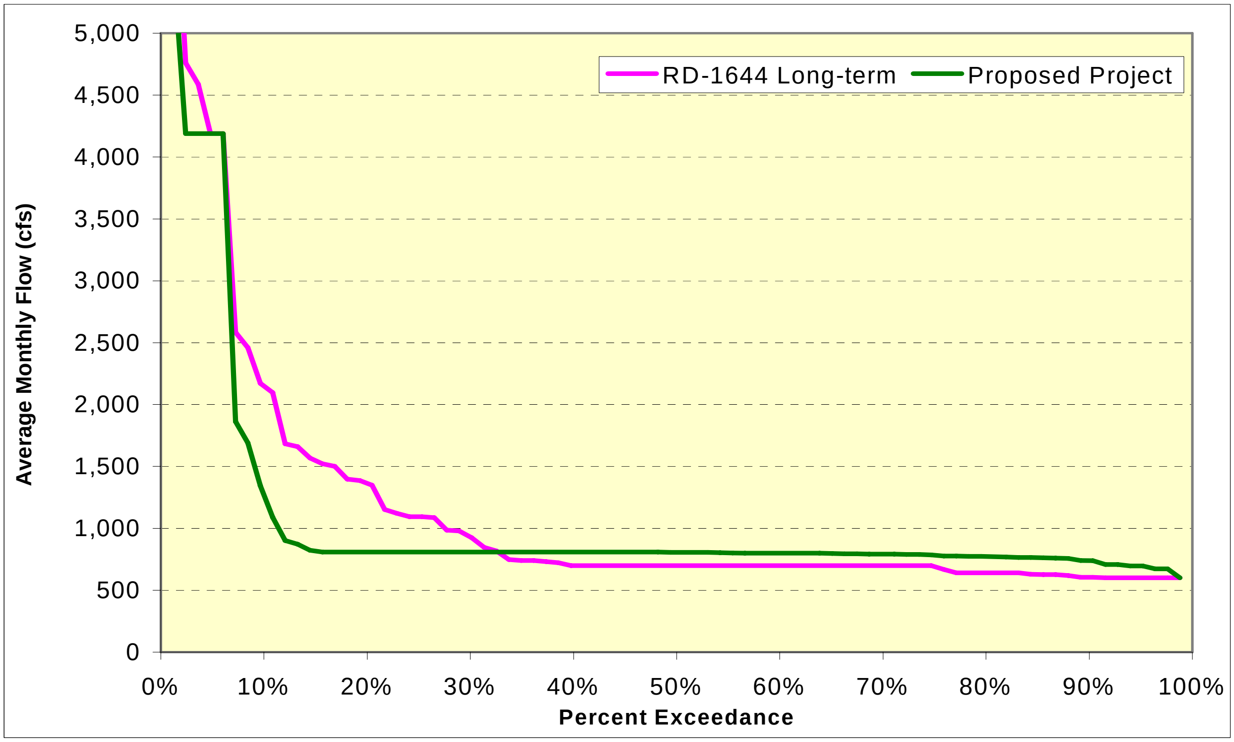

Figure 4-28. Exceedance Plot of Average Flows at the Smartville Gage During the Month of November Over the 83-Year Simulation Period.

December

Species, Runs and Life Stages Occurring

- Steelhead (Adult Immigration and Holding; Spawning and Embryo Incubation; Juvenile Rearing; Smolt Emigration)
- Spring-run Chinook Salmon (Spawning and Embryo Incubation; Juvenile Rearing; Smolt Emigration)
- Fall-run Chinook Salmon (Adult Immigration and Holding; Spawning and Embryo Incubation; Juvenile Rearing and Outmigration)
- Green Sturgeon (Juvenile Rearing)

Simulated Actual Flows

Flows at the Marysville and Smartville gages during 60 percent of the cumulative flow distribution are the result of flood control operations. During controlled flows, which occur during the lowest 40 percent of the cumulative flow distribution, flows under the proposed project are equivalent to or higher than the basis of comparison (Appendix D, Figures D-9, D-20).

January

Species, Runs and Life Stages Occurring

- Steelhead (Adult Immigration and Holding; Juvenile Rearing)
- Spring-run Chinook Salmon (Juvenile Rearing; Smolt Emigration)
- Fall-run Chinook Salmon (Spawning and Embryo Incubation; Juvenile Rearing and Outmigration)
- Green Sturgeon (Juvenile Rearing)

Simulated Actual Flows

Flows at the Marysville and Smartville gages are the result of flood control operations during 90 percent of the cumulative flow distribution. Flows under the proposed project that occur during the lowest 10 percent of the cumulative flow distribution are equivalent to or higher than the basis of comparison (Appendix D, Figures D-10, D-21).

February

Species, Runs and Life Stages Occurring

- Steelhead (Adult Immigration and Holding; Spawning and Embryo Incubation; Juvenile Rearing; Smolt Emigration)
- Spring-run Chinook Salmon (Adult Immigration and Holding; Juvenile Rearing; Smolt Emigration)
- Fall-run Chinook Salmon (Adult Spawning and Embryo Incubation; Juvenile Rearing and Outmigration)
- Green Sturgeon (Adult Immigration and Holding; Juvenile Rearing)

Simulated Actual Flows

Flows at the Marysville and Smartville gages were the result of flood control operations during 90 percent of the cumulative flow distribution. Flows under the proposed project that occurred during the lowest 10 percent of the cumulative flow distribution were equivalent to or higher than the basis of comparison (Appendix D, Figures D-11, D-22).

Spawning Habitat Availability

Spring-run Chinook salmon

The spawning and embryo incubation life stage encompasses the time adult spring-run Chinook salmon select a spawning site in September through the time when emergent fry begin to exit the gravel and enter the open water column in December. Spring-run Chinook salmon reportedly spawn in the Garcia Pit Gravel Reach, downstream to Daguerre Point Dam (SWRCB 2003).

The spring-run Chinook salmon spawning habitat analysis emphasized the month of September because this is the only month during the spring-run Chinook salmon spawning period that does not temporally overlap with fall-run Chinook salmon spawning (CDFG 2000). For September, Chinook salmon spawning habitat availability, expressed as percent maximum WUA, under the proposed project is lower (up to about 10 percent) than under the basis of comparison for approximately 56 percent of the cumulative WUA distribution; and is higher (up to approximately 5 percent) than under the basis of comparison for the remainder of the distribution (**Figure 4-29**). Overall, over the 83-year simulation period, the proposed project provides an average of about 86 percent of maximum WUA, and the basis of comparison provides about 90 percent of maximum WUA. Under the proposed project, approximately 99 to 100 percent of the maximum WUA is provided for 40 percent of the cumulative WUA distribution, whereas the basis of comparison does not provide spawning habitat over about 96 percent of maximum WUA.

Fall-run Chinook Salmon

The fall-run Chinook salmon spawning period generally extends from October into January. Fall-run Chinook salmon primarily spawn in the Garcia Pit Gravel Reach downstream to Daguerre Point Dam, with about one-third of the fish spawning in the later part of the season below Daguerre Point Dam (SWRCB 2003).

The fall-run Chinook salmon spawning habitat analysis focused on the months of October through December. As previously mentioned, WUA estimates were utilized to estimate the annual quantity and quality of spawning habitat availability. Over an 83-year period of simulation, Chinook salmon spawning habitat availability under the proposed project was generally higher than the basis of comparison (**Figure 4-30**). Overall, over the 83-year simulation period, the proposed action achieves an average annual probability of 86 percent of maximum WUA, whereas the basis of comparison (RD-1644 long-term) achieves an average annual 81 percent of maximum WUA. Under the proposed project, over 90 percent of the maximum WUA is achieved about 60 percent of the cumulative WUA distribution, while under the basis of comparison 90 percent is achieved for only approximately 48 percent of the cumulative WUA distribution. The percentage of maximum WUA is higher (up to approximately 17 percent) under the proposed project than under the basis of comparison for over 50 percent (i.e., from 40 percent to 94 percent on the x-axis) of the cumulative WUA distribution.

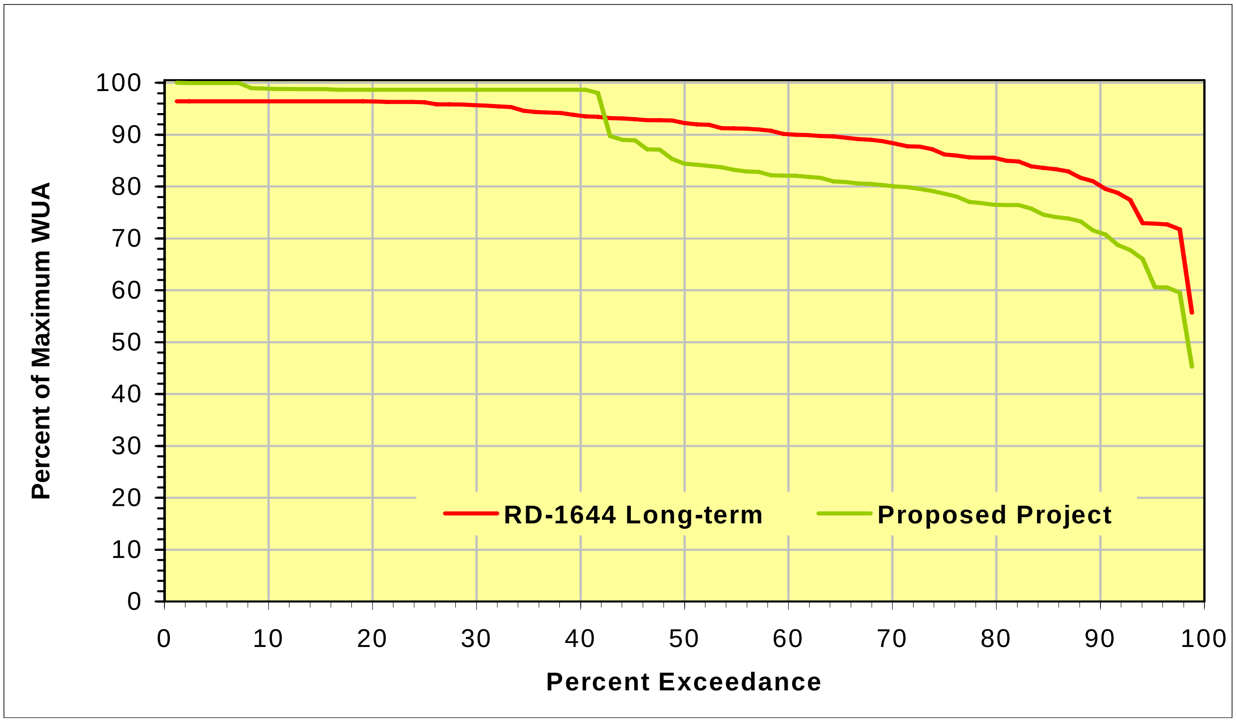

Figure 4-29. Exceedance Plot Comparison of Chinook Salmon Spawning Habitat Availability, as Represented by WUA, During September Under the Proposed Project and the Basis of Comparison (RD-1644 long-term).

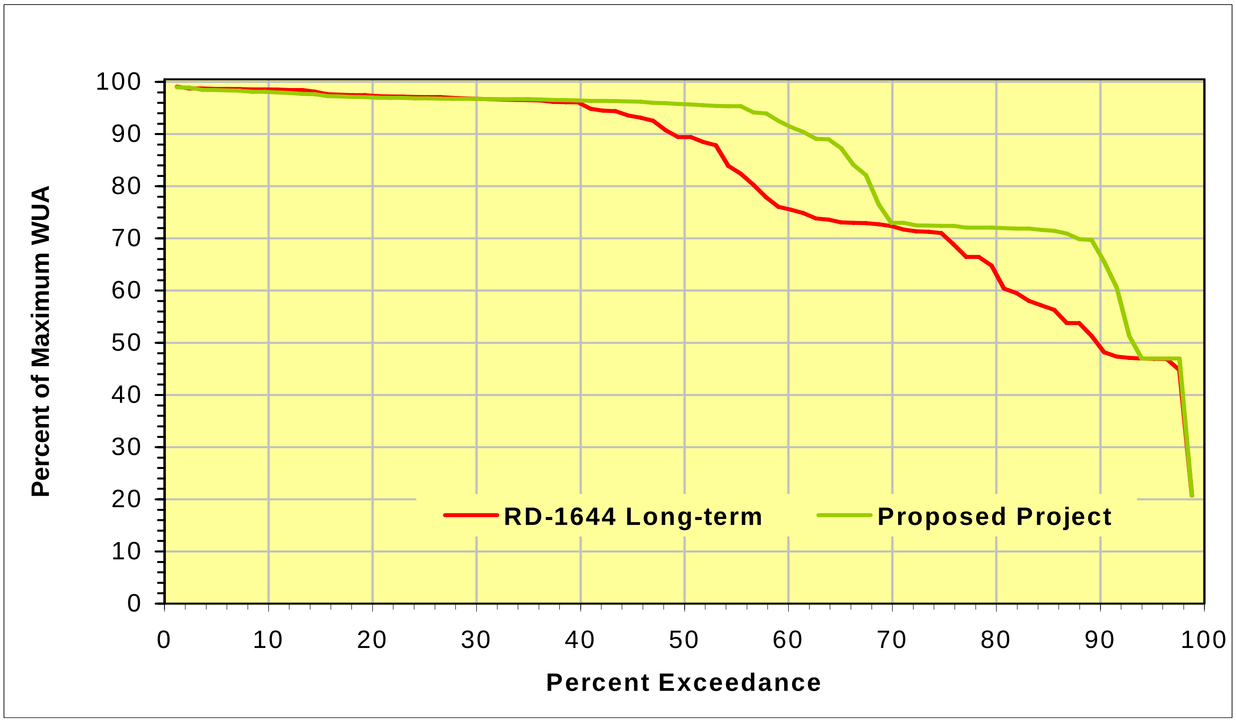

Figure 4-30. Exceedance Plot Comparison of the Annual Chinook Salmon Spawning Habitat Availability, as Represented by WUA, During the Months of October, November, and December, Under the Proposed Project and Under the Basis of Comparison (RD-1644 long-term).

Fisheries Issues Related to Recent Water Transfers

The discussion of potential fisheries resources impacts for the lower Yuba River also focuses on issues raised related to recent water transfers and a subsequent synthesis of species specific potential impacts. Specifically, the topics addressed in this evaluation include:

- Potential Effects on Juvenile Salmonid Movement in the Yuba River
  - Inducement of Juvenile Salmonid Downstream Movement
  - Downstream Extension of Cold Water Habitat
- Potential Effects on Attraction of Non-native Adult Chinook Salmon in the Yuba River
- Cold Water Reserves for Fall Releases from New Bullards Bar Reservoir
- Beaching, Stranding, and Isolation of Anadromous Salmonids in the Lower Yuba River

Juvenile Salmonid Downstream Movement

Water transfers characterized by substantial increases in flows at the onset of the transfer, particularly when initiated in summer months when flows are at the instream minimum levels, have the potential to result in adverse impacts to aquatic resources. CDFG indicates that a significant increase in the magnitude of flow is a primary factor that induces steelhead and Chinook salmon to outmigrate (CDFG 2004).

Results from the simulated flow analysis performed (Appendix D) show that flows in the lower Yuba River under the proposed project are expected to be equal to or above the basis of comparison during most months.

In 2004, the total ramp-up for the water transfer was 122 cfs over the course of two days; a 67 cfs increase in flows from June 30 to July 1, 2004 and a 55 cfs increase in flows from July 1 to July 2, 2004 (at the Smartville Gage). The 2004 water transfer monitoring and evaluation studies did not observe or report any consistent trend between juvenile steelhead counts (at the rotary screw traps) and Yuba River streamflow prior to, during, or immediately following initiation of the 2004 water transfer. Under the proposed project, a pronounced ramp-up is not anticipated because the flow schedules under the 2006 Pilot Program Fisheries Agreement were designed to minimize such occurrences, and because flow increases during spring 2006 are not expected to exceed those which occurred during 2004. Therefore, the proposed project would not be expected to result in the inducement of juvenile salmonid downstream movement from above Daguerre Point Dam to below Daguerre Point Dam in the lower Yuba River, or from the Yuba River to the Feather River.

Downstream Extension of Cold Water Habitat

Resource agency representatives also have expressed concern regarding the creation or extension of coldwater habitat in the lower Yuba River associated with water transfer operations. As discussed previously (Summary of Recent Water Transfer Fisheries Monitoring Studies and Findings), it appears that water transfers may be associated with the extension of cooler water temperatures farther downstream in the lower reaches of the Yuba River (i.e., below Daguerre Point Dam). Generally, such extension of coldwater habitat further downstream can be beneficial to fisheries resources by providing a larger area of suitable habitat. However, once the transfer terminates, if the extended cool water habitat is not maintained, areas of suitable cool water habitat may shift upstream, and fish in the lower downstream reaches that do not also shift upstream may be subjected to stressful water temperatures.

In the Yuba River, habitat in the lower river below Daguerre Point Dam and, in particular, below Hallwood Boulevard generally is considered poor over-summering habitat for juvenile salmonids, relative to reaches upstream of Daguerre Point Dam (see Yuba River Environmental Setting). CDFG has identified concerns regarding the decreased survival of fish remaining in the lower reaches of the river following the end of the water transfer due to elevated water temperatures and increased predation (CDFG 2004).

Water temperatures in the lower Yuba River below Daguerre Point Dam during the period of the year (May through October) included in the water temperature analysis are consistently lower much of the time under the proposed project, relative to the basis of comparison. Simulated water temperatures in the lower reaches of the lower Yuba River (i.e., represented by the Marysville Gage) are anticipated to be more suitable for juvenile steelhead from the period extending from May through October 2006, under the proposed project, relative to the basis of comparison. However, it is recognized that water temperature conditions are variable and are influenced by climatic conditions, and should continue to be monitored during the proposed project.

Potential Effects on Attraction of Non-native Adult Chinook Salmon in the Lower Yuba River

Chinook salmon straying is fairly common in Central Valley streams throughout the Chinook salmon distribution. However, introducing non-native Chinook salmon (especially of hatchery origin) at high rates may be detrimental to the overall well-being of self-sustaining natural Chinook salmon populations, such as those in the Yuba River. Although some straying of non-indigenous Chinook salmon into the Yuba River occurs every year, resource agencies have expressed concern regarding the potential for the Yuba River water transfers via decreased water temperatures and increased proportions of flow, relative to the Feather River, to encourage non-natal Feather River hatchery Chinook salmon to stray into the Yuba River.

As described previously in the discussions under *Summary of Recent Water Transfer Fisheries Monitoring Studies and Findings*, some straying of anadromous salmonids into the Yuba River is a natural phenomenon, and also occurs every year under various prevailing water conditions. It should be recognized that increases in Yuba River flows, whether from water transfers, increased minimum instream flow requirements ordered by the SWRCB, or flood flow releases potentially may attract salmonids into the Yuba River. Additionally, straying of non-Yuba River origin adult Chinook salmon can be influenced by Feather River flows, hatchery release location and timing, and other factors.

Overall, based on the findings of monitoring studies conducted for recent YCWA water transfers, the flow and water temperature differences between the proposed project and the basis of comparison are not expected to increase straying of non-indigenous adult salmonids in the Yuba River.

Coldwater Reserves for Fall Releases from New Bullards Bar Reservoir

During previous water transfers involving YCWA, concern has been expressed about the loss of coldwater reserves for fall releases from New Bullards Bar Reservoir. Monitoring conducted for the SWRCB following YCWA's 1997 water transfer to Reclamation indicates that a reduction of 75,000 acre-feet did not significantly reduce available coldwater storage. In addition, water temperature profiles in the reservoir indicate that the thermocline (the depth zone of a lake or reservoir in which there is a rapid decrease in temperature with water depth) extends to depths of 50 to 60 feet in late summer and early fall. Below a depth of about 120 feet, water temperatures are relatively low and stable (40°F to 45°F) ((YCWA 2004); Appendix B). The low-level penstock outlet draws water at reservoir elevations from 1,623 to 1,675 feet. It is expected that the proposed project would not cause any unreasonable impacts on the coldwater pool.

Beaching, Stranding and Isolation of Anadromous Salmonids in the Lower Yuba River

Substantial decreases in instream flows at the conclusion or "ramp-down" phase of water transfers are of concern because of the potential that fish stranding could result when flows in the river decrease. As juvenile salmonids grow, they move from the shallower backwater/side channel habitats to faster water associated with the main channel. However, stranding or isolation of juvenile salmonids can occur in side pools or channels with an increasing gradient towards the main channel if these areas become isolated from the main river channel due to flow reductions. It is recognized that there are side channels along the lower Yuba River that could become isolated from the main river channel if flow reductions at the end of the transfer period are not managed carefully. Due to these concerns, during the proposed project, YCWA would implement a maximum ramp-down rate of 200 cfs per day, in four increments of about 50 cfs each, as was done for the 2004 water transfer (YCWA 2004). These proposed rates are more restrictive than the ramp-down rates in the current SWRCB RD-1644 long-term regulatory baseline. Additionally, YCWA and resource management agencies have developed the experimental design and study plan to evaluate potential for redd dewatering and fry stranding in the lower Yuba River, as required by RD-1644 (YCWA 2003c).

Synthesis of Evaluation Considerations and Conclusions

Steelhead

The adult immigration and holding life stage begins in August and encompasses the time steelhead enter the lower Yuba River to the time spawning site selection begins in January. Based on the simulated flow analysis, there is a 95 percent or higher probability that flows under the proposed project at the Marysville Gage would be higher than they would be under the basis of comparison from August through November. Potential increases in flow under the proposed project could increase the quantity of usable adult steelhead holding habitat due to increases in water depth, and increases in the longitudinal cross sectional area of the river channel that would occur from increases in river stage elevations. Also, lower water temperatures could increase the quality of available adult holding habitat and, thus, potentially decrease overall adult steelhead holding habitat densities.

The spawning and embryo incubation life stage for steelhead generally begins in January, and encompasses the time adult steelhead select a spawning site through the time when emergent fry exit the gravel and enter the open water column, through May.

During January through March, simulated flows below Englebright Reservoir near Smartville under both the proposed project and basis of comparison are similar. Larger differences in flows are expected below Englebright Reservoir during April and May, but the magnitude of these differences would not be expected affect steelhead spawning and embryo incubation. During the lowest 10 percent of the cumulative flow distribution (i.e., "driest" conditions) instream flows under the proposed project in April and May would be expected to enhance conditions for steelhead spawning and embryo incubation, relative to conditions provided under the basis of comparison.

The juvenile rearing life stage of steelhead occurs year-round in the lower Yuba River. Specific habitat-discharge relationships for juvenile rearing salmonids have not been developed for the lower Yuba River. Available information indicates that physical habitat for this life stage is not limiting under the flow regimes anticipated for either operational scenario. By contrast, water temperatures from spring through fall are considered to be the primary stressor to juvenile rearing steelhead in the lower Yuba River.

Water temperatures in the lower Yuba River below Daguerre Point Dam during the juvenile steelhead over-summer rearing period are anticipated to be substantially lower and, therefore, more suitable, than those with the basis of comparison. During the simulated warmest 30 percent of conditions that could occur during late summer and fall, water temperatures under the proposed project would be up to 2°F lower than those under the basis of comparison.

Steelhead young-of-the-year downstream movement is believed to occur from May through September, and yearling or older individuals are believed to emigrate from October through May. The downstream movement of emigrating juvenile anadromous salmonids is stimulated by both physiological and environmental cues. Physical cues, such as rapid increases in flows, may be more closely associated with the downstream movement of juvenile salmonids, rather than sustained flow conditions (see Section 4.4.1.2, Summary of Recent Water Transfer Fisheries Monitoring Studies and Findings).

During April under controlled flow conditions, flows at both the Marysville and Smartville gages are expected to be higher under the proposed project than under the basis of comparison. During May, at the Marysville Gage, the proposed project is expected to provide the lower flow considered to be optimum (1,000 cfs) or higher with about an 80 percent probability, versus an approximate 90 percent probability under the basis of comparison. By contrast, the proposed project is expected to provide the upper optimal flow level (2,000 cfs) or higher with over a 60 percent probability, versus about a 50 percent probability under the basis of comparison. During the lowest (8 percent) of flow conditions, flows under the proposed project are similar to or higher (up to 245 cfs) than under the basis of comparison.

During June, the proposed project is expected to provide somewhat lower flows than the basis of comparison during the lowest 30 percent of flow conditions. However, the proposed project is expected to provide the upper optimal flow level (1,500 cfs) or higher with over a 60 percent probability, versus about a 40 percent probability under the basis of comparison. Water temperatures during June at Marysville are expected to be higher (from 0.6ºF to 1.8ºF) during the warmest (i.e., nearly 30 percent) temperature conditions under the proposed project, relative to the basis of comparison. Nonetheless, water temperatures are expected to remain below 62.5ºF under any condition, and at 60ºF or less with about a 75 percent probability.

Flows that could occur under the proposed project are not expected to affect juvenile steelhead movement relative to flows under the basis of comparison. YCWA, as part of its normal Yuba Project operations, would continue to adhere to accepted ramping rates developed (see Section 4.4.1.2) to minimize potential effects on juvenile steelhead downstream movement.

Based on the findings of YCWA's recent monitoring studies conducted in 2002, 2003, and 2004, and the flow and temperature analyses conducted for this Environmental Analysis, it is concluded that relative to the basis of comparison, the proposed project is expected to provide:

- Substantially lower (up to 2°F) and therefore more suitable water temperatures below Daguerre Point Dam during late summer and early fall during adult immigration and holding;

- Equivalent or better flow and water temperature conditions during the spawning and embryo incubation life stage;
- Substantially lower (up to 2°F) and therefore more suitable water temperatures below Daguerre Point Dam during the juvenile steelhead over-summer rearing period;
- Substantially lower (up to 2°F) and therefore more suitable water temperatures below Daguerre Point Dam during the late summer and early fall portion of the juvenile downstream movement life stage; generally equivalent or better flow and water temperature conditions during the smolt emigration life stage; and
- Similar protection against juvenile non-volitional downstream movement.

In conclusion, the proposed project is not expected to result in unreasonable impacts to the lower Yuba River steelhead population, and is expected to provide an equivalent or higher level of protection relative to the basis of comparison (RD-1644 long-term).

Spring-run Chinook Salmon

The adult immigration and holding life stage begins in February and encompasses the time spring-run Chinook salmon enter the lower Yuba River, to the time spawning site selection begins in September. The majority of spring-run Chinook salmon reportedly enter the lower Yuba River in May and June. Flows in the lower Yuba River throughout the upstream migration period, and specifically during May and June, remain within ranges sufficient to allow adequate passage of adult spring-run Chinook salmon through the Daguerre Point Dam fish ladders (Daguerre Point Dam fish ladders are not effectively operational at flows above 10,000 cfs). The fish reportedly continue their upstream migration to spend the summer in deep pools in the Narrows Reach below Englebright Dam where they hold until spawning commences in September (SWRCB 2003).

The presence of adult spring-run Chinook salmon below Daguerre Point Dam, during their immigration to holding period in the Narrows Reach, is transitory. Water temperatures below Daguerre Point Dam under both the proposed project and the basis of comparison are not expected to affect the upstream migration of spring-run Chinook salmon. Flows and water temperatures under both the proposed project and the basis of comparison are expected to provide essentially equivalent holding habitat conditions in the Narrows Reach from February to September.

Spring-run Chinook salmon spawning and embryo incubation reportedly occurs above Daguerre Point Dam from September through December. During September, the proposed project is expected to provide higher flows (generally up to about 200 cfs) than the basis of comparison, which results in an overall average less amount of spawning habitat (86 vs. 90 percent of maximum WUA) due to the nature of the spawning habitat–discharge relationship. However, the proposed project provides more spawning habitat during "drier" conditions (i.e., the lowest 40 percent of the cumulative flow distribution). Moreover, higher amounts of Chinook salmon spawning habitat are expected to be provided by the proposed project than by the basis of comparison (overall average of 86 percent vs. 81 percent of maximum WUA) from October through December. Water temperatures at Daguerre Point Dam are cool and nearly identical during September and October under the proposed project and the basis of comparison.

The juvenile rearing life stage of spring-run Chinook salmon is believed to extend year-round. Specific habitat-discharge relationships for juvenile rearing salmonids have not been developed for the lower Yuba River. Available information indicates that physical habitat for this life stage is not limiting under the flow regimes anticipated for either operational scenario. Elevated water temperatures from spring through fall are considered to be the primary stressor to juvenile rearing spring-run Chinook salmon in the lower Yuba River.

Under the proposed project, water temperatures in the lower Yuba River during the juvenile spring-run Chinook salmon over-summer rearing period are anticipated to be substantially lower, and therefore more suitable, than those under the basis of comparison. During the simulated warmest 30 percent of conditions that could occur during late summer and fall, water temperatures under the proposed project would be up to 2°F lower than those under the basis of comparison below Daguerre Point Dam.

The smolt emigration life stage of spring-run Chinook salmon extends from November through June in the lower Yuba River. During each of the 1999/2000, 2000/2001, and 2001/2002 monitoring seasons, an estimated 90 percent of juvenile Chinook salmon emigrated from the lower Yuba River by April 21 (see Section 4.4.1.2). Simulated flows during the month of April are expected to be higher under the proposed project, relative to the basis of comparison. During May, the proposed project is expected to provide the lower flow considered to be optimum (1,000 cfs) or higher with about an 80 percent probability, versus an approximate 90 percent probability under the basis of comparison. By contrast, the proposed project is expected to provide the upper optimal flow level (2,000 cfs) or higher with over a 60 percent probability, versus about a 50 percent probability under the basis of comparison. Moreover, lower flows in May under the proposed project than under the basis of comparison during drier years (lowest 30 percent of the cumulative flow distribution) occur due to an intentional operational shift in spring peak flows from late-spring to early-spring (e.g., late-May to April). This temporal shift in flows was designed to mimic Yuba River unimpaired flow patterns that would occur during drier year classes. During the lowest 8 percent of the cumulative flow distribution, flows under the proposed project are similar to or higher (up to 245 cfs) than under the basis of comparison.

Based on the findings of YCWA's recent monitoring studies conducted in 2002, 2003, and 2004, and the flow and temperature analyses conducted for this Environmental Analysis, it is concluded that, relative to the basis of comparison, the proposed project is expected to provide:

- Similar rates of non-indigenous adult Chinook salmon straying;
- Similar adult upstream migration and holding conditions;
- Higher spawning habitat availability during drier flow conditions, and lower spawning habitat availability during wetter conditions in September; higher spawning habitat availability from October through December; and nearly identical spawning water temperatures;
- Substantially lower (up to 2°F) and therefore more suitable water temperatures during the juvenile spring-run Chinook salmon over-summer rearing period below Daguerre Point Dam;
- Similar protection against juvenile non-volitional downstream movement; and
- Generally equivalent smolt outmigration conditions with an improved temporal pattern which more closely mimics unimpaired hydrology.

In conclusion, the proposed project is not expected to result in unreasonable impacts to the lower Yuba River spring-run Chinook salmon population, and is expected to provide an equivalent or higher level of protection, relative to the basis of comparison (RD-1644 long-term).

Fall-run Chinook Salmon

The adult immigration and holding life stage generally extends from August through November, which encompasses the time fall-run Chinook salmon enter the lower Yuba River to the time spawning site selection begins. The majority of fall-run Chinook salmon reportedly enter the lower Yuba River during October and November. Based upon simulated flow analysis, the proposed project flows at the Marysville Gage during August, September, October, and November would be higher most of the time, relative to the basis of comparison. Increased flows would increase the mean width and depth of the river channel, thus increasing the total area of holding habitats, which could decrease the overall holding fish density. Potential increases in flows, under the proposed project, could also be beneficial in facilitating the migration of adult fall-run Chinook salmon to holding habitats in upstream areas. Associated decreases in water temperature (up to 2°F) below Daguerre Point Dam could decrease the potential spread of infectious parasitic diseases and, thus, increase the general fitness level of adult fall-run Chinook salmon holding during late summer and early fall.

Fall-run Chinook salmon spawning generally extends from October through December. The proposed project is expected to provide higher flows under drier flow conditions than the basis of comparison. Consequently, the proposed project provides more (generally 10–20 percent) spawning habitat when spawning habitat is least available, which occurs with about a 60 percent probability. Water temperatures below Daguerre Point Dam during the early part of the spawning season (i.e., October) could be up to 1°F cooler than under the basis of comparison.

The juvenile rearing and outmigration life stage of fall-run Chinook salmon generally extends from December through June in the lower Yuba River. Simulated flows during the month of April are expected to be higher under the proposed project, relative to the basis of comparison. During May, the proposed project is expected to provide the lower flow considered to be optimum (1,000 cfs) or higher for about an 80 percent probability, versus an approximate 90 percent probability under the basis of comparison. By contrast, the proposed project is expected to provide the upper optimal flow level (2,000 cfs) or higher with over 60 percent probability, versus about a 50 percent probability under the basis of comparison. Moreover, lower flows in May under the proposed project than under the basis of comparison during drier years (lowest 30 percent of the cumulative flow distribution) occur due to an intentional operational shift in spring peak flows from late-spring to early-spring (e.g., late-May to April). This temporal shift in flows was designed to mimic Yuba River unimpaired flow patterns that would occur during drier year classes (Figure 2-2). During the lowest 8 percent of the cumulative flow distribution, flows under the proposed project are similar to or higher (up to 245 cfs) than under the basis of comparison.

Based on the findings of YCWA's recent monitoring studies conducted in 2002, 2003, and 2004, and the flow and temperature analyses conducted for this Environmental Analysis, it is concluded that relative to the basis of comparison, the proposed project is expected to provide:

- Substantially higher flows (up to 250 cfs) and lower water temperatures (up to 2°F) below Daguerre Point Dam during the late-summer and fall period of the adult immigration and holding life stage;

- Similar rates of non-indigenous salmonid straying;
- More spawning habitat overall, and more spawning habitat (generally 10 to 20 percent) when spawning habitat is least available, which occurs with about a 60 percent probability;
- Lower (up to 1°F) and therefore more suitable water temperature during the early part (i.e., October) of the spawning season;
- Similar protection against juvenile non-volitional downstream movement; and
- Generally equivalent juvenile outmigration conditions with an improved temporal pattern, which more closely mimics unimpaired hydrology.

In conclusion, the proposed project is not expected to result in unreasonable impacts to the lower Yuba River fall-run Chinook salmon population, and is expected to provide an equivalent or higher level of protection relative to the basis of comparison (RD-1644 long-term).

Green Sturgeon

Flows during green sturgeon immigration and holding (February through July) and spawning and embryo incubation (March through July) are expected to allow adequate upstream migration and spawning habitat availability, under the proposed project, relative to the basis of comparison. During the lowest 30 percent of the cumulative flow distribution, flows under the proposed project would be higher during the spring and early summer, relative to the basis of comparison. These higher flows could potentially increase the amount of green sturgeon adult holding, possibly and spawning habitat availability.

Water temperatures under the proposed project during May could range from 54°F to 58°F. These water temperatures are within the range of water temperatures reported to be suitable for green sturgeon immigration and holding and spawning and embryo incubation.

Green sturgeon juvenile rearing is reported to occur year-round in their natal stream habitats. Average monthly flows under the proposed project are expected to be generally higher during most months of the year, and therefore would not be expected to be a limiting factor impacting green sturgeon juvenile habitat availability, relative to the basis of comparison.

Average monthly water temperature in the lower Yuba River under the proposed project would not be expected to exceed the water temperatures reported to be optimal for juvenile green sturgeon growth.

Green sturgeon begin their emigration to the Delta from May through September. Flows during this period are expected to allow juvenile emigration under the proposed project and the basis of comparison. During the lowest 30 percent of the cumulative flow distribution, higher flows during the summer and fall months under the proposed project could potentially be more beneficial to green sturgeon juvenile emigration, relative to the basis of comparison.

Thermal requirements for the green sturgeon juvenile emigration life stage have not been reported; therefore, it is assumed for the purpose of this analysis, that water temperature suitabilities reported for the juvenile rearing life stage also are appropriate for juvenile emigration. Water temperatures under the proposed project would be between 58°F and 59°F during the month of May, and would be substantially lower during the summer and late-fall, relative to the basis of comparison.

Based on the flow and temperature analyses conducted for this Environmental Analysis, it is concluded that relative to the basis of comparison, the proposed project is expected to provide:

- Similar or better flows and water temperatures during the adult immigration and holding and spawning and embryo incubation life stages;
- Substantially lower water temperatures during over-summer juvenile rearing periods; and
- Similar flows and substantially lower water temperatures during juvenile emigration.

In conclusion, the proposed project is not expected to result in unreasonable impacts to green sturgeon in the lower Yuba River, and is expected to provide an equivalent or higher level of protection, relative to the basis of comparison (RD-1644 long-term).

American Shad

The proportion of lower Yuba River outflow to the lower Feather River would be up to 7 percent higher under the proposed project during the month of April, 5 percent lower during May, and approximately 6 percent higher during the month of June, relative to the basis of comparison. American shad adult immigration and spawning would not be expected to be affected by potential overall reductions in flows during May under the proposed project due to the fact that the timing of the adult spawning run can be adjusted to the timing of river outflows. Flows under the proposed project during April, May, and June are expected to provide flows of sufficient magnitude to attract American shad into the lower Yuba River to spawn (Appendix D).

Therefore, the proposed project would not be expected to unreasonably impact American shad immigration and spawning in the lower Yuba River, relative to the basis of comparison.

Feather River

Overall, flows in the Feather River would not be expected to differ substantially under the proposed project, relative to the basis of comparison. The difference in average simulated monthly mean flows (Marysville Gage) and the percentage of these flows to Feather River (Gridley Gage) flows under the proposed project relative to the basis of comparison for the 83-year simulation period are represented in Table 4-1**.**

These potential monthly changes in flow would not be of sufficient magnitude to result in unreasonable impacts to Feather River fisheries resources. Neither physical habitat availability for fish residing in the Feather River nor immigration of adult or emigration of juvenile anadromous fish would be substantially affected by the anticipated differences in flows that could occur under the proposed project, relative to the basis of comparison. These relatively small differences in flow between the proposed project and the basis of comparison are not expected to result in substantial differences in water temperatures, would not persist downstream and, therefore, would not unreasonably impact fish resources in the lower Feather River.

Sacramento River

Although the specific release pattern is uncertain at this time and will depend on SWP/CVP operational conditions as they develop over the summer, the release, when it occurs, will be subject to certain operational constraints (e.g., ramping criteria) that are within normal operational parameters.

The proposed project would not compromise compliance with environmental regulations that specify minimum flow requirements for winter-run and spring-run Chinook salmon, and Central Valley steelhead. Required releases from New Bullards Bar Reservoir, Englebright Reservoir, and Oroville Reservoir for the protection of fisheries resources would continue to be made by YCWA and DWR.

Overall, flows in the Sacramento River would not be expected to differ substantially under the proposed project, relative to the basis of comparison. The difference in average simulated monthly mean flows at the Marysville Gage for the 83-year simulation period between the proposed project and the basis of comparison and the percentage of these flows to Sacramento River (Freeport) flows are represented in Table 4-2.

These potential changes in flow would not be of sufficient magnitude to result in unreasonable impacts to Sacramento River fisheries resources. Neither physical habitat availability for fish residing in the Sacramento River nor immigration of adult or emigration of juvenile anadromous fish would be substantially affected by the anticipated differences in flows that could occur under the proposed project, relative to the basis of comparison. These relatively small differences in flow between the proposed project and the basis of comparison are not expected to result in substantial differences in water temperatures, would not result in water temperature differences in the Sacramento River, and, therefore, would not unreasonably impact fish resources in the Sacramento River.

Sacramento-San Joaquin Delta

The current regulatory requirements for managing Delta exports include:

- 1995 SWRCB Delta Water Quality Control Plan
- 2004 NMFS Biological Opinion on OCAP
- 2005 USFWS Biological Opinion on OCAP

Compliance with the environmental agreements and requirements stipulated in these regulations would preclude the occurrence of unreasonable impacts on fish as a result of the pumping from the Delta of the water made available by the proposed project. DWR would provide YCWA water transfer water only to SWP or CVP water contractors within the service area (or place of use) as authorized in DWR's water right permits. Provision of the YCWA transfer water through either the EWA Program or a Dry Year Water Purchase Program, if implemented in 2006, would be within permitted and authorized operational and regulatory requirements (or constraints). Consequently, the proposed project water would become part of the overall SWP or CVP water supply with attendant environmental limitations for exporting water from the Delta. The impacts on the Delta from SWP/CVP making full use (within prescribed constraints) of its pumping capacities and any necessary mitigation have been documented (Reclamation 2004).

Related to the EWA Program, potential Delta impacts associated with EWA asset acquisitions were addressed through separate environmental compliance processes (i.e., NEPA, CEQA, ESA), which included preparation of an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) and corresponding Action Specific Implementation Plan (ASIP). Based on the analyses, conclusions and mitigation measures presented in the EWA EIS/EIR and

ASIP, a Record of Decision (Reclamation *et al.* 2004a) was issued by Reclamation and the EIR was certified by DWR (DWR 2004). Thus, the necessary regulatory compliance requirements of NEPA and CEQA have been satisfied for the EWA Program. Similarly, federal and state ESA compliance requirements have been satisfied through the ASIP process. In particular, the USFWS concurred in its Programmatic Biological Opinion on the EWA Program that the EWA was not likely to adversely affect delta smelt or its critical habitat (USFWS 2004). Similarly, NMFS found that the EWA was not likely to adversely affect Sacramento River winter-run Chinook salmon and its critical habitat, Central Valley spring-run Chinook salmon, and Central Valley steelhead (NMFS 2004).

Completed in 2004, the EWA Final EIS/EIR analyzed EWA Program actions through 2007. As described in the EWA Draft EIS/EIR (2003), the Flexible Purchase Alternative included potential asset acquisitions from the Yuba River Basin in the amount of: (1) 100,000 acre-feet of stored reservoir water; and (2) 85,000 acre-feet of groundwater, both of which could be provided to the EWA Program by YCWA (Reclamation *et al.* 2003).

The expected amount of water entering the Delta as a result of the proposed project is within the levels evaluated in the EWA Final EIS/EIR (Reclamation *et al.* 2004a). The proposed project would result in the potential for DWR to acquire a minimum of 60,000 acre-feet and a maximum of 125,000 acre-feet of transfer water. Therefore, the total quantity of YCWA water (i.e., 125,000 acre-feet) proposed for transfer in 2006 is less than the maximum asset acquisition (185,000 acre-feet) identified for the Yuba River Basin as part of the EWA Program.

Although Delta diversions generally can result in fishery impacts, it is expected that the proposed project may have a slight overall benefit to Delta fisheries through its actions that exceed the regulatory baseline established by the above environmental agreements (e.g., EWA Program). To illustrate, findings supporting the conclusion that habitat conditions resulting from implementation of the EWA Program (i.e., Flexible Purchase Alternative) would result in beneficial effects on fisheries resources in the Delta, as described in the EWA Draft EIS/EIR (2003), are as follows:

- The ratio between exports and Delta inflow (E/I ratio) has been identified as an indicator of the vulnerability of fish and macroinvertebrates to direct and indirect impacts resulting from SWP and CVP operations (Reclamation *et al.* 2003). The E/I ratio limits are identified in the 1995 Water Quality Control Plan, with the greatest reductions in exports, relative to inflows, occurring during the biologically sensitive February through June period. As part of the EWA Program, export pumping would be curtailed in July if the density data shows that fish species of primary management concern are present at the SWP and CVP pumping facilities. The occurrence and density of fish species of primary management concern would be determined from routine salvage monitoring. This practice would be effective in preventing potential salvage-related adverse effects at the SWP and CVP pumping facilities.

- The average annual Chinook salmon and steelhead salvage estimates would decrease in all 15 years simulated, and delta smelt and splittail salvage estimates would decrease in 14 out of the 15 years simulated. Although there would be increases in salvage in individual months and in some years, annual salvage estimates for delta smelt, Chinook salmon, steelhead, splittail and striped bass would decrease, relative to the Baseline Condition.

- The EWA water transfers would provide a benefit by decreasing the frequency of reverse flows and reducing the magnitude when reverse flows would still occur. Overall, such changes would be considered a benefit to juvenile salmonid emigration and the transport of planktonic eggs and larvae (Reclamation *et al.* 2003).

The EWA Draft EIS/EIR (2003) concluded that, "*implementation of the Flexible Purchase Alternative would result in less-than-significant impacts on fisheries and aquatic resources within the Sacramento-San Joaquin Delta Region.*" Because the 2006 YCWA transfer water is within the quantity of the asset acquisitions evaluated in the EWA EIS/EIR, potential impacts associated with the conveyance of EWA assets that could occur as a result of changes in the magnitude, timing and duration of Delta conditions have been previously addressed by the analyses conducted for the full 185,000 acre-feet Yuba River Basin asset acquisition presented in the EWA EIS/EIR (2003). Thus, potential changes in Delta conditions and resultant impacts on Delta fisheries resources associated with the YCWA transfer water (i.e., 125,000 acre-feet) in 2006 are anticipated to be within the range of that which was previously evaluated for the EWA Program and no further analyses are required.

Water transfers such as the proposed project have been identified as an effective means of minimizing overall environmental effects and increasing SWP/SWP operational flexibility (SWRCB 1995). Consequently, potential impacts on Delta fisheries resources resulting from the proposed project would not be unreasonable given the on-going compliance with existing environmental requirements, the presence of EWA assets that could be used to offset any potential impacts, and the ability to enhance EWA assets through the transfer to DWR. In addition, the EWA Project Agencies also will coordinate EWA water acquisition and transfer actions with federal (USFWS and NMFS), state (DWR and CDFG), other CALFED agencies, and regional programs (e.g., the San Francisco Bay Ecosystem Goals Project, the Anadromous Fish Restoration Program, the Senate Bill [SB] 1086 program, the Corps' Sacramento and San Joaquin Basin Comprehensive Study, the Riparian Habitat Joint Venture, the Central Valley Project Improvement Act (CVPIA), the Central Valley Habitat Joint Venture, and the Grassland Bird Conservation Plan) that could affect management of evaluated species. Coordination will avoid conflicts among management objectives.

4.5 Terrestrial Resources (Wildlife and Vegetation)

CDFG's Wildlife Habitat Relationship Program identifies 249 species of wildlife that use the valley and foothill habitats of the Sacramento Valley. These include 151 species of birds, 65 species of mammals, and 33 species of reptiles and amphibians. Riparian zones in the basin, the only terrestrial habitat that could potentially be affected by the proposed project, provide migratory corridors, food, and cover for wildlife species typical of riverine and upland areas. Numerous special-status and sensitive wildlife and plant species are found in the Sacramento River Basin including wildlife species that utilize riparian habitats, such as Swainson's hawk (*Buteo swainsoni*), bald eagle (*Haliaeetus leucocephalus*) western yellow-billed cuckoo (*Coccyzus americanus*), willow flycatcher (*Empidonax traillii*), western pond turtle (*Emys marmorata*), and valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*).

4.5.1 Environmental Setting

4.5.1.1 Yuba River

The Yuba River Basin is located on the eastern edges of the Sacramento Valley. It is bounded by the Feather River to the west, the Bear River to the south, Honcut Creek to the north and the Sierra foothills to the east. The primary land use is agriculture, with rice, pasture, and fruit and nut trees accounting for most of the crops. Rice fields are flooded in fall for rice stubble decomposition and the creation of wintertime waterfowl habitat. Agricultural drains and canals support wetland vegetation in some areas and provide habitat for wetland-associated species. In addition to agricultural land, the valley floor supports non-native grassland. Approximately two-thirds of the Yuba River Basin is in the Sierra Nevada foothills. Vegetation communities and their associated wildlife species in this portion of the basin include blue oak woodland, and valley oak woodland. In addition to the wildlife species identified above for the Sacramento River Basin, the foothill yellow-legged frog and the California red-legged frog also are identified as terrestrial species of management concern in the Yuba River Basin.

Foothill Yellow-Legged Frog

One occurrence (1997) of foothill yellow-legged frog (*Rana boylii*) in the Yuba River area is recorded in CDFG's California Natural Diversity Database (CNDDB). This record is from Grizzly Gulch, which runs into Oregon Creek about 2 miles from upper New Bullards Bar Reservoir and is 4 to 5 miles from the location where flows would be released to the Yuba River. There are no records of foothill yellow-legged frog occurrences along the lower Yuba River below Englebright Reservoir. Historically, foothill yellow legged frogs were found in the Coast Ranges from the Santiam River drainage in Oregon (Mehama and Marion Counties) to the San Gabriel River Drainage in California (Los Angeles County), and along the west slopes of the Sierra Nevada/Cascade Crest in most of central and northern California. The elevation range of the foothill yellow-legged frog extends from near sea level to about 6,000 feet in the Sierra Nevada. Foothill yellow legged frogs have disappeared from about 45 percent of their historic range in California and 66 percent of their historic range in the Sierra Nevada Mountains. Based on the results of recent surveys conducted on the Pit, North Fork Feather, North Fork Mokelumne, and Middle Fork Stanislaus rivers, breeding populations of foothill yellow-legged frogs documented on these regulated rivers have all been below 3,000 feet in elevation, with the majority of the frogs occurring at elevations at or below 2,600 feet (Ibis Environmental, Inc. 2004) Therefore, because the closest reported occurrence of the foothill yellow-legged frog is approximately 4 or more miles from where releases into the lower Yuba River would occur, this species has been eliminated from further consideration.

California Red-legged Frog

The California red-legged frog was federally listed as threatened on June 24, 1996 (67 FR 57830-57831). On November 3, 2005, the USFWS proposed new critical habitat for the California red-legged frog that includes 51 units in 23 counties, including Yuba County. Yuba County contains one (YUB-1, Little Oregon Creek) of the 51 proposed critical habitat units, and this unit consists of: (1) approximately 6,322 acres of land surrounding Little Oregon Creek, which flows southwesterly into New Bullards Bar Reservoir; and (2) land surrounding the Little Oregon Creek finger of New Bullards Bar Reservoir. YUB-1 is considered an area that is essential for the conservation of California red-legged frog because it contains all the primary constituent elements for the species including aquatic breeding habitat, non-breeding aquatic habitat, upland habitat and dispersal habitat, and is occupied by the species. California red-legged frogs are relatively prolific breeders, usually laying egg masses during or shortly following large rainfall events in late winter or early spring. The breeding period for the California red-legged frog typically extends from November through early April (Storer 1925). Adult frogs often utilize dense, shrubby or emergent vegetation closely associated with deep-water pools with fringes of cattails and dense stands of overhanging vegetation such as willows (USFWS 2002). Frogs living in coastal drainages are rarely inactive, whereas those found in interior sites where temperatures are lower may become inactive for long periods (USFWS 2002). Additionally, adult frogs that have access to permanent water will generally remain active throughout the summer. If water is not available, upland habitat areas provide important dispersal, estivation and summer habitat for the species (USFWS 2002).

4.5.1.2 New Bullards Bar Reservoir

New Bullards Bar Reservoir supports a pair of nesting southern bald eagles, a species listed as endangered under the California ESA and listed as threatened under the federal ESA. Bald eagle production may be adversely affected by extreme drawdown of reservoirs during the period when eagle chicks are in the nest (DWR 1988).

4.5.1.3 Feather River

Although levees restrict the extent of riparian and wetland vegetation along the Feather River, this system still supports a diversity of riparian, and wetland vegetation and wildlife communities. Willow scrub riparian habitat occupies frequently flooded areas closest to the river. Cottonwoods are more prominent in less frequently flooded areas, but still require and tolerate regular inundation. Valley oaks occupy the least flooded portion of the river. Backwater areas support freshwater emergent wetlands, which contribute to increasing the overall habitat diversity of the river. Wildlife consists of species typically found in riparian habitats of the Central Valley.

4.5.1.4 Oroville Reservoir

Habitats adjacent to Oroville Reservoir are predominantly oak woodland with some chaparral. The oak woodland habitat includes live oak, blue oak, and foothill pine, with several species of understory shrubs and forbs including poison oak, manzanita, California wild rose, and lupine. The reservoir rim is mostly devoid of vegetation as a result of regular and frequent fluctuations in water elevations. Wildlife consists of species that are typically associated with oak woodlands and chaparral habitats in the Central Valley. In addition, large numbers of waterfowl and gulls overwinter in the Thermalito Afterbay, although few use the lake itself.

4.5.1.5 Sacramento River

Much of the Sacramento River is confined by levees that reduce the natural diversity of riparian vegetation. Agricultural land (rice, dry grains, pastures, orchards, vineyards, and row and truck crops) is common along the lower reaches of the Sacramento River, but is less common in the upper portions. The bands of riparian vegetation that occur along the Sacramento River are similar to those found along the lower American River, but are somewhat narrower and not as botanically diverse. The riparian communities consist of Valley oak, cottonwood, wild grape, box elder (*Acer negundo*), elderberry (*Sambucus mexicanus*), and willow. The largest and most significant tract of riparian forest remaining on the Sacramento River is a stretch between Chico

Landing and Red Bluff. Freshwater, emergent wetlands occur in the slow moving backwaters and are primarily dominated by tules (*Scirpus acutus* var. *occidentalis*), cattails, rushes, and sedges (SAFCA and Reclamation 1994). Although riparian vegetation occurs along the Sacramento River, these areas are confined to narrow bands between the river and the river side of the levee.

The wildlife species inhabiting the riparian habitats along the lower Sacramento River are essentially the same as those found along the lower American River. These include, but are not limited to, wood duck great blue heron (*Ardea herodias*), great egret (*Ardea alba*), green heron (*Butorides virescens*), black phoebe (*Sayornis nigricans*), ash-throated flycatcher (*Myiarchus cinerascens*), sora (*Porzana carolina*), great horned owl (*Bubo virginianis*), Swainson's hawk (*Buteo swainsoni*), California ground squirrel (*Spermophilus beecheyi*), and coyote (*Canis latrans*). The freshwater/emergent wetlands represent habitat for many wildlife species, including reptiles and amphibians such as the western pond turtle, bullfrog (*Rana catesbeiana*), and Pacific Chorus Frog (*Pseudacris regilla*). Agricultural areas adjacent to the river also represent foraging habitat for many raptor species.

4.5.1.6 Sacramento–San Joaquin Delta

Most of the vegetation in the Delta consists of irrigated agricultural fields and associated ruderal (disturbed), non-native vegetation fringes that border cultivated fields. Throughout much of the Delta, these areas border the levees of various sloughs, channels, and other waterways within the historic floodplain. Native habitats include remnant riparian vegetation that persists in some areas, with brackish and freshwater marshes also being present. Saline wetlands consist of pickleweed (*Salicornia virginica*), cord grass (*Spartina* sp.), glasswort (*Salicornia* sp.), saltgrass (*Distichlis spicata*), sea lavender (*Limonium californicum*), arrow grass (*Triglochin* spp.), and shoregrass (*Monanthochloe littoralis*). These wetlands are very sensitive to fluctuations in water salinity, which are determined by water flows into the Delta (SFEP 1993).

There are pockets of water resulting from old channels of the river that have been cut off, or where dredge-mining activities have left deep depressions. These backwater areas typically contain large fringes of emergent and isolated vernal pools bordered by emergent marsh plants such as cattails and rushes. The calm waters provide excellent habitat for ducks such as cinnamon teal (*Anas cyanoptera*), American wigeon (*Anas Americana*), and mallard (*Anas platyrhynchos*).

The wetlands of the Delta represent habitat for a number of shorebirds and waterfowl species including killdeer (*Charadrius vociferous*), California black rail (*Laterallus jamaicensis coturniculus*), western sandpiper (*Calidris mauri*), long-billed curlew (*Numenius americanus*), greater yellow-legs (*Tringa melanoleuca*), American coot (*Fulica americana*), American wigeon, gadwall (*Anas strepera*), mallard, canvasback (*Aythya valisineria*), and common moorhen (*Gallinula chloropus*). These areas also support a number of mammals such as coyote, gray fox (*Urocyon cinereoargenteus*), muskrat (*Ondarta zibethicus*), river otter (*Lontra Canadensis*), and beaver (*Aplodontia rufa*). Several species of reptiles and amphibians also occur in this region.

The complex interface between land and water in the Delta has led to a rich and varied plant life that provides habitat for a diversity of wildlife species, especially birds. Wildlife habitats include agricultural land, riparian forest, riparian scrub-shrub, emergent freshwater marsh, heavily shaded riverine aquatic, and grassland/rangeland. Many species that either are listed or are candidates for listing as rare, threatened, and endangered inhabit the Delta, but none are endemic to that area.

4.5.1.7 San Luis Reservoir

Habitat types found at San Luis Reservoir include lacustrine, riparian, and scattered blue oak woodlands. Riparian habitat is limited to scattered patches of mule fat and occasional willows. Blue oak woodlands occur on the western shore of the reservoir.

4.5.1.8 South-of-Delta Groundwater Banks

Groundwater recharge basins associated with groundwater banks provide habitat for waterfowl, wading birds, and shorebirds.

4.5.2 Impact Assessment Methodology

The analysis of potential impacts on wildlife and vegetation associated with the proposed water transfer within the affected waterbodies was based on the following criteria:

- Changes in river flow, relative to the basis of comparison, of sufficient magnitude and duration for any given month to result in unreasonable impacts upon river corridor riparian habitat or other sensitive natural communities and associated species.
- Changes in reservoir water surface elevation, relative to the basis of comparison, of sufficient magnitude and duration, to result in unreasonable impacts upon reservoir near-shore habitat and associated species.

Potential changes in reservoir water surface elevation and river flows were evaluated to determine if changes in reservoir water surface elevations of sufficient magnitude and duration would occur and result in unreasonable impacts to reservoir near-shore, riparian, and river corridor riparian habitats, or other sensitive natural communities and associated special-status wildlife species.

4.5.3 Impact Assessment

4.5.3.1 Yuba River

Under the proposed project, flows in the Yuba River below New Bullards Bar Reservoir are expected to be similar to the basis of comparison; unreasonable impacts to river corridor riparian habitat or other sensitive natural communities and associated species are not expected.

4.5.3.2 New Bullards Bar Reservoir

Changes in reservoir levels associated with the proposed project are not expected to adversely or unreasonably impact aquatic and littoral habitat near New Bullards Bar Reservoir that may be used by the California red-legged frog. In April, which is the reported end of the breeding period, average end of month surface water elevation would be approximately 11 feet lower under the proposed project, relative to the basis of comparison. In September, average end of month surface water elevation would be approximately 24 feet lower under the proposed project, relative to the basis of comparison. Although the California red-legged frog is rarely found far from water during dry periods, the USFWS Draft Recovery Plan (2002) reports that the species will disperse to upland areas in response to receding water, which often occurs during the driest time of the year (e.g., September). However, because adult frog movements of up to 3 miles have been reported in the literature (USFWS 2002), a change in distance of 24 feet would not be of a magnitude to unreasonably impact the species' ability to access or utilize aquatic habitat in New Bullards Bar Reservoir.

Although New Bullards Bar Reservoir supports a pair of nesting southern bald eagles, the proposed project is not expected to have any unreasonable impact on bald eagles. The reservoir drawdown associated with the proposed project would be similar to the drawdown under the basis of comparison, and is expected to be within historical and recent operation levels. The reductions in reservoir levels resulting from the proposed project would not be large enough to either substantially affect prey fish populations or substantially increase the distance from the nest to the reservoir surface. The change in reservoir levels associated with the proposed project is not expected to adversely or unreasonably impact foraging success of bald eagles inhabiting New Bullards Bar Reservoir.

Additionally, although water surface elevation reductions are anticipated with the proposed project, these decreases would not adversely impact the vegetation and wildlife at New Bullards Bar Reservoir. However, the anticipated lower surface water elevations at New Bullards Bar Reservoir would be within historical operational limits, and would not go below the minimum drawdown zone and, therefore, would not be expected to unreasonably affect any moderate to high value vegetation or wildlife habitat.

Surface Streams and Wetlands

In the past, CDFG has expressed concern regarding the potential impacts of the groundwater substitution component of YCWA water transfers to potentially affect surface streams and wetlands due to surface-groundwater interactions. This topic is addressed in the Groundwater Resources section of this Environmental Analysis.

4.5.3.3 Feather River

Flows within the Feather River may be higher under the proposed project during most schedules, but are anticipated to remain within the range of normal instream flows and fluctuations resulting from Oroville Reservoir. Specific operations of the Feather River system as a result of the proposed project are presently uncertain. However, the potential slight change in flows is not expected to unreasonably impact the vegetation and wildlife communities along the Feather River, relative to the RD-1644 long-term instream flow requirements.

4.5.3.4 Oroville Reservoir

Oroville Reservoir water levels would not be unreasonably affected by the proposed project, relative to the basis of comparison, would not result in unreasonable impacts to the wildlife or vegetation at Oroville Reservoir. The operation of Oroville Reservoir would remain within normal operational parameters. The proposed project, relative to RD-1644 long-term instream flow requirements, would not unreasonably impact the vegetation or wildlife communities of Oroville Reservoir.

4.5.3.5 Sacramento River

Flows within the lower Sacramento River under the proposed project may be higher or lower during the proposed project, but are anticipated to remain within the normal flow ranges and fluctuations resulting from SWP and CVP operations. Specific operations of the Sacramento River system as a result of the proposed project are uncertain at this time. However, the potential change in flows is not expected to unreasonably impact the vegetation and wildlife communities along the lower Sacramento River, relative to the basis of comparison.

4.5.3.6 Sacramento-San Joaquin Delta

Flows within the Sacramento-San Joaquin Delta may be slightly higher or lower under the proposed project, but would remain within the range of normal flow ranges and fluctuations resulting from SWP and CVP operations, which were previously evaluated in the EWA Draft EIS/EIR (Reclamation *et al.* 2003). Specific operations of the Delta system as a result of the proposed project are presently uncertain, but would remain within authorized operational constraints. Therefore, the potential changes to Delta inflows are not expected to unreasonably impact the vegetation and wildlife communities within the Delta, relative to the basis of comparison.

The EWA Project Agencies will coordinate EWA water acquisition and transfer actions with federal (Reclamation, USFWS and NMFS), state (DWR and CDFG), other CALFED agencies, and regional programs (e.g., the San Francisco Bay Ecosystem Goals Project, the Anadromous Fish Restoration Program, the Senate Bill [SB] 1086 program, the Corps' Sacramento and San Joaquin Basin Comprehensive Study, the Riparian Habitat Joint Venture, the CVPIA, the Central Valley Habitat Joint Venture, and the Grassland Bird Conservation Plan) that could affect management of evaluated species. Coordination would avoid conflicts among management objectives and would be facilitated through CALFED's water transfer. Therefore, the potential changes to Delta inflows are not expected to unreasonably impact the vegetation and wildlife communities within the Delta, relative to the basis of comparison.

4.5.3.7 San Luis Reservoir

It is anticipated that DWR would store a portion of the proposed project transfer water in San Luis Reservoir. It is unknown how DWR may operate San Luis Reservoir, however, if proposed project transfer water is stored in the reservoir, there is potential for a slight beneficial effect upon near-shore habitat areas through increased water level elevations. Drawdown of San Luis Reservoir for the purpose of delivering the proposed project transfer water would be expected to occur within normal SWP/CVP operational practices for the reservoir and according to existing regulatory requirements or limitations. Therefore, the proposed project is not expected to result in unreasonable impacts to wildlife or vegetation associations of San Luis Reservoir.

South of Delta Groundwater Banks – Groundwater Recharge Basins

DWR may store proposed project transfer water in groundwater banks south of the Delta. This operation includes spreading water in recharge basins for recharge and storage into the groundwater banks. This practice temporarily could increase habitat for waterfowl, wading birds, and shorebirds.

No additional areas would be flooded or inundated as a result of the proposed project. The proposed project also would not develop or cultivate any native untilled land. Overall, there would not be any unreasonable impacts on any wildlife or vegetation in the areas affected by the proposed project. There would be no unreasonable impacts on any state or federal special status animal or plant species.

4.6 Recreation

Recreational activities at reservoirs or rivers within the study area could be affected by changes in water operations associated with the proposed project. Changes in reservoir storage or water surface elevation levels at New Bullards Bar Reservoir, Oroville Reservoir, or San Luis Reservoir could affect swimming, boating, water-skiing, or other water-based activities. Surface water storage at these reservoirs normally varies throughout the year due to water releases made for agricultural, urban, and environmental needs and the necessity to have a designated volume available to store runoff during winter and spring (flood control). Recreational activities along or within the Yuba, Feather, and Sacramento river corridors and the Delta that could be affected by the proposed project include swimming, boating, fishing, camping, and picnicking.

4.6.1 Environmental Setting

4.6.1.1 Yuba River

Numerous rivers, creeks, tributaries, and reservoirs along the Yuba River offer recreational opportunities. Where access to the river is available, fishing, picnicking, rafting, kayaking, tubing, and swimming are the dominant recreational uses. The Yuba River offers excellent American shad, Chinook salmon, and steelhead fishing (Reclamation *et al.* 2003).

4.6.1.2 New Bullards Bar Reservoir

New Bullards Bar Reservoir recreation facilities are managed by the U.S. Forest Service (USFS). Popular recreation activities include boating, fishing, and camping. Over 20 miles of hiking and mountain biking trails exist in the area, including Bullards Bar Trail, which runs along the perimeter of the reservoir. Several campgrounds, including Schoolhouse and Dark Day, are in the vicinity. Some campgrounds around the reservoir, such as Madrone Cove and Garden Point, are accessible only by boat. Emerald Cove Resort and Marina is a floating marina that is operable at all surface water elevations. The marina offers a variety of services to recreationists including, a general store, fuel pumping station, boat launch, boat rentals, moorage, and annual slips. Boat access to the reservoir is provided by the Cottage Creek boat ramp (at Emerald Cove Marina) and Dark Day boat ramp. Cottage Creek boat ramp is unusable when surface water elevations are below 1,822 feet-msl, and Dark Day boat ramp becomes inoperable when surface water elevation are below 1,798 feet-msl (Reclamation *et al.* 2003). Low reservoir levels affect day swimming areas and boat-in campgrounds before boat ramps are affected. Some boat launchings occur year-round; however, the typical boating season extends from about early May through mid-October. The heaviest use of the ramps occurs on weekends and holidays from Memorial Day to Labor Day (USFS 1999). Fishing also is a popular recreational activity; some species found in the reservoir include rainbow trout, brown trout, kokanee salmon, smallmouth bass, largemouth bass, bluegill, crappie, and bullhead catfish.

4.6.1.3 Feather River

Feather River recreational activities include swimming, fishing, camping, bird-watching, picnicking, and bicycling. Rafting on the North and Middle forks of the Feather River runs from January to April or May, depending on flow. Summer rafting and kayaking occurs on the North Fork depending on upstream PG&E reservoir operations. Recreational activities along the Low Flow Channel reach of the Feather River include fishing, sightseeing, hiking, bicycling, and wildlife and bird watching. The Oroville Wildlife Area, downstream of the Thermalito Afterbay Outlet, provides opportunities for bird-watching, in-season hunting, fishing, swimming, and camping.

4.6.1.4 Oroville Reservoir

The California Department of Parks and Recreation (CDPR) manages the recreation facilities of the Oroville Reservoir complex. Oroville Reservoir has a surface area of approximately 15,800 acres and a shoreline of 167 miles when full (SWRCB 1997). The peak recreation season is from late spring through summer.

Oroville Reservoir has two full-service marinas, nine parks provide facilities for baseball, tennis, swimming, and picnicking within the vicinity of the reservoir. There are major boat launch ramps at Bidwell Canyon, Loafer Creek, and Lime Saddle (DWR 2001b). The spillway has an 8-lane and 12-lane boat ramp in two stages. Construction of extensions on boat ramps at Bidwell Canyon, the Spillway, and Lime Saddle allow the ramps to remain open when lake elevations remain at or greater than 700 feet above msl (Reclamation *et al.* 2003). Average water surface elevation in Oroville Reservoir historically has been between 817 and 787 feet above msl between July and September, respectively. Although boat ramps remain usable, lower lake elevations can adversely affect swimming beaches and boat-in campgrounds (Reclamation *et al.* 2003). The Oroville Reservoir State Recreation Area (SRA) provides camping, picnicking, boating, fishing, hunting, horseback riding, hiking, bicycling, sightseeing, and a variety of other activities. Major facilities in the SRA include Loafer Creek, Bidwell Canyon, Spillway, Lime Saddle, Oroville Reservoir Visitor Center, and North and South Thermalito Forebay. The SRA also provides several less-developed car-top launching areas, boat-in campsites, and floating campsites on Oroville Reservoir. DWR maintains three launch ramps and a day-use area at the Oroville Wildlife Area, which includes Thermalito Afterbay.

4.6.1.5 Sacramento River

On the upper Sacramento River, water-dependent activities (e.g., swimming, boating, and fishing) account for approximately 52 percent of the recreation uses (Reclamation and Sacramento County Water Agency 1997). Fishing, rafting, canoeing, kayaking, swimming, and power boating are available along most of the upper Sacramento River. While fishing is a year-round activity, boating, rafting, and swimming use take place primarily in summer months when air temperatures are high. Between Colusa and Sacramento, major recreation facilities are located at Colusa-Sacramento River Recreation Area, Colusa Weir access, Tisdale Weir access, River Bend Boating Facility, Knights Landing, Sacramento Bypass, and Elkhorn Boating Facility.

Recreational use of the lower Sacramento River, between the American River confluence and the Delta, is closely associated with recreational use of Delta waterways. This section of the river, influenced by tidal action similar to the Delta, is an important boating and fishing area with several private marinas located on the river.

4.6.1.6 Sacramento-San Joaquin Delta

As a complex of waterways affected by both freshwater inflows and tidal action, the Delta is a very important recreation resource that provides a variety of water-dependent and water-enhanced recreation opportunities. Boating is the most popular activity in the Delta region, accounting for approximately 17 percent of visitation, with other popular uses including fishing, relaxing, sightseeing, and camping (DWR and Reclamation 1996). Boating and related facilities are located throughout the Delta and include launch ramps, marinas, boat rentals, swimming areas, camping sites, dining and lodging facilities, and marine supply stores. Most recreation facilities are privately owned and operated commercially.

Located near several metropolitan areas, the Delta supports about 12 million user days of recreation a year (DWR 1993). Parks along the mainstem of the Sacramento River and Delta sloughs provide access for water-oriented recreation as well as picnic sites and camping areas. Brannan Island State Park and Delta Meadows River Park are major water-oriented recreational areas. Use of these parks typically peaks in July.

4.6.1.7 San Luis Reservoir

San Luis Reservoir SRA is open year-round. Recreational activities include boating, waterskiing, fishing, camping, and picnicking. Boat access is available via one boat ramp at the Basalt area at the southeastern portion of the reservoir and at Dinosaur Point at the northwestern portion of the reservoir. The boat ramp at Basalt becomes difficult to use because of low reservoir levels at elevation 340 feet above msl; the boat ramp at Dinosaur Point is difficult to access at elevation 360 feet above msl (San Joaquin River Group 1999). There are no designated swimming areas or beaches at San Luis Reservoir.

4.6.2 Impact Assessment Methodology

The potential for impacts to recreation opportunities at reservoirs was analyzed based on a comparison of the percent probability that that a dewatering event would occur during the recreation use season (i.e., May through September) such that the reservoir surface water elevations would drop below the level to sustain boat ramp use under the basis of comparison and the proposed project. The potential impact to recreation along the river was analyzed based on a comparison of changes in river flows and water temperatures during the recreation use season under the proposed project and basis of comparison.

The analysis of the potential impacts on recreation opportunities associated with the proposed project was based on the following criteria:

- Reduction in river flows, relative to the basis of comparison, of sufficient magnitude during the recreation season, such that boating opportunities are decreased.
- Changes of river water temperature, relative to the basis of comparison, of sufficient magnitude and duration during the recreation season, to unreasonably impact recreational swimming, tubing, canoeing, kayaking, and rafting.
- Reduction in reservoir water levels, relative to the basis of comparison, of sufficient magnitude during the recreation season, such that boat ramps become unusable.
- Changes in reservoir water levels or river flows, relative to the basis of comparison, of sufficient magnitude and duration for a given month of the recreation use season to unreasonably impact (substantially reduce) recreational opportunities.

4.6.3 Impact Assessment

4.6.3.1 Yuba River

River flows on the Yuba River under the proposed project would be higher than the basis of comparison during some months. During some water year types, Yuba River instream flows would be less than the basis of comparison but would remain within the range of normal flow levels and fluctuations. Flow decreases that occur under the proposed project during the recreation use season at the Marysville Gage would not result in flows dropping below the optimum flow range and flows at the Smartville Gage under the proposed project would be the same or higher than flows under the basis of comparison. Any impacts on river recreation activities would be minimal, or beneficial. The increased flows could benefit rafting and other boating opportunities. The greater water volumes under the proposed project could enhance angling opportunities on the Yuba River. In addition, the slight increase in flows would not adversely or unreasonably impact water temperatures in the Yuba River. During the recreation use season, the water temperatures simulated at Daguerre Point Dam under the proposed project and the basis of comparison are similar (always within 0.1°F of each other) and water temperatures simulated at Marysville did not increase or decrease by more than 2.5°F under the proposed project, relative to the basis of comparison. Therefore, the temperature changes associated with the proposed project would not be of sufficient magnitude to reduce the recreational opportunities on the Yuba River. Ramping rates have been developed with consideration for the overall safety of anglers and other recreationists. Therefore, no unreasonable impacts on recreation, including angling, are expected to occur as a result of the proposed project.

4.6.3.2 New Bullards Bar Reservoir

Cottage Creek boat ramp is unusable when the lake level is below 1,822 feet above msl, and Dark Day boat ramp is unusable when the reservoir level is below 1,798 feet above msl. Emerald Cove Marina is operable at all reservoir levels. During the recreation use season there would be an additional 1.5 percent probability under the proposed project that surface water elevations would decrease below the 1,798 feet msl threshold over the 83-year simulation period (Appendix B). During the recreation use season there would be an additional 2.0 percent probability under the proposed project that surface water elevations would decrease below the 1,822 feet msl threshold over the 83-year simulation period (Appendix B). These minor increases in probability of exceeding a threshold are most likely to occur at the end of the recreation season and during dry or critical water year types. Therefore, based on the low probability of occurrence and the timing of the occurrence, the proposed project will not result in unreasonable impacts to boat ramp use at New Bullards Bar Reservoir. Lower reservoir levels would generally affect boat ramps prior to affecting other recreational activities (e.g., swimming or fishing). If boat ramps remain usable, it is assumed that there are sufficient water levels in the reservoir to sustain other recreational activities. Therefore, there would be no unreasonable impacts to recreation opportunities at New Bullards Bar Reservoir under the proposed project, relative to the basis of comparison.

4.6.3.3 Feather River

Flows in the Feather River potentially would be higher under proposed project, relative to the basis of comparison. Increased flows potentially would improve recreational opportunities during most months and flow schedules. Overall, the range of flows anticipated under the proposed project in the Feather River would be within normal operating ranges (Table 4-1) and would not be expected to result in unreasonable impacts to recreational opportunities on the Feather River. In addition, the slight increase in flows would not adversely or unreasonably impact water temperatures in the Feather River and, therefore, would not reduce the recreational opportunities on the Feather River.

4.6.3.4 Oroville Reservoir

Water levels in Oroville Reservoir during the primary recreation season (May through September) would remain within normal operational parameters under the proposed project, relative to the basis of comparison. Therefore, the proposed project would not result in unreasonable impacts upon recreation activities at Oroville Reservoir.

4.6.3.5 Sacramento River

Flows within the lower Sacramento River may be higher or lower during the proposed project relative to the basis of comparison, but are anticipated to remain within normal flow ranges and fluctuations resulting from SWP and CVP operations (Table 4-2). Although specific operations of the Sacramento River system as a result of the proposed project are uncertain, the potential changes in flow are not expected to unreasonably impact recreation, relative to the basis of comparison, and may be slightly beneficial. Also, the slight increase in flows would not adversely or unreasonably impact water temperatures in the Sacramento River and, therefore, would not reduce the recreational opportunities on the Sacramento River.

4.6.3.6 Sacramento-San Joaquin Delta

Flows within the Delta could be slightly higher or lower during the proposed project, but are anticipated to remain within normal flow ranges and fluctuations resulting from SWP and CVP operations, which were previously evaluated in the EWA Draft EIS/EIR (Reclamation *et al.* 2003). Although specific operations of the Delta system are uncertain as a result of the proposed project, the potential slight increases in flow are not expected to adversely or unreasonably impact recreation, relative to basis of comparison.

4.6.3.7 San Luis Reservoir

DWR potentially would store some portion of the proposed project transfer water in San Luis Reservoir. Increased storage levels at San Luis Reservoir therefore could be anticipated during primary recreational months (May through September) and may provide a beneficial effect upon recreational opportunities at the reservoir. The proposed project would not be anticipated to lower reservoir surface water elevations affecting boat ramp accessibility. Therefore, the proposed project would not be expected to result in unreasonable impacts upon recreation activities at San Luis Reservoir.

4.6.3.8 Groundwater Recharge Basins

The groundwater recharge basins located south of the Delta provide habitat for waterfowl and water birds and provide recreational opportunities for bird watching. The potential increase in water stored in south-of-Delta groundwater banks possibly could increase habitat for waterfowl and water birds at the recharge basins and would not be expected to result in unreasonable impacts upon bird watching opportunities at the groundwater recharge basins.

4.7 Other Environmental Resource Issues

4.7.1 Air Quality

The proposed groundwater substitution component of the proposed project has the potential to result in air quality impacts related to the generation of criteria pollutants from fossil-fueled pumps. The EWA EIS/EIR (Reclamation *et al.* 2003) presents a detailed analysis of potential air quality impacts associated with groundwater substitution practices, and includes mitigation measures to ensure avoidance of significant air quality impacts.

The proposed project would be conducted in compliance with the mitigation requirements included in the Record of Decision for the EWA EIS/EIR. In particular, YCWA groundwater substitution water would be delivered only from wells approved by DWR for use in water transfers for EWA purposes (i.e., wells fitted with electric or other non-diesel fueled pumps).

4.7.2 Cultural Resources

Drawdown of water from New Bullards Bar Reservoir for the purposes of providing transfer water to the EWA Program is subject to consideration under Section 106 of the National Historic Preservation Act as discussed in the EWA EIS/EIR (Reclamation *et al.* 2003). The proposed project is not anticipated to result in water elevations in New Bullards Bar Reservoir lower than historic normal operations and, therefore, would not result in creation of a new drawdown zone. Potential impacts upon cultural resources due to potential exposure of formerly unexposed resources beneath the water would be avoided during the proposed project.

4.8 Carryover Storage

The proposed project would result in a reduction in storage of at least 60,000 acre-feet in New Bullards Bar Reservoir by the mid-October 2007, and could affect the probability, or at least the timing and duration, of spilling in water year 2008 (or subsequent water years, if no spilling occurs in 2007). Spills would not occur as early, or may be smaller, under the proposed project compared to the basis of comparison.

If water year 2007 is a dry or critically dry year, it is possible that no spilling would take place regardless of whether the proposed project occurs; thus, potential impacts of a transfer on storage refill could be delayed into subsequent water years. If water year 2007 were a below-normal water year, the potential storage refill effects of a transfer would be largest because some spilling (a marginal amount) would be likely under the basis of comparison conditions. If water year 2006 were an above-normal or wet water year, potential storage refill effects likely would be minor because of the large quantity of spilling that probably would occur, regardless of whether the proposed project is implemented. However, it is difficult to predict storage refill effects even with respect to water year types because substantial spilling could occur even in a dry water year.

Storage refill effects for the proposed project are not considered to be unreasonable given the speculative nature of the potential impacts, and the maintenance of minimum instream flow requirements at all times regardless of when storage refill effects may occur. Additionally, Yuba River instream flow requirements specified in RD-1644 long-term would require reservoir releases greater than the volume of the proposed project, and the potential effects of proposed project would be smaller than those of the releases that would be made to satisfy the RD-1644 long-term flow requirements. Overall, the effects of operations under the proposed project would not be considered unreasonable.

Chapter 5
Cumulative Impacts

5.1 Introduction

Cumulative effects are considered for the incremental effects of the proposed water transfer when added to other past, present, and reasonably foreseeable future actions, regardless of which agency or entity undertakes them. Cumulative effects can result from individually minor, but collectively significant, actions taking place over time. As discussed previously, BVID may transfer up to 3,100 acre-feet of water to SCVWD during the first two weeks of October 2006. CALFED Program actions, CVPIA actions, and ongoing SWP and CVP operations and actions, in particular, are all highly adaptable programs subject to great change as hydrologic, environmental, regulatory, and water supply conditions change. Because the proposed water transfer would increase operational flexibility of DWR's programs (EWA and Dry Year Water Purchase), the analysis of cumulative effects is necessarily general. However, it must be recognized that this flexibility provides an operational buffer for avoidance of adverse cumulative impacts.

Ongoing operations of YCWA, SWP, CVP, CALFED's Operations Group, and water contractors are complex and part of the affected environment. Both the SWP and CVP consist of a complex network of reservoirs and delivery systems. SWP and CVP management decisions to provide water for water contractors require the balancing of water for irrigation and domestic water supplies, fish and wildlife protection, restoration and mitigation and hydropower generation. In developing operations decisions, YCWA, DWR, and Reclamation collectively use criteria related to reservoir operations and storage, downstream conditions and needs, prevailing water rights, environmental requirements, flood control requirements, carryover storage objectives, reservoir recreation, hydropower production capabilities, cold water reserves, pumping costs, contract requirements, and other factors. The possibility of using multiple water sources for some requirements and environmental opportunities adds flexibility to project operations and complexity to operations decisions.

DWR and Reclamation are participants in several statewide programs that currently involve or will involve water transfers from stored surface water, groundwater substitution, or farmland fallowing practices. These include CALFED programs, such as EWA and the Environmental Water Program, DWR's Dry Year Water Purchase Program, and the state-proposed Critical Water Shortage Reduction Marketing Program. Programs such as the EWA and the proposed Critical Water Shortage Reduction Marketing Program are intended to benefit water supply and environmental conditions, including increased instream flows in source areas and increased water levels in SWP/CVP reservoirs.

5.2 Other Related Projects

The EWA Program for 2006 likely will include upstream acquisitions, stored water, and 2005 carryover surface supply. In addition to the EWA Program, DWR's Dry Year Water Purchase Program and the Critical Water Shortage Contingency Plan (if needed), the Environmental Water Program, and Reclamation's CVPIA Level 4 Wildlife Refuge Water Purchase Program may need to acquire north of the Delta water supply options during 2006. These programs will need to be coordinated between DWR and Reclamation. Some of the information presented below is based on the DWR and Reclamation water purchase agreement for the EWA (DWR and Reclamation 2002).

5.2.1 CALFED EWA – Other Acquisitions

5.2.1.1 EWA Water Transfers

Under the EWA, assets acquired are used to manage water for environmental purposes while decreasing conflicts in use of water in the Bay-Delta estuary. The more flexible means of managing water operations, existing fish protection measures and the implementation of the EWA achieve fish recovery opportunities while providing improvements in water supply reliability and water quality in the Delta. DWR has been successful in creating water assets of over 150,000 to more than 200,000 acre-feet annually in 2001 through 2004.

5.2.2 DWR Dry Year Water Purchase Program Acquisitions

In 2001 and 2002, the Dry Year Water Purchase Program acquired approximately 138,800 acre-feet and 22,000 acre-feet of water, respectively (YCWA 2004). DWR initiated the Dry Year Water Purchase Program for 2003 and 2004, but the amounts of water purchased were lower (11,355 and 487 acre-feet, respectively) (DWR 2005a; DWR 2005b). In August 2004, DWR announced its plans to implement the Dry Year Water Purchase Program beginning in 2005. The Dry Year Water Purchase Program is open to all agencies and is intended to reduce the possibility of adverse economic impacts and hardship associated with water supply shortages. The quantity of water to be acquired in any year is unknown and depends on requests made by the participants, if any, in the Dry Year Water Purchase Program, what options are exercised in their contracts, available SWP pumping capacity and environmental conditions in the Delta. Much of this water is purchased from north of the Delta during dry years. Currently, it is unknown whether DWR would implement the Dry Year Water Purchase Program in 2006. However, if 2006 were to be a dry water year, then the program could be implemented, and YCWA water could be acquired if it was available.

5.2.3 CALFED Environmental Water Program

The Environmental Water Program will continue to acquire water to assist in carrying out the goals of CALFED's Ecosystem Restoration Program Plan in 2006.

5.2.4 Reclamation CVPIA Level 4 Wildlife Refuge Water Purchase Program

CVPIA requires the U.S. Department of Interior (Interior) to acquire additional water supplies to meet optimal waterfowl habitat management needs at national wildlife refuges in California's Central Valley, certain state wildlife management areas, and the Grassland Resource Conservation District (collectively know as refuges). The optimum water supply levels are referred to as Level 4. The annual water acquisition goal is 163,000 acre-feet to meet full Level 4 requirements at the refuges. Typical annual water acquisition needs are lower because refuge water supplies are partially met in most years by rainfall, runoff, and/or local supplies (Reclamation 2005). For the 2005 contract year (March 2004 through February 2005), 73,024 acre-feet were acquired (pers. comm., Meier 2005).

5.2.5 Sacramento Valley Water Management Program Short-term Agreement

Phase 8 of the SWRCB's Bay-Delta water rights proceedings has evolved to a settlement between DWR, Reclamation, export interests, and certain water rights holders in the Sacramento Valley, including YCWA. This settlement has resulted in a short-term agreement between the parties. As part of the short-term agreement, YCWA has agreed to provide 15,000 acre-feet of water for the program in dry years. The water would be made available through groundwater substitution.

5.2.6 Other Water Transfers

Other water transfers between currently unknown and unidentified parties also may be proposed and undertaken in 2006. YCWA currently is not considering any other water transfers for 2006. However, BVID may transfer up to 3,100 acre-feet of water to the Santa Clara Valley Water District in October 2006. There is a high likelihood that other local or regional transfers may occur in the Sacramento Valley and Delta in 2006 that cannot be identified at this time. In 2003, Reclamation released an Environmental Assessment to comply with NEPA to cover eight Sacramento River contractors desiring to transfer up to 110,000 acre-feet of water to Metropolitan Water District (MWD), DWR for its Dry Year Water Purchase Program, the EWA Program, or other SWP or CVP contractors. These transfers would not affect the Yuba or Feather rivers, but would increase flows in the Sacramento River during July through September.

5.3 Potential Cumulative Impacts

5.3.1 Yuba River

YCWA in prior years has undertaken transfers similar to the proposed project water transfer and has prepared environmental documentation for each transfer (Reclamation 1997; Reclamation 1999; YCWA 2004; YCWA and SWRCB 2001; YCWA and SWRCB 2002; YCWA and SWRCB 2003). These past evaluations and subsequent reviews of the water transfer effects (YCWA 2002; YCWA 2003a; YCWA 2005), have not identified any significant adverse or unreasonable environmental impacts upon legal users of the water or upon fish, wildlife, vegetation, recreation, or other beneficial uses of the water. Yuba River adult Chinook salmon population trends have remained stable or increased over time, including during periods of water transfers. For example, the 2001 to 2003 Yuba River salmon spawning escapements were approximately 23,000 to 29,000 salmon in each year, well above the average annual escapement levels over the past 45 years. The most recent 8-year period of escapement records (1996 through 2003) indicate higher escapements than any other 8-year period of Chinook salmon escapement on the Yuba River since data have been collected (over the past 50 years).

Fisheries monitoring programs instituted in 2001, 2002 and 2004 to collect data regarding YCWA's water transfer effects on fisheries found no conclusive evidence of adverse impacts (YCWA 2002; YCWA 2003a; YCWA 2005). While much of the existing information is inconclusive, protections such as minimizing fluctuations during spawning periods and implementing ramping rates at the end of transfers have reduced the potential for unreasonable adverse effects on Yuba River fisheries.

5.3.2 Sacramento-San Joaquin Delta and Environmental Water Account

The EWA will allow further curtailment of Delta pumping to reduce the entrainment of fish at the SWP Banks Pumping Plant to achieve benefits beyond the existing environmental baseline. Pumping could be increased to move water controlled by the EWA to periods when substantial impacts on sensitive fish are not likely to occur. However, the ultimate/final pumping pattern will remain within the possible patterns that the SWP is allowed under the existing SWRCB Delta Water Quality Control Plan.

Most water transfers likely will be exported through the Delta during summer and fall months to maximize benefits to migrating winter-run Chinook salmon and to minimize adverse effects on delta smelt. The EWA is expected to make relatively small changes in the overall operations of the SWP and CVP facilities. Operational changes to the SWP and CVP in 2006 as a result of EWA generally can be characterized as shifts in pumping rates at the SWP and CVP Delta diversion pumps, shifts in storage and release patterns at SWP/CVP reservoirs, shifts in groundwater pumping in local areas, and shifts in surface water storage release patterns in local areas. Overall, programs such as the EWA, the Dry Year Water Purchase Program, and the Critical Water Shortage Reduction Marketing Program will benefit instream resources by reducing Delta pumping and the entrainment of fish at the Delta pumping plants during sensitive periods. Programs such as the EWA will rely primarily on surface water in wet years and shift to reliance on groundwater in dry years.

The EWA transfer from YCWA may affect Oroville Reservoir storage levels if releases have to be made to prevent water quality impacts in the Delta during the period when New Bullards Bar Reservoir is being refilled. Changes in storage levels and release patterns at Oroville Reservoir also may result from changes in operations at the Banks Pumping Plan in the Delta as a result of other EWA projects. In most instances, changes in operations would lead to temporary increases in reservoir storage levels. In some instances, the EWA could borrow water from upstream reservoirs, (i.e., Shasta Reservoir on the Sacramento River) thereby lowering reservoir storage levels.

The nature of the EWA Program, specifically acquisition of up to approximately 200,000 acre-feet of water annually from various sources, along with the regulatory framework currently in place, makes the potential for significant and/or unreasonable adverse cumulative impacts during 2006 implementation and over the life of the proposed program highly unlikely. The EWA Program is being implemented and will be adaptively managed to actually maintain and/or benefit both Delta fisheries and contractor water supplies.

Early in 2001, DWR prepared an environmental document addressing the specific impacts from implementing the Year 2001 Water Transfer Agreement between YCWA and DWR for support of CALFED's EWA (DWR 2001a). This document provides additional background information on the larger program of establishing numerous other individual assets to create the EWA, as specified in the CALFED ROD, dated August 28, 2000. Additional environmental documents were prepared annually for additional assets, as appropriate. In 2004, the EWA Final EIR/EIS was released, which evaluated numerous transfer scenarios including transfers from YCWA to Delta users. The conclusion in the Final EIR/EIS and by the USFWS and NMFS was that the

EWA transfers would not likely adversely affect delta smelt, Sacramento River winter-run Chinook salmon and critical habitat, Central Valley spring-run Chinook salmon, and Central Valley steelhead (NMFS 2003; Reclamation *et al.* 2004b; USFWS 2004).

5.4 Conclusion

For the proposed project water transfer in 2006, cumulative effects are not likely to be unreasonable. Environmental considerations have been strongly integrated into the design of the related projects described above. Salmon populations in the lower Yuba River remain healthy since transfers were first initiated in the late 1980s. Less information is available for steelhead, but there is no conclusive information demonstrating any unreasonable impacts to this species. The regulatory framework currently in place and the use of most of this transfer water for environmental purposes in the EWA Program also lead to the conclusion that there would be no unreasonable cumulative effects.

Chapter 6
Summary of Unreasonable Impacts, Mitigation Measures, and Water Transfer Benefits

Potential impacts that could occur within and downstream of the Yuba River watershed were evaluated to determine whether the proposed project would adversely affect surface water and groundwater supply and quality, fisheries resources, wildlife and vegetation, recreation, air quality and cultural resources in the potentially affected waterbodies. The proposed project would not result in any adverse effects on the beneficial uses of the Yuba River, Yuba Project, Yuba groundwater subbasins, Feather River, Oroville Reservoir, Sacramento River, or Delta. The following sections summarize the determination regarding the potential for unreasonable impacts, describe mitigation measures to be implemented during the proposed project, and discuss the anticipated benefits.

6.1 Unreasonable Impacts

The proposed project would not have any unreasonable impacts on instream beneficial uses of the waterbodies associated with the proposed project. Similar YCWA water transfers in recent years also have not resulted in any known significant, substantial, or unreasonable impacts to any beneficial uses. These transfers have provided additional water for various uses, including environmental uses and thereby have provided multiple benefits.

6.2 Mitigation

The environmental assessment determined that there would be no unreasonable impacts associated with the proposed project. Although no specific mitigation actions are required, this section summarizes the measures incorporated into the proposed project to ensure protection of water supply, groundwater, fisheries, and air quality.

- DWR will comply with SWRCB Decision 1641 (D-1641) Tables 1, 2 and 3 to ensure that no unreasonable effects on fish, wildlife or other instream beneficial uses are caused by the addition of the Clifton Court Forebay and the Tracy Pumping Plant as points of rediversion.
- YCWA and its Member Units have voluntarily agreed to cooperate with DWR to investigate any claim of adverse impact on residents or groundwater users and to adjust operations as necessary to address any such impact. Additionally, YCWA and DWR will implement a Groundwater Monitoring and Reporting Program.
- YCWA will continue to consult and coordinate with fishery resources agencies regarding the appropriate level of monitoring and reporting for the proposed project.
- YCWA will provide water obtained only from DWR-approved wells for the groundwater substitution component of the proposed project.

6.3 Benefits

Benefits that may result from the proposed project would include:

- DWR would be provided with increased flexibility to meet its water supply and environmental protection obligations.
- YCWA would receive funds that it would use to meet its multi-objective mission of providing flood control, hydroelectric generation, water supply, and fisheries enhancement and related recreation for Yuba County residents.
- Yuba River water temperatures may be reduced, which may provide slight benefits to anadromous species in the river.
- September and October flows below Daguerre Point Dam would be stabilized, which would maintain migration of adult spring-run and fall-run Chinook salmon in the Yuba River, as well as any spawning by adult spring-run and fall-run Chinook salmon.
- The higher river flows would allow for increased rafting and other boating opportunities and, therefore, could increase recreational opportunities.
- The increases in reservoir storage and river flows would increase the potential dilution of contaminants and, therefore, improve the water quality at these locations.

Chapter 7
Consistency With Plans and Policies

The proposed project would be implemented and consistent with existing plans and policies, as described below.

Coordinated Operations Agreement (DWR/Reclamation)

DWR and Reclamation shall continue to adhere to the general sharing principles contained in the 1986 Coordinated Operations Agreement (COA) as modified by interim operating agreements to reflect changes in regulatory standards, facilities, and operating conditions, including the EWA.

Yuba County Water Agency

- California Water Code §1732
- SWRCB Orders
- FERC License Agreements
- PG&E Power Purchase Agreement
- Narrows II Preliminary Biological Opinion (NMFS) – (Final anticipated by November 2005)

DWR/State Water Project

- South Delta Improvements Program
- Kern Water Bank Operating Plan
- California Department of Health Services Drinking Water Standards
- Article 19 Water Quality Objectives for Long-term SWP Contracts
- 2004 NMFS Biological Opinion on OCAP
- 2005 USFWS Biological Opinion on OCAP
- 2004 USFWS Programmatic Biological Opinion on the Proposed Environmental Water Account
- 1995 Bay-Delta Water Quality Control Plan

Chapter 8
Consultation and Coordination

YCWA and legal counsel, and environmental consultants preparing this Water Code Environmental Analysis, contacted and coordinated with resource agency personnel regarding the potential impacts of the proposed project. This section summarizes the consultations and coordination activities.

8.1 Fisheries Resources Agencies

YCWA and technical resource consultants met with resource agency representatives from CDFG, USFWS, and NMFS during August and September 2005 to discuss the Pilot Program. On August 3, 2005, YCWA presented a brief overview presentation summarizing the 2006 Pilot Program and a Draft 2006 Pilot Program Fisheries Agreement. The purpose of the Draft 2006 Pilot Program Fisheries Agreement was to specify the minimum instream flows that would occur in the lower Yuba River between April 1, 2006 and February 28, 2007. YCWA requested the resource agency representatives to review the Draft 2006 Pilot Program Fisheries Agreement and provide comments.

During the August 10, 2005 meeting, the discussion between YCWA and resource agency representatives focused on the 2006 Pilot Program time period for construction of the Narrows II Full Flow Bypass Project. During periods in 2006 or 2007 in which the Narrows II Powerhouse would be shut down for construction of the Narrows II Full Flow Bypass Project, minimum flows at the Marysville Gage will be 350 cfs. YCWA, in consultation with the resource agency representatives, agreed to make reasonable efforts to make flows greater than or equal to 350 cfs available at the Marysville Gage during such periods in 2006 or 2007. YCWA also agreed to consult with the resource agency representatives regarding the timing of such additional flows. Specific resource agency representative comments and revisions to the Draft 2006 Pilot Program Fisheries Agreement were discussed during the September 1, 2005 meeting between YCWA and the resource agency representatives. YCWA agreed to incorporate the resource agency representative's comments into the Draft 2006 Pilot Program Fisheries Agreement. Additionally, YCWA and the resource agency representatives discussed the Pilot Program RMF accounting and monitoring activities (including water temperature, streamflow, juvenile emigration, and adult escapement) throughout the August and September period.

Agency and consultant representatives at the three meetings were as follows:

August 3, 2005	**August 10, 2005**	**September 1, 2005**
Mike Tucker (NMFS)	Mike Tucker (NMFS)	Mike Tucker (NMFS)
Cesar Blanco (USFWS)	Cesar Blanco (USFWS) – by telephone	Cesar Blanco (USFWS) – by telephone
John Nelson (CDFG)	John Nelson (CDFG)	John Nelson (CDFG)
Ian Drury (CDFG)	Ian Drury (CDFG)	Ian Drury (CDFG)
Jeff Opperman (SYRCL)	Jeff Opperman (SYRCL)	Jeff Opperman (SYRCL)
Curt Aikens (YCWA)	Curt Aikens (YCWA) – by telephone	Curt Aikens (YCWA) – by telephone
Tom Johnson (YCWA)	Tom Johnson (YCWA)	Tom Johnson (YCWA)

August 3, 2005	August 10, 2005	September 1, 2005
Paul Bratovich (SWRI)	Paul Bratovich (SWRI)	Paul Bratovich (SWRI)
	Ben Ransom (SWRI)	Ben Ransom (SWRI)
	Bill Mitchell (JSA)	

8.2 Central Valley Regional Water Quality Control Board

Richard McHenry, Senior Water Quality Control Engineer for the RWQCB, was contacted on March 2, 2005 to discuss any potential concerns the RWQCB may have regarding the proposed 2005 water transfer, and again on September 24, 2005 to discuss the applicability of the issues addressed during the 2005 water transfer consultations to the proposed project. Mr. McHenry indicated that the RWQCB identified the potential for shifts in hardness levels related to water transfers to be of concern and indicated that the current Environmental Analysis should provide a description of hardness levels in the potentially affected waterbodies. The potential water quality concern is related to the potential for metals to become more readily bioavailable if the hardness level of the receiving water is substantially reduced by introduction of the transfer source water. Therefore, transfer of a high volume of low hardness waters into waters of higher hardness levels potentially could be of concern. Mr. McHenry and his staff provided data for the Yuba, Feather, and Sacramento rivers for use in this discussion. Mr. McHenry indicated that due to the anticipated volume of water released from New Bullards Bar Reservoir, the available dilution potential as the water flows downstream from the Yuba River to the Feather River, Sacramento River and to the Delta, and the relatively low or "clean" hardness levels of these waterbodies, that there likely would not be a water quality concern related to the proposed 2005 water transfer, or during the currently proposed project. A discussion of this topic is provided in the water quality assessment.

Chapter 9
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Chapter 10
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10.2 Personal Communications

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