UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

ORIGINAL

NOV - 4 2005

In response refer to:
151422SWR2001SA5670:MET

P-2246-047

George H. Taylor
Chief, Biological Resources Branch
Federal Energy Regulatory Commission
Washington, D.C. 20426

Dear Mr. Taylor:

This is in response to your letter of June 14, 2005, requesting NOAA's National Marine Fisheries Service (NMFS) confirmation of the preliminary biological opinion (preliminary BO) for the proposed Yuba River Development Project license amendment (Federal Energy Regulatory Commission (FERC) License No. 2246), as a final biological opinion. The preliminary BO analyzed the effects of a proposal to install a full-flow bypass structure on the Narrows II hydropower facility on the Yuba River, and to implement specific ramping and flow fluctuation criteria for flows downstream of the Narrows II facility. The preliminary BO analyzed these effects on Federally listed threatened Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) and threatened Central Valley steelhead (*O. mykiss).*

Your June 14, 2005 letter also requested initiation of formal conferencing on: (1) proposed critical habitat for Central Valley spring-run Chinook salmon and Central Valley steelhead; and (2) the proposed listing of the southern distinct population segment (DPS) of North American green sturgeon (*Acipenser medirostris*) as threatened. A final rule designating critical habitat for spring-run Chinook salmon and steelhead was published on September 2, 2005 (70 FR 52488). The rule becomes effective on January 2, 2006. Enclosure 1 (attached) is a final biological and conference opinion for the proposed Yuba River Development Project license amendment for FERC License No. 2246, and its effects on Central Valley spring-run Chinook salmon and Central Valley steelhead, designated critical habitat for Central Valley spring-run Chinook salmon and Central Valley steelhead, and the proposed threatened southern DPS of North American green sturgeon.

Also enclosed are Essential Fish Habitat (EFH) conservation recommendations for Pacific salmon as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSA) as amended (16 U.S.C. 1801 *et seq.*; Enclosure 2). This document has not been changed and is identical to the one sent to you along with the preliminary biological opinion on January 26, 2005. This document concludes that the proposed Yuba River Development Project License Amendment will adversely affect the EFH of Pacific salmon in the action area and adopts the ESA reasonable and prudent measures and associated terms and conditions from the biological opinion as the EFH conservation recommendations.

Section 305(b)4(B) of the MSA requires FERC to provide NMFS with a detailed written response within 30 days, and 10 days in advance of any action, to the EFH conservation recommendations, including a description of measures adopted by FERC for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR 600.920[j]). In the case of a response that is inconsistent with our recommendations, FERC must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed action and the measures needed to avoid, minimize, or mitigate such effects.

Please contact Mr. Michael Tucker at (916) 930-3604, or via e-mail at michael.tucker@noaa.gov, if you have any questions concerning this correspondence or require additional information.

Sincerely,

Rodney R. McInnis

Rodney R. McInnis
Regional Administrator

cc: NMFS-PRD, Long Beach, CA
Mr. Curt Aikens, YCWA, 1402 D Street, Marysvillle, CA 95901

Enclosure 1

BIOLOGICAL AND CONFERENCE OPINION

ACTION AGENCY:	Federal Energy Regulatory Commission
ACTIVITY:	Yuba River Development Project License Amendment (FERC No. 2246)
CONSULTATION CONDUCTED BY:	Southwest Region, National Marine Fisheries Service
FILE NUMBER:	151422SWR01SA5670:MET
DATE ISSUED:	NOV - 4 2005

I. BACKGROUND AND CONSULTATION HISTORY

The hydroelectric project licensed under the Federal Energy Regulatory Commission (FERC) License No. 2246 is Yuba County Water Agency's (YCWA) Yuba River Development Project (YRDP). The YRDP's operations are coordinated with the U.S. Army Corps of Engineers' (Corps) and Pacific Gas and Electric Company's (PG&E) operation of Englebright Dam and Reservoir and the operation of Narrows I Powerhouse on the lower Yuba River, just below Englebright Dam (Figure 1 & Figure 2). The FERC license for YRDP will expire in 2016.

NOAA's National Marine Fisheries Service (NMFS), FERC, and YCWA have been engaged in ongoing interactions concerning Project No. 2246. The history of those interactions is as follows:

On May 14, 1999, NMFS sent a letter to FERC stating that YCWA's YRDP (FERC No. 2246) and Deadwood Creek Project (FERC No. 6780) could potentially affect Federally listed species and requested that FERC initiate consultation under the Endangered Species Act (ESA).

On August 5, 1999, FERC sent a letter to NMFS designating YCWA as its non-Federal representative for conducting consultations with NMFS, if necessary. In this letter FERC identified the need to fill potential biological information gaps and noted that some of this information may have been made available through YCWA's and NMFS' involvement in the State Water Resources Control Board (SWRCB) hearings.

On September 10, 1999, NMFS replied to FERC with comments on their August 5, 1999, letter and a request for specific information to be submitted to NMFS by FERC or their non-Federal representatives.

On September 29, 2000, NMFS, FERC, and YCWA staff met to coordinate the approach regarding possible consultation.

Figure 1. Location of Yuba River Development Project facilities.

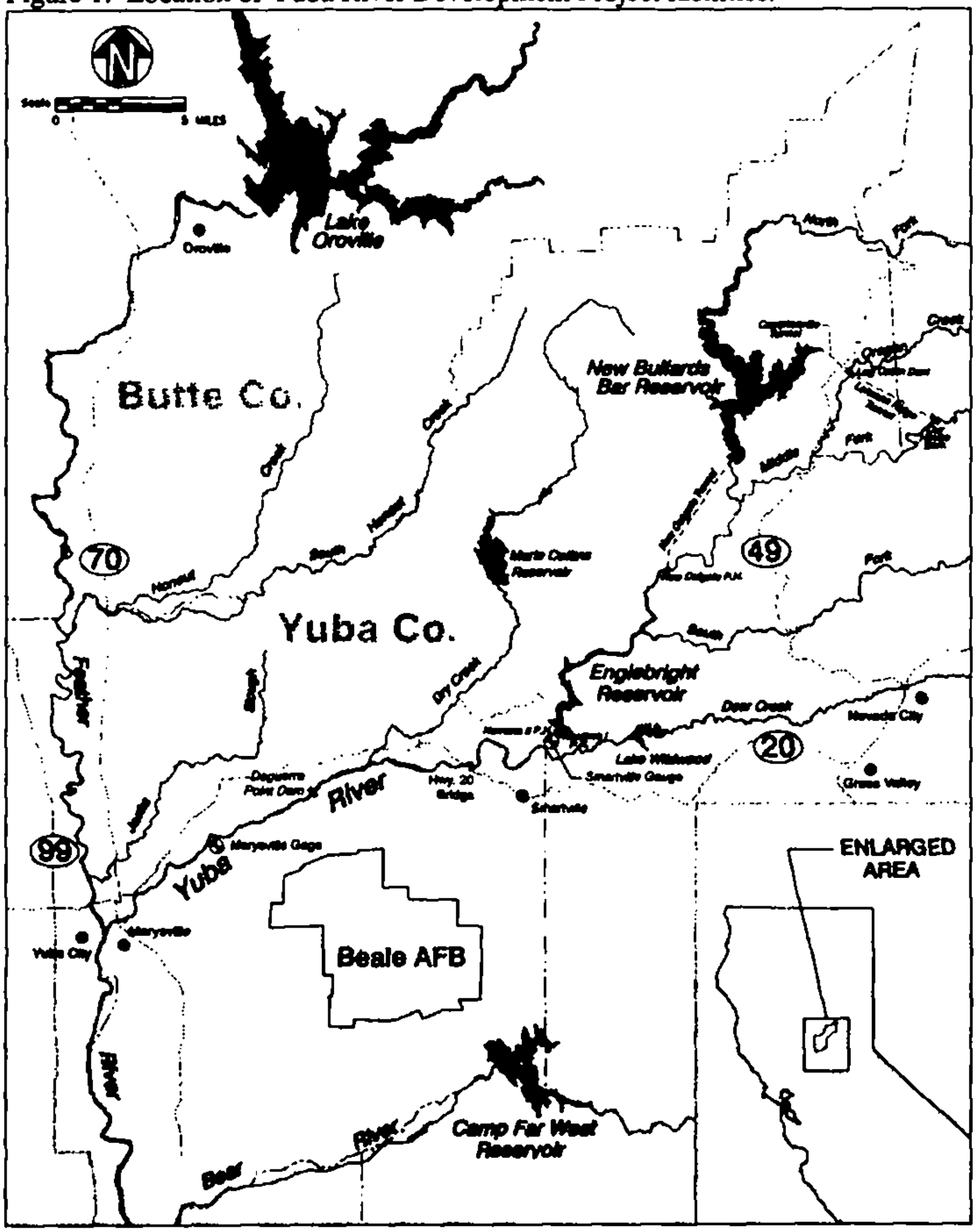
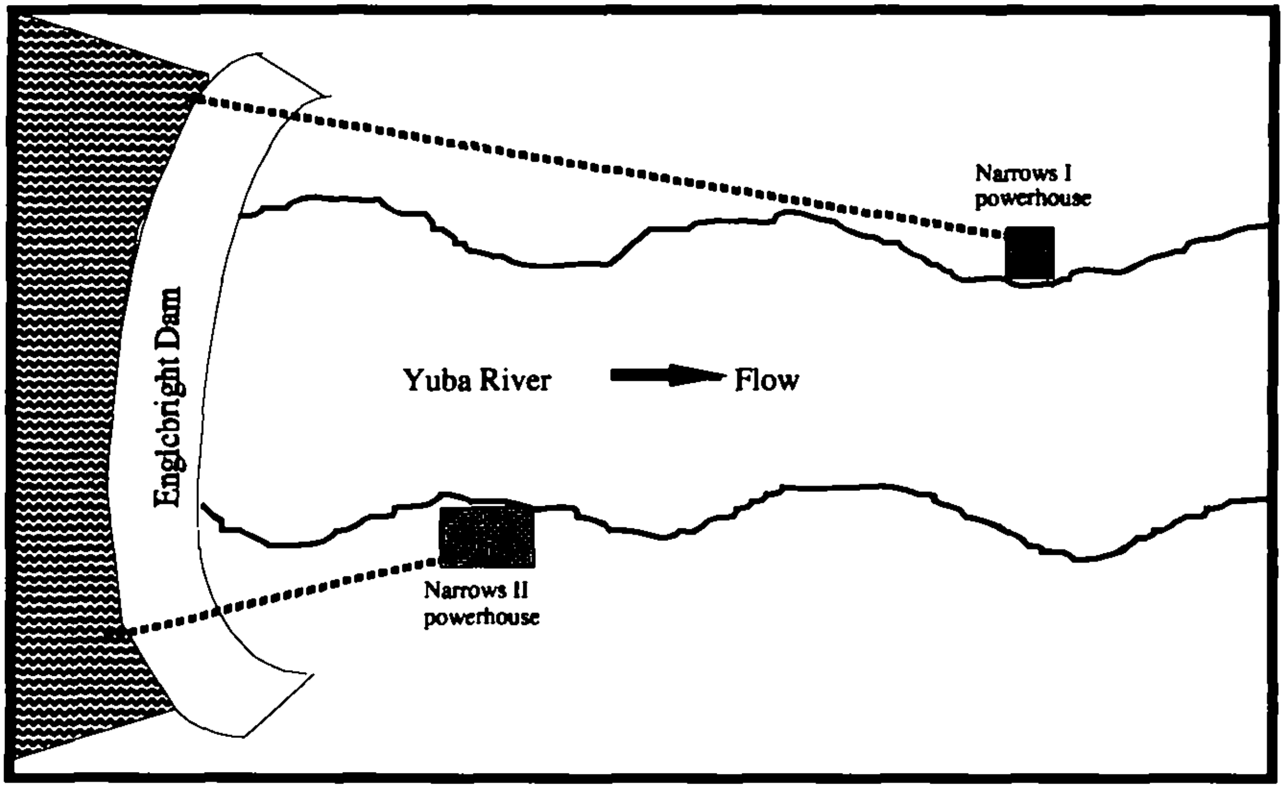


Figure 2. Englebright Dam and Narrows Powerhouses I & II



On October 4, 2000, NMFS requested a response from FERC summarizing its intentions regarding a formal section 7 consultation.

On October 26, 2000, FERC sent NMFS a letter summarizing the September 29, 2000, meeting and responding to NMFS' October 4, 2000, letter. FERC's letter also directed YCWA to prepare an environmental evaluation report (EER) on YRDP's impacts, if any, on threatened Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) and Central Valley steelhead (*O. mykiss*) by mid-December 2000.

On January 4, 2001, YCWA filed with FERC an EER evaluating the environmental effects on anadromous salmonids of YCWA's operation of the New Bullards Dam and Reservoir and Narrows II Powerhouse components of the YRDP.

On April 26, 2001, FERC issued a draft biological evaluation on FERC Project No. 2246 along with several other FERC projects on the upper Yuba River (FERC 2001).

On July 6, 2001, NMFS filed comments on FERC's draft biological evaluation with FERC.

In June 2002, FERC issued a final biological evaluation.

On January 15, 2003, YCWA and NMFS met to discuss a possible early consultation concerning a proposed license amendment.

On March 21, 2003, YCWA and NMFS met to discuss the scope and possible schedule for the early consultation for a proposed license amendment.

On April 22, 2003, FERC sent letters to YCWA and to NMFS confirming that YCWA would be FERC's non-Federal representative for an early consultation concerning YCWA's proposed license amendments.

On October 16, 2003, FERC sent a letter to NMFS (received October 20, 2003) requesting initiation of early consultation on YCWA's proposed YRDP license amendments. Included with this letter was a final biological assessment which was found by NMFS to contain sufficient information to initiate consultation and to allow NMFS to issue a preliminary biological opinion.

On May 27, 2004, NMFS sent a letter to FERC, requesting a time extension for completion of the early consultation process and submission of a preliminary biological opinion.

On January 26, 2005, NMFS issued a preliminary biological opinion (BO) to FERC analyzing the potential effects of the proposed YRDP License Amendment (FERC License No. 2246) on threatened Central Valley spring-run Chinook salmon and Central Valley steelhead. Subsequent to the completion of that preliminary BO, the action area for the project was proposed for designation as critical habitat for these two species. In addition, the southern distinct population segment (DPS) of North American green sturgeon (*Acipenser medirostris*), which also may be affected by the proposed project, was proposed for listing as threatened throughout its range within the Sacramento/San Joaquin river systems, which includes the lower Yuba River and the action area.

In a letter dated June 14, 2005, FERC requested confirmation of the preliminary BO and its conversion into a final BO. In addition, FERC requested the initiation of formal conferencing on the proposed listing of North American green sturgeon as threatened within the project area, and on proposed critical habitat for spring-run Chinook salmon and steelhead.

A final rule designating critical habitat was published on September 2, 2005 (70 FR 52488). The rule becomes effective on January 2, 2006. Therefore this document is a final biological opinion considering project effects on Central Valley spring-run Chinook salmon, Central Valley steelhead and their designated critical habitat, and a conference opinion considering project effects on North American green sturgeon.

II. DESCRIPTION OF THE PROPOSED ACTION

FERC proposes to amend the license for Project No. 2246 in order to: (1) authorize YCWA to construct and operate a full-flow bypass at its Narrows II Powerhouse at Englebright Dam; and (2) revise the flow reduction and fluctuation criteria in the FERC license.

A. Project Activities

1. Narrows II Powerhouse Full-Flow Bypass

YCWA proposes to construct and operate a 3,000 cfs bypass which would increase the maximum controlled bypass release from Englebright Reservoir (through the Narrows I and Narrows II Powerhouses) to about 3,540 cfs. This bypass would minimize the possibility that emergencies or other events requiring that Narrows II Powerhouse be taken offline cause significant flow fluctuations in the lower Yuba River, and thereby minimize the possibility that such fluctuations would strand juvenile Central Valley spring-run Chinook salmon and Central Valley steelhead or dewater redds of those species.

The bypass involves the installation of a "Y" bifurcation and turbine shut-off valve in the Narrows II Powerhouse tunnel (*i.e.*, penstock) immediately above the existing powerhouse. The bifurcation will allow bypass of penstock flow past the powerhouse to an energy-dissipating valve, and valve house, to be located just upstream of the Narrows II Powerhouse. Project activities associated with the bypass specifically will include construction/installation of the bifurcation, bypass pipe, valves, outlet structure, and valve controls, and modifications to the existing powerhouse control system to allow coordinated operations of the bypass system.

The bifurcation will be installed by excavating an approximately 35-foot diameter vertical shaft approximately 65 feet deep near the upstream wall of the powerhouse to intersect the existing penstock, removing a 25-foot long section of the existing penstock, and installing a pre-fabricated steel Y. A 10-foot diameter, approximately 35-foot long bypass tunnel, will be excavated to convey bypassed flows to the river. A 78-inch diameter fixed cone valve will provide release of flows into a 65-foot high reinforced concrete valve structure with a 16-foot diameter steel hood liner at the outlet of the bypass tunnel. Excavation would involve the use of explosives as well as mechanical removal methods.

Access to the in-channel construction area will be from the powerhouse deck and the adjacent gravel fill area. The preferred method of accessing the area is to use a crane situated on top of or next to the powerhouse to lift and swing equipment and materials down into the lower construction area.

If this method is not feasible, due to limited space on the powerhouse deck or other limitations, a second alternative could be employed using a temporary access road or ramp which would begin on the powerhouse deck and extend down to the level of the construction area. This road would be constructed outside of the ordinary high water mark by cutting into the rock face behind the powerhouse and, where necessary, creating a road bed of native rock. The road would be built on solid rock or large boulders and all road bed materials would be greater than one inch in diameter with minimal fine sediments introduced to the area from construction of the road. The entire road including all road bed material will be removed at the end of each construction season, before the possibility of spill over the top of Englebright Dam. If it is necessary to use a road or ramp to access the lower construction area, a detailed plan for the construction of the road will be furnished by the contractor for approval by the California Department of Fish and Game (CDFG) and NMFS prior to the commencement of any construction. A construction staging area will be located approximately one-quarter mile from the Yuba River on a relatively flat plateau above Englebright Dam.

The majority of the work, including tunnel excavation and installation of the bifurcation and turbine shut-off valve, would occur outside the ordinary high water mark near the landing for the Narrows II Powerhouse. Construction activities will also include intermittent periods of ground disturbing activities (*i.e.*, tunnel excavation, rubble removal and outlet structure construction) below the ordinary high water mark. However, due to the highly controlled nature of the flows within the construction area, and the fact that nearly all river flows originate downstream from the construction site (at the two power houses), flows passing through the construction area will be limited to the seepage that occurs through Englebright Dam and the backwater effect of water released from Narrows II. It is therefore expected that no construction activities will occur within the wetted portion of the channel at any time.

Ground disturbing activities are expected to take place from August 1, 2005, through December 31, 2006. The following construction schedule has been proposed by YCWA:

1. The contractor will begin to mobilize into the site on or around August 1, 2005.

2. The contractor will potentially start construction of facilities in the river channel (*i.e.*, the outlet structure and tunnel) in August 2005.

3. The contractor will remove all equipment and construction materials (including excavation materials) from the river channel before there is any possibility of spill over the top of Englebright Dam. This could be as early as November 2005, or as late as January 2006. YCWA will provide the contractor guidance on reservoir conditions to insure that they have time to pull out of the in-channel construction area prior to reservoir spill.

4. The contractor will move back in to complete construction in the river channel and at the powerhouse as soon as there is no longer a possibility of spill over the top of Englebright Dam in the spring. This could be as early as April 2006, or as late as June 2006. YCWA will provide the contractor guidance on reservoir conditions.
5. The shutdown of Narrows II Powerhouse is scheduled for September 10 through November 30, 2006. The contractor will install the Y branch and the valves during that period.

6. The powerhouse will resume operations by December 1, 2006. The contractor will close out construction and complete site cleanup between December 1, 2006, and approximately February 1, 2007.

Operation of the bypass system will be controlled by the existing Narrows II Powerhouse control system. In the event of a planned power outage, flows through the Narrows II Powerhouse turbine gradually will be ramped down while the bypass is slowly opened. Upon completion of this process all flows from Narrows II will be going through the bypass. In the event of an unplanned (emergency) outage, the transition between turbine and bypass flows will happen quickly, in about two to four minutes. In either case, total net flow to the river from the Narrows II Powerhouse should not fluctuate significantly for more than a few minutes.

2. Changes to Flow Reduction and Fluctuation Criteria

A revision to the flow reduction and fluctuation criteria contained in the FERC license for Project No. 2246 is a component of the proposed action. These new criteria would govern YCWA's releases of water from Narrows II Powerhouse and require YCWA to make reasonable efforts to operate New Bullards Bar Reservoir and Englebright Reservoir to avoid fluctuations in the flow of the lower Yuba River. Daily changes in project operations affecting releases or bypasses of flow from Englebright Dam shall be continuously measured at the USGS gage at Smartville, and shall be made in accordance with the following conditions:

1. Project releases or bypasses that increase streamflow downstream of Englebright Dam shall not exceed a rate of change of more than 500 cfs per hour.

2. Project releases or bypasses that reduce streamflow downstream of Englebright Dam shall be gradual and, over the course of any 24-hour period, shall not be reduced below 70 percent of the prior day's average flow release or bypass flow.

3. Once the daily project release or bypass level is achieved, fluctuations in the streamflow level downstream of Englebright Dam due to changes in project operations shall not vary up or down by more than 15 percent of the average daily flow.

4. During the period from September 15 to October 31, YCWA shall not reduce the flow downstream of Englebright Dam to less than 55 percent of the maximum five-day average release or bypass level that has occurred during that September 15 to October 31 period or the minimum streamflow requirement that would otherwise apply, whichever is greater.

5. During the period from November 1 to March 31, YCWA shall not reduce the flow downstream of Englebright Dam to less than the minimum streamflow release or bypass established under (4) above; or 65 percent of the maximum five-day average flow release or bypass that has occurred during that November 1 to March 31 period; or the minimum streamflow requirement that would otherwise apply, whichever is greater.

YCWA will not be required to follow these flow reduction and fluctuation criteria during emergencies, releases required by the Corps' flood control criteria, releases required to maintain a flood control buffer or for other flood control purposes, bypasses of uncontrolled flows into Englebright Reservoir, uncontrolled spilling, or uncontrolled flows of tributary streams downstream of Englebright Dam.

B. Proposed Conservation Measures

The following conservation measures were taken directly from the project description in the biological assessment and from the contractor bidding documents, and will be included as required conditions of the final construction contract.

1. Implement applicable measures to reduce short-term construction-generated emissions:

    a. Contractors shall use non-toxic soil stabilizers according to manufacturers' specifications to stabilize all inactive construction areas.

    b. All grading operations shall be suspended when winds exceed 20 miles per hour.

    c. The construction site shall be watered as needed to control fugitive dust generated by construction equipment and activities at the project site and in surrounding areas.

    d. All trucks hauling dirt, sand, soil, or other loose material shall be covered or shall be maintained with at least two feet of freeboard (i.e., minimum vertical distance between top of the load and top of the trailer) in accordance with the requirements of California Vehicle Code Section 23114.

    e. Paved streets shall be swept at the end of each day if substantial volumes of soil material have been carried onto adjacent paved, public roads from the project site.

    f. The idling of equipment engines shall be minimized when equipment is not in use.

    g. The primary contractor shall be responsible to ensure that all heavy-duty equipment is properly tuned and maintained, in accordance with manufacturers' specifications.

2. Obtain geotechnical analysis of the project site and implement measures to stabilize slopes:

    a. YCWA shall obtain a geotechnical analysis of the project site, performed by a qualified soil scientist or geologist, that evaluates the site's geologic and geotechnical conditions and identifies measures to ensure that construction activities do not destabilize rock slopes in the project area or otherwise contribute to increased risk of landslide. YCWA shall require the construction contractor to implement the identified slope stabilization measures as part of construction specifications for the project. Such measures may include temporary or permanent retaining walls, fencing, and appropriate construction and blasting techniques.

3. Implement standard erosion and sedimentation control measures, obtain authorization under the National Pollutant Discharge Elimination System (NPDES), and prepare and implement a Sedimentation Prevention Plan (SPP):

   a. Project construction is likely to involve disturbance of more than 1 acre of land area. Accordingly, YCWA shall require the contractor to implement standard erosion and sedimentation control measures. In addition, the contractor shall comply with the State Water Resource Control Board's NPDES General Permit for discharges associated with construction activities. The NPDES General Permit requires the preparation of a Storm Water Pollution Prevention Plan that establishes site-specific erosion and sedimentation control measures.

   b. Erosion control measures such as silt fences, straw bales, sediment traps and other collection devices shall be used to intercept and retain sediment around the perimeter of the construction staging area and the Narrows II Powerhouse landing and parking area to prevent sediment runoff produced by construction activities from entering the river.

   c. All excavated materials shall be moved to the primary staging area or another location outside of the 100-year flood zone.

   d. Any soil stockpiles that are subject to erosion shall be protected using erosion control measures or covered with plastic, as appropriate.

   e. The contractor shall develop an SPP for submittal to CDFG and NMFS before the onset of construction-related activities. The SPP shall include discharge control requirements that are expected to prevent impacts resulting from erosion and sedimentation, as would be required with water quality certification under Clean Water Act section 401.

4. Prepare and implement a Hazardous Materials Control Plan (HMCP):

   a. Before construction begins, YCWA shall require the construction contractor to prepare and implement an HMCP. The HMCP shall identify all potential hazardous materials that will be used during construction activities. The HMCP shall also identify staging areas where hazardous materials would be stored during construction and shall include an Accidental Spill Prevention and Response Plan (ASPRP). The ASPRP shall identify measures to prevent accidental spills from leaving the site and methods for responding to and cleaning up spills before they spread beyond the spill area or to drainages. The ASPRP shall be implemented as needed during construction.

   b. Fueling of vehicles and other construction-related equipment shall be conducted at the construction staging area.

c. Any vehicles which are expected to enter the in-channel area of the construction site will be steam-cleaned in the construction staging area prior to entering the channel.

d. Construction crews shall be properly trained to utilize standard spill prevention and cleanup equipment and techniques, including rapid deployment of spill absorption and retention materials.

e. The HMCP shall incorporate blasting specifications and shall include information about maximum charge weight, staging and storage areas, setup and handling instructions, blasting protocols, provisions for an initial coordination meeting among construction personnel, and a Blasting Accident Prevention and Response Plan.

f. The HMCP shall be reviewed and approved by YCWA and the Corps and shall be implemented as needed during construction.

5. Design and implement blasting specifications to limit noise exposure for nearby receptors including vibration controls and limitations as recommended in the evaluation of blasting concerns and controls prepared for this project (Revey Associates 2002):

a. Use vibration prediction equations to establish minimum scaled distance controls that the contractor can use to determine maximum charge weight limits based on target peak particle velocity (PPV) values.

i. PPV at the penstock pipe inside the plant shall not exceed 5.0 inches per second.

ii PPV at the ground surface adjacent to the closest point of the plant building shall not exceed 4.0 inches per second.

b. With respect to air overpressure (impulsive blast noise), a standard of 133 decibels (dBL) shall be used as recommended by the U.S. Bureau of Mines. This measurement shall be made adjacent to the closest point of the plant building using the compliance seismograph.

c. All excavation activities, including the use of explosives, will occur no nearer than 60 feet from the active wetted channel.

d. Fixed-cartridge, water-based emulsion or gel explosives, and non-electric shock-tube ignition systems shall be used.

e. The contractor shall purchase two seismographs that will be used by the engineer's staff to monitor compliance with vibration limits.

f. The contractor shall notify the Corps and Lake Englebright Marina operator in writing of the anticipated blasting schedule.

C. Interrelated and Interdependent Activities

The proposed action is interrelated to the operations of Englebright Dam including the operations of the Narrows I Powerhouse. NMFS completed formal consultation and issued a biological opinion to the Corps on the operations of Englebright Dam in 2002 (NMFS 2002a). Therefore, the interrelated effects associated with Englebright Dam and its operations are included in the environmental baseline analysis for the action area. NMFS also consulted on the operations of the Narrows I Powerhouse in 2004 and found that those operations were not likely to adversely affect listed salmonids on the Yuba River. There are no interdependent activities associated with the proposed action.

D. Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR §402.02). The action area for this project includes the active stream channels and riparian corridors of the Yuba River starting at and including Englebright Dam (39° 14'18"N, 121°16'07"W, River Mile [RM] 23.9), downstream to the confluence with the Feather River (39°07'46"N, 121°35'56"W, RM 0).

III. STATUS OF THE SPECIES AND CRITICAL HABITAT

The following listed threatened species and designated critical habitat occur in the action area and may be affected by the YRDP License Amendment (FERC License No. 2246):

Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*) – threatened
Central Valley steelhead (*O. mykiss*) – threatened
Central Valley spring-run Chinook salmon – designated critical habitat
Central Valley steelhead – designated critical habitat

The following proposed threatened species occur in the action area and may be affected by the YRDP License Amendment (FERC License No. 2246):

Southern DPS of North American green sturgeon – proposed threatened

A. Species Life History, Population Dynamics, and Likelihood of Survival and Recovery

1. <u>Central Valley Spring-Run Chinook Salmon and Designated Critical Habitat</u>

NMFS listed the Central Valley spring-run Chinook salmon evolutionarily significant unit (ESU) as threatened on September 16, 1999 (64 FR 50394). A final rule designating critical habitat for spring-run Chinook salmon in the lower Yuba River was published on September 2, 2005 (70 FR 52488). The rule becomes effective on January 2, 2006. Historically, spring-run Chinook salmon were the dominant run in the Sacramento River Basin, occupying the middle and upper elevation reaches (1,000 to 6,000 feet) of most streams and rivers with sufficient habitat for over-summering adults (Clark 1929). Clark (1929) estimated that there were 6,000 miles of salmon habitat in the Central Valley Basin (much of which was high elevation spring-run Chinook salmon habitat) and that by 1928, 80 percent of this habitat had been lost. Yoshiyama *et al.* (1996) determined that, historically, there were approximately 2,000 miles of salmon habitat available prior to dam construction and mining and that only 18 percent of that habitat remains.

This tremendous loss of habitat and the scarcity of remaining areas that maintain all of the primary constituent elements necessary to support spring-run Chinook salmon is the primary factor affecting the status of critical habitat for these fish. Since this initial loss of habitat, other factors have continued to impact the remaining critical habitat and affected the ESU's ability to recover. These factors include a combination of physical, biological, and management factors such as insufficient flows, elevated water temperatures, and predation (CDFG 1998).

Instream flows in several areas designated as critical habitat for spring-run Chinook salmon (Butte Creek, Battle Creek, Yuba River, *etc.*) are controlled by upstream dams. These dams can, at times, release insufficient flows or cause severe flow fluctuations that impact the quality of critical habitat in these streams. Low summer flows (both natural and controlled) can cause elevated water temperatures in spring-run holding and spawning habitat, resulting in pre-spawning mortality and reduced reproductive success.

Accelerated predation is also a significant factor affecting critical habitat for spring-run Chinook salmon. Although predation is a natural component of spring-run Chinook salmon life ecology, the rate of predation likely has greatly increased through the introduction of non-native predatory species such as striped bass (*Morone saxatilis*) and largemouth bass (*Micropterus salmoides*), and through the alteration of natural flow regimes and the development of structures that attract predators, including dams, bank revetment, bridges, diversions, piers, and wharfs (Stevens 1961; Vogel *et al.* 1988; Garcia 1989; Decato 1978). The U.S. Fish and Wildlife Service (FWS) found that more predatory fish were found at rock revetment bank protection sites between Chico Landing and Red Bluff than at sites with naturally eroding banks (Michny and Hampton 1984). On the mainstem Sacramento River, high rates of predation are known to occur at RBDD, Anderson-Cottonwood Irrigation District, Glenn-Colusa Irrigation District, and at south Delta water diversion structures (CDFG 1998). From October 1976 to November 1993, CDFG conducted ten mark/recapture experiments at the SWP's Clifton Court Forebay to estimate pre-screen losses using hatchery-reared juvenile Chinook salmon. Pre-screen losses ranged from 69 to 99 percent. Predation from striped bass is thought to be the primary cause of the loss (CDFG 1998; Gingras 1997).

Adult spring-run Chinook salmon enter the Delta from the Pacific Ocean beginning in January and enter natal streams from March to July. In Mill Creek, Van Woert (1964) noted that of 18,290 spring-run Chinook salmon observed from 1953 to 1963, 93.5 percent were counted between April 1 and July 14, and 89.3 percent were counted between April 29 and June 30.

During their upstream migration, adult Chinook salmon require streamflows sufficient to provide olfactory and other orientation cues used to locate their natal streams. Adequate streamflows are also necessary to allow adult passage to upstream holding habitat. CDFG reported that the preferred temperature range for upstream migration is 38 °F to 56 °F (CDFG 1998; Bell 1991).

Upon entering fresh water, spring-run Chinook salmon are sexually immature and must hold in cold water for several months to mature. Typically, spring-run Chinook salmon utilize mid-to high-elevation streams that provide appropriate temperatures and sufficient flow, cover, and pool depth to allow over-summering. Spring-run Chinook salmon may also utilize tailwaters below dams if cold water releases provide suitable habitat conditions. Spawning occurs between September and October and, depending on water temperature, emergence occurs between November and February.

Spring-run Chinook salmon emigration is highly variable (CDFG 1998). Some may begin outmigrating soon after emergence, whereas others oversummer and emigrate as yearlings with the onset of increased fall storms (CDFG 1998). The emigration period for spring-run Chinook salmon extends from November to early May, with up to 69 percent of young-of-the-year outmigrants passing through the lower Sacramento River between mid-November and early January (Snider and Titus 2000). Outmigrants are also known to rear in non-natal tributaries to the Sacramento River, and the Delta (CDFG 1998).

Chinook salmon spend between one and four years in the ocean before returning to their natal streams to spawn (Myers *et al.* 1998). Fisher (1994) reported that 87 percent of Chinook trapped and examined at Red Bluff Diversion Dam (RBDD) between 1985 and 1991 were three-year-olds.

Spring-run Chinook salmon were once the most abundant run of salmon in the Central Valley (Campbell and Moyle 1992) and were found in both the Sacramento and San Joaquin drainages. More than 500,000 spring-run Chinook salmon were caught in the Sacramento-San Joaquin commercial fishery in 1883 alone (Yoshiyama *et al.* 1998). The San Joaquin populations were essentially extirpated by the 1940s, with only small remnants of the run that persisted through the 1950s in the Merced River (Hallock and Van Woert 1959, Yoshiyama *et al.* 1998). Populations in the upper reaches of the Sacramento, Feather, and Yuba Rivers were eliminated with the construction of major dams during the1950s and 1960s. Naturally spawning populations of spring-run Chinook salmon are currently restricted to accessible reaches of the upper Sacramento River, Antelope Creek, Battle Creek, Beegum Creek, Big Chico Creek, Butte Creek, Clear Creek, Deer Creek, Mill Creek, Feather River, and the Yuba River (CDFG 1998).

Since 1969, the Central Valley spring-run Chinook salmon ESU has displayed broad fluctuations in abundance, ranging from 1,403 in 1993 to 25,890 in 1982 (CDFG unpublished data). The average abundance for the ESU was 12,499 for the period of 1969 to 1979, 12,981 for the period of 1980 to 1990, and 6,542 from 1991 to 2001. Evaluating the abundance of the ESU as a whole, however, complicates trend detection. For example, although the mainstem Sacramento River population appears to have undergone a significant decline, the data are not necessarily comparable because coded wire tag information gathered from Central Valley fall-run Chinook salmon returns since the early 1990s has resulted in adjustments to ladder counts at RBDD that have reduced the overall number of fish that are categorized as spring-run Chinook salmon (Colleen Harvey-Arrison, CDFG, pers. comm., June, 2002).

Sacramento River tributary populations in Mill, Deer, and Butte Creeks are probably the best trend indicators for spring-run Chinook salmon abundance. These streams have shown positive escapement trends since 1991, yet recent escapements to Butte Creek, including 20,259 in 1998, 9,605 in 2001 and 8,785 in 2002, are responsible for the majority of tributary abundance (CDFG 2002a and CDFG, unpublished data). Although recent tributary production is promising, annual abundance estimates display a high level of fluctuation and the overall number of Central Valley spring-run Chinook salmon remains well below estimates of historic abundance.

During the drought of 1984 to 1992, spring-run Chinook salmon populations declined substantially. Reduced flows resulted in warm water temperatures and impacted adults, eggs, and juveniles. For adult spring-run Chinook salmon, reduced instream flows delayed or completely blocked access to holding and spawning habitats. Water management operations, including reservoir releases, and unscreened and poorly screened diversions in the Sacramento River and it's tributaries, and the Sacramento-San Joaquin Delta compounded drought-related problems by reducing river flows, warming river temperatures, and entraining juvenile spring-run Chinook salmon.

Hatchery practices as well as spatial and temporal overlaps of habitat use and spawning activity between spring- and fall-run led to the hybridization and homogenation of some subpopulations (CDFG 1998). As early as the 1960s, Slater (1963) observed that early fall-run were competing with spring-run Chinook salmon for spawning sites in the Sacramento River below Keswick Dam and speculated that the two runs may have hybridized. Feather River hatchery spring-run Chinook salmon have been documented as straying throughout Central Valley streams for many years, and in many cases have been recovered from the spawning grounds of fall-run Chinook salmon (Colleen Harvey-Arrison and Paul Ward, CDFG, pers. comm., June, 2002), an indication that Feather River Hatchery spring-run Chinook salmon may exhibit fall-run life history characteristics. Although the degree of hybridization has not been comprehensively determined, it is likely that the populations of spring-run Chinook salmon spawning in the Feather River and counted at RBDD contain introgressed fish.

Spring-run Chinook salmon are harvested in ocean commercial, ocean recreational, and inland recreational fisheries. Coded wire tag returns indicate that Sacramento River salmon congregate off the coast between Point Arena and Morro Bay. Ocean fisheries have affected the age structure of spring-run Chinook salmon through targeting large fish for many years and reducing the number of four- and five-year-olds (CDFG 1998). An analysis of six tagged groups of Feather River Hatchery spring-run Chinook salmon by Cramer and Demko (1997) indicates that harvest rates of three-year-old fish ranged from 18 to 22 percent, four-year-olds ranged from 57 to 84 percent, and five-year-olds ranged from 97 to 100 percent. Reducing the age structure of the species reduces it's resiliency to factors that may impact a year class. In-river recreational fisheries have historically taken fish throughout the species' range. During the summer, holding adult spring-run Chinook salmon are easily targeted by anglers when they congregate in large pools. Poaching also occurs at fish ladders, and other areas where adults congregate, however, the significance of poaching on the adult population is unknown.

Several actions have been taken to improve the condition of critical habitat and restore populations of spring-run Chinook salmon. These actions include improved management of Central Valley water (*e.g.*, through use of CALFED Bay-Delta Program [CALFED] Environmental Water Account [EWA] and Central Valley Project Improvement Act [CVPIA] section [b][2] water accounts), removal of several small dams in spring-run spawning tributaries, installation of new and improved fish screens at water diversions along juvenile spring-run Chinook salmon migration routs, and changes in ocean and inland fishing regulations to minimize harvest. Although protective measures likely have led to recent increases in spring-run Chinook salmon abundance, the ESU is still below levels observed from the 1960s through 1990. Threats from hatchery production, climatic variation, predation, and water diversions persist. Because the Central Valley spring-run Chinook salmon ESU is confined to relatively few remaining streams and continues to display broad fluctuations in abundance, high quality critical habitat containing spawning sites with adequate water and substrate conditions, or rearing sites with adequate floodplain connectivity, cover, and water conditions (*i.e.*, key primary constituent elements of critical habitat that contribute to its conservation value) is considered to be limited and the population is at a moderate risk of extinction.

2. Central Valley Steelhead and Designated Critical Habitat

NMFS listed the Central Valley steelhead ESU as threatened on March 19, 1998 (63 FR 13347). The ESU includes all naturally-produced Central Valley steelhead in the Sacramento-San Joaquin River Basin. NMFS published a final 4(d) rule for steelhead on July 10, 2000 (65 FR 42422). A final rule designating critical habitat for Central Valley steelhead in the lower Yuba River was published on September 2, 2005 (70 FR 52488). The rule becomes effective on January 2, 2006.

All steelhead stocks in the Central Valley are winter-run steelhead (McEwan and Jackson 1996). Steelhead are similar to Pacific salmon in their life history requirements. They are born in fresh water, emigrate to the ocean, and return to freshwater to spawn. Unlike other Pacific salmon, steelhead are capable of spawning more than once before they die.

The majority of the steelhead spawning migration occurs from October through February and spawning occurs from December to April in streams with cool, well oxygenated water that is available year round. Van Woert (1964) observed that in Mill Creek, the steelhead migration is continuous, and although there are two peak periods, sixty percent of the run is passed by December 30. Similar bimodal run patterns have also been observed in the Feather River (Ryan Kurth, California Department of Water Resources (DWR), pers. comm., June, 2002), and the American River (John Hannon, U.S. Bureau of Reclamation, pers. comm., July, 2002).

Incubation time is dependent upon water temperature. Eggs incubate for one and a half to four months before emerging. Eggs held between 50 °F and 59 °F hatch within three to four weeks (Moyle 1976). Fry emerge from redds within about four to six weeks depending on redd depth, gravel size, siltation, and temperature (Shapovalov and Taft 1954). Newly emerged fry move to shallow stream margins to escape high water velocities and predation (Barnhart 1986). As fry grow larger they move into riffles and pools and establish feeding locations. Juveniles rear in freshwater for one to four years (Meehan and Bjornn 1991) emigrating episodically from natal springs during fall, winter and spring high flows. Steelhead typically spend two years in fresh water. Adults spend one to four years at sea before returning to freshwater to spawn as four or five year olds (Moyle 1976).

Steelhead historically were well-distributed throughout the Sacramento and San Joaquin Rivers (Busby *et al.* 1996). Steelhead were found from the upper Sacramento and Pit River systems south to the Kings and possible the Kern River systems and in both east- and west-side Sacramento River tributaries (Yoshiyama *et al.* 1996). The present distribution has been greatly reduced (McEwan and Jackson 1996). The California Advisory Committee on Salmon and Steelhead (1988) reported a reduction of steelhead habitat from 6,000 miles historically to 300 miles. The California Fish and Wildlife Plan (CDFG 1965) estimated there were 40,000 steelhead in the early 1950s. Hallock *et al.* (1961) estimated an average of 20,540 adult steelhead through the 1960s in the Sacramento River, upstream of the Feather River.

Existing wild steelhead stocks in the Central Valley are mostly confined to upper Sacramento River and its tributaries, including Antelope, Deer, and Mill Creeks and the Yuba River. Populations may exist in Big Chico and Butte Creeks and a few wild steelhead are produced in the American and Feather Rivers (McEwan and Jackson 1996). Until recently, steelhead were thought to be extirpated from the San Joaquin River system. Recent monitoring has detected self sustaining populations of steelhead in the Stanislaus, Mokelumne, Calaveras, and other streams previously thought to be void of steelhead (McEwan 2001). It is possible that naturally spawning populations exist in many other streams but are undetected due to lack of monitoring programs (Interagency Ecological Program Steelhead Project Work Team 1999).

Reliable estimates of steelhead abundance for different basins are not available (McEwan 2001); however, McEwan and Jackson (1996) estimate the total annual run size for the entire Sacramento-San Joaquin system, based on RBDD counts, to be no more than 10,000 adults. Steelhead counts at the RBDD have declined from an average of 11,187 for the period of 1967 to 1977, to an average of approximately 2,000 through the 1990s (McEwan and Jackson 1996; McEwan 2001).

The factors affecting the survival and recovery of Central Valley steelhead and their critical habitat are similar to those affecting spring-run Chinook salmon and are primarily associated with habitat loss (McEwan 2001). McEwan and Jackson (1996) attribute this habitat loss and other impacts to critical habitat primarily to water development resulting in inadequate flows, flow fluctuations, blockages, and entrainment into diversions. Other effects on critical habitat related to land use practices and urbanization have also contributed to steelhead declines (Busby *et al.* 1996). Although many of the factors affecting salmon critical habitat are common to steelhead, some stressors, especially summer water temperatures cause greater effects to steelhead because juvenile steelhead rear in freshwater for more than one year. Suitable rearing sites for steelhead, which are primary constituent elements of critical habitat, mainly occur in mid- to high elevation streams. Because most suitable habitat has been lost to dam construction, juvenile rearing is generally confined to lower elevation stream reaches where water temperatures during late summer and early fall can be sub-optimal.

Many of the improvements to critical habitat that have benefited spring-run Chinook salmon, including water management through the CVPIA (b)(2) water supply and the CALFED EWA, improved screening conditions at water diversions, and changes in inland fishing regulations (there is no ocean steelhead fishery) benefit Central Valley steelhead. However, many dams and reservoirs in the Central Valley do not have water storage capacity or release mechanisms necessary to maintain suitable water temperatures for steelhead rearing through the critical summer and fall periods, especially during critically dry years (McEwan 2001).

Both the Biological Review Team (Good *et al.* 2005) and the Artificial Propagation Evaluation Workshop (69 FR 33102) concluded that the Central Valley steelhead ESU presently is "in danger of extinction." However, in the proposed status review NMFS concluded that the ESU in-total is "not in danger of extinction, but is likely to become endangered within the foreseeable future" citing unknown benefits of restoration efforts and a yet to be funded monitoring program (69 FR 33102). Steelhead already have been extirpated from most of their historical range in this region. Habitat concerns in this ESU focus on the widespread degradation, destruction, and blockage of freshwater habitat within the region, and water allocation problems. Widespread hatchery steelhead production within this ESU also raises concerns about the potential ecological interactions between introduced stocks and native stocks. Because the Central Valley steelhead population has been fragmented into smaller isolated tributaries without any large source population and the remaining habitat continues to be degraded by water diversions, the population is at high risk of extinction.

3. Southern DPS of North American Green Sturgeon

The green sturgeon is the most widely distributed member of the sturgeon family Acipenseridae (70 FR 17386). North American green sturgeon are found in rivers from British Columbia south to the Sacramento River, California, though their ocean range is from the Bering Sea to Ensenada, Mexico (Moyle 2002). In assessing North American green sturgeon status, NMFS determined that two DPSs exist. The northern DPS is made up of known North American green sturgeon spawning (or single stock populations) in the Rogue, Klamath and Eel rivers. The southern DPS presently contains only a single spawning population in the Sacramento River (70 FR 17386). NMFS proposed to list the southern DPS of North American green sturgeon as threatened on April 6, 2005 (70 FR 17386).

a. *Life History*

North American green sturgeon is an anadromous species that generally migrate upstream into fresh water between late February and late July (CDFG 2002b). In the Klamath River, the water temperature tolerance of immigrating adult North American green sturgeon reportedly ranges from 44.4 °F to 60.8 °F (6.9 °C to 16 °C); North American green sturgeon were not found in areas of the river outside this surface water temperature range (FWS 1995a). Mature males range from 139 to 199 centimeters (cm) fork length (FL) and 15 to 30 years of age (Van Eenennaam *et al.* 2001). Mature females range from 157 to 223 cm FL and 17 to 40 years of age. Maximum ages of adult North American green sturgeon are likely to range from 60 to 70 years (Moyle 2002).

Adult North American green sturgeon are thought to spawn every three to five years (70 FR 17386), but new information suggests that spawning could occur as frequently as every two years (Stephen Lindley, NMFS, pers. comm., 2004). Spawning occurs from March through July, with peak activity from April through June (Moyle *et al.* 1995). North American green sturgeon appear to spawn within 200 miles (322 km) of the ocean. Spawning occurs in deep turbulent river mainstems. Specific spawning habitat preferences are unclear, but eggs likely are broadcast over large cobble where they settle into the cracks (Moyle *et al.* 1995). North American green sturgeon reportedly prefer to spawn in water temperatures ranging from 46.4 °F to 57.2 °F (8 °C to 14 °C) (FWS 1995b; Environmental Protection Information Center *et al.* 2001; Moyle 2002). Water temperatures above 68 °F (20 °C) are reportedly lethal to North American green sturgeon embryos (Cech *et al.* 2000; Beamesderfer and Webb 2002). North American green sturgeon females produce 60,000 - 140,000 eggs (Moyle *et al.* 1992), and they are the largest eggs (diameter 4.34 mm) of any sturgeon species (Cech *et al.* 2000).

North American green sturgeon larvae hatch at around 200 hours (at 54.9° F) after spawning, and are dissimilar to other sturgeon species in that they lack a distinct swim-up or post-hatching stage (Moyle 2002; NMFS 2002b). Optimal growth rates for North American green sturgeon juveniles reportedly occur at water temperatures of 59 °F (Cech *et al.* 2000). North American green sturgeon larvae first feed at 10 days post hatch and grow quickly reaching a length of 66 mm and a weight of 1.8 g in three weeks of exogenous feeding. Metamorphosis to the juvenile stage is complete at 45 days. Juveniles continue to grow rapidly, reaching 300 mm in one year. Juveniles spend from one to four years in fresh and estuarine waters and disperse into salt water at lengths of 300 to 750 mm.

The North American green sturgeon is the most marine oriented of the Pacific Coast sturgeon species (NMFS 2003). Individuals apparently remain near the estuaries at first, but then migrate considerable distances in the ocean as they grow. Based on recoveries of North American green sturgeon tagged in the San Francisco Bay estuary, most North American green sturgeon migrate northward, in some cases as far as British Columbia (Moyle 2002; NMFS 2002b). Similarly, tagged North American green sturgeon from the Sacramento and Columbia rivers are primarily captured to the north in coastal and estuarine waters, with some fish tagged in the Columbia River being recaptured as far north as British Columbia (Washington Department of Fish and Wildlife (WDFW) 2002). While there is some bias associated with recovery of tagged fish through commercial fishing, the pattern of a northern migration is supported by the large concentration of North American green sturgeon in the Columbia River estuary, Willapa Bay, and Grays Harbor, which peaks in August. These fish tend to be immature; however, mature fish and at least one ripe fish have been found in the lower Columbia River (WDFW 2002). Genetic evidence suggests that most Columbia River green sturgeon are a mixture of fish spawned in other river systems including the Sacramento, Klamath, and Rogue Rivers (Israel *et al.* 2002).

Some general information is available on North American green sturgeon feeding habits. Adult North American green sturgeon scour the Sacramento-San Joaquin Delta benthos for invertebrates including shrimp, mollusks, amphipods, isopods, and small, disabled or dead fish (Environmental Protection Center *et al.* 2001). The primary diet for juvenile North American green sturgeon reportedly consists of small crustaceans, such as amphipods and opossum shrimp

(CDFG 2001). As juvenile North American green sturgeon develop, they reportedly eat a wider variety of benthic invertebrates, including clams, crabs, and shrimp (CDFG 2001).

b. *Southern DPS North American Green Sturgeon Population Status*

Population abundance information concerning the Southern DPS of North American green sturgeon is scant as described in the status review (NMFS 2002b). Limited population abundance information comes from incidental captures of North American green sturgeon from the white sturgeon (*Acipenser transmontanus*) monitoring program by the CDFG sturgeon tagging program (CDFG 2002c). CDFG (2002c) utilizes a multiple-census or Peterson mark-recapture method to estimate the legal population of white sturgeon captures in trammel nets. By comparing ratios of white sturgeon to green sturgeon captures, CDFG provides estimates of adult and sub-adult North American green sturgeon abundance. Estimated abundance between 1954 and 2001 ranged from 175 fish to more than 8,000 per year and averaged 1,509 fish per year. Unfortunately, there are many biases and errors associated with these data, and CDFG does not consider these estimates reliable. Fish monitoring efforts at Red Bluff Diversion Dam and Glen Colusa Irrigation District on the upper Sacramento River have captured between 0 and 2,068 juvenile North American green sturgeon per year, mostly between June and July (NMFS 2002b). The only existing information regarding changes in the abundance of the Southern DPS of North American green sturgeon includes changes in abundance at the John Skinner Fish Protection Facility between 1968 and 2001 (State facility). The estimated average annual number of North American green sturgeon taken at the State Facility prior to 1986 was 732; from 1986 on, the average annual number was 47 (70 FR 17386). For the Tracy Fish Collection Facility (Federal facility), the average annual number prior to 1986 was 889; from 1986 to 2001 it was 32 (70 FR 17386). In light of the increased exports, particularly during the previous 10 years, it is clear that the abundance of the Southern DPS of North American green sturgeon is dropping. Catches of sub-adult and adult North American green sturgeon by the IEP between 1996 and 2004 ranged from 1 to 212 green sturgeon per year (212 occurred in 2001), however, the portion of these catches that were made up of the Southern DPS of North American green sturgeon is unknown as these captures were primarily located in San Pablo Bay which is known to consist of a mixture of the Northern and Southern population segments. Additional analysis of North American green and white sturgeon taken at the State and Federal facilities indicates that take of both North American green and white sturgeon per acre-foot of water exported has decreased substantially since the 1960's (70 FR 17386).

Larval and post larval North American green sturgeon are caught each year in rotary screw traps at the Red Bluff Diversion Dam (Gaines and Martin 2001). A total of 2,608 juvenile sturgeon were captured from 1994-2000. All were assumed to be North American green sturgeon since 124 of these fish were grown by the University of California, Davis' researchers to an identifiable size and all were North American green sturgeon. Young sturgeon appear in catches from early May through August. Most range in size from 1 to 3 inches. Catch rates were greatest in 1995 and 1996 and were lowest in 1999 and 2000 (Gaines and Martin 2001).

No North American green sturgeon have been detected during intensive salmonid monitoring efforts in Clear, Battle, Butte, Deer and Mill creeks, all of which are tributaries to the Sacramento River (Matt Brown, FWS, pers. comm., 2004; Colleen Harvey-Arrison, CDFG, pers. comm., 2004). Sampling on these tributaries includes monitoring adult passage at fish ladders (Battle Creek), snorkel surveys (Deer, Butte, Clear and Battle creeks), and rotary screw trapping (Deer, Mill, Clear, Battle and Butte creeks). Much of this monitoring has occurred during time periods when adult North American green sturgeon would be expected to be in the rivers spawning, and when juvenile North American green sturgeon would be expected to be hatching, rearing and migrating through the river systems (S.P. Cramer & Associates, Inc. 2004).

Similar monitoring activities have likewise failed to detect North American green sturgeon in the American River (Mike Healey, CDFG, pers. comm., 2004; John Hannon, U.S. Bureau of Reclamation, pers. comm., 2004; Trevor Kennedy, Fishery Foundation of California, pers. comm., 2004). These sampling efforts included snorkeling, rotary screw trapping, and seining, and were conducted during periods when adult and juvenile North American green sturgeon would have been expected to be in the river (S.P. Cramer & Associates, Inc. 2004).

Green and white sturgeon adults have been observed periodically in small numbers in the Feather River (S.P. Cramer & Associates, Inc.2004). There are at least two confirmed records of adult North American green sturgeon. There are no records of larval or juvenile sturgeon of either species, even prior to the 1960's when Oroville Dam was built. There are reports that North American green sturgeon may reproduce in the Feather River during high flow years (CDFG 2002c), but these are not specific and are unconfirmed (S.P. Cramer & Associates, Inc. 2004).

c. *Factors Affecting North American Green Sturgeon*

The principal factor for the decline of North American green sturgeon reportedly comes from the reduction of North American green sturgeon spawning habitat to a limited area of the Sacramento River (70 FR 17391). Keswick Dam is an impassible barrier blocking North American green sturgeon access to what are thought to have been historic spawning grounds upstream (70 FR 17386). In addition, a substantial amount of what may have been spawning and rearing habitat in the Feather River above Oroville Dam has also been lost (70 FR 17386). There is a lack of historical information on presence or absence of North American green sturgeon spawning in the Feather River, and it remains unclear whether suitable spawning habitat currently is available or has ever been available in the Feather River (S.P. Cramer & Associates, Inc. 2004).

Potential adult migration barriers to the Southern DPS of North American green sturgeon include RBDD, Sacramento Deep Water Ship Channel locks, Fremont Weir, Sutter Bypass, and the Delta Cross Channel Gates on the Sacramento River, and Shanghai Bench and Sunset Pumps on the Feather River (70 FR 17391). The threat of screened and unscreened agricultural, municipal, and industrial water diversions in the Sacramento River and Delta to North American green sturgeon are largely unknown as juvenile sturgeon are often not identified, and the current CDFG and NMFS' screen criteria are not specifically designed to protect sturgeon. Based on the temporal occurrence of juvenile North American green sturgeon and the high density of water diversion structures along rearing and migration routes, the potential threat of these diversions are found to be serious and in need of study (70 FR 17391).

CDFG (1992) found a strong correlation between mean daily freshwater outflow (April to July) and white sturgeon year class strength in the Sacramento-San Joaquin Estuary, suggesting that insufficient flow rates are likely to pose a significant threat to the Southern DPS of North American green sturgeon. It is postulated that low flow rates could dampen survival by hampering the dispersal of larvae to areas of greater food availability, hampering the dispersal of larvae to all available habitat, delaying the transportation of larvae downstream of water diversions in the Delta, or decreasing nutrient supply to the nursery, thus stifling productivity (CDFG 1992). The subject studies primarily involve the more abundant white sturgeon; however, the threats to North American green sturgeon are thought to be similar (70 FR 17391). It is important to note, however, that white sturgeon spend more time in a riverine environment than North American green sturgeon, and the aforementioned correlation may not be applicable. The full relationship between flow and North American green sturgeon year class strength has not yet been determined.

The installation of the Shasta Dam temperature control device in 1997 is thought to have improved the situations related to high water temperatures in the upper Sacramento River, although Shasta Dam has a limited storage capacity and cold water reserves could be depleted in long droughts. Water temperatures at RBDD have not been higher than 62 °F since 1995 and are within the North American green sturgeon egg and larvae optimum range for growth and survival of 59 to 66 °F (Mayfield and Cech 2004). Conversely, CDFG (2002c) has indicated that water temperatures may be inadequate for spawning and egg incubation in the Feather River during many years as the result of releases of warmed water from Thermalito Afterbay. It is likely that high water temperatures (greater than 63 °F) may deleteriously affect sturgeon egg and larval development, especially for late-spawning fish in drier water years (70 FR 17386).

Non-native species are an ongoing problem in the Sacramento-San Joaquin River and Delta systems (CDFG 2002c). One risk for North American green sturgeon associated with the introduction of non-native species involves the replacement of relatively uncontaminated food items with those that may be contaminated. For example, the non-native overbite clam, *Potamocorbula amurensis*, introduced in 1988, has become the most common food of white sturgeon and was found in the only North American green sturgeon examined thus far (CDFG 2002c). The overbite clam is known to bioaccumulate selenium, a toxic metal (CDFG 2002c; Linville *et al.* 2002). The significance of this threat to North American green sturgeon is unclear. North American green sturgeon also are likely to experience predation by introduced species including striped bass, but the actual impacts of predation have yet to be estimated (70 FR 17392).

Contamination of the Sacramento River increased substantially in the mid-1970s when application of rice pesticides increased (70 FR 17386). Estimated toxic concentrations for the Sacramento River during 1970-1988 may have deleteriously affected striped bass larvae (Bailey *et al.* 1994). White sturgeon also may accumulate PCBs and selenium (White *et al.* 1989). While North American green sturgeon spend more time in the marine environment than white sturgeon and, therefore, may have less exposure, the Biological Review Team for North American green sturgeon has concluded that contaminants also pose some risk for North American green sturgeon. However, this risk has not been quantified or estimated.

Existing efforts are being carried out to protect North American green sturgeon. The Central Valley Project Improvement Act (CVPIA) is a Federal act directing the Secretary of the Interior to amend previous authorizations of California's Central Valley Project to include fish and wildlife protection, restoration, and mitigation as project purposes having equal priority with irrigation and domestic use, and fish and wildlife enhancement as a project purpose equal to power generation. Since the CVPIA was enacted in 1992, FWS and the U.S. Bureau of Reclamation have led an effort to implement a significant number of activities across the Central Valley including projects such as (1) river restoration, (2) land purchases, (3) fish screen projects, (4) water acquisitions for the environment, and (5) special studies and investigations. The Anadromous Fish Restoration Program (AFRP), a component of the CVPIA, implements a doubling program in an attempt to *"implement a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991."* The AFRP specifically applies the doubling effort toward Chinook salmon, Central Valley steelhead, striped bass, and white and North American green sturgeon. Though most efforts of the AFRP have primarily focused on Chinook salmon as a result of their listing history and status, North American green sturgeon may receive some unknown amount of benefit from these restoration efforts. For example, the acquisition of water for flow enhancement on tributaries to the Sacramento River, fish screening for the protection of Chinook salmon and Central Valley steelhead, or riparian revegetation and instream restoration projects likely would have some ancillary benefits to sturgeon. The AFRP also has invested in one North American green sturgeon research project that has helped improve our understanding of the life history requirements and temporal distribution patterns of North American green sturgeon within the southern DPS (70 FR 17398).

The California Bay-Delta Program (CALFED) is a cooperative effort of more than 20 State and Federal agencies designed to improve water quality and reliability of California's water supply while recovering the Central Valley ecosystem. The CALFED program contains four key objectives, which include water quality, ecosystem quality, water supply and levee system integrity. Many notable beneficial actions have originated and been funded by the CALFED program including such projects as floodplain and instream restoration, riparian habitat protection, fish screening and passage projects, research regarding non-native invasive species and contaminants, restoration methods, and watershed stewardship and education and outreach programs (70 FR 17398). Prior Federal Register notices have reviewed the details of CVPIA and CALFED programs and potential benefits towards anadromous fish, particularly Chinook salmon and Central Valley steelhead (69 FR 33102).

Information received from CALFED regarding potential projects that may serve as conservation measures for North American green sturgeon indicated a total of 118 projects of various types and levels of progress funded between 1995 and 2004. Projects primarily consisted of fish screen evaluation and construction projects, restoration evaluation and enhancement activities, contaminations studies, and dissolved oxygen investigations related to the San Joaquin River Deep Water Ship Channel. Two evaluation projects specifically addressed North American green sturgeon while the remaining projects primarily address anadromous fish in general, particularly listed salmonids. The new North American green sturgeon information from research will be used to enhance our understanding of the risk factors affecting the species, thereby improving our ability to develop effective management measures. However, at present they do not directly help to alleviate threats that this species faces in the wild (70 FR 17398). All ongoing fish screen and passage studies are designed primarily to meet the minimum qualifications outlined by the NMFS and CDFG fish screen criteria. Though these improvements will likely benefit salmonids, there is no evidence showing that these measures will decrease the likelihood of North American green sturgeon mortality. While one of CALFED's goals is to recover a number of at-risk species (including North American green sturgeon) and the program has and continues to provide funding for a variety of laboratory-based research projects, there are no specific actions aimed at alleviating the primary risks that threaten the continued existence of North American green sturgeon in the wild (70 FR 17398).

Other potential conservation measures such as the opening of the RBDD gates have helped North American green sturgeon passage in the Sacramento River during the early part of their spawning season, but it is not known how effective this measure has been. In addition, the fish ladders on RBDD do not allow North American green sturgeon to pass after May 15, when the RBDD gates are closed each year (70 FR 17386). Fish salvaging efforts at the Tracy Fish Collection Facility and the Skinner Delta Fish Protective Facility in the South Delta have been operating for decades, but it is unknown whether efforts to relocate adults have resulted in restoration of spawning potential and whether the salvage of juveniles is effective (70 FR 17398). Other conservation measures targeted at anadromous salmonids, such as improving river thermal and flow regimes, are likely to improve conditions for North American green sturgeon as well (70 FR 17398).

Both white and green sturgeon are protected by the same fishing regulations in the Sacramento-San Joaquin system. No commercial take is permitted and angling take is restricted to one fish per day between 117 and 183 cm TL. An additional closure in central San Francisco Bay occurs between January 1 and March 15, coinciding with the herring spawning season to protect sturgeon feeding on herring eggs (CDFG 2002c). Active sturgeon enforcement often is employed in areas where sturgeon are concentrated and particularly vulnerable to the fishery (70 FR 17397).

The protective efforts described above, when evaluated pursuant to NMFS' "*Policy for Evaluation of Conservation Efforts,*" do not as yet, individually or collectively, provide sufficient certainty of implementation and effectiveness to counter the extinction risk assessment conclusion that the southern DPS of North American green sturgeon is likely to become an endangered species in the foreseeable future throughout its range (70 FR 17398).

IV. ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the current status of the species within the action area. The environmental baseline "includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of

State or private actions which are contemporaneous with the consultation in process" (50 CFR § 402.02).

The lower Yuba River extends approximately 24 miles from Englebright Dam to its confluence with the Feather River. Two tributaries, Deer Creek and Dry Creek, enter the lower Yuba River at about RM 23 and RM 14, respectively. Based on general differences in hydraulic conditions, channel morphology, geology, water conditions, and fish species distribution, Beak Consultants, Inc. (1989) divided the river into four reaches: Narrows Reach, Garcia Gravel Pit Reach, Daguerre Point Dam Reach, and Simpson Lane Reach.

The Narrows Reach extends from Englebright Dam about two miles downstream to the mouth of the narrows canyon. In this reach, the channel is steep and consists of a series of rapids and deep pools confined by a bedrock canyon. Spring-run and fall-run Chinook salmon and steelhead can migrate as far as Englebright Dam, but spawning gravels are scarce in the Narrows Reach.

Downstream of the Narrows Reach, the channel enters the alluvial valley plain where massive quantities of hydraulic mining debris remain from past gold mining operations. The Garcia Gravel Pit and Daguerre Point Dam reaches continue 18.5 miles to the downstream end of the Yuba Goldfields (RM 3.5) near Marysville. These reaches, which contain most of the Chinook salmon and steelhead spawning and rearing habitat in the lower Yuba River, consist of alternating pools, runs, and riffles with predominantly cobble and gravel substrates. Daguerre Point Dam, located at RM 11.5, marks the boundary between the Garcia Gravel Pit and Daguerre Point Dam reaches. The Garcia Gravel Pit Reach generally provides greater habitat complexity than the Daguerre Point Dam Reach, including greater development of bar complexes, side channels, and shaded riverine aquatic (SRA) cover. The channel downstream of Daguerre Point Dam tends to be more uniform with a lower proportion of bar complexes and riffles. The lower 3.5 miles of the lower Yuba River (*i.e.*, Simpson Lane Reach) are subject to the backwater influence of the Feather River. The streambed in this reach is dominated by finer-grain sediments and lower abundance of gravels and cobbles. This area is used primarily as a migratory corridor by listed salmonids and as a rearing area when water temperatures are suitable.

A. Status of the Listed Species and Designated Critical Habitat within the Action Area

1. <u>Central Valley spring-run Chinook salmon</u>

The Central Valley spring-run Chinook salmon is Federally-listed as threatened. Part of the significance of the Yuba River fishery is that it supports natural reproduction which is not augmented with hatchery transplants, although CDFG did conduct a one-time stocking of a small number of juvenile spring-run fish from the Feather River Hatchery into the Lower Yuba River in 1980 (CDFG 1991).

Little is known about the size of the spring-run Chinook salmon population in the Lower Yuba River. Recent spawning surveys and adult monitoring at the fish ladders on Daguerre Point Dam conducted by CDFG have detected a small population of spring-run Chinook salmon (fish that enter the river in spring and early summer and that begin spawning in early September). A 2001 study conducted by CDFG (2002d) attempted to quantify the number of adult spring-run Chinook salmon immigrating into the Yuba River. This study was conducted from March 1, 2001, through July 31, 2001, which is considered the primary historical migration period for spring-run Chinook salmon. Adult Chinook salmon were trapped in the fish ladders located on Daguerre Point Dam. A total of 108 adult Chinook salmon were estimated to have passed the dam during this period (CDFG 2002d). Recent installation of infrared and videographic sampling equipment at Daguerre Point Dam is expected to substantially contribute to the current understanding of the number and timing of immigration of spring-run Chinook salmon. In the spring of 2004 (the first spring that this equipment was fully operational) a total of 413 adult Chinook salmon were detected migrating up past Daguerre Point Dam from April through June (CDFG, unpublished data). The migration timing and location of these fish indicate that they were all Central Valley spring-run Chinook salmon.

Spawning and carcass surveys conducted by private consultants funded by YCWA have likewise detected the persistence of spring-run Chinook salmon in the Yuba River, although none of these reports provided population estimates specifically for spring-run Chinook salmon.

According to CDFG, for 1999, spawning occurred in the 10-mile reach from the Narrows Reach to Daguerre Point (*i.e.*, Garcia Gravel Pit Reach) during the last three weeks of September. In 2000, spawning was initiated the first week of September, evidenced by a total of 205 redds found in the lower Yuba River (CDFG 2002d). In 2001, spawning also was initiated the first week of September, evidenced by a total of 288 redds.

In addition to CDFG studies, FWS is currently engaged in an effort to collect information for an Instream Flow Incremental Methodology (IFIM) study in the lower Yuba River. Data on the geographical location and bathymetric distribution of 168 spring-run Chinook salmon redds was collected on September 16 to 17, September 19 and September 23 to 26, 2002. The observed 168 redds were located in the Garcia Gravel Pit Reach.

Congregations of adult Chinook salmon (approximately 30 to 100 fish) have been observed in the outlet pool at the base of Narrows II Powerhouse, generally in late August or September when the powerhouse is shut down for maintenance, and the pool becomes clear enough to see the fish (Michael Tucker, NMFS, pers. obs., September, 2003; Steve Onken, YCWA, pers. comm., April, 2004). While it is impossible to visually distinguish spring-run from fall-run Chinook salmon in this situation, the fact that these fish are congregated this far up the river at this time of year makes it likely that some of them are spring-run Chinook salmon. This documented holding site is directly adjacent to the proposed construction site for this project.

In general, the current data indicate that adult escapement of spring-run Chinook salmon is low and has been greatly reduced from historic levels. Historic accounts of spring-run populations on the Yuba River prior to the impacts caused by gold mining, dam construction and water diversions, show that large numbers of spring-run Chinook salmon were taken by miners and Native Americans as far upstream as Downieville on the North Yuba River, and that during the construction of the original Bullards Bar Dam (1921-1924), so many salmon congregated and died below the dam that they had to be burned (Yoshiyama *et al.* 1996). Due to their presence high up in the watershed, Yoshiyama (1996) concluded that these fish were spring-run Chinook salmon.

2. Central Valley steelhead

The Central Valley steelhead is Federally-listed as threatened. Part of the significance of the Yuba River population is that it supports natural reproduction which is no longer augmented with hatchery fish (McEwan and Jackson 1996). As with the spring-run Chinook salmon, there has been very little information published on population trends and absolute abundance of steelhead in the Yuba River. The vast majority of spawning and rearing habitat for steelhead in the Yuba River was first impacted by gold mining activities and then totally cut off by Englebright Dam. Prior to construction of Englebright Dam, fisheries biologists for CDFG stated that they observed large numbers of steelhead spawning in the uppermost reaches of the Yuba River and its tributaries (CDFG 1998; Yoshiyama *et al.* 1996).

As steelhead have been heavily affected by mining operations and dam construction on the Yuba River since the 1800s, the steelhead population likely has been relatively small since that time. CDFG estimated a spawning population of only about 200 fish annually prior to 1969. During the 1970s, CDFG annually stocked hatchery steelhead from Coleman National Fish Hatchery into the lower Yuba River, and by 1975 estimated a run size of about 2,000 fish (CDFG 1991). Since 1975, the run size has not been estimated, but is believed to be "stable" and supports a significant recreational fishery. CDFG stopped stocking steelhead into the lower Yuba River in 1979, and currently manages the river to protect natural steelhead through strict "catch-and release" fishing regulations.

3. Central Valley Spring-run Chinook Salmon and Steelhead - Designated Critical Habitat

Because the habitat requirements and conditions are similar for spring-run Chinook salmon and steelhead in the lower Yuba River, descriptions of the status of critical habitat for the two species will be discussed together in this section. Much of following information on salmonid habitat conditions in the lower Yuba River was taken *verbatim* from the draft Implementation Plan for Lower Yuba River Anadromous Fish Habitat Restoration, prepared by the Lower Yuba River Fisheries Technical Working Group (LYRFTWG 2005).

a. *Spawning Habitat*

The vast amounts of hydraulic mining debris deposited in the lower Yuba River's channel and floodplain a century ago, and the lack of the gravel recruitment caused by Englebright Dam continue to have a dominant influence on the geomorphic character and processes of the lower Yuba River. Because of large quantities of unconsolidated cobbles and gravels, the lack of extensive riparian forests, and confinement of the active river corridor by dredge tailings, high winter flows continue to cause extensive channel migration and erosion of bars and dredger tailings along the lower Yuba River.

The Narrows Reach is steep and consists of a series of rapids and deep pools confined by a bedrock canyon. Spawning gravels are scarce in the Narrows Reach because of the lack of upstream gravel recruitment that resulted from the construction of Englebright Dam, and the high-energy nature of this reach. Spring-run Chinook salmon and steelhead can migrate as far as Englebright Dam, but because spawning gravels are scarce in the Narrows Reach, spawning activity in that reach is severely limited. Conversely, downstream of the Narrows Reach, spawning gravels are abundant and generally of high quality throughout the Garcia Gravel Pit and Daguerre Point Dam Reaches. Spawning gravels have been supplied to the river largely from local sources including deposition of hydraulic mining debris in the riverbed between the mid-1800s and 1941 (Beak 1989). In the Garcia Gravel Pit and Daguerre Point Dam Reaches spawning gravel consists of unconsolidated cobbles and gravels and occurs in the existing bars and dredge tailings. Much of this material is within the preferred size range for spawning fall-run Chinook salmon (*O. tshawytscha*).

b. *Physical passage impediments*

Physical passage impediments at Daguerre Point Dam may delay or prevent the upstream migration of adult spring-run Chinook salmon and steelhead in the lower Yuba River. Daguerre Point Dam includes suboptimal ladder design and sheet flow across the dam spillway that may obscure attraction to ladder entrances, particularly during high flow periods (January through March). The ladder entrances are located where the overflow from the spillway makes it difficult for adults to find the entrances. Both ladders, particularly the south ladder, tend to clog with woody debris and debris from gravel buildup that can block passage or substantially reduce attraction flows. The north and south ladders' exit are close to the spillway, which potentially causes fish to be carried back over the dam.

c. *Habitat Complexity and Diversity*

The geomorphic conditions caused by hydraulic and dredge mining since the mid-1800s continue to limit the extent of riparian vegetation along the lower Yuba River. Although the ability of the lower Yuba River to support riparian vegetation has been substantially reduced by the historic perturbations from mining activities, the dynamic nature of the river channel results in periodic creation of high-value SRA cover for fish and wildlife. SRA cover generally occurs in the lower Yuba River as scattered, short strips of low-growing woody species (*Salix spp.*) adjacent to the shoreline. The most extensive and continuous segments of SRA cover occur along bars where recent channel migrations or avulsions have cut new channels through relatively large, dense stands of riparian vegetation (Beak 1989).

At present, large quantities of unconsolidated cobble and gravel and active channel migration limit the extent of riparian vegetation adjacent to the river. In 1986, riparian vegetation was present along 44 percent of the Garcia Gravel Pit Reach, 72 percent of the Daguerre Point Dam Reach, and 78 percent of the Simpson Lane Reach (Beak 1989). Downstream of Parks Bar, most riparian vegetation occurs as remnant strips along the main channel, side channels, and backwater reaches of the river. During spring snorkeling surveys of the lower Yuba River over the last several years, juvenile Chinook salmon were observed exhibiting a strong preference for nearshore areas with instream woody cover. Thus, the reduction of the lower Yuba River's ability to support riparian vegetation and SRA cover potentially affects spring-run Chinook salmon and steelhead juvenile rearing.

d. *Water Temperatures*

Elevated water temperatures during May through October are among the primary factors believed to be affecting the lower Yuba River spring-run Chinook salmon and steelhead populations. This period can encompass parts of the spring-run Chinook salmon and steelhead adult immigration and holding periods, the primary spring-run Chinook salmon spawning period and a significant portion of the juvenile rearing and outmigration periods for these two species in the lower Yuba River. Elevated water temperatures below Daguerre Point Dam may result in delayed upstream migration, resulting in later and less successful spawning, incubation and emergence (*e.g.*, decreased fertilization, increased egg retention, reduced embryo viability, presence of abnormalities in the emergent fry), particularly during critical dry years.

4. Southern DPS of North American Green Sturgeon

Despite extensive salmonid monitoring activities in the Yuba River over the last decade, only two adult sturgeon (unconfirmed species but believed to be white sturgeon) have been documented in the lower Yuba River (Bill Mitchell, Jones and Stokes, pers. comm., 2004). Both were observed holding in the large hole below Daguerre Point Dam (RM 12) during the 1990s. Additional unconfirmed sightings of adult sturgeon (species unknown) have been periodically reported to CDFG in recent years (Ian Drury, CDFG, pers. comm., 2005). Although there is a fish ladder at Daguerre Point Dam, it was designed for salmonid passage and it is believed that adult sturgeon are unable to ascend the structure. Periodic monitoring of these ladders for adult salmonid passage, including the use of a Vaki River Watcher system since July 2003, has detected no sturgeon passing up the ladders. Since 1999, rotary screw traps have been operated periodically at several locations in the lower Yuba River. No sturgeon have ever been observed in any of those trapping efforts (Ian Drury, CDFG, pers. comm., 2005).

Although there is very little indication that North American green sturgeon are present in the Yuba River, there are no physical impediments preventing green sturgeon from reaching the lower river (below Daguerre Point Dam) and the river does provide some of the primary constituent elements necessary for green sturgeon spawning and rearing (deep, fast water, large pools, and cool water temperatures). It is therefore assumed that North American green sturgeon may now, or could in the future, inhabit the Yuba River.

B. Factors Affecting Listed and Proposed Species Environment within the Action Area

1. Gold Mining

A massive influx of sediment from hydraulic and dredge mining in the lower Yuba River during the late 1800s and early 1900s caused dramatic changes in critical habitat including channel course, geometry, and bed elevation. Since that time, the river has incised into the debris plain downstream of the Narrows Reach and has changed from an unstable, braided channel to a relatively stable, single-thread channel (Beak Consultants, Inc. 1989). However, because the channel and floodplain below the Narrows Reach are still dominated by unconsolidated cobble and gravel substrates, occasional, extremely high winter flows can result in active channel migration, especially in the Garcia Gravel Pit Reach. Occasional channel migration and bed disturbance is generally considered to be beneficial to salmonid spawning success as it cleans the spawning gravels and recruits new gravel into the river.

Hydraulic mining practices during the late 1800s and early 1900s introduced vast quantities of silt and sediment to the river throughout much of the year, including the spawning and incubation periods for Chinook salmon, steelhead and green sturgeon. It is likely that these sediment loads greatly impacted the primary constituent elements of critical habitat, devastating early life stages of salmonids and sturgeon as the fine sediments would have settled over incubating eggs and pre-emergent fry suffocating these fish. Gold mining also introduced mercury to the river as a waste product of the gold amalgamation process (Beak Consultants, Inc. 1989). Although mercury has been found to be extremely toxic in its methylated form, no specific studies have been conducted to determine the current effects of mercury on salmon and steelhead in the Yuba River.

Extensive dredger tailings occur along the lower Yuba River in an area known as the Yuba Goldfields. Past and ongoing gold dredging operations in this area have resulted in loss of fine-grained sediments and creation of porous and uniform deposits of cobbles and gravels. The Goldfields contain a network of dredger ponds and channels connected hydraulically by surface and subsurface flows. This area, along with other large areas of mining debris deposits along the lower Yuba River absorb and retain water during periods of high flows and/or precipitation and can release that water in the form of underflow that persists through the dry months and contributes to river flows through lateral accretion. This slow release of underflow is beneficial to salmonids and sturgeon as it helps to reduce water temperatures and increases the amount of suitable habitat during low reservoir releases.

2. Daguerre Point Dam

Since its construction in 1906, Daguerre Point Dam has been a complete barrier to North American green sturgeon and caused varying degrees of passage problems for salmonids. For many years, there were no functional ladders and the dam was a total barrier to upstream migration, which likely decimated salmonid populations on the Yuba River as there was very little suitable spawning habitat below the dam (CDFG 1991). Fish passage was improved with the installation of new ladders in 1950, but the dam is still a complete barrier to green sturgeon and passage is considered inadequate for Chinook salmon and steelhead throughout much of the year. Under current conditions, adult salmonid passage is severely impaired when major runoff events create high flow conditions at the dam, which is often the same period when spring-run Chinook salmon and steelhead are attempting to migrate upstream to their spawning areas. The angle of the entrance orifices and proximity to the plunge pool also make it difficult for fish to find the entrances to the ladders. This passage problem may lead to injury, delayed migration, and/or pre-spawning mortality.

Upstream passage at Daguerre Point Dam also occasionally has been adversely impacted when sediment has built up near the upstream exit of the fish ladders. Normal geofluvial action has, in the past, caused gravel to build up on the upstream side of the dam where it can impede flows into the ladders, thereby reducing the ability of fish to climb the ladders and reducing the attraction flow coming out at the base of the ladders. In addition, the gravel bars have built up to the point where they greatly reduce access to the main channel for fish that have exited at the top of the ladders and are attempting to continue their upstream migration.

Juvenile salmonids have also been adversely affected by Daguerre Point Dam on their downstream migration. The large plunge pool at the base of the dam creates an area of unnatural advantage for predatory fish such as Sacramento pikeminnow *(Ptychocheilus grandis)*, largemouth bass, striped bass, American shad (*Alosa sapidissima*), and adult rainbow trout/steelhead which reside in or seasonally inhabit this section of the Yuba River. The deep pool provides excellent ambush habitat for predators in an area where juvenile salmonids can be disoriented after plunging over the face of the dam into the turbulent waters at the base, making them highly vulnerable to predation.

3. Englebright Dam

The Corps built Englebright Dam in 1941, at the beginning of the Narrows Reach (RM 21.9) of the Yuba River, just below the confluence of the North, Middle and South Yuba rivers. Similar to Daguerre Point Dam, Englebright Dam was built to stabilize hydraulic mining debris in the Yuba River. Englebright Dam, therefore, was built without an outlet at the base of the dam.

Englebright Dam blocks upstream migration of fish in the lower Yuba River and, in particular, blocks the migration of steelhead and spring-run Chinook salmon to their historic spawning grounds (NMFS 2002a). By forcing steelhead and spring-run Chinook salmon to oversummer in the lower Yuba River, they have been subjected to unsuitably warm summer and fall water temperatures which cause reduced fecundity and egg survival, increased susceptibility to disease, and increased mortality rates (CDFG 1991; JSA 1992). Because there was no significant storage devoted to the lower Yuba River before the construction of New Bullards Bar Dam, there was little water available in the summer and fall to support critical habitat for juvenile steelhead and spring-run Chinook salmon summer rearing, or adult spring-run Chinook salmon summer holding and fall spawning in the lower Yuba River. Although the operation of New Bullards Bar Dam has generally improved water temperatures in the lower Yuba River, there are still periods when temperatures climb well above the preferred levels in much of the designated critical habitat. The construction of Englebright Dam also upset the natural geofluvial process resulting in decreased recruitment of other primary constituent elements to critical habitat such as gravel and large woody debris to the lower river.

4. Trans-Basin Diversions

Three projects divert or consume significant amounts of water from the upper Yuba River watershed. Oroville-Wyandotte Irrigation District, via its South Fork Project, diverts water from Slate Creek (a tributary to the North Yuba River), to the South Fork Feather River. PG&E's South Yuba Canal diverts water from the South Yuba River, some of which is consumptively used by the Nevada Irrigation District (NID) and some of which is released into the Bear River watershed. These diversions also support NID's Yuba-Bear Hydroelectric Project. PG&E's Drum-Spaulding Project diverts water, via the Drum Canal, to the Drum Forebay. If that water is used at PG&E's Drum Powerhouse, it is released to the Bear River watershed. If the water is not used, it is released to Canyon Creek (a tributary of the north fork of the North Fork American

River), where it is eventually used for consumptive purposes by Placer County Water Agency and other entities.

The annual amount of water that these projects collectively divert from the Yuba River watershed ranges between 589,000 AF in wetter years, which would equate to approximately 17.3 percent of unimpaired runoff in wet years, and 267,000 AF in drier years which would equate to approximately 31.1 percent of unimpaired runoff in critical years (SWRCB 2000). The impact of these diversions on water availability in the lower Yuba River is particularly high during the April through September period for snowmelt runoff, reaching an average of 43.2 percent of the runoff in critical years. A computer simulation of the hydrologic conditions in 1931 shows that these diversions would have consumed approximately half of the unimpaired runoff in that type of a drought year (SWRCB 2000).

The diversion of this water out of the Yuba River, particularly in dry and critical years, reduces the ability of operators in the lower Yuba River (specifically YCWA) to maintain suitable water temperatures and flows necessary to support healthy juvenile steelhead, spring-run Chinook salmon and North American green sturgeon rearing, and adult spring-run holding and spawning in the lower Yuba River.

5. Historic Flow Fluctuations from Pacific Gas and Electric Company Hydropower Operations

PG&E built Narrows I Powerhouse just below Englebright Dam in the early 1940s. Narrows I Powerhouse draws water from Englebright Reservoir and, thus, provides an alternative to the release of spill water over the crest of Englebright Dam. Several times during the late 1950s, PG&E drew water from Englebright Reservoir to generate power at Narrows I Powerhouse in October, during the period when adult Chinook salmon were returning to the Yuba River to spawn (Wooster and Wickwire 1970). PG&E's releases attracted adult Chinook salmon in the lower Yuba River, but most of them were stranded, and subsequently died when PG&E altered its releases, and there was no water left in the lower Yuba River. Significant losses of adult Chinook salmon occurred as a result of these operations in several years. In 1960, several parties, including PG&E and CDFG, reached an agreement to prevent similar fish losses in future years. Under that agreement, CDFG agreed to install a temporary barrier across the lower Yuba River's mouth before September 7 in order to prevent Chinook salmon from entering the Yuba River "*until October 15, when adequate transportation and spawning flows are provided*" (Wooster and Wickwire 1970). While this measure may have helped in protecting fall-run Chinook salmon, it would not have provided any protection for spring-run Chinook salmon, as they would have entered the river long before September 7, and would therefore have been exposed to all of the adverse conditions that occurred in the river during the late summer and fall. These practices were halted following the construction of New Bullards Bar Dam because the new reservoir provided enough storage to insure adequate fall flows in most years.

6. Irrigation Diversions

There are three significant water diversions associated with Daguerre Point Dam that have a combined diversion capacity of 1,085 CFS. For many years these diversions were completely unscreened, allowing large numbers of juvenile salmonids to be entrained into the canals where they had little chance of survival. The three diversions are the Brown's Valley Diversion, the South Yuba-Brophy diversion and the Hallwood-Cordua diversion. Recent efforts to reduce the loss of juvenile salmonids at these diversions have led to the construction of fish exclusionary devices at each diversion. At the Brown's Valley Diversion, a fully compliant positive barrier fish screen was built in 1999. In coordination with NMFS and CDFG, a nearly compliant positive barrier fish screen was built at the Hallwood-Cordua diversion in 2001, meeting as many of the necessary criteria as was reasonable, given the location of the structure and the urgency in which it was built. No recent improvements have been made at the South Yuba-Brophy diversion, where a porous rock weir that was built in 1984 serves as the only protection against entrainment of listed salmonids. This structure fails to meet many of the critical criteria developed by NMFS and CDFG for adequate fish screen operation and fish safety.

7. New Bullards Bar Reservoir

The commencement of operations at New Bullards Bar Reservoir in 1970 altered the lower Yuba River streamflow regime by reducing late-winter and spring snowmelt runoff flows, while providing higher, cooler, and more stable streamflows during the summer and fall. YCWA water rights include the right to directly divert a total of 1,550 cfs for irrigation and other uses, and to divert a total of 960,000 AF to storage from October 1 to June 30 in New Bullards Bar Reservoir for subsequent irrigation and other uses (SWRCB 1994). Under an existing power purchase agreement between PG&E and YCWA, PG&E can require the release of water from New Bullards Bar Reservoir for power generation based on monthly quotas and available storage in the reservoir above an established index or "critical level."

Operation of New Bullards Bar Reservoir improved conditions for salmonids in the lower Yuba River by providing cooler water temperatures and more reliable flows in the summer and fall, with post-New Bullards Bar Reservoir summer temperatures being up to 10 °F lower than pre-New Bullards Bar Reservoir temperatures (YCWA *et al.* 2000). A 1984 CDFG field memorandum (CDFG 1984) stated:

> *Water released into the lower Yuba River is colder than before construction of New Bullards Bar Dam. One reason is that Englebright Dam . . . is now kept full for maximum head on power generating facilities. Water released for power generation comes from cool deep levels of this lake. Another reason is the large volume of cold water stored in New Bullards Bar Reservoir. New Bullards Dam is equipped with facilities to release water from several levels in the reservoir allowing releases of cold water from the depths all summer long. This cold water forms a density current along the bottom of Englebright and is reflected in downstream release temperatures.*

The alteration of the natural flow regime in the lower Yuba River due to the filling, pooling, and emptying of New Bullards Bar Reservoir may also have adverse affects on salmonids including disrupting the cues used by these fish to determine timing of adult upstream migration and spawning as well as juvenile out-migration and rearing habitat selection.

8. Minimum Instream Flow Requirements

For the period from initial operation of the YRDP until March 1, 2001, minimum instream flow requirements were set by the Federal Power Act (FPA) license, which incorporated minimum instream flow requirements from YCWA's 1965 agreement with CDFG. On March 1, 2001, the SWRCB adopted D-1644, which imposed higher instream flow requirements for the lower Yuba River. On July 16, 2003, following a court challenge to D-1644, the SWRCB adopted RD-1644 without any significant changes from the previous order. Most of the parties to the SWRCB's hearing process and the subsequent State court litigation are engaged in settlement discussions, which are expected to result in different minimum flow requirements for the lower Yuba River some time in the near future (possibly as early as 2005).

While there is uncertainty regarding the precise minimum flow regime that will be mandated for the project in future years, the historic flow regimes are known. YCWA's FPA license governed minimum flows from the commencement of operations in 1970 until March 1, 2001. Those flow requirements are shown in Table 1. Minimum instream flow requirements which have been in place from March 1, 2001, until the present are shown in Table 2.

Table 1. Lower Yuba River instream flow requirements (cfs), 1970 - March 1, 2001.

Time Period	Flow Requirements Below Daguerre Point Dam
January 1 - June 30	245 cfs
July 1 - September 30	70 cfs
October 1 - December 31	400 cfs

Table 2. Interim instream flow requirements.

Period	Wet & Above Normal Years (cfs)		Below Normal Years (cfs)		Dry Years (cfs)		Critical Years (cfs)	
	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage	Smartville Gage	Marysville Gage
Sep 15-Oct 14	700	250	550	250	500	250	400	150-250
Oct 15-Apr 20	700	500	700	500	600	400	600	400
Apr 21-Apr 30	--	1,000	--	900	--	400	--	400
May 1-May 31	--	1,500	--	1,500	--	500	--	270-280
Jun 1	--	1,050	--	1,050	--	400	--	(see note)
Jun 2-Jun 30	--	800	--	800	--	400	--	(see note)
Jul 1	--	560	--	560	--	280	--	(see note)
Jul 2	--	390	--	390	--	250	--	(see note)
Jul 3-Sep 14	--	250	--	250	--	250	--	100

Table Note: The interim instream flow requirements for June 1-30 of critical years shall be 245 cfs pursuant to the provisions of the agreement between YCWA and CDFG dated September 2, 1965, except if a lower flow is allowed pursuant to the provisions of the 1965 agreement. The minimum flow on July 1 shall be 70 percent of the flow on June 30, and the minimum flow on July 2 shall be 70 percent of the flow on July 1 (Source: D-1644, pg. 175).

Because these new instream flow standards have been in place for a short period of time, their actual effect on critical habitat and salmonid and green sturgeon populations is not yet known. However, the intent of the SWRCB in instituting these requirements was to provide significant improvement in flows, water temperatures and resultant critical habitat conditions for anadromous fish in the lower Yuba River, when compared to the previous requirements (SWRCB 2003).

9. Flow Reductions and Fluctuations

Flow reductions resulting from normal maintenance and emergency operations of Narrows I and II Powerhouses have been a major concern in recent years because of potential adverse flow and temperature effects on listed spring-run Chinook salmon and steelhead. The ability to manage releases from Englebright Dam during maintenance and emergency operations is limited by the design of Englebright Dam and the bypass capability of Narrows I and Narrows II Powerhouses. The only way to pass water from Englebright Reservoir downstream is to discharge water through Narrows I and Narrows II Powerhouses, or to spill water over the top of the dam. Because Englebright Dam was originally designed as a debris dam, there is no other outlet on the dam to bypass water. Currently, Narrows I can bypass the maximum generating capacity of the plant (650 cfs) in the event of a shut-down. Narrows II has a maximum generating capacity of 3,400 cfs and a bypass capability of only 650 cfs.

a. *Planned Maintenance Shutdowns*

Maintenance activities at Narrows II include generator brush replacement, which requires a 6-hour shut-down 2-3 times per year, and annual maintenance, which typically requires a 2-3-week shut-down but can be longer if major maintenance is needed. During brush replacement, the 650 cfs bypass valve at Narrows II can be opened. During annual maintenance, the Narrows II bypass valve usually cannot be operated, and Narrows I is used to maintain instream flows. Consequently, in the absence of water spilling over the top of Englebright Dam, flows in the river must be reduced to a maximum of 650 cfs for several days to several weeks, depending on the type of maintenance. YCWA schedules annual maintenance activities during periods when the potential for redd dewatering and fish stranding is lowest (late August to mid-September), as determined by redd and fish stranding surveys.

b. *Low-Flow Shutdowns*

In addition to maintenance outages, low-flow shutdowns (outages) at Narrows II Powerhouse can occur when streamflows in the lower Yuba River are below 650 cfs. During such times, YCWA's and PG&E's coordinated operation of Narrows I and Narrows II Powerhouses result in releases to the lower Yuba River being made exclusively by Narrows I Powerhouse. Low-flow outages at Narrows II Powerhouse, therefore, generally do not involve significant fluctuations in lower Yuba River streamflows.

c. *Unplanned Outages*

Short-term emergency outages at Narrows II Powerhouse most typically result from electrical transmission line faults (caused by birds, trees, lightning strikes, storms) or plant malfunction. Depending on the cause of the outage, Narrows II Powerhouse flow can be reduced to somewhere between 0 and 650 cfs (the capacity of the Narrows II Powerhouse bypass) for a period of minutes to one or more hours. The frequency of these types of outages has ranged from none to several in a year, with an annual average of about two per year. Corrective actions have been taken by both YCWA and PG&E to minimize future outages of this type. Unplanned outages can result in flow reductions of as much as 3,400 cfs but the extent of downstream flow impact depends on pre-outage flow conditions and the type of outage.

With the current facilities and under the current operation protocols, a long-term emergency outage at Narrows II Powerhouse could result from a catastrophic failure of the PG&E transmission system linking the plant to the transmission grid, a major component failure at Narrows II Powerhouse, or a broad-range natural disaster such as earthquake or fire. Depending on the failure type, there could be no flow through Narrows II Powerhouse, 650 cfs if the bypass can be operated, or up to 1,350 cfs if the bypass and Narrows I Powerhouse can be operated concurrently. If an emergency outage was expected to be of long duration, there would be some potential for releasing additional water from Englebright Reservoir, including installing temporary siphons over the dam, or allowing spills over the dam crest. However, it should be noted that these interim measures may not be feasible, or may have other direct impacts, depending on the nature and timing of the outage.

Although these types of long-term emergency outages are very rare, they could last from days to months. Historically, there has been one of these outages in the 30 years since Narrows II Powerhouse has been in operation. However, flow reductions were not associated with this particular outage because it occurred during the annual maintenance period when water did not flow through Narrows II Powerhouse.

d. *Outage Impacts*

The outages at Narrows II Powerhouse described in sections a, b, and c, above do not necessarily result in flow fluctuations in the lower Yuba River that equal the amount of the fluctuation in Narrows II Powerhouse releases. Changes in releases from Englebright Reservoir are attenuated by the geomorphic characteristic of the lower Yuba River channels. Just below Englebright Dam there is a large pool, called the Narrows Pool which naturally attenuates fluctuations in releases from Englebright Reservoir. Also, the majority of the lower Yuba River's bed and banks are formed by loose, unconsolidated cobble that was washed downstream from hydraulic gold mining in the mid-1800s. These cobble banks have significant water storage capacity, and release water when the river level drops and absorb water when the river level increases. One example of downstream flow reduction attenuation is represented by an event that occurred on May 22, 1999. On that day, flow from Englebright Reservoir to the lower Yuba River dropped by 72 percent (*i.e.*, 1,727 cfs), although the resultant maximum flow reduction at the Marysville Gage, which is located 14 miles downstream, was only about seven percent (*i.e.*, 152 cfs) of the base flow.

Nonetheless, an unconfirmed report from an angler on the Yuba River during an uncontrolled flow reduction due to an unexpected outage at Narrows II on April 23, 1998, stated that he saw "hundreds of dead fish in a side channel" less than one mile upstream from the Highway 20 bridge (JSA 1998). While there have been no scientifically confirmed incidences of salmonid or green sturgeon mortalities on the Yuba River caused by uncontrolled flow reduction due to unexpected outages at Narrows II, Hunter (1992) documented extensive impacts caused by this type of flow fluctuations on other rivers including stranding of juvenile and adult fish, dewatering of spawning areas, and elevation of water temperatures.

10. Riparian Vegetation

Large woody debris, SRA and other components of a healthy riparian corridor are primary constituent elements of critical habitat for salmonids as they are important features for the health and survival of riverine fish. Juvenile salmonids and green sturgeon depend on such habitat for resting and avoidance of predators as well as the food source provided by the many aquatic invertebrates associated with this vegetative material. Healthy riparian cover also helps to shade the stream, providing cooler water temperatures and cover for adults.

The deposition of hydraulic mining debris, subsequent dredge mining, and loss/confinement of the active river corridor and floodplain of the lower Yuba River which started in the mid-1800s and continues to a lesser extent today, has greatly impacted critical habitat by eliminated much of the riparian vegetation along the lower Yuba River. In addition, the large quantities of cobble and gravel that remained generally provided poor conditions for re-establishment and growth of riparian vegetation. Construction of Englebright Dam also inhibited regeneration of riparian vegetation by preventing the transport of any new fine sediment, woody debris, and nutrients from upstream sources to the lower river. Subsequently, mature riparian vegetation is sparse and intermittent along the lower Yuba River, leaving much of the bank areas unshaded and lacking in large woody debris. This loss of riparian cover has greatly diminished the value of the rearing sites in this area, thereby reducing the critical habitat conservation value to listed salmonids and green sturgeon in the lower Yuba River

11. Predation

The introduction of non-native predatory fish to the lower Yuba River has caused an increase in predation impacts on salmonids and green sturgeon in this system. Striped bass, American shad, largemouth bass, and smallmouth bass (*Micropterus dolomieui*) are some of the non-native species which have been introduced to the Yuba River and which are known to prey on juvenile salmonids. In addition to these introduced species there are several native fishes which also prey on juvenile salmonids, such as Sacramento pikeminnow, hardhead (*Mylopharodon conocephalus*) and adult rainbow trout/steelhead.

Englebright and Daguerre Point Dams exacerbate the impacts of predation on juvenile salmonids in the Yuba River. Englebright Dam completely blocks access to the cold water habitat in the upper basin where temperature conditions are inhospitable to warm water predators such as bass and pikeminnow and where juvenile salmonids could otherwise hatch and rear in areas relatively free of these predators. Daguerre Point Dam, as discussed above, tips the natural balance in the favor of the predators by creating an unnatural condition below the dam where predators are provided excellent ambush habitat in an area where juvenile salmonids are disoriented after plunging over the face of the dam into the deep pool below.

12. Poaching

Poaching of salmon has been a long standing problem on the Yuba River, particularly at Daguerre Point Dam (John Nelson, CDFG, pers. comm., November 2000). Poaching within the fish ladders and downstream of the dam occurs when fish become concentrated in the area due to delayed passage. Most poached fish likely are fall-run salmon as they are by far the largest run on the river. However, since the spring-run Chinook salmon are in the river during the period of highest recreational use (spring and summer), there is a greater potential for people to encounter these fish and because the current population is very small, the loss of any pre-spawned adults could cause a significant adverse impact.

V. EFFECTS OF THE ACTION

Pursuant to section 7(a)(2) of the ESA (16 U.S.C. §1536), Federal agencies are directed to ensure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. This biological opinion assesses the effects of the YRDP License Amendment for FERC License Number 2246 on Central Valley spring-run Chinook salmon and Central Valley steelhead. The proposed YRDP License Amendment for FERC License Number 2246 is likely to adversely affect listed species and critical habitat through temporary construction impacts and long-term flow management.

Regulations that implement section 7(b)(2) of the ESA require biological opinions to evaluate the direct and indirect effects of Federal actions and actions that are interrelated with or interdependent to the Federal action to determine if it would be reasonable to expect them to appreciably reduce listed species' likelihood of surviving and recovering in the wild by reducing their reproduction, numbers, or distribution (16 U.S.C. §1536; 50 CFR 402.02), or destroying or adversely modifying critical habitat (16 U.S.C. §1536).

A. Approach to the Assessment

NMFS generally approaches "jeopardy" analyses in a series of steps. First, we evaluate the available evidence to identify the direct and indirect physical, chemical, and biotic effects of proposed actions on individual members of listed species or aspects of the species' environment (these effects include direct, physical harm or injury to individual members of a species; modifications to something in the species' environment - such as reducing a species' prey base, enhancing populations of predators, altering its spawning substrate, altering its ambient temperature regimes; or adding something novel to species' environment - such as introducing exotic competitors or disruptive noises). Once we have identified the effects of an action, we *evaluate the available evidence to identify a species' probable response (including behavioral* responses) to those effects to determine if those effects could reasonably be expected to reduce a species' reproduction, numbers, or distribution (for example, by changing birth, death, immigration, or emigration rates; increasing the age at which individuals reach sexual maturity; decreasing the age at which individuals stop reproducing; *etc.*). We then use the evidence available to determine if these reductions, if there are any, could reasonably be expected to appreciably reduce a species' likelihood of surviving and recovering in the wild.

The regulatory definition of adverse modification has been invalidated by the courts. Until a new definition is adopted, NMFS will evaluate destruction or adverse modification of critical habitat by determining if the action reduces the value of critical habitat for the conservation of the species.

To conduct this assessment, NMFS examined an extensive amount of information from a variety of sources. Detailed background information on the status of these species and the potential effects of this project on these species has been taken from a number of documents including peer reviewed scientific journals, primary reference materials, government and non-government reports, project-specific environmental reports, and project meetings.

B. Assessment

The dominant effect of the structural and operational changes to the YRDP proposed in this project would be to improve overall conditions for listed salmonids by reducing the potential for severe flow reductions and fluctuations to adversely affect these species in the lower Yuba River. Installation of the full-flow bypass will also provide increased flexibility in management of flows in the lower river, which could provide additional benefits to salmonids and green sturgeon.

1. <u>Construction Effects</u>

Adverse construction-related effects on and critical habitat could occur within the immediate construction area as well as downstream from the construction area. Potential impacts that could occur within and downstream from the construction area include soil erosion and sedimentation, hydrocarbon spills, and in-water noise and disturbance. Utilization of specific design elements, construction techniques, and conservation measures should minimize the likelihood and severity of any such effects.

a. *Sedimentation*

Based on expected construction methods and the fact that the substrate within the excavation and construction area consists almost exclusively of bedrock and large boulders, the potential for large quantities of sediment to enter the Yuba River resulting from construction related activities is low. No construction within the flowing river is expected to occur and, therefore, addition of sediment to the river due to in-river construction is not anticipated. Activities occurring at the construction staging area are not expected to contribute sediment to the Yuba River due to the large distance between the staging area and the river. As a result of traffic between the staging area and Narrows II Powerhouse, the potential exists for dust to accumulate on the road and enter the Yuba River as sediment, but the amount of dust accumulated during construction activities is expected to be small because the access road is paved. Blasting and excavation of bedrock may result in the creation of fine sediment that could be transported to the river through the air or over land during a subsequent rain event. However, due to the proposed timing of these activities (during the dry, low runoff season) and the other conservation measures listed in the project description which are designed to prevent sedimentation, the sediment produced by blasting and excavation that would be expected to reach the river is not likely to cause adverse impacts to listed salmonids.

As discussed in the project description, it may be necessary to construct a temporary access road from the powerhouse deck down to the in-channel construction area. Construction of a temporary access road would elevate the level of adverse effects of the project above that which is discussed above. Construction of a temporary access road would increase impacts by increasing the amount of blasting and excavation necessary, requiring the placement of a large amount of material into the dry river channel and increasing the amount of fine sediments produced within and/or transported into the river channel. Therefore, this option should be avoided if possible. If a temporary access road is constructed, it would be constructed using native rock (primarily from blasting refuse), greater than one inch in diameter. The entire road and all road building material would be removed at the end of each construction season, before the possibility of the road being washed out by flood flows spilling over the top of Englebright Dam.

The increase in production of fine sediments associated with the repeated construction and removal of an access road would adversely affect listed salmonids. High turbidity caused by fine sediment transport into the river affects salmonids by reducing feeding success, causing avoidance of rearing habitats, and disrupting upstream and downstream migration. Displacement of juveniles from preferred habitats may cause increased susceptibility of juveniles to predation. Bisson and Bilby (1982) reported that juvenile coho salmon avoid turbidities exceeding 70 NTUs, and Sigler *et al.* (1984) in Bjornn and Reiser (1991) found that turbidities between 25 and 50 NTUs reduced growth of juvenile coho salmon and steelhead. Turbidity should affect Chinook salmon in much the same way it affects juvenile steelhead and coho salmon because of similar physiological and life history requirements between the species. Increased sediment delivery and high levels of sediment transport also can cause infiltration of fine sediment into spawning gravels, decreased substrate permeability and intergravel flow and, ultimately, lead to reductions in the numbers of emergent salmonid fry (Lisle and Eads 1991). Increased sediment delivery can also fill interstitial substrate spaces and reduce abundance and availability of aquatic invertebrates for food (Bjornn and Reiser 1991).

The potential increases in turbidity associated with road construction and removal would injure some juvenile salmonids by temporarily disrupting normal feeding behaviors and causing reduced growth rates or possibly weight loss. Turbidity increases may also affect the sheltering abilities of some juvenile salmon and steelhead by causing them to avoid good sheltering areas due to high turbidity, and may thus decrease their likelihood of survival by increasing their susceptibility to predation. Based on the distribution of juvenile salmonids throughout the river and the proportion of that juvenile population that is expected to be exposed to increased turbidity levels caused by the project, the maximum injury and death rates that are likely to occur to salmon and steelhead from changes in feeding behavior, distribution and predation are expected to be less than 1% of the juvenile population, and are not expected to result in measurable changes to listed salmonid populations.

b. *Accidental Spills*

Water quality and fish habitat could be impacted from accidental spills or seepage of hazardous materials during construction. The implementation of the SWPPP and an HMCP are expected to prevent these adverse effects from occurring by implementing the best available preventative measures.

c. *Blasting Effects*

During earth excavation activities, the potential exists for vibration and pressure waves generated by blasting activities to adversely affect juvenile and adult spring-run Chinook salmon and steelhead. It is important to note that large congregations of adult Chinook salmon have been observed holding in the Narrows II Powerhouse outlet pool immediately adjacent to the project construction site (Michael Tucker, NMFS, pers. obs., September 2003; Steve Onken, YCWA, pers. comm., April 2004). Due to the absence of appropriate spawning habitat within the project area, larval fish and eggs are not expected to be present in the area and therefore would not be affected by blasting activities. No sampling for larger juveniles has occurred in this area so the extent of their presence of absence is unknown.

Underwater blasting has been reported to cause greater impacts to fish than blasting on land, adjacent to fish-bearing waters (JSA 2001). Because construction of the bypass facilities will require no in-stream work, underwater blasting is not expected to occur and above-water blasting would take place no less than 60 feet from the active watercourse. Blasting in the dry channel is expected to occur from October 2005 through mid-January 2006. Blasting specifications have also been designed to set vibration limitations to protect the existing Narrows II Powerplant infrastructure, including an 18-foot steel penstock and sensitive electronics. A minimum setback distance of 15 feet and a maximum explosive charge weight of 20 pounds have been recommended to protect the existing structures.

Vibration and hydrostatic pressure waves generated by blasting activities have been reported to adversely impact all life stages of fish (Washington *et al.* 1992; Keevin 1998; JSA 2001; Bonneville Power Administration 2002). Rapid increases in hydrostatic pressure and subsequent decreases to below ambient pressures produced by underwater blasting have been reported to rupture internal organs, especially the swim bladder of non-embryonic life stages of fish (Washington *et al.* 1992; JSA 2001). Sublethal effects of vibration, such as movement of fish into less suitable habitats, also have been reported (Bonneville Power Administration 2002).

Investigators have found the swim bladder to be the most frequently damaged organ associated with blasting-induced mortality (Christian 1973; Faulk and Lawrence 1973; Linton *et al.* 1985; Yelverton *et al.* 1975). The swim bladder, a gas-containing organ, is subject to rapid contraction and overexertion in response to the explosive shock waveform (Wiley *et al.* 1981). Because the swim bladder appeared to burst outward, some investigators have suggested that the negative phase (relative to ambient) of the pressure wave is responsible for damage to the swim bladder (Anonymous 1948; Hubbs and Rechnitzer 1952; Wiley *et al.* 1981).

Blasting in rock near, but not within, the active watercourse presents a much different scenario than blasting underwater. When complete confinement of the explosive is achieved (*i.e.*, no explosive gases are vented into the water), water pressure is generated only by seismic waves (Oriard 1985). The maximum transferred energy ratio of these waves is produced when the substrate is solid, unbroken rock and the rock/water boundary is perpendicular. Under these conditions energy transfer ratio is approximately 37 percent. Oriard (1985) describes the scenario in which the rock/water boundary deviates from perpendicular, as it would with the sloping shoreline found at the project site. The amount of energy transferred decreases slowly as the slope of the boundary layer decreases. Another important change takes place when the slope decreases from perpendicular. At increasingly oblique angles of incidence, there is a corresponding increase in the duration of the incoming pulse. This fact has a significant bearing on the effects of pressure waves in water because it is usually favorable to increase the time period that the pressure is increasing, even if the peak pressure is not decreased, because a slower increase in pressure is less likely to burst the fish's air bladder or cause other structural damage to the body of the fish (Oriard 1985).

The Canadian Department of Fisheries and Oceans' "*Guidelines for the Use of Explosives in Canadian Fisheries Waters*" have guidelines for on-shore setback distances from fish habitat based on substrate type to meet the maximum pressure guideline of 100 kPa to avoid physical impacts to fish. The equation for determining setback distance in rock is:

$$R = \sqrt{W} * K$$

Where:
R = the minimum setback distance (m)
W = the weight of the charge (kg)
K = 5.03 (a coefficient for blasting in rock)

Applying this equation using the maximum charge weight of 20 pounds proposed for this project results in the following:

$$R = \sqrt{W} * K = \sqrt{9.07} * 5.03 = \underline{15.15m}$$

Therefore, to meet the Canadian Department of Fisheries and Oceans' criteria the setback distance of a 20-pound charge would have to be a minimum of 15.15 m from the lower Yuba River. The nearest blasting excavation will occur no nearer than approximately ten feet beyond this distance.

Oriard (1985) developed the following equation, similar in function to the above setback equation, that could be used to predict water overpressure levels caused by nearby land-based blasting:

$$P_w = 12.8(\frac{D}{\sqrt{W}})^{-1.33}$$

Where: P_w= water pressure (psi)
D= distance (feet)
W= maximum-charge-weight-per-delay (pounds)

This equation, based on scaling laws, was developed by regression analyses of actual water pressure and ground motion monitoring data. Applying this equation using the maximum charge weight of 20 pounds proposed per delay for this project results in the following:

$$P_w = 12.8(\frac{D}{\sqrt{W}})^{-1.33} = 12.8(\frac{60}{\sqrt{20}})^{-1.33} = 0.405 psi$$

One hundred kilopascals (kPa) equals approximately 14.5 pounds per square inch (psi). Therefore, 0.405 psi equals approximately 2.79 kPa, approximately 36 times lower than the threshold established by the Canadian Department of Fisheries and Oceans. Moreover, site conditions such as the angle of wave-incidence of the ground vibration waves and the shoreline contact surface will influence energy transmission. During blasting excavation activities for the proposed project, the angle of incidence would be much less than perpendicular and thus, the actual pressure will likely be lower than levels predicted by the above equation.

The following environmental protection measures, which have been suggested by Keevin (1998) and others including the Canadian Department of Fisheries and Oceans will be implemented in the project excavation and blasting plan:

1) Use of the least powerful charges possible to accomplish the excavation; the maximum charge weight will be 20 pounds;

2) Use of timing delays; large explosive charges can be broken into a series of smaller charges by the use of timing delays. Resulting blast overpressure levels are directly related to the size of the charge per delay, rather than the summation of charges detonated (Munday *et al.* 1986). Keevin *et al.* (1997) report that there has been no field testing to determine the effectiveness of this technique in reducing aquatic mortality. However, if the pressure wave can be broken into a series of smaller waves that the internal organs of fish can dynamically respond to, then the technique should be effective in reducing mortality (Keevin *et al.* 1997).

3) Use of stemming; stemming is the use of a selected material, usually angular gravel or crushed stone, to fill a drill hole above the explosive. Stemming is commonly used in the blasting industry to contain the explosive force and increase the amount of energy applied to the surrounding strata (Konya and Davis 1978). Stemming decreases the amount of gas energy that is lost out the drill hole and thus reduces the impact to the environment.

Blasting mats should be placed on top of the holes to minimize the scattering of blast debris around the area and further contain the blast.

In addition to the above measures, there are several aspects of the proposed drill-blasting excavation activities that contribute to minimize the potential effects of explosive-induced pressure waves on anadromous salmonids in the project area. First, salmonids have been shown to be relatively insensitive to overpressure waves created by explosives relative to other species of fish (Teleki and Chamberlain 1978; Fitch and Young 1948). Second, larger fish such as adult salmonids--which are more likely to be present near the construction area than are juvenile fish or incubating eggs--also are less sensitive than smaller fish to overpressure waves created by explosives (Yelverton *et al.* 1975). Third, the site characteristics and blasting criteria including: 1) no instream/underwater blasting; 2) a minimum setback distance of 60 feet from the blasting zone to the river's edge; and 3) a sloping rock/water boundary layer all contribute to the minimization of impacts.

Provided that all of the proposed protective measures and guidelines are strictly adhered to, there is a very low potential for pressure waves and fluctuations associated with the proposed blasting activities to harm listed salmonids.

The noise levels produced by the proposed blasting and other excavation activities are not expected to reach a level that would startle or disrupt adult and juvenile salmonids to the point of causing non-volitional movement of these fish out of their preferred habitat. Proposed conservation measure 5b (see section II [*Description of the Proposed Action*]) limits the maximum impulsive blast noise to 133 dB to be measured at a point above water adjacent to the power plant building. As all blasting will occur above water, the noise levels in the air (max 133 dB) would be much higher than those created under water. This phenomenon was discussed by Gausland (1998) who stated in "*Physics of Sound in Water*", that a principle associated with the difference in acoustic impedance between media is that the air/water interface will act as a very good reflector, known as the Lloyd mirror. Very little energy will pass this reflector, and sound generated in the air will not pass through to the water, and vis versa. NMFS has found that sound pressure levels less than 150 dB are not likely to result in temporary abnormal behavior indicative of stress or cause a startle response, nor will they result in permanent harm or injury.

2. Effects of Operational Flow Fluctuation and Ramping Criteria

While the proposed revisions to the flow reduction and fluctuation criteria are expected to result in more rigorous and protective requirements than the existing criteria, there is still the potential for operational flow changes in compliance with these new criteria to result in adverse impacts to critical habitat, dewatering of redds and the stranding of juvenile salmonids.

The timing, magnitude and frequency of flow reduction and fluctuation events have the potential to influence the quality of critical habitat and the condition and production of salmonids and green sturgeon in the lower Yuba River. Flow reductions and fluctuations can cause redd dewatering and resultant egg mortality, particularly for redds created in side channels or near the river margins in shallow waters. The extent of a flow reduction and fluctuation impact depends upon a number of factors including the magnitude and duration of the flow fluctuation event, the site-specific stage reduction as determined by the local channel geometry, the percentage of redds affected by the event, the length of time that specific redds are dewatered, and the intra- and inter-specific differences in sensitivity to short-term redd dewatering (Reiser and White 1981). In addition, the developmental stage of the embryos contained in the redd, based on redd dewatering periodicity, can substantially influence the effects of redd dewatering (Healey 1991). Both natural and operational flow reductions and fluctuations have the potential to dewater redds below the level of the eggs, and although the magnitude of the impact is difficult to accurately assess, mortality of eggs and alevins may occur when redds are completely dewatered, thereby exposing eggs and alevins to desiccation or adverse water temperatures. In addition, when intra-gravel flows become insufficient to provide oxygen to incubating embryos and remove waste metabolites from the redd, the potential for egg and alevin mortality increases.

In addition to redd dewatering, rapidly receding flow conditions have the potential to strand juvenile salmonids. Stranding is defined as the separation of fish from flowing surface water because of a declining river stage, and can manifest in two forms. Beaching is the stranding of fish on beach substrates in areas that have been dewatered. Isolation occurs when receding flows trap fish in side channels, secondary channels, and off-channel areas disconnected from the free-flowing river water. The potential impact to juvenile salmonids resulting from flow fluctuations depends upon a number of factors including the magnitude, duration and location of the flow fluctuation event, life stage(s) present in the river, site-specific habitat preferences, local channel configuration, the abundance of predators in and around the isolated habitat, and changes in macroinvertebrate community composition and abundance.

Chinook salmon and steelhead fry are particularly vulnerable to beaching because of their limited swimming ability, tendency to hide in the streambed, and preference for side channels and shallow river margins. Isolation is not necessarily lethal if the pools or lateral channels produce or receive adequate food supplies, low rates of competition and predation occur, and the channel is eventually reconnected to the main river course with a subsequent flow increase. In fact, young salmon appear to survive and grow well in some large, isolated backwaters along the lower Yuba River where significant subsurface flows maintain high-quality rearing habitat throughout the spring and summer (JSA 1998, 1999). In general, the potential for stranding increases when sustained flows (natural or regulated) allow young fish to disperse and occupy side channels and other off-channel habitats where they do not have continuous and direct access to the main river over the full range of flow conditions.

An analysis conducted by YCWA (2003) indicates that the greatest effects associated with specific annual operational flow changes generally occur during specific time periods each year. Those time periods and operational scenarios are as follows: a) February through May, associated with alterations in water year type designations; b) September through October, due to reductions of irrigation water deliveries; and c) August through September upon completion of water transfers. The latter two scenarios have the potential to overlap with each other, compounding the potential flow reductions in the upper river. The magnitude of flow reductions would vary by individual action, and depend on the specific environmental conditions within the river.

a. *Spring Flow Reductions*

Table 2 in the *Environmental Baseline* shows that spring flow reductions associated with changes in water-year type can vary from no reductions to a maximum of 1,000 cfs (from 1,500 cfs to 500 cfs; over 65 percent of the river flow) during a May re-classification from "below normal" to "dry" water-year type designation. During the February through May period, several Chinook salmon and steelhead life stages may be present in the lower Yuba River. Adult spring-run Chinook salmon may immigrate between late February and July. Juvenile spring-run Chinook salmon have emerged from the gravels by February, but varying sizes of juveniles are likely to be rearing or outmigrating during the February through May period. Rotary screw trap (RST) data from 1999 to 2002 show that most juvenile salmon outmigrate between January and May. Relatively small Chinook salmon fry are likely to be associated with instream cover near the channel margins, side channels, and off-channel areas. In addition, adult steelhead may immigrate into the lower Yuba River through February and can spawn through April. Consequently, adults, incubating eggs, and varying sizes of fry and juvenile steelhead, including larger juveniles hatched during the previous spawning season, can be present in the lower Yuba River during the February through May period. Adult and relatively large juvenile steelhead generally inhabit main channel areas and have sufficient swimming capacity to be unaffected by expected flow reductions during the February through May period. However, like Chinook salmon, small juvenile steelhead often are associated with the channel margins, side channel habitats, and off-channel areas. This association can seriously increase the risk of stranding, because nearshore areas are likely to be most affected by flow fluctuation. Furthermore, incubating steelhead eggs, due to their immobility and presence in shallow to moderate water depths, have the potential to become dewatered during flow reductions.

The magnitude of a specific flow reduction, redd depth distribution at the time of the reduction, developmental stage of incubating eggs, and other physical parameters (*e.g.*, water and air temperature) will ultimately influence the magnitude of the adverse effects to incubating eggs associated with any spring flow reductions. The 1,000 cfs operational flow reduction scenario described above is a worst-case scenario and has not occurred since the institution of the current water-year type designations and minimum instream flow requirements. An analysis of the historic hydrologic data for the basin indicates that the likelihood of occurrence of controlled operations (non-flood control) resulting in a 1000 cfs flow reduction due to a late change in water-year type is less that 5% in any year (YCWA, unpublished data). Additionally, under controlled conditions, the flows during the primary spawning period for steelhead (through April 20) would only be 500 to 700 cfs (Table 2). Therefore, the actual flow reduction experienced by steelhead redds would only be 100 to 300 cfs under the scenario described above. Assuming a 300 cfs reduction, flow-stage relationship data indicates that river stage would drop by approximately 6 inches throughout much of the river (Beak Consultants, Inc. 1989). Recent data on Chinook and steelhead redd depth distribution collected in 2003-2004 (FWS, unpublished data) further indicates that less than one percent of redds were constructed in water 6 inches deep or less, and would thus be dewatered by such a drop.

Should naturally high flows occur in March and April due to uncontrolled runoff, redds created at these higher flows could be exposed to the full 1,000 cfs reduction in May (under the scenario described above). In this case, a 1,000 cfs flow reduction would cause the river stage to drop by approximately 20 inches throughout much of the river (Beak Consultants, Inc. 1989). FWS data collected in 2003-2004 (FWS unpublished data) indicates that over 65 percent of redds were constructed in water 20 inches deep or less, and would thus be dewatered by such a drop.

b. *Late Summer/Fall Flow Reductions*

Table 3 shows the annual flow reductions that have occurred (and are likely to continue into the future) between August 15 and October 1, over the past three years since the current instream flow requirements have been in effect. During this period, in which flow reductions are generally associated with the ramp-down of water transfers and reduction in irrigation deliveries, several spring-run Chinook salmon and steelhead life stages are likely to inhabit the lower Yuba River. Adult spring-run Chinook salmon are expected to be holding and spawning and adult steelhead may be starting their upstream migration. Sub-yearling steelhead (and possibly Chinook salmon) may remain in the river after rearing over the summer months. Neither adult nor large juvenile salmonids are likely to be influenced by these late summer flow reductions, as they generally inhabit the mainstream habitats and exhibit suitable swimming capabilities to avoid stranding during the relatively slow ramp down rates that have occurred.

The greatest reductions in flows are scheduled in August, prior to the usual onset of spring-run Chinook salmon spawning, but Table 4 shows that the tail end of these flow reductions may continue into September when spring-run Chinook salmon are spawning. Because incubating eggs in redds are particularly vulnerable to flow fluctuation events due to their immobility, it is possible for these flow reductions to cause mortality to the egg incubation life stage of spring-run Chinook salmon.

The reductions that occurred in 2001, 2002, and 2003 from September 1 to October 1 were 100 cfs, 401 cfs, and 235 cfs, respectively (Table 3). Using the rough estimate from Beak Consultants, Inc. (1989) that a 100 cfs change equals two inches of stage change, these reductions would have resulted in river stage reductions of approximately 2, 8, and 4.7 inches, respectively. The recent data collected by FWS in 2003 and 2004 (FWS, unpublished data) on the depth of Chinook salmon spawning redds indicates that the September reductions in 2001 and 2003 would not have been likely to have dewatered redds, but the 8-inch drop in 2002 would have the potential to dewater approximately 5 percent of the redds that were built prior to the flow reduction.

Table 3. Stream flows at the Smartville gage on the Yuba River during the late summer/fall ramp down periods from 2001 through 2003 (California Data Exchange Center).

	2001	**2002**	**2003**
August 15 flows	2,024 cfs	2,125 cfs	3,080 cfs
September 1 flows	752 cfs	1,085 cfs	975 cfs
September 15 flows	599 cfs	945 cfs	826 cfs
October 1 flows	652 cfs	684 cfs	740 cfs

The extent and magnitude of potential adverse effects associated with the proposed flow fluctuation and ramping criteria on listed salmonids in the lower Yuba River currently cannot be well defined. While the results of a 15-year-old study conducted by Beak Consultants, Inc. (1989) provide a rough estimate of flow-stage relationships in some areas of the river, the actual extent of fry stranding and redd dewatering that these fluctuations might produce is not thoroughly understood. YCWA is working cooperatively with NMFS, CDFG, FWS, and others in a multi-year study of stranding and redd dewatering in the lower Yuba River. The study is intended to produce more definitive information concerning the effects of flow fluctuations and reductions on salmonids in the lower Yuba River. The development of data and analysis from that study is expected to take two to four more years. Upon the completion of that study, a flow reduction and fluctuation management plan (FRFMP) will be developed. This FRFMP is expected to be designed and implemented in a way that will minimize the take of listed salmonids and proposed North American green sturgeon due to controlled operational ramping and flow fluctuations on the Yuba River. This plan is to be developed in collaboration with NMFS, YCWA, CDFG, and FWS.

3. Effects of Unplanned Powerhouse Outages

Currently, because the bypass capacity of Narrows II Powerhouse is 650 cfs, it is possible for releases from Englebright Reservoir to drop quickly, by about 2,800 cfs if Narrows II Powerhouse is forced to go off-line from a full-flow condition. Installation of the proposed 3,000 cfs synchronous bypass at Narrows II Powerhouse would reduce the potential reduction in Englebright Reservoir releases to about 450 cfs when Narrows II Powerhouse is operating at full capacity (approximately 3,450 cfs). If Narrows I Powerhouse is not operating at the time of the outage, Narrows I Powerhouse bypass can be operated to return flows to a full 3,450 cfs in a short time. Therefore, the only time that the 450 cfs drop would occur is if an emergency shutdown were to occur when the full capacity of approximately 4,100 cfs were being released. In this situation, with over 4,000 cfs flowing from the dam, a 450 cfs or 11 percent reduction is not expected to cause measurable impacts to listed salmonids or salmonid habitat. During periods when Narrows II Powerhouse is releasing 3,000 cfs or less, installation of the proposed bypass essentially would eliminate flow fluctuations when a short-term emergency outage at Narrows II Powerhouse occurs.

Based on the construction timeline, the new Narrows II bypass is expected to be operative by December 2006. Based on recent history, there is a probability of approximately 15 percent in any given month, that Narrows II would be forced offline and the lower Yuba River could experience an uncontrolled flow reduction (YCWA 2003). Anadromous salmonids in the lower Yuba River will continue to be subjected to stranding, redd dewatering, temperature fluctuations, and other effects of these flow reduction events as was described in the baseline section of this document, until the new bypass is operational.

4. Effects on Central Valley Spring-run Chinook Salmon and Central Valley Steelhead Designated Critical Habitat

The analyses of effects of construction, flow fluctuations, and unplanned powerhouse outages provided above for the YRDP license amendment are habitat-based, and focus on project effects to the freshwater "primary constituent elements" of designated critical habitat necessary for species conservation described in the Final Rule released September 2, 2005 (70 FR 52488). Spawning and rearing habitat especially are likely to be affected by flow fluctuations allowable under the proposed criteria. Minor effects are also expected for adult holding and rearing habitat immediately adjacent to the project construction site.

With regards to flow fluctuations, the analysis above indicates that the worst case scenario during spring steelhead spawning would be a 1000 cfs reduction in flow, which could result in dewatering of up to 65 percent of redds that were in the river at that time. This scenario is expected to occur in fewer than 1 out of 20 years. The worst case scenario for September flow reductions, during the spring-run Chinook salmon spawning period, is approximately 400 cfs which could result in the dewatering of up to 5 percent of spring-run redds in the river at the time of the reduction. The development of protective criteria resulting from the completion of the comprehensive redd dewatering/fry stranding study currently underway is expected to reduce the potential for adverse impacts to critical habitat and incubating eggs from flow reductions.

Small, rearing juvenile Chinook salmon and steelhead often are associated with channel margins, side channel habitats, and off-channel areas. Therefore, small individuals are expected to be most at risk of stranding, because nearshore areas are likely to be most affected by flow fluctuation.

The analysis above indicates that holding, rearing and migration elements of critical habitat could be adversely affected by construction impacts (*i.e.*, blasting, sedimentation and accidental spills). However, the proposed conservation measures are expected to greatly reduce the potential for such impacts to occur.

5. <u>Effects on North American Green Sturgeon</u>

The project effects on North American green sturgeon are expected to be similar to those described for listed salmonids due to similar life cycles and habitat needs. However, the construction-related effects and all other project effects that occur above Daguerre Point Dam are not expected to impact North American green sturgeon as North American green sturgeon are not able to pass above this migration barrier. Additionally, those project effects that have the potential to dewater salmonid redds (planned and unplanned flow fluctuations) are not expected to have similar adverse effects on North American green sturgeon spawning success. North American green sturgeon do not build nests for their eggs in swift shallow riffles as salmonids do. Instead, they broadcast their eggs and milt in deep main-channel areas where the fertilized eggs sink to the bottom and incubate for approximately 200 hours before hatching out to become free swimming larvae. The success of North American green sturgeon spawning is therefore much less likely to be impacted by moderate flow fluctuations than is salmonid spawning. However, the other effects described above for salmonids, such as juvenile stranding and habitat reductions resulting from flow fluctuations, are also likely to impact North American green sturgeon.

VI. CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act.

NMFS is aware of only one significant State or local action that is reasonably likely to occur in the action area. YCWA has proposed, and received approval of $3.15 million in grant funding from DWR for a Yuba/Wheatland In-Lieu Groundwater Recharge and Storage Project (Wheatland Project). The purpose of the Wheatland Project is to extend the YCWA surface water delivery capabilities to the Wheatland Water District (WWD) by constructing canal facilities to deliver YRDP water to the WWD in southern Yuba County (YCWA 2002).

The total future projected annual agricultural water demand for the WWD that could be served by the Wheatland Project is about 41,000 AF. Water will be diverted from the Yuba River at Daguerre Point Dam and conveyed to the project area through the existing South Main Canal. The new facilities will convey water from the South Main Canal to the WWD service area. The diverted water will either be provided through the direct diversion of the natural flow of the Yuba River or, during dry periods, through rediversion of stored water released from New Bullards Bar Reservoir, which is located on the North Yuba River. YCWA anticipates that the Wheatland Project potentially could divert YRDP water for delivery within the next five years.

YCWA (2002) estimates that the Wheatland Project would divert a maximum of an additional 160 cfs from the lower Yuba River through the South Yuba/Brophy diversion (a 40% increase). This increase in total diversions through the South Yuba/Brophy diversion facility would increase the level of impacts to listed salmonids associated with exposure to this facility (see Environmental Baseline section).

The potential increase in diversion rates at the South Yuba-Brophy diversion associated with the proposed Wheatland project is likely to cause a reduction in survival of juvenile steelhead and spring-run Chinook salmon due to entrainment and increased predation at the diversion headworks.

Results of model simulations for changes in flows in the lower Yuba River for the reach from Englebright Dam to Daguerre Point Dam show that during many summer months, flows would be higher with the Wheatland Project due to increased storage releases from Englebright Reservoir for the additional irrigation diversion deliveries downstream. Flows throughout the river during the winter would be somewhat lower with the Wheatland Project during some occasions. This reduction in flows would occur because of delay or reduction in spill amounts caused by lower storage levels, which, in turn, are the result of increased summer releases (YCWA 2002).

For the reach below Daguerre Point Dam, where North American green sturgeon may occur, the Wheatland Project may result in a reduction in flows when flows would otherwise be above the minimum instream flow requirements, either because of power releases or uncontrolled flows.

Changes in flow are not expected to occur if flows are already at or near the minimum instream flow requirement (YCWA 2002).

The changes in flow levels associated with implementation of the Wheatland project may be of sufficient magnitude, timing or duration to adversely affect critical habitat, listed salmonids and proposed North American green sturgeon in the lower Yuba River. However, NMFS believes that it is likely that the benefits of increased flows in the primary spawning and rearing reaches above Daguerre Point Dam during certain periods could offset the adverse impacts to salmonids of reduced flows in the lower reaches by providing increased habitat values and reduced water temperatures in the upstream reaches during the summer and fall irrigation season. We therefore expect that the effects of potential changes in stream flows associated with the proposed Wheatland project would not cause a reduction in survival of adult steelhead or spring-run Chinook salmon, nor will it cause a net reduction in the quality of critical habitat within the Yuba River. However, the likely reduction in flows in the lower river could have a disproportionate effect on adult and juvenile North American green sturgeon, and the expected 40 percent increase in entrainment at the South Yuba-Brophy diversion is expected to cause a reduction in survival of juvenile steelhead and spring-run Chinook salmon in the Yuba River.

VII. INTEGRATION AND SYNTHESIS

Populations of Central Valley spring-run Chinook salmon and Central Valley steelhead have declined drastically over the last century. The southern DPS of North American green sturgeon have been cut off from much of their historic spawning grounds and are thought to be limited to a single spawning population in the mainstem Sacramento River. The current status of Central Valley spring-run Chinook salmon and steelhead, based upon their risk of extinction, has not significantly improved since the ESUs were listed (Good *et al.* 2005). This severe reduction in critical habitat and decline in populations over many years, as discussed in sections III and IV, demonstrates the need for actions which will assist in the restoration of critical habitat and the recovery of listed salmonids and proposed green sturgeon in the Yuba River, and that if measures are not taken to reverse these trends, the continued existence of these species could be at risk.

The most significant long-term effect of the proposed project would be to improve overall habitat conditions for salmonids and green sturgeon by reducing the potential for severe flow reductions and fluctuations to adversely affect these species and habitats in the lower Yuba River Short-term, construction-related effects include a slight potential to cause harm and harassment due to blasting, increased sediment loading, or other water quality impacts due to accidental spills of hydrocarbons and other contaminants. These impacts may cause physiological stress to the extent that the normal behavior patterns (*e.g.*, feeding) of affected individuals may be disrupted. Several impact avoidance and minimization measures have been incorporated into the project plan that are expected to protect listed salmonids and water quality in the lower Yuba River.

The primary long-term impact associated with the proposed project is the implementation of specific flow fluctuation and ramping criteria. While these new criteria are expected to provide increased protection for salmonids and green sturgeon over the current FERC requirements, the new criteria still have the potential to cause juvenile stranding and isolation and salmonid redd dewatering. Juvenile stranding and isolation can cause mortality through dessication, intolerable water temperatures, predation or starvation. Dewatering of eggs can cause mortality through dessication, oxygen depletion and/or intolerable water temperatures. The extent of the risks of such impacts under the proposed criteria are not well known, but YCWA has initiated a comprehensive study to address this question and provide information on the most suitable criteria for minimizing such impacts. Upon completion of this study an FRFMP will be cooperatively developed by YCWA, NMFS, CDFG, and FWS. Implementation of this plan is expected to minimize the take of listed salmonids and proposed North American green sturgeon due to controlled operational ramping and flow fluctuations on the Yuba River.

There is also the potential for emergency shutdowns of Narrows II Powerhouse to cause severe flow reductions and fluctuations in the lower Yuba River. This potential will exist until the new bypass facility (intended to alleviate this potential impact) becomes operational. The expected operation date analyzed in this biological opinion is December of 2006.

The adverse effects that are anticipated to result from the proposed project are not of the type or magnitude that would be expected to appreciably reduce the likelihood of survival and recovery of the affected species within the action area. NMFS expects that any adverse effects of this project will be greatly outweighed by the long-term benefits to species survival produced by the improvement in control over the flows released from Narrows II Powerhouse.

A. Critical habitat

The quality and amount of critical habitat upon which listed salmonids depend has been severely reduced over the past century through the construction of impassible dams and the general degradation of the remaining accessible habitat below those dams. The primary constituent elements necessary to support healthy salmonid populations such as spawning gravels, holding habitats, appropriate water temperatures, rearing habitats, and unobstructed migration corridors likewise have been greatly reduced and degraded. The lower Yuba River habitat has been subjected to nearly all forms of manmade impacts common to the Central Valley.

The most significant long-term effect of the proposed project would be to improve overall critical habitat conditions by reducing the potential for severe flow reductions and fluctuations to adversely affect these habitats and the primary constituent elements which support salmonid populations in the lower Yuba River. There also are expected to be some minor, short-term adverse effects on critical habitat associated with construction of the Narrows II bypass as well as some potential long-term effects associated with the revised flow fluctuation and ramping criteria. Additionally, there is the potential of adverse impacts to critical habitat associated with emergency shutdowns of Narrows II Powerhouse until the proposed new bypass is functioning. Finally, the cumulative effects of increased water diversions associated with the Wheatland project have been included in this analysis of critical habitat.

The primary long-term effect on critical habitat associated with the proposed project is the implementation of specific flow fluctuation and ramping criteria. While these new criteria are expected to provide increased protection and stability to critical habitat conditions over the current FERC requirements, the new criteria still have the potential to adversely affect spawning and juvenile rearing habitat in the Yuba River. Impacts to rearing habitats can result in juvenile stranding and isolation and lead to mortality of listed salmonids through desiccation, intolerable water temperatures, predation or starvation. Dewatering of spawning habitat can cause mortality through desiccation, oxygen depletion and/or intolerable water temperatures. The extent of the risks of such impacts under the proposed criteria are not well known, but YCWA has initiated a comprehensive study to address this question and provide information on the most suitable criteria for minimizing such impacts. Upon completion of this study an FRFMP will be cooperatively developed by YCWA, NMFS, CDFG, and FWS. Implementation of this plan is expected to minimize impacts to critical habitat due to controlled operational ramping and flow fluctuations on the Yuba River.

There is also the potential for emergency shutdowns of Narrows II Powerhouse to cause severe flow reductions and fluctuations in the lower Yuba River. This potential will exist until the new bypass facility (intended to alleviate this potential impact) becomes operational. The expected operation date analyzed in this biological opinion is December of 2006.

The adverse effects that are anticipated to result from the proposed project are not of the type or magnitude that would be expected to modify critical habitat to the extent that it could lead to an appreciable reduction in the likelihood of recovery of the affected species within the action area. NMFS expects that any adverse effects to critical habitat from this project will be greatly outweighed by the long-term benefits to habitat and overall species survival produced by the improvement in control over the flows released from Narrows II Powerhouse.

VIII. CONCLUSION

After reviewing the best available scientific and commercial information, the current status of the species, the environmental baseline for the action area, the effects of the proposed YRDP license amendment for FERC license number 2246, and the cumulative effects, it is NMFS' biological opinion that the project as proposed, is not likely to jeopardize the continued existence of Central Valley spring-run Chinook salmon or Central Valley steelhead, or destroy or adversely modify designated critical habitat for these species.

It is NMFS' conference opinion that the effects of the proposed YRDP license amendment for FERC license number 2246 are not likely to jeopardize the continued existence of the southern DPS of North American green sturgeon.

IX. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS as an act which kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not the purpose of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

Because the proposed action is likely to result in the taking of listed species incidental to the action, NMFS has included an incidental take statement pursuant to section 7(b)(4) of the ESA. This statement provides your agency and the applicant with knowledge of the terms and conditions that are required now that this application has been filed with your agency.

A. Amount or Extent of Take

The impacts associated with the implementation of the measures included in the proposed YRDP license amendment for FERC license number 2246 have the potential to harm and harass juvenile and adult life stages of Central Valley spring-run Chinook salmon, Central Valley steelhead, and North American green sturgeon. Such take could result from dewatering of salmonid redds and stranding of juveniles of all three species during flow fluctuations caused by normal flow management operations or from emergency, unplanned shutdowns of Narrows II Powerhouse prior to installation of the new bypass facility. If it becomes necessary to build an access road down into the river channel (because the use of a crane is not feasible), the resultant increase in blasting and sedimentation also is likely to harm juvenile Central Valley spring-run Chinook salmon and Central Valley steelhead. If no road construction is necessary, then the level of sedimentation from the normal construction activities is not anticipated to cause take of listed salmonids or proposed green sturgeon, primarily due to the avoidance and minimization measures that have been incorporated into the project plan.

The actual number of individuals likely to be subjected to each form of take from this project is impossible to determine due to annual variations in population size, run timing, meteorological conditions, and water management practices. However, it is possible to describe the conditions that will lead to the maximum amount of incidental take anticipated in this opinion. NMFS uses these conditions as surrogates to determine if the level of incidental take has been exceeded. Specifically, take from the project is not expected to exceed that associated with:

1. Excavation blasting occurring at least 60 feet from the active river channel, using charges no greater than 20 pounds in weight, and following all other conservation measures previously described in this document. Underwater hydrostatic pressure waves caused by blasting should not exceed 100 kPa nor should noise levels exceeded 190 dB.

2. Implementation of the proposed revisions to the Yuba River flow fluctuation and ramping criteria as described in the *Description of the Proposed Action* section of this document. Upon completion of the ongoing *fry stranding/redd dewatering study* on the Yuba River, an FRFMP will be developed and implemented which

will be designed to further reduce the level of take of listed salmonids and proposed green sturgeon on the Yuba River.

3. Two significant unplanned, emergency shutdowns of Narrows II Powerplant per year, over the next two years (through 2006). A significant shutdown is one that results in a 50% or greater reduction in stream flows lasting for one hour or longer. Depending on time of year, such shutdowns may result in dewatering of redds, stranding and isolation of adult and juvenile fish, and/or impacts to primary constituent elements of critical habitat such as water temperature and food production.

4. If necessary, the construction of a single access road from the powerhouse deck down to the in-channel construction area, and the subsequent removal and rebuilding of the road one time in each construction year, as described in the *Description of the Proposed Action.*

Anticipated incidental take may be exceeded if project activities exceed the criteria described above or if the project is not implemented as described in the BA for the proposed project, including the full implementation of the proposed conservation measures listed in the *Description of the Proposed Action* section.

B. Effect of the Take

In the accompanying biological opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to the listed and proposed species.

C. Reasonable and Prudent Measures

Pursuant to section 7(b)(4) of the ESA, the following reasonable and prudent measures are necessary and appropriate to minimize take of Central Valley spring-run Chinook salmon, Central Valley steelhead and North American green sturgeon. Because these measures are necessary to protect listed salmonids, they are nondiscretionary and must be implemented upon issuance of this biological opinion. The prohibitions against taking of listed species in section 9 of the ESA do not apply to proposed North American green sturgeon unless and until the species is listed. However, NMFS advises FERC to consider implementing the following reasonable and prudent measures for proposed North American green sturgeon. If this conference opinion for North American green sturgeon is adopted as a biological opinion following a listing, these measures, with their implementing terms and conditions will be nondiscretionary for North American green sturgeon.

1. Measures shall be taken to minimize the potential impacts of blasting and other in-channel construction activities on listed salmonids and proposed North American green sturgeon.

2. Measures shall be taken during construction activities to minimize stream bank erosion, sediment transport and discharge of hazardous materials into waterways.

3. Measures shall be taken to minimize salmonid and green sturgeon stranding and egg dewatering associated with controlled, operational ramping and flow fluctuations.

D. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the Act, FERC and the applicant must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are non-discretionary.

1. Measures shall be taken to minimize the potential impacts of blasting and other in-channel construction activities on listed salmonids and North American green sturgeon.

    a. Monitoring of hydrostatic pressure fluctuations and noise levels shall be conducted within Narrows II outlet pool, at the closest point to the blasting area during all blasting activities taking place in the in-channel (lower) construction area. The creation of hydrostatic pressure waves in exceedance of 100 kPa or noise levels exceeding 190 dB shall be reported to the Sacramento Area Office of NMFS within 24 hours. A final report on the results of this monitoring shall be provided to the Sacramento Area Office of NMFS within six months of completion of blasting activities for the project (see contact information below).

    b. To reduce the amount of blasting and other in-channel construction activities necessary to complete this project, every effort shall be made to avoid the construction of a road into the channel. If it is found that it is necessary to build a road, a detailed plan for its construction shall be furnished for approval by NMFS prior to the commencement of any construction activities.

2. Measures shall be taken during construction activities to minimize stream bank erosion, sediment transport and discharge of hazardous materials into waterways.

    a. FERC shall review the SWPPP and the SPCP described in the project description and ensure that the measures and requirements put forth in those plans are incorporated as binding conditions of any license amendment issued for the proposed project.

3. Measures shall be taken to minimize salmonid and North American green sturgeon stranding and redd dewatering associated with controlled, operational ramping and flow fluctuations.

    a. The fry stranding and redd dewatering study discussed in the biological assessment for this project (YCWA 2003) shall be completed within three years of the final signing date of this biological and conference opinion and the results of that investigation shall be used as the basis for the development of an FRFMP.

This plan is to be developed in collaboration with NMFS, YCWA, CDFG, and FWS.

Updates and reports required by these terms and conditions shall be submitted to:

Supervisor
Sacramento Area Office
National Marine Fisheries Service
650 Capitol Mall, Suite 8-300
Sacramento, CA 95814
FAX: (916) 930-3629
Phone: (916) 930-3600

If FERC violates the terms and conditions set forth in this incidental take statement, then the level of incidental take anticipated in the accompanying biological opinion may be exceeded. Such incidental take represents new information requiring reinitiation of consultation and review of the reasonable and prudent measures provided. If such a situation arises, FERC must immediately notify NMFS to provide an explanation of the increase in take and review with NMFS the need for reinitiation of consultation and modification of the reasonable and prudent measures or project actions.

X. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

The primary purpose of the proposed project is to benefit listed salmonids by improving control over river flows in the lower Yuba River. Throughout the development of the project plan, YCWA has worked closely with NMFS and the other resource agencies and stakeholders to ensure that the project would provide the maximum possible benefits to listed salmonids while reducing, to the greatest extent possible, any adverse effects that might result from the implementation of the project. Therefore NMFS has no conservation recommendations for salmonids.

The fry stranding and redd dewatering study discussed in the biological assessment for this project (YCWA 2003) should include North American green sturgeon as a study subject, to determine if the new flow fluctuation and ramping rates called for in the proposed FERC license amendment will have adverse effects on North American green sturgeon.

XI. REINITIATION NOTICE

This concludes early consultation on the action outlined in the biological assessment for the Yuba River Development Project license amendment for FERC license number 2246. As provided in 50 CFR §402.16, reinitiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: 1) the amount or extent of incidental take is exceeded, 2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, 3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this opinion, or 4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

This concludes formal conferencing on the action outlined in the Biological Assessment for the YRDP license amendment for FERC License Number 2246. You may ask NMFS to confirm the conference opinion as a biological opinion issued through formal consultation if the southern DPS of North American green sturgeon is listed as threatened. The request must be in writing. If NMFS reviews the proposed action and finds that there have been no significant changes in the action as planned or in the information used during the conference, NMFS will confirm the conference opinion as the biological opinion for the project and no further section 7 consultation will be necessary.

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Enclosure 2

Magnuson-Stevens Fishery Conservation and Management Act (MSA)

ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS[1]
Yuba River Development Project License Amendment (FERC No. 2246)

I. IDENTIFICATION OF ESSENTIAL FISH HABITAT

The geographic extent of freshwater essential fish habitat (EFH) for the Pacific salmon fishery is proposed as waters currently or historically accessible to salmon within specific U.S. Geological Survey hydrologic units (Pacific Fisheries Management Council 1999). For the Sacramento River watershed, the aquatic areas identified as EFH for Chinook salmon are within the hydrologic unit maps numbered 18020109 (Lower Sacramento River) and 18020112 (upper Sacramento River to Clear Creek). The upstream extent of Pacific salmon EFH in the Yuba River is to Englebright Dam at river mile (RM) 23.9.

EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purpose of interpreting the definition of essential fish habitat, "waters" include aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means habitat required to support a sustainable fishery and a healthy ecosystem; and "spawning, breeding, feeding, or growth to maturity" covers a species' full life cycle.

The attached biological opinion thoroughly addresses the species of Chinook salmon listed under the Endangered Species Act (ESA) as well as the MSA which will potentially be affected by the proposed action, the Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*). Therefore, this EFH consultation will concentrate most heavily on the Central Valley fall/late fall-run Chinook salmon (*O. tshawytscha*) which is also covered under the MSA although not listed under the ESA.

The Sacramento, Feather, Yuba, American, Cosumnes, Mokelumne, Stanislaus, Tuolumne, Merced, and San Joaquin Rivers, and many of their tributaries, support wild populations of the fall/late-fall Chinook salmon ESU. However, 40 to 50 percent of spawning and rearing habitats once used by these fish have been lost or degraded. Fall/late-fall run (herein "fall-run") Chinook salmon were once found throughout the Sacramento and San Joaquin River drainages, but have

[1] The 1996 amendments to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) set forth new mandates for the National Marine Fisheries Service (NMFS) and Federal action agencies to protect important marine and anadromous fish habitat. Federal action agencies which fund, permit, or carry out activities that may adversely impact EFH are required to consult with NMFS regarding potential adverse effects of their actions on EFH, and respond in writing to NMFS "EFH Conservation Recommendations." The Pacific Fisheries Management Council has identified essential fish habitat (EFH) for the Pacific salmon fishery in Amendment 14 to the Pacific Coast Salmon Fishery Management Plan.

suffered declines since the mid-1900s as a result of several factors, including commercial fishing, blockage of spawning and rearing habitat, water flow fluctuations, unsuitable water temperatures, loss of fish in agricultural diversions, loss of genetic fitness and habitat competition due to straying hatchery fish, and a reduction in habitat quality.

All Chinook salmon in the Sacramento/San Joaquin Basin are genetically and physically distinguishable from coastal forms (Clark 1929). In general, San Joaquin River populations tend to mature at an earlier age and spawn later in the year than Sacramento River populations. These differences could have been phenotypic responses to the generally warmer temperature and lower flow conditions found in the San Joaquin River Basin relative to the Sacramento River Basin. There is no apparent difference in the distribution of marine coded wire tag (CWT) recoveries from Sacramento and San Joaquin River hatchery populations, nor is there genetic differences between Sacramento and San Joaquin River fall-run populations (based on DNA and allozyme analysis) of a similar magnitude to that used in distinguishing other ESUs. This apparent lack of distinguishing life-history and genetic characteristics may be due, in part, to large-scale transfers of Sacramento River fall-run Chinook salmon into the San Joaquin River Basin.

Central Valley fall-run Chinook salmon are often caught in monitoring efforts throughout the basin which are primarily focused on studying winter-run and spring-run Chinook salmon. However, despite many diverse sources of information, there has been little effort at coordinating data to attain population estimates, or to determine the viability of the wild fall-run populations remaining in the Central Valley. A general increase in salmon runs in the Sacramento River since 1990 may be attributable to several factors including, increased water supplies following the 1987-1992 drought, stricter ocean harvest regulations, and fisheries restoration actions throughout the Central Valley. This population increase has likely carried over to the wild fall-run Chinook salmon population as well. Chinook salmon production is supplemented by fall and late-fall Chinook salmon reared at the U.S. Fish and Wildlife (FWS)-operated Coleman Fish Hatchery on the Sacramento River; and California Department of Fish and Game-operated Feather River Hatchery on the Feather River, Nimbus Hatchery on the American River, and Mokelumne Hatchery on the Mokelumne River (all fall-run Chinook salmon). There are indications that fall-run populations are generally stable or increasing, but it is unclear if natural populations are self-sustaining or if the appearance of stability is due to high hatchery production. Concern remains over impacts from high hatchery production and harvest levels, although ocean and freshwater harvest rates have been recently reduced.

Estimates of fall-run Chinook salmon escapement in the lower Yuba River since 1953 have indicated that the population has remained relatively stable, with a slow but statistically significant increase over time. Prior to the construction of New Bullards Bar Reservoir (1953-1971), the average estimated escapement was 12,906 fish, with a range of 1,000 to 37,000 fish. Since construction of New Bullards Bar Reservoir (1972-2003), the average estimated escapement is 14,814 to 16,050 (depending on the methodology used), with a range of 3,779 to 39,367 fish (Table 1). The run is maintained primarily by natural production, since there have been on significant stocking programs in the lower Yuba River, and the extent of straying from other hatchery stocks in the Sacramento River Basin is believed to be low.

Table 1. Estimated annual fall-run Chinook salmon spawning escapement in the lower Yuba River prior to and after the completion of New Bullards Bar Reservoir (**Source: YCWA 2000,** *updated 2003*).

Pre- New Bullards Bar Reservoir		Post- New Bullards Bar Reservoir	
Year	**Estimated Escapement**	**Year**	**Estimated Escapement**
1953	6000	1972	9258
1954	5000	1973	24119
1955	2000	1974	17809
1956	5000	1975	5641
1957	1000	1976	3779
1958	8000	1977	8722
1959	10000	1978	7416
1960	20000	1979	12430
1961	9000	1980	12406
1962	34000	1981	14025
1963	37000	1982	39367
1964	35000	1983	14256
1965	10000	1984	9965
1966	8000	1985	13066
1967	23500	1986	19406
1968	7000	1987	18510
1969	5230	1988	8501
1970	13830	1989	9837
1971	5650	1991*	14413
-	-	1992	6361
-	-	1993	6516
-	-	1994	10691
-	-	1995	14561
-	-	1996	27520
-	-	1997	25778
-	-	1998	30802
-	-	1999	23067
		2000	14852
		2001	22384
		2002	23202
		2003	28897
Average	12906	Average	16050

* No estimate made in 1990.

Life History and Habitat Requirements

Central Valley fall-run Chinook salmon are "ocean-type", entering the Sacramento and San Joaquin Rivers from July through April, and spawning from October through December. Peak spawning occurs in October and November (Reynolds et al. 1993). Chinook salmon spawning generally occurs in swift, relatively shallow riffles or along the edges of fast runs at depths greater than 6 inches, usually 1-3 feet to 10-15 feet. Preferred spawning substrate is clean loose gravel. Gravels are unsuitable for spawning when cemented with clay or fines, or when sediments settle out onto redds reducing intergravel percolation (NMFS 1997).

Egg incubation occurs from October through March, and juvenile rearing and smolt emigration occurs from January through June (Reynolds et al. 1993). Shortly after emergence from their gravel nests, most fry disperse downstream towards the Delta and estuary (Kjelson et al. 1982). The remainder of fry hide in the gravel or station in calm, shallow waters with bank cover such as tree roots, logs, and submerged or overhead vegetation. These juveniles feed and grow from January through mid-May, and emigrate to the Delta and estuary from mid-March through mid-June (Lister and Genoe 1970). As they grow, the juveniles associate with coarser substrates along the stream margin or farther from shore (Healey 1991). Along the emigration route, tributary streams are used as rearing habitat. These non-natal rearing areas are highly productive micro-habitats providing abundant food and cover for juvenile Chinook salmon to grow to the smolt stage. Smolts are juvenile salmonids that are undergoing a physiological transformation that allows them to enter saltwater. These smolts generally spend a very short time in the Delta and estuary before entry into the ocean.

In contrast, the majority of fry carried downstream soon after emergence are believed to reside in the Delta and estuary for several months before entering the ocean (Healey 1980, 1982; Kjelson et al. 1982). Principal foods of Chinook salmon while rearing in freshwater and estuarine environments are larval and adult insects and zooplankton such as *Daphnia*, flies, gnats, mosquitoes or copepods (Kjelson et al. 1982), stonefly nymphs or beetle larvae (Chapman and Quistdorff 1938) as well as other estuarine and freshwater invertebrates. Whether entering the Delta or estuary as a fry or juvenile, fall-run Chinook salmon depend on passage through the Sacramento-San Joaquin Delta for access to the ocean.

The fish rear in calm, marginal areas of the river, particularly back eddies, behind fallen trees, near undercut tree roots or over areas of bank cover, and emigrate as smolts from April through June. They remain off the California coast during their ocean migration.

Spawning habitat in the Yuba River occurs from the lower end of the Narrows Reach downstream to about 2.5 miles below the Marysville Gage (California Water Resources Control Board [SWRCB] 1992a). Generally, about 60 percent of the fall-run Chinook salmon spawn between the Highway 20 Bridge and Daguerre Point Dam, but from 1975 to 1979, about 60 percent of the spawning occurred downstream of Daguerre Point Dam (SWRCB 1992b).

Recent efforts by FWS to collect information for an Instream Flow Incremental Methodology study in the lower Yuba River have resulted in the collection of data on the geographical location and bathymetric distribution of 855 fall-run Chinook salmon redds. Data was gathered on November 13 to 16, 2001, November 19, 2001, November 4 to 6, 2002 and November 18 to 21, 2002. The observed redds were located both in the Garcia Gravel Pit Reach (490 redds, 57.3 percent) and the Daguerre Point Dam Reach (365 redds, 42.7 percent). Within the Garcia Gravel Pit Reach, 190 redds (22.2 percent) were located from upstream Daguerre Point Dam through the Highway 20 Bridge (RM 18), while the remaining 300 redds (35.1 percent) were found upstream of the Highway 20 Bridge, on Timbuctoo Bend, Rose Bar and immediately downstream of the Narrows Reach. The depth distribution of the 855 fall-run Chinook salmon redds observed in November 2001 and 2002 did not show redds at depths greater than 3.8 feet. The observed range was 0.2 feet to 3.8 feet, with 95 percent of redds observed between 0.6 and 2.7 feet. The average, median and modal depths were 1.5 feet, 1.5 feet and 1.3 feet, respectively (FWS unpublished data).

Fry utilize all reaches of the lower Yuba River downstream of the Narrows Reach for rearing. The largest concentration appears to be upstream of Daguerre Point Dam in the Garcia Gravel Pit Reach (SWRCB 1992a).

II. DESCRIPTION OF THE PROPOSED ACTION

The proposed action is described in the *Description of the Proposed Action* section of the attached biological opinion for the threatened Central Valley steelhead and Central Valley spring-run Chinook salmon ESUs.

III. EFFECTS OF THE PROPOSED ACTION

The most significant long-term effect of the proposed project would be to improve overall conditions for Chinook salmon by reducing the potential for severe flow reductions and fluctuations to adversely affect these species in the lower Yuba River. There are also expected to be some minor, short-term adverse effects associated with construction of the Narrows II bypass as well as some potential long-term effects associated with the revised flow fluctuation and ramping criteria. Additionally, there is the potential of adverse impacts associated with emergency shutdowns of Narrows II powerhouse until the proposed new bypass is functioning. Finally, the cumulative effects of increased water diversions associated with the Wheatland project has been included in this analysis.

Short-term, construction-related effects include a slight potential to cause harm and harassment due to blasting, increased sediment loading, or other water quality impacts due to accidental spills of hydrocarbons and other contaminants. Several impact avoidance and minimization measures have been incorporated into the project plan that are expected to protect Chinook salmon and water quality in the lower Yuba River.

The primary long-term impact associated with the proposed project is the implementation of specific flow fluctuation and ramping criteria. While these new criteria are expected to provide increased protection for Chinook salmon over the current FERC requirements, the new criteria still have the potential to cause juvenile salmon stranding and redd dewatering. The extent of the risks of such impacts under the proposed criteria are not well known, but YCWA has initiated a comprehensive study to address this question and provide information on the most suitable criteria for minimizing such impacts.

There is also the potential for emergency shutdowns of Narrows II powerhouse to cause severe flow reductions and fluctuations in the lower Yuba River. This potential will exist until the new bypass facility (intended to alleviate this potential impact) becomes operational.

Finally, the increase in diversion rates at the South Yuba-Brophy diversion associated with the proposed Wheatland project is likely to cause a reduction in survival of juvenile Chinook salmon due to entrainment and increased predation at the diversion headworks.

IV. CONCLUSION

Upon review of the effects of the proposed Yuba River Development Project license amendment for FERC license number 2246, NMFS believes that the associated construction activities and proposed flow fluctuation and ramping criteria will adversely affect EFH of Pacific Chinook salmon protected under MSA.

V. EFH CONSERVATION RECOMMENDATIONS

As the habitat requirements of Central Valley fall/late fall-run Chinook salmon within the action area are similar to those of the Federally listed species addressed in the attached biological opinion, NMFS recommends that Terms and Conditions 1b and 2a listed in the Incidental Take Statement prepared for the Central Valley spring-run Chinook salmon and Central Valley steelhead ESUs in the attached biological opinion, be adopted as EFH conservation recommendations.

VI. ACTION AGENCIES STATUTORY REQUIREMENTS

Section 305(b)(4)(B) of the Magnuson-Stevens Act and Federal regulations (50 CFR § 600.920) to implement the EFH provisions of the Magnuson-Stevens Act require Federal action agencies to provide a detailed written response to NMFS, within 30 days of its receipt, responding to the EFH Conservation Recommendations. The response must include a description of measures adopted by the Agencies for avoiding, mitigating, or offsetting the impact of the project on Pacific salmon EFH. In the case of a response that is inconsistent with NMFS' recommendations, the Agencies must explain their reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(j)).

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