COMBINED AQUATICS WORKING GROUP

CAWG 13-ANADROMOUS FISH

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EXECUTIVE SUMMARY

The purpose of this report is to meet the objectives of the CAWG 13 Anadromous Fish Study Plan (CAWG 13 Study Plan) (SCE 2001) including evaluation of the potential effects (if any) of Big Creek Project operations and maintenance on the anadromous salmonid resources in the San Joaquin River (SJR) downstream of Friant Dam. The study objectives are:

1. Review available information on the history, status and habitat of anadromous salmonids in the San Joaquin River downstream of Friant Dam.

2. Review available information on existing and proposed projects or programs pertaining to the San Joaquin River that may affect anadromous salmonids.

3. Evaluate the effects of operations and maintenance of the Big Creek Projects on anadromous salmonids in the San Joaquin River downstream of Friant Dam.

4. Evaluate the direct, indirect, and cumulative effects of the existing Big Creek Projects and any SCE proposed Project alternatives on anadromous salmonids and their habitat.

5. Evaluate opportunities to benefit anadromous salmonids or their habitat during development and evaluation of any SCE proposed Project alternatives.

The general approach used to meet the study objectives included review, summarization, and reporting of information describing the historical and current status of anadromous salmonid populations in the SJR and the potential effects of past, present and foreseeable projects, including habitat restoration. This would be accomplished through completion of five study elements. These study elements are:

1. Review available information to describe status of anadromous salmonids and their habitat in the San Joaquin River downstream of Friant Dam.

2. Identify limiting factors of anadromous salmonids downstream of Friant Dam that may be affected by operations or maintenance of the Big Creek Projects.

3. Review available information that describes other projects, programs, and initiatives in the watershed that may positively or negatively affect anadromous salmonids and their habitats downstream of Friant Dam.

This review should consider past, present, and reasonably foreseeable projects.

4. Use information obtained from reviews of existing information and developed from CAWG 12 Water Use and CAWG 6 Hydrology to describe likely direct, indirect, and cumulative effects of the existing SCE Projects and Project alternatives on anadromous salmonids and their habitats.

5. Use existing studies and existing models to evaluate any SCE proposed Project alternatives with other projects, programs, and initiatives in the watershed to minimize Project effects on anadromous salmonids and their habitats. Identify opportunities to benefit anadromous salmonids and their habitats.

This report summarizes publicly available information. This report does not present conclusions or evaluations. Evaluations will be included in Study Element 4, which has not yet been implemented, and is described below.

The first three study elements have been completed. First, available information describing the status of anadromous salmonids and their habitat in the SJR downstream of Friant Dam was reviewed and summarized in Sections 4.1 and 4.2 of this report. Second, potential limiting factors of anadromous salmonids downstream of Friant Dam were identified in Section 4.3.1. Those limiting factors that may potentially be affected by Big Creek operations were identified in Section 4.3.2. Third, available information that describes other projects, programs, and initiatives in the watershed that may positively or negatively affect anadromous salmonids and their habitats downstream of Friant Dam are reviewed in Sections 4.4 and 4.5 of this report. This review includes past, present, and reasonably foreseeable projects at the time of the preparation of this report.

Study elements 4 and 5 have not been implemented at this time. Information developed from the CAWG 6 Hydrology and CAWG 12 Water Use study plans (SCE 2001) will be used to describe likely direct, indirect, and cumulative effects of the existing SCE Projects and Project alternatives on anadromous salmonids and their habitats. Information from Land-3 Cumulative Effects Analysis also will be used for this description. Secondly, existing studies and existing models will be used to evaluate any SCE proposed Project alternatives with other projects, programs, and initiatives in the watershed to minimize Project effects on anadromous salmonids and their habitats. Opportunities to benefit anadromous salmonids and their habitats will be identified. Information included in the protection, mitigation, and enhancement measures (PM&E) phase of the Big Creek Alternative Licensing Process (ALP), as well as CAWG 6 Hydrology and CAWG 12 Water Use reports may be used to assist in implementation of this study element.

Historically, the SJR supported what was reportedly one of the largest, spring-run Chinook salmon population in North America. Fall-run Chinook salmon and steelhead trout also were present. During the past 150 years, however, spring-run Chinook salmon have been extirpated and fall-run Chinook salmon and steelhead now only occur in the lower reaches of the SJR's three major tributaries, the Stanislaus, Tuolumne and Merced rivers. Spring-run Chinook in the Central Valley are listed as threatened under both the federal and state endangered species acts (ESA). Central Valley steelhead are federally listed as threatened. The Central Valley Fall/Late Fall-run Chinook Salmon are not listed, but are considered a candidate species under the federal ESA (see Section 4.2.1).

Beginning with the California Gold Rush in 1849, the salmon and steelhead populations in the SJR and its three major tributaries began to decline (see Section 4.1.2 and Table CAWG 13-2). In the early 20th Century, construction of Kerckhoff Dam in the upper SJR (see Map CAWG 13-1) reduced the access to upstream spawning/rearing habitat for salmon (see Section 4.1.3). Increased irrigation diversions within the lower river (e.g., Sack Dam) hindered upstream migration of fall-migrating salmon and steelhead and diverted out-migrating juvenile salmon to agricultural fields. During this period, salmon, and steelhead numbers were reduced, although there was still a fair sized spring-run Chinook salmon population. However, fall-run Chinook salmon numbers had been noticeably reduced.

Friant Dam is 319 feet high with a crest length of 3,488 feet. In 1941, Friant Dam was completed, essentially eliminating salmon access to most of the remaining historic habitats in the upper SJR, below Kerckhoff Dam and completely modifying the hydrology of the lower river (see Section 4.1.4). Following construction of the Friant Dam, agricultural and urban development increased and brought increased demand for surface water supplies. To meet this demand, flow was increasingly diverted from Millerton Lake and less flow was released into the SJR. Gravel extraction downstream of Friant Dam also increased. Canals were built to move water around the natural channel to accommodate water delivery to agriculture along the lower river. Agricultural runoff increased, becoming the primary source of flow in the lower reaches between Sack Dam and the Merced River. Ultimately, salmon and steelhead production was eliminated from the SJR mainstem upstream of the Merced River.

Nearly all the salmonids in the system today are fall-run Chinook salmon. However, the California Department of Fish and Game has found that some spring-run Chinook and steelhead still occur in the SJR tributaries. No runs currently exist upstream of the confluence with the Merced River.

Factors currently limiting anadromous salmonid populations within the mainstem of the SJR are discussed in Sections 4.2 and 4.3, and are summarized in Table CAWG 13-7. They include discontinuous flow within much of its course during

most of the year, very poor water quality throughout most of the lower reaches downstream of Highway 41, severely modified channels including numerous dead-end sloughs, secondary channels and similar conditions that trap fish and inhibit migrations, reductions in gravel availability and modifications of channel structure necessary for spawning, and insufficient flows for migration, rearing and spawning. A short reach of potential habitat that exists just downstream of Friant Dam is essentially isolated from salmon except during rare periods of flood releases. High water temperatures may limit upstream migration during the early fall and downstream migration during the mid- to late spring.

Beginning in the early 1990s, restoration actions in the Central Valley have intensified following enactment of the Central Valley Project Improvement Act (CVPIA) and associated Anadromous Fisheries Restoration Program, and the establishment of CALFED (see Section 4.4). Numerous issues regarding restoration of environmental conditions within the SJR and its major tributaries have been identified. Issues concerning flow management both at Friant Dam, the major downstream tributaries, and within the lower SJR and Delta have resulted in more intensive investigation of the factors limiting salmon in the SJR and identifying management actions that might restore salmon to the river. Much of the salmonid habitat restoration effort within the Central Valley has occurred within the SJR system – mostly within the SJR tributaries including the Stanislaus, Merced, and Tuolumne rivers. The Vernalis Adaptive Management Program is being conducted to evaluate and improve conditions for salmonids outmigrating from the SJR system. Efforts also are ongoing to develop and eventually implement a restoration plan for the SJR.

Future actions that would influence anadromous salmonids within the SJR, if implemented, include the completion and implementation of the SJR restoration plan. Additional actions are presented in Section 4.5 Future Programs and Projects.

1.0 INTRODUCTION

A primary goal of the CAWG 13 Study Plan (SCE 2001) is to identify possible factors that limit anadromous fish populations in the San Joaquin River (SJR) downstream of Friant Dam that may be affected by operation and maintenance activities of the Big Creek hydroelectric projects. To meet this goal, this report addresses the objectives of the CAWG 13 Study Plan (SCE 2001). These objectives are listed in Section 2.1, Study Objectives, below.

2.0 STUDY IMPLEMENTATION

2.1 STUDY OBJECTIVES

The study objectives of the CAWG 13 Study Plan (SCE 2001) are:

1. Review available information on the history, status and habitat of anadromous salmonids in the San Joaquin River downstream of Friant Dam.

2. Review available information on existing and proposed projects or programs pertaining to the San Joaquin River that may affect anadromous salmonids.

3. Evaluate the effects of operations and maintenance of the Big Creek Projects on anadromous salmonids in the San Joaquin River downstream of Friant Dam.

4. Evaluate the direct, indirect, and cumulative effects of the existing Big Creek Projects and any SCE proposed Project alternatives on anadromous salmonids and their habitat.

5. Evaluate opportunities to benefit anadromous salmonids or their habitat during development and evaluation of any SCE proposed Project alternatives.

2.2 STUDY ELEMENTS AND IMPLEMENTATION

Implementation of the CAWG 13 Study Plan was designed to take place through a general approach that contained the following elements (Table CAWG 13-1). This table presents the five study elements and their current status.

Table CAWG 13-1. Study Implementation Elements.

Study Elements to be Implemented	Elements Implemented
1. Review available information to describe status of anadromous salmonids and their habitat in the San Joaquin River downstream of Friant Dam.	Available information was reviewed and summarized in section 4.1 and 4.2 of this report.

Table CAWG 13-1. Study Implementation Elements (continued)

Study Elements to be Implemented	Elements Implemented
2. Identify limiting factors of anadromous salmonids downstream of Friant Dam that may be affected by operations or maintenance of the Big Creek Projects.	Limiting factors in the SJR downstream of Friant Dam identified during a review of the available literature are included in Section 4.3.1 of this report. Physical aspects of the Big Creek Project that may have the potential to affect anadromous fish downstream of Friant Dam are identified in Section 4.3.2.
3. Review available information that describes other projects, programs, and initiatives in the watershed that may positively or negatively affect anadromous salmonids and their habitats downstream of Friant Dam. This review should consider past, present, and reasonably foreseeable projects.	Available information was reviewed and summarized. This element is included in sections 4.4 and 4.5 of this report.
4. Use information obtained from reviews of existing information and developed from CAWG 12 Water Use and CAWG 6 Hydrology to describe likely direct, indirect, and cumulative effects of the existing SCE Projects and Project alternatives on anadromous salmonids and their habitats.	Not implemented at this time. The US Bureau of Reclamation (USBR) is developing temperature modeling for Millerton Reservoir and has established a monitoring program to continuously measure inflow temperatures, reservoir temperature and water quality profiles, and Friant Dam release temperatures. If information developed through this investigation, CAWG 6 Hydrology, CAWG 12 Water Use, and/or Land 3 Cumulative Effects Analysis shows the Big Creek Project affects anadromous fish or their habitat downstream of Friant Dam, effects would subsequently be evaluated. Flow routing and temperature considerations would be components of this evaluation.

Table CAWG 13-1. Study Implementation Elements (continued)

Study Elements to be Implemented	Elements Implemented
5. Use existing studies and existing models to evaluate any SCE proposed Project alternatives with other projects, programs, and initiatives in the watershed to minimize Project effects on anadromous salmonids and their habitats. Identify opportunities to benefit anadromous salmonids and their habitats.	Not implemented at this time. This will occur during the evaluation of impacts and protection, mitigation, and enhancement measures (PM&E) phases of the Big Creek Alternative Licensing Process (ALP). Information included in the PM&E phase, CAWG 6 Hydrology, and CAWG 12 Water Use may assist in evaluating potential contributions the Big Creek Project may make to these activities. Flow routing and temperature considerations would be components of this evaluation.

3.0 METHODS

3.1 GENERAL APPROACH

Information about anadromous salmonids and their habitat in the SJR was gathered from literature, personal communications and other available media (e.g., internet databases). This information was summarized and integrated to characterize the history, present status, limiting factors, restoration and other programs and projects, to describe the past, present and foreseeable future conditions of anadromous salmonids in the SJR. The information review focused on the SJR and its three major tributaries (Merced, Tuolumne and Stanislaus rivers) downstream of Friant Dam.

3.2 DETAILED METHODS

3.2.1 REVIEW OF INFORMATION ON HISTORY, STATUS AND HABITAT OF ANADROMOUS SALMONIDS IN THE SJR DOWNSTREAM OF FRIANT DAM

The majority of historical information in this report was obtained from Moore et al. (1990) and Yoshiyama et al. (1998). These reports provide a comprehensive summary of historic conditions and distribution of Chinook salmon in the Central Valley drainages, including the SJR. Sources referenced in these reports, particularly those describing the salmon and steelhead populations since the early 1940s, also were reviewed.

The current status of the SJR anadromous salmon and steelhead was evaluated based on population trends and environmental conditions (including droughts and floods) observed during the past 15 years. Information was gathered from agency reports (i.e., California Department of Fish and Game [CDFG], CALFED) and personal contacts with individuals involved with managing salmon and steelhead resources within the SJR system. Information on existing habitat conditions, including hydrology, water quality, and channel morphology, was obtained from the proceedings of the SJR Restoration Plan Technical Workshop 2000 sponsored by the Friant Water Users Authority (FWUA) and the Natural Resources Defense Council (NRDC), and from the *San Joaquin River Restoration Study Background Report* (McBain & Trush 2002) prepared for FWUA and NRDC. Additional water quality and habitat information was obtained from US Geological Survey (USGS) reports.

3.2.2 Review of Information on Existing and Proposed Projects Including Restoration Programs that may Affect SJR Anadromous Salmonid Populations

Information on past, present and foreseeable future restoration actions and programs was obtained from reports and summaries prepared by CALFED and the Natural Resource Project Information database (NRPI).

Information on existing and future programs and projects that would likely affect the status of the anadromous salmonid resources in the SJR system was gathered from reports and summaries prepared by USBR and FWUA.

4.0 RESULTS

4.1 HISTORY OF ANADROMOUS SALMONIDS IN THE SJR SYSTEM

Yoshiyama et al. (1998) grouped the reported histories into three periods: probable original, mid-term, and recent or current. The "probable original" period is defined as the period prior to intensive gold mining, ca. 1850 to 1890. After this, substantial changes, including dams, intensive channel modification and abundant siltation, occurred in many rivers throughout the Sierra Nevada. Salmonid distributions during the probable original period were determined by considering the presence of obvious natural barriers to upstream salmonid migration together with results of ethnographic evaluations of Native Americans and historical information typically derived from anecdotal accounts of gold miners and early settlers. The "mid-term" period (1928 to 1940) salmonid distributions were determined from published literature and unpublished documents. This period begins with initiation of directed investigations regarding water development in the Central Valley (eventually the Central Valley Project [CVP]) and ends with initiation of construction of the CVP. The majority of information reported by Yoshiyama et al. (1998) describing this period was obtained from Clark (1929) and Hatton (1940). Recent or current history extends from the initial implementation of the CVP, including the construction of Friant Dam on the SJR, to the near-present (early 1990s).

4.1.1 PRE 1850

Moore et al. (1990) and Yoshiyama et al. (1998) conclude that salmonid populations in the SJR system prior to the mid-1840s were large and expansive. The anadromous fish populations were dominated by Chinook salmon, primarily spring-run. Populations also included fall-run and possibly late-fall-run Chinook salmon (Moyle 2002). Steelhead populations also were reportedly extensive, ranging into the Kings River and Tulare Lake drainages (Yoshiyama et al. 1998, McEwan 2001). Both spring-run Chinook salmon and steelhead occurred in the upper reaches of many San Joaquin drainages (Brown and Moyle 1987, Yoshiyama et al. 1998, McEwan 2001). Steelhead were likely more broadly distributed than Chinook salmon in the Central Valley because, in general, they are found in all tributaries containing spring-run Chinook salmon and are distributed at higher elevations in the stream (Yoshiyama et al. 1996, McEwan 2001). In the SJR, a small natural barrier near the present-day site of Redinger Lake and Big Creek Dam No. 7 (constructed in 1949 as part of the Big Creek 4 Project) (Map CAWG 13-1) may have stopped upstream migration during drier years (Yoshiyama et al. 1998). According to accounts of Native Americans occupying the drainage, Chinook salmon (spring-run) and steelhead both occurred as far upstream as the vicinity of the present-day Mammoth Pool Dam (SJR RM 322) (Map CAWG 13-1) (Yoshiyama et al.1998). Tributaries above the

present location of Friant Dam (SJR RM 267) that reportedly supported salmon and steelhead included Fine Gold, Cottonwood and Willow creeks. These tributaries are located downstream of the present-day Big Creek Dam No. 7, which is the lowest elevation migration barrier within the Big Creek hydroelectric system complex.

The entire Chinook salmon population during the probable original period likely exceeded 500,000 fish at times, as the post-1900 commercial catch exceeded 500,000 twice (Moore et al. 1990). CDFG (1990) described the former (pre-1850s) Chinook spring-run of the SJR as "one of the largest Chinook salmon runs anywhere on the Pacific Coast" and numbering "possibly in the range of 200,000 – 500,000 spawners annually".

4.1.2 1850 TO 1920

According to numerous accounts, salmon populations were still large even during the intervening years, between the start of the Gold Rush and the "mid-term period" (1920's) when salmonid resources in the Central Valley were first documented (Table CAWG 13-2) (Moore et al. 1990,Yoshiyama et al. 1998). Harvest catch records dating back to the early 1870s, particularly data on early commercial salmon harvests, are available in the serial reports of the California State Board of Fish Commissioners (the predecessor of the CDFG) and the United States Fish Commissioner, and they provide some of the earliest data used to estimate run sizes. Rough estimates of pre-20th century run sizes (including harvest for the entire Central Valley and based on historical catch data) may have approached 900,000 fish for the fall-run, 100,000 for the late fall-run, and 700,000 for the spring-run (Fisher 1994, cited in Yoshiyama et al. 1998). In 1883 alone, 567,000 spring-run Chinook salmon and 213,400 fall-run fish reportedly were caught in the Sacramento-San Joaquin commercial fishery (California Fish Commission [CFC] 1884, cited in Yoshiyama et al. 1998). Spring-run Chinook salmon runs in the upper San Joaquin River probably exceeded 200,000 fish at times, and it is likely that an equal number were once produced by the combined runs in Merced, Tuolumne and Stanislaus rivers (Moyle 2002).

Table CAWG 13-2. Time line of activities and events affecting salmonid populations and temporal descriptions of salmonid populations in the San Joaquin River from pre 1849 to present (McBain & Trush 2002, NRDC-FWUA 2000, Yoshiyama et al. 1998).

Date (period)	Activity/Event	Relationship to anadromous salmonids
Pre 1849	Pre development period	Spring-run Chinook salmon number in 100 thousands, steelhead and fall-run Chinook salmon present.
1849-1880	Gold Rush and associated activities	Mining associated activities including construction of small dams, and increased siltation of streams degrades salmonid habitat in SJR.
1870-1880	Irrigation diversions increase; Sack Dam (SJR RM 182) and Mendota Dam (SJR RM 205) initiate operation	Fall migrating salmonids (fall-run Chinook salmon and steelhead) are partially impeded in lower SJR; lower reach of SJR is seasonally or regularly dewatered downstream of Sack Dam to Merced River.
1880-1910	Commercial salmon fisheries thrive	Salmon population (primarily spring run) appears to recover from mining damage; commercial salmon landings exceed estimated 500,000 fish twice between 1910 and 1920.
1910	First comprehensive flood management plan for Central Valley sent to Congress	Infrastructure development along the SJR has impacts on geomorphological and ecological processes.
1916	Kerckhoff Dam (SJR RM 292) constructed	Dam blocks access to historic spring-run and steelhead habitat; seasonally dewaters downstream areas of habitat.
1923	Big Creek Project Dam 6 (SJR RM 312)	Constructed upstream of Kerckhoff Dam with no potential to impact anadromous salmonid passage, already blocked downstream.
1916-1940	Description of salmon population	Salmon habitat characterized as excellent extends 26 miles from below Kerckhoff Dam to Lanes Bridge (Hatton 1940). Most used and spawning reach extends from Lanes Bridge to Friant (SJR RM 241 to 267).
1939-1941	Construction and completion of Friant Dam (SJR RM 267)	Over 33 percent of contemporary salmon habitat is lost due to inundation of SJR and complete blockage of access to areas upstream of Friant Dam.

Table CAWG 13-2. Time line of activities and events affecting salmonid populations and temporal descriptions of salmonid populations in the San Joaquin River from pre 1849 to present (NRDC-FWUA 2000, Yoshiyama et al. 1998) (continued)

Date (period)	Activity/Event	Relationship to anadromous salmonids
1940	Description of salmon population	1940s spring-run Chinook salmon population is characterized as "excellent," producing over 30,000 spawners per year for three years during the early to mid 1940s, with a peak production of 56,000 spawners. The fall-run is considered "small" (Fry 1961).
1944	Use of Madera Canal begins	Less water is released to SJR.
1944	Flood Control Act of 1944 authorizes SJR and Tributaries Project and other flood control projects	Past and ongoing infrastructure development along the SJR, with large-scale impacts on the geomorphological and ecological processes that continue to influence the river.
1949	Use of Friant-Kern Canal begins	Less water is released to SJR.
1949	Description of salmon population	Spring-run Chinook are declared extirpated from SJR (Skinner 1958); SJR system salmon and steelhead populations are restricted to the lower reaches of the Stanislaus, Tuolumne, and Merced rivers.
1949	Big Creek Project Dam 7 (SJR RM 301)	Project is constructed upstream of Friant Dam with no perceived impact upon contemporary salmonid populations (FERC 2002).
1990-present	Restoration programs in SJR intensify per CVPIA and CALFED directions; litigation encourages cooperation among stakeholders to implement restoration planning.	Restoration actions increase in the three tributaries. NOAA Fisheries notes increasing trend in fall-run Chinook populations during recent 10-year period. Spring-run Chinook salmon (Sacramento River and tributaries) and Central Valley steelhead are listed as threatened under federal ESA; Sacramento River spring-run Chinook salmon listed as threatened under the California ESA.

Moore et al. (1990) reports that in 1910, the commercial river catch alone exceeded 10 million pounds (588,000 fish at 17 lbs per fish: Leidy and Myers 1984) for the first time since 1880. However, the commercial catch, an indicator of natural salmon production, exceeded that catch level only once more before a consistently declining trend began around 1920.

4.1.3 1920 TO 1940

Kerckhoff Dam (SJR RM 292) (ca. 1920) blocked spring-run Chinook salmon and steelhead access to the upper SJR and seasonally dewatered about 14 miles of stream below the dam (CDFG 1921) (Map CAWG 13-1, Table CAWG 13-2). Clark (1929) described salmonid spawning and rearing habitat during the late 1920s as encompassing 36 stream miles including the reach between Fine Gold Creek and Kerckhoff Dam, and in small tributaries within that reach. He also identified a "few" scattered spawning beds below the town of Friant. At the time of Clark's (1929) report, three irrigation diversions located downstream of Kerckhoff Dam partially impeded salmonid migration up the SJR: the Delta Weir and Stevensons Weir (aka Sack Dam first built as a seasonal dam ca 1870) (SJR RM 182) and Mendota Weir (aka Mendota Dam built in 1871 at SJR RM 205), near Mendota (Table CAWG 13-2). Clark (1930) reports these diversions acted as seasonal barriers (typically in the fall during fall-run Chinook and steelhead migration), reduced streamflow, and apparently disoriented migrating adults and juveniles that strayed into dead-end drainage canals. Adult fall-run Chinook salmon historically arrived at Mendota and Sack dams during low flows in late summer, when they formed "nearly complete" barriers to migration (McBain & Trush 2002). The San Joaquin River fall-run Chinook salmon run, historically composing a smaller portion of the river's salmon runs than spring-run (Moyle 2002), was greatly reduced by the late 1920s due to reduced fall flows in the mainstem and commercial harvest (Clark 1929, cited in McBain & Trush 2002 p. 7-12). Because spring-run Chinook salmon migrated upstream during higher flow (due to spring snowmelt runoff), Mendota and Sack dams posed less of a barrier to upstream migration (McBain & Trush 2002).

The first Big Creek Project dam in the mainstem of the San Joaquin River was constructed several years later in 1923 (Table CAWG 13-2). This was Big Creek Dam No. 6 (SJR RM 312), which is located 20 miles upstream of Kerckhoff Dam (Map CAWG 13-1).

Hatton (1940) described the spawning areas in the SJR (26 miles from Lane's Bridge to Kerckhoff Dam) as "the most suitable spawning beds of any stream in the San Joaquin system". He identified the reach from Lane's Bridge to Friant (SJR RM 241 to SJR RM 267) (Map CAWG 13-1) as the best and most frequently used spawning reach in the River. He described the reach upstream of Friant, comprised mainly of long, deep, bedrock-pools and short stretches of turbulent water, as unsuitable for spawning.

Hatton (1940) also reported fish passage obstructions downstream of the spawning reach, including Sack Dam (constructed in the 1870s), the lowermost obstruction located several miles downstream of Firebaugh. He stated that even in an average water year, Sack Dam "destroys any possibility of a fall-run up the San Joaquin" as it completely dewaters the stream bed downstream to the mouth of the Merced River. In spite of the obstacles and reductions in available habitat, both the spring and fall-runs of Chinook salmon managed to persist (Hatton 1940). By 1942, the upper SJR was declared to have had "a fair-sized spring run of king [Chinook] salmon for many years" and a fall-run that "had been greatly reduced" (Clark 1943).

4.1.4 1940-1990

Fry (1961) also reported that prior to construction of Friant Dam (in the early 1940s), the SJR had "an excellent spring run and a small fall-run". He considered the spring run "the most important" one in the Central Valley with an annual value of almost one million dollars (Hallock and Van Woert 1959). The spring-run Chinook salmon population exceeded 30,000 fish three times during the 1940s, with a high of 56,000 in 1945 (Fry 1961). In 1946, the sport catch of spring-run Chinook salmon in the San Joaquin Valley was estimated at 25,000 salmon; the ocean catch included another 1,000 spring-run Chinook salmon from the SJR population. The average commercial harvest of SJR salmon between 1946 and 1952 was 714,000 pounds (from Yoshiyama et al. 1998). However, the last substantial run was 1,900 fish in 1948 (Warner 1991).

The spring-run Chinook salmon runs of the mainstem SJR were extirpated after 1947, a few years after completion of Friant Dam (SJR RM 267) and by operation of the Central Valley Project (CDFG 1987). The dam blocked over 33 percent of the contemporary spawning areas, inundated several miles of spring-run Chinook salmon habitat, and allowed nearly complete control of flows in the lower SJR. The downstream flow regime, at least to the mouth of the Merced River (SJR RM 119), was drastically altered (Skinner 1958, Hallock and Van Woert 1959, Fry 1961). For several years after the dam was in place, the USBR released sufficient water to sustain a salmon fishery. By the late 1940s, following completion of the Delta-Mendota Canal, operations at the dam caused long stretches of the river to dry up, and some sixty miles of the river downstream of Sack Dam and upstream of the confluence with the Merced River are now dry, except during rare flood events (McBain & Trush 2002). In 1948, CDFG crews trapped spring-run Chinook adults, trucked them to the base of Friant Dam where they held over through the summer and spawned successfully. However, juvenile salmon were stranded in a dry stretch of river during their outmigration. Rescue efforts in 1949 and 1950 also failed, and thus San Joaquin spring-run Chinook salmon became extinct (Moyle 2002). Since the 1950s, remaining salmon in the San Joaquin Basin consist of fall-run Chinook salmon.

Yoshiyama et al. (1998) used data from Fisher (1994), CDFG files, and the PFMC to compile spawning stock estimates for Chinook salmon for a thirty-year

period. Within the San Joaquin River system (including the Cosumnes and Mokelumne Rivers), fall-run Chinook spawning stock estimates in the period between 1967 and 1997 varied from 1,100 to 77,500, and in half of the years these numbers were fewer than 10,000 fish (Yoshiyama et al. 1998, Table 5 on p. 506). Moyle (2002), citing these spawning stock estimates from Yoshiama et al. (1998), notes that these runs approached extinction during the drought years of 1989 to 1992, and that these runs are heavily supplemented with hatchery fish. He also notes that it is not known to what extent naturally spawning salmon depend on hatchery production to maintain their populations, or vice versa. Reduction in the ocean fishery, combined with favorable ocean conditions resulted in increased returns in the late 1990s of both hatchery and wild fish (Moyle 2002). Moyle (2002) suggests that it is likely that the San Joaquin River once supported a late fall-run, but that it is now extinct.

Since 1950, salmon have ascended to the foot of Friant Dam only during very wet years. Salmon strays were reported near Friant Dam during the fall-winter periods between 1988 and 1990 (Brown 1996). The number of strays ranged from 2,300 in 1988 to 280 in 1990 (Brown 1996).

There is little documentation of historical steelhead distribution in the Central Valley (McEwan 2001). However, there is evidence that winter steelhead were once widely distributed in the Sacramento and San Joaquin drainage, but construction of dams on most of its tributaries separated them from historical spawning and rearing areas (McEwan 2001, Moyle 2002). Because juvenile steelhead rear in fresh water for one year or longer (unlike most fall-run Chinook salmon that emigrate in the spring), they require suitable water temperatures that occur naturally only in mid- to high-elevation reaches and tributaries that are no longer accessible due to dam construction. Moyle (2002, citing Yoshiyama [1999, unpublished data]) reports that steelhead appear to have been extirpated from the San Joaquin River basin, possibly with the exception of a small population in the lower Stanislaus River.

However, McEwan (2001) states that reports of extinction of steelhead in the San Joaquin River system are based on little information and no field studies. He suggests that evidence supports the presence (although controversial), of an extant, self-sustaining steelhead run in the San Joaquin River system (based on CDFG unpublished data, USFWS unpublished data, Demko and Cramer 1997, 1998, Cramer & Assoc. unpublished data). He also cites recent CDFG captures of large rainbow trout/steelhead and steelhead smolts in the Stanislaus, Tuolumne and Calaveras rivers, the lower San Joaquin River, and the confluence of the Merced and San Joaquin rivers.

4.1.5 MAJOR TRIBUTARIES

The three major tributaries to the SJR downstream of Friant Dam, the Stanislaus, Tuolumne and Merced rivers (Map CAWG 13-1), continue to support “remnant” fall-run Chinook salmon and steelhead populations (CDFG 1987, Yoshiyama et

al. 1998, Moyle 2002). The history of salmon and steelhead decline in these drainages was very similar to that of the SJR. Large dams built on the Stanislaus River (Goodwin Dam), the Tuolumne River (La Grange Dam) and on the Merced River (Crocker-Huffman Dam) completely blocked anadromous salmonid access to the majority of their historic spawning and rearing habitats (Yoshiyama et al. 1998). Prior to the construction of these terminal dams there was a history of incremental elimination of habitat due first to the Gold Rush, followed by hydroelectric development, then flood control and water development supporting expanding agricultural and urban development (NRDC-FWUA 2000). Unlike on the SJR, however, flow downstream of the terminal dams did not completely stop. Small populations of fall-run Chinook salmon and extremely small populations of steelhead persist in conditions much less suitable than in historic times (Yoshiyama et al. 1998, Moyle 2002).

4.2 STATUS OF ANADROMOUS FISH AND THEIR HABITAT

4.2.1 ANADROMOUS SALMONID POPULATION STATUS

The California Central Valley Steelhead Evolutionarily Significant Unit (ESU), which includes steelhead in the San Joaquin River, is listed as threatened under the federal ESA (Table CAWG 13-3). Only naturally spawned populations below natural and man-made impassable barriers (e.g. dams or natural barriers) are listed. The Central Valley Fall/Late Fall-run Chinook Salmon ESU is not listed, but is considered a candidate species (National Marine Fisheries Service [NMFS] 1999). The Central Valley Spring-run Chinook Salmon ESU is listed as threatened under the federal ESA and includes all naturally spawned populations in the Sacramento River and its tributaries in California (NMFS 1999). The Central Valley Spring-run Chinook ESU does not include the San Joaquin River because native populations have apparently been extirpated (West Coast

Table CAWG 13-3. Federal Register Notices and CESA listings for Relevant Anadromous Salmonids of the Central Valley.

Species	Listing	Take Prohibitions	Critical Habitat[1]
	Federal Listing		
Central Valley fall- and late fall-run Chinook salmon	Not listed, considered a candidate species: FR Vol. 64, No. 179, pp. 50394-50415 Sept. 16, 1999		
Central Valley spring-run Chinook salmon[2]	FR Vol 64, No. 179, pp. 50394-50415 Sept. 16, 1999	FR Vol. 67, No. 6, pp. 116-1133 January 9, 2002	FR Vol. 65, No. 32, pp. 7764-7787 February 16, 2000
Sacramento River winter-run Chinook salmon[3]	FR Vol 59, No. 2, pp 440-450 January 4, 1994		FR Vol 58, No. 114, pp 33212-35219
Steelhead	FR Vol. 63, No. 53, pp. 13347-13371 March 19, 1998	FR Vol. 65, No. 132, pp. 42422-42481 July 10, 2000	FR Vol. 65, No. 32, pp. 7764-7787 February 16, 2000
	State of California Listing		
Sacramento River fall / late fall-run Chinook salmon	Listed as a Fish Species of Special Concern, 1995		
Sacramento River spring-run Chinook salmon	Listed as Threatened, February 5, 1999		
Sacramento River winter-run Chinook salmon	Listed as Endangered, September 22, 1989		

[1]Critical habitat designations vacated by April 30, 2002 court order; National Association of Home Builders v. Donald L. Evans, Civil Action No. 00-2799 (CKK). Sacramento winter-run Chinook ESU was unaffected.

[2]The federal Central Valley spring-run ESU includes the Sacramento River and tributaries. Native populations in the San Joaquin River drainage have apparently been extirpated.

[3]The federal Central Valley winter-run ESU does not include the San Joaquin River.

Chinook Salmon Biological Review Team 1997). The Sacramento River winter-run Chinook ESU is listed as endangered (NMFS 1994), but does not include the San Joaquin River. Sacramento River spring-run and winter-run Chinook salmon also are listed as threatened and endangered, respectively, under the California ESA (CESA) (CDFG 2004). Fall/late fall-run Chinook salmon are a California species of special concern. The pertinent Federal Register (FR) notices and CESA listings for the salmon and steelhead in the Central Valley and San Joaquin River are provided in Table CAWG 13-3.

On March 11, 2002, NOAA Fisheries (formerly NMFS) submitted a proposed settlement agreement in U.S. District Court that would rescind critical habitat designations for 19 ESUs, including steelhead and spring-run Chinook salmon

populations in the Central Valley. The court accepted the proposed settlement and remanded critical habitat designation to the NOAA Fisheries for reconsideration. NOAA Fisheries published an advanced notice of proposed rulemaking (ANPR) on September 29, 2003 (68 FR 55926). NOAA Fisheries undertook a more thorough analysis of the economic effects from designation of critical habitat and on November 30, 2004, filed proposed rules with the *Federal Register* to designate critical habitat areas for 20 species of Pacific salmon and steelhead, including the Central Valley spring-run Chinook salmon and steelhead ESUs (50 CFR Part 226). Areas within the San Joaquin River basin are proposed for designation as critical habitat, which is changed from previous critical habitat designations vacated in the April 30, 2002 court order. NOAA Fisheries also is seeking public comment on identified unoccupied areas that may be essential to species conservation. Following a public comment period and hearings, final rules are scheduled to be completed by June 2005.

A proposed rule issued by NOAA Fisheries on June 14, 2004 proposes the Central Valley spring-run Chinook ESU and California Central Valley *O. mykiss* ESU remain listed as threatened under the ESA. The Sacramento River winter-run Chinook ESU, presently listed as an endangered species, is proposed to be listed as a threatened species (NMFS 2004).

4.2.1.1 Steelhead

The Central Valley steelhead ESU includes the Sacramento and San Joaquin Rivers and their tributaries. Steelhead from San Francisco and San Pablo Bays are excluded since they are part of the Central California Coast ESU. The current range of steelhead in the San Joaquin River is believed to be limited to the Stanislaus, Tuolumne, and Merced rivers and their tributaries and the mainstem San Joaquin River to its confluence with the Merced River (NMFS 1998).

Steelhead smolts found in the lower SJR and the Merced River during a time juvenile hatchery steelhead were not released in the basin (outside of the Mokelumne River) indicate natural production has occurred in recent years (NMFS 1998).

4.2.1.2 Chinook Salmon

Recent fall-run Chinook salmon spawner population estimates for the three SJR tributaries combined have averaged 12,000 fish (1992 to 1997) (Yoshiyama et al. 2000). Although this represents an increase in fall-run Chinook salmon since the early 1990s, the SJR system contributes only four percent of the total spawner escapement to Central Valley streams.

NOAA Fisheries recently evaluated Chinook salmon populations within the SJR system relative to petitions to list the populations for protection under the ESA (NMFS 1999) and concluded that:

> *Populations of fall-run Chinook salmon in the San Joaquin River Basin (i.e., the Stanislaus, Tuolumne and Merced river populations) have exhibited "synchronous" population booms and busts and currently appear to be on an upward trend in abundance. Aside from a negative short-term trend in abundance in the Stanislaus River (-6.2 percent per year through 1998), the other tributaries to the San Joaquin River are exhibiting increases in abundance over the most recent 10 years. Lindley (NMFS, unpubl. data) developed a series of models relating recruitment of fall Chinook in the Tuolomne and Stanislaus Rivers to various factors to see if there was a simple explanation for the high variability in recruitment. Explanatory variables examined included spring river flow, ocean harvest, hatchery releases, sea surface temperature, and spawning stock. The model providing the best fit to empirical data was a logistic growth (stock- recruit) model with the carrying capacity parameter a linear function of river flow during the downstream juvenile migration period (Lindley, NMFS, unpubl. data). The apparent dependency of stock-recruitment relationships on flow does not rule out the potential influences of other factors (e.g., hatchery production) on variability in recruitment (Lindley, NMFS, unpubl. data).*

NOAA Fisheries determined that the influence of hatchery fish on natural populations in the San Joaquin River Basin is not clear (NMFS 1999). As in the rest of the Central Valley, it was difficult to estimate hatchery influence due to uncertainties related to coded wire tag (CWT) applications and insufficient sampling of natural spawners (Lindley, NMFS, unpubl. data, cited in NMFS 1999).

4.2.2 CURRENT PHYSICAL ENVIRONMENTAL CONDITIONS

Salmon and steelhead upstream and downstream migration requirements include: sufficient supplies of cool, clean water; clean, loose gravels; diverse and somewhat complex channel structure; contiguous flow; and unobstructed access. In the SJR downstream of Friant Dam, there are currently only a few areas in the upper part of the river with even marginal habitat conditions for salmon and steelhead. Since the completion of Friant Dam in 1941, changes have occurred in river flow and channel morphology, and these areas have essentially been isolated from anadromous salmon and steelhead. The following sections describe river conditions related to flow, channel morphology, and water quality. Factors affecting salmonid migration are discussed in the following section.

4.2.2.1 Flow

The headwaters of the SJR originate 12,000 ft above sea level on the west slope of the Sierra Nevada. The drainage upstream of Friant Dam encompasses about

1,650 square miles. The average annual "full natural flow" at Friant Dam, as computed by USBR (2002, cited in McBain & Trush 2002) from 1906 to 2002 is approximately 1.8 million acre-feet. Most of the runoff is diverted at Friant Dam to the Madera and Friant-Kern canals to provide agricultural water supplies in the San Joaquin Valley. The combined capacity of the two canals is about 6,500 cubic feet per second (cfs). Based on USGS gaging records from 1948 to 2000, typical irrigation diversions into the Madera Canal and the Friant-Kern Canal are 800 to 1,200 cfs, and up to 4,500 cfs, respectively (McBain & Trush 2002). The canals are sometimes used to convey flows during flood control releases. Millerton Lake, impounded by Friant Dam, has a published storage capacity of 520,500 acre-feet (DOI 1981). Three tributaries, the Merced River (SJR RM 118), the Tuolumne River (SJR RM 83) and the Stanislaus River (SJR RM 74) contribute flow into the lower SJR.

There are no minimum flow requirements to protect fish populations downstream of Friant Dam. The USBR releases between 35 cfs in winter and up to 300 cfs during the irrigation season (May through October) to support riparian water rights between the dam and Gravelly Ford (SJR RM 218). Under the terms of the water rights holding contracts, the USBR is required to provide enough releases at Friant Dam to maintain five cfs past each riparian diversion (the downstream-most diverter is located near Gravelly Ford gage site). The SJR is essentially dry from Gravelly Ford to the Mendota Pool (Reach 2, Map CAWG 13-1), except under flood release conditions. The river channel is used to transport Delta-Mendota Canal water between Mendota and Sack Dam (Reach 3). At Sack Dam, all flows less than 600 cfs are typically diverted into Arroyo Canal. Flows are intermittent in the reach downstream of Sack Dam (Reach 4) and agricultural drainage water and seepage from canals provide the only surface flow. The Sand Slough Control Structure (SJR RM 168.5) diverts all flows into the Eastside Bypass, downstream the river is perennially dry. Reach 5 (Bear Creek confluence with Eastside Bypass to the Merced River confluence, Hills Ferry Bridge) is sand bedded, meandering, and flows continuously with agricultural return flows (McBain & Trush 2002). This reach of the river from Mendota Dam down to the confluence with the Merced River is characterized by generally low flows and poor water quality (McBain & Trush 2002) (see Section 4.2.2.3 Water Quality). Several wetlands and wildlife refuges are located along parts of the river.

McBain & Trush (2002, p. 2-14) note that groundwater pumping over the last 150 years has reduced the shallow groundwater table in most reaches (between Friant Dam and the confluence of the Merced River). Therefore, instream flows infiltrate into the shallow groundwater table and instream flows decrease with distance downstream, particularly when releases from Friant Dam are less than 500 cfs.

4.2.2.2 Channel Morphology and Substrate

Before the river was reduced in flow and confined between levees, the floodplains along the San Joaquin River to the valley floor and its larger tributaries filled with water from winter rain and spring snow melt. The flooded areas were likely very productive of small invertebrates, which supported rapid growth of native fishes, including small salmon migrating downstream (Moyle 2002). These areas also provided protection from predators. McBain & Trush (2002) list among the constraints to restoration efforts, the transformation of the river from a natural riparian and tule marsh floodway to a leveed water supply and flood control channel with a completely altered hydrology, geomorphology, and channel morphology, and that wetlands and riparian habitats have been lost (McBain & Trush 2002 p. 5-45).

Channel aggradation and degradation has been locally variable, with most significant degradation (incision) associated with instream aggregate extraction, and most significant aggradation associated with the backwater effect of the Chowchilla Bifurcation Structure (SJR RM 216) (McBain & Trush 2002 p. 3-125). Overall, the channel in much of Reach 1 (Friant Dam [SJR RM 267] to Gravelly Ford [SJR RM 229], Map CAWG 13-1) is a "hydraulically disrupted flood conveyance system that is comprised of single channel segments, multi channel segments and breached pits" (gravel mining sites) (Jones & Stokes Assoc. 2002, cited in McBain & Trush 2002 p. 3-113).

The river reach from Highway 41 (SJR RM 255) to Mendota Pool (SJR RM 205) is highly sinuous with severe aggradation. The backwater from Mendota Pool dominates about five miles of this reach. The remaining 87 miles from Mendota Pool to the confluence with the Merced River is a single channel bounded by levees.

McBain & Trush (2002 p. 3-34) describe the bed materials in Reach 1A (Friant Dam to State Route 99 [SJR RM 243]) and the upstream portion of Reach 1B (State Route 99 to Gravelly Ford) as primarily composed of gravel- and cobble-size materials, whereas the bed material in downstream reaches (to the Merced River confluence) are composed primarily of finer gravels and sands.

To maintain channel geomorphic conditions, adequate flows are periodically needed to mobilize the streambed and transport sediments (Trush, McBain, and Leopold 2000). Such flows are needed to provide suitable spawning and rearing conditions for salmonids, to flush fine sediments from the streambed and maintain bar-pool morphology. McBain & Trush (2002) present an analysis of the flood flow regime in the San Joaquin River. Analysis of historical, pre-Friant Dam (1908 to 1943) and regulated (1944 to 2000) streamflow recorded at the USGS "San Joaquin River near Friant" gaging station (USGS station No. 11-251000) shows a dramatic reduction of flood flows. The 1.5-year flood (floods having a recurrence interval of 1.5 to 2.0 years are generally considered responsible for defining channel geometry and maintaining channel morphology)

was reduced from 11,400 cfs to 400 cfs, and the 10-year flood (also important for creation and maintenance of channel features) was reduced from 32,400 cfs to 8,950 cfs (McBain & Trush 2002 p. 2-23). Although these flood control releases are much smaller than they were before Millerton Reservoir and other upstream reservoirs provided storage, McBain & Trush (2002, p. 2-121) concluded they are large enough to provide significant restoration opportunities, including geomorphic process flows.

4.2.2.3 Water Quality

Water Temperature

The historical transition zone from the cold water streams of the upper reaches of the San Joaquin River to the warm water conditions in valley reaches likely occurred between the foothills and the valley bottom (McBain & Trush 2002). Summer water temperatures downstream of Friant Dam were likely too high to support rearing salmonids (McBain & Trush 2002). Unimpaired spring snowmelt floods generally peaked during May and June, and likely extended through July and August of wetter years, providing cooler water, about 60 to 70ºC (15 to 20ºC) in this reach during wet (and perhaps "normal") water years (McBain & Trush 2002).

Currently, hypolimnetic releases from Friant Dam in the summer can be cooler when Millerton Lake is thermally stratified, but low stream flow in the San Joaquin River allows water temperatures to warm more quickly than in the past. McBain & Trush (2002, p. 5-43) conclude that Millerton Lake is large enough to provide cold hypolimnetic releases in most water years, with the possible exception of the driest years. It could provide adequate summer rearing temperatures in Reach 1 (Map CAWG 13-1) throughout the summer months. It also could potentially influence water temperatures in the early spring and late fall for juvenile outmigation and adult immigration, respectively. The USBR is currently implementing a temperature study to investigate the thermal regime of Millerton Lake.

A summary of summer temperature records for stations in the San Joaquin River is provided in Table CAWG 13-4 (from McBain & Trush 2002). Under the current flow regime, mean monthly temperatures were generally suitable for salmonids from November to April in most years, but rose above 20ºC (68ºF) from May through October (McBain & Trush 2002). Since 2001, the Vernalis Adaptive Management Plan increased instream flows below the Merced River during May of each year, which has decreased temperatures in May, as recorded at Vernalis (USGS gage 11303500).

Daily water temperature data recorded at the Friant hatchery provide some of the only published temperature data in the vicinity of Friant Dam (McBain & Trush 2002). Water used at the Friant hatchery is a mixture of deeper (cooler) water from the San Joaquin River outlet sluice gates and upper layer (warmer) water

from the Kern Canal outlet, so reservoir release temperatures are difficult to predict from this record. Temperatures recorded at the hatchery from 1993 to 2001 indicate that minimum annual temperatures from January through March ranged between 6 to 10ºC (45 to 50ºF). Water temperatures increased from about 10 to 13ºC (50 to 55ºF) by the end of June. Summer hatchery temperature remained below 16ºC (60ºF), with maximum daily temperatures often recorded at the end of September. Water temperatures decreased during the fall to about 10ºC (50ºF) by the end of December (McBain & Trush 2002).

Table CAWG 13-4 Monthly Summer Water Temperatures in the San Joaquin River (McBain & Trush 2002).

SJR Site	USGS Period of Record	CVRWQCB Period of Record	Monthly Water Temperatures (ºC)															
			Apr		May		Jun		Jul		Aug		Sep		Oct		Nov	
			Mean	S.D.	Mean	S.D	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Below Friant[1]			10.6		10.6		10.4		10.6		10.6				10.6		11.0	
Near Mendota													22.9		22.9			
At Sack Dam							24.5		26.0		25.7		23.5		23.3			
Salt Slough @ Lander/Hwy 165[2]	1985-1994	1996-2002	17.3	2.6	20.0	3.2	22.8	2.9	24.6	1.9	24.4	2.0	22.3	2.6	17.8	2.5	14.2	3.4
Mud Slough (Downstr)[2]	1985-1999	1996-2002	17.9	3.2	21.2	3.9	24.1	3.3	26.0	2.2	25.0	2.4	23.8	2.5	18.9	2.6	14.6	2.4
At Stevinson[2]	1985-1993	1996-2002	17.6	3.1	20.3	3.2	24.0	3.6	26.0	2.3	25.5	2.2	23.1	2.3	18.4	2.5	14.7	3.2
At Fremont Ford[2]	1979-1994	1996-2002	16.9	2.7	20.3	3.3	23.5	3.0	24.9	2.2	24.6	2.2	22.4	2.2	17.6	2.4	13.8	2.6
Upstream of Merced River	2000-2000								27.5	0.7	25.5	1.4	23.0	2.8				
Near Newman	1984-1988		17.0	4.6	16.0	2.5	24.0	1.1	24.8	1.8	24.2	0.9	20.8	1.7	17.5	2.8	13.0	1.4
At Crows Landing	2000-2000								26.0	1.4	23.8	0.4	22.0	2.1				
At Patterson[2]	1985-1994	1996-2002	17.8	2.8	20.9	3.1	23.2	2.7	24.6	1.7	24.8	2.2	22.5	2.3	18.6	2.1	14.5	2.5
At Maze[2]	1985-1994	1996-2002	16.9	3.0	20.3	3.4	23.2	2.5	24.5	1.9	24.6	1.9	22.5	2.1	18.6	2.3	14.5	2.3
At Airport Way/Vernalis[2]	1961-2000	1996-2002	15.7	2.1	18.5	2.2	21.0	2.3	23.5	2.0	23.3	1.9	20.9	1.9	17.2	2.1	12.7	2.0

[1]Year 2001 Temp Data from SJRTEMP Model calibration report (JSA 2001). Note, no standard deviation is reported for a single year of data.

[2]Temperature means for these sites were compiled from USGS and CVRWQCB data.

Friant Dam has four release outlets to the river, which cover a range of elevations. Small releases to the river flow through two pipes branching from Penstocks 3 and 4. Release temperatures can be influenced by the location of the outlet used to release water from the reservoir during months when thermal stratification exists. For example, in 1999 water temperatures measured at the hatchery remained below 10.0°C (50°F) until August, then increased to about 12.8°C (55°F) when the release was switched from the lower outlet to the upper outlet (NRDC-FWUA 2000).

Water temperatures in the SJR near the Merced River are much warmer than those released at Friant Dam, as indicated by a comparison of water temperatures at Friant Hatchery and at Stevinson, located just upstream of the Merced River (NRDC-FWUA 2000). During 1993, temperature at the hatchery ranged from 7.2°C (45°F) in March to between 12.8 and 15.6°C (55 and 60°F) during the summer. Temperatures at Stevinson exceeded 15.6°C (60°F) in March and increased to 29.4°C (85°F) during the summer months.

September temperatures also were compared at several sites located from the Friant Hatchery to Chowchilla to obtain information on longitudinal temperature distribution during the warmer portion of the year. During 2000, temperatures at Friant Hatchery varied between 10.0 to 12.8°C (50 to 55°F) while temperatures at Highway 41 ranged between 15.6 to 21.1°C (60 to 70°F) (essentially 5.6°C (10°F) warmer than the release temperatures); temperatures at Chowchilla ranged from 21.1 to 31.7°C (70 to 89°F) (NRDC-FWUA 2000). It should be noted that water temperatures are dependent upon distance from release point (exposure to warming), flows, time of year, and meteorological conditions.

A temperature model (JSATEMP) was developed as a component of the SJRiver Model (JSA 2001) to evaluate effects of flow releases on temperature in the San Joaquin River (McBain & Trush 2002). Temperature monitoring for model calibration occurred in the years 2000 to 2001. In 2000, hourly water temperatures were recorded from mid-September through October at 13 locations from Friant Dam to about 25 miles downstream of Sack Dam (Table CAWG 13-4, McBain & Trush 2002). Flows below Friant Dam ranged from 150 to 200 cfs, and at Gravelly Ford were around 100 cfs. Significant warming occurred by the State Highway 41 Bridge (12 miles downstream of Friant Dam), equilibrium temperature (with the atmosphere) was reached by the Santa Fe Railroad Bridge (22 miles downstream of Friant Dam), and temperatures at downstream locations were relatively constant. In 2001, thermographs collected water temperatures from April through early October. Flows downstream of Friant Dam were almost constant at 200 cfs, except during a pulse flow from June 15 to 24 that resulted in flows of 360 to 400 cfs. At 200 cfs, water temperatures at State Route 41 warmed to 60 to 70 percent of equilibrium temperatures. During the pulse flow, water temperature warming dropped to about 40 percent of the equilibrium temperature between Friant Dam and State Route 41, then rose to 70 percent of the equilibrium temperature within three days after the pulse flow.

Model results suggest that by mid-August, a 250 cfs base flow would provide approximately 14 miles of <68ºF temperature habitat for salmonids from Friant Dam to near the State Route 41 Bridge. The dominant temperature change occurs near Gravelly Ford. Below Gravelly Ford, the model shows instream temperatures are in equilibrium and that temperature changes are controlled by meteorological conditions (McBain & Trush 2002, p. 6-16).

In the future, additional information may become available from USBR investigations on the temperature regime in Millerton Lake and its effects on water temperature downstream of Friant Dam. USBR has taken the initiative to develop temperature modeling for Millerton Reservoir. USBR also has established a monitoring program to continuously measure inflow temperatures, reservoir temperature and water quality profiles, and Friant Dam release temperatures (V. Curley, USBR, Pers. Comm. 2004).

Chemical and Physical Constituents

The Central Valley Regional Water Quality Control Board (CVRWQCB) listed reaches of the San Joaquin River in California's 2002 Clean Water Act (CWA) Section 303(d) List of Water Quality Limited Segments for a number of constituents (Table CAWG 13-5). Bear Creek, Salt Slough, and Mud Slough were also listed in the CVRWQCB Section 303(d) list.

Chemical constituent levels in the water and sediment are relatively low in the SJR upstream of the influence of Mendota Pool. The CVRWQCB listed no impairments in Reaches 1 and 2 (Map CAWG 13-1). Chemical constituent levels generally increase in a downstream direction from near Highway 41 with the addition of canal and drain waters from the Delta-Mendota Canal, Fresno Slough, Mariposa slough, Bear Creek, Salt Slough, and Mud Slough. Agriculture, urban and other waters draining into the SJR contain salts, arsenic, boron, cadmium, chromium, copper, lithium, manganese, mercury, molybdenum, nickel, selenium, strontium, uranium, vanadium, and zinc (San Joaquin Valley Drainage Program 1990, Dubrovsky et al. 1998). Total dissolved solids also increase substantially within this reach. McBain & Trush (2002) note that the transition from high water quality (Reach 1 and 2) to the area of impaired water quality designation for salinity below Mendota Dam (Reaches 3 through 5) is due to the inputs of agricultural runoff and from water imported from the Delta via the Central Valley Project (CVP) and State Water Project (SWP). It is not due to water released from Friant Dam. They also note that the degree to which groundwater exchanges during the irrigation season will affect present and future salinity levels in the river is unknown.

Table CAWG 13-5. San Joaquin River reaches designated on the CVRWQCB 2002 Section 303(d) list.

San Joaquin River Reach	Selenium	Mercury	Boron, Chlorpyrifos, DDT, Diazinon, EC1, Group A Pesticides2, Unknown Toxicity
Mendota Pool to Bear Creek			X
Bear Creek to Mud Slough		X	X
Mud Slough to Merced River	X	X	X
Merced River to South Delta Boundary		X	

[1]Measure of salinity by electrical conductivity.

[2]Group A pesticides include one or more of: aldrin, dieldrin, chloradane, endrin, heptachlor, epoxide, hexachlorocyclohexane (including lindane), endosulfan and toxaphene.

Pesticide concentrations are high in the areas receiving runoff from agricultural drains (Dubrovski et al. 1998). Nearly all pesticides applied within the drainage were found to occur in drainwater and in the receiving water. This report noted high concentrations of pesticides and other constituents entering the river during periods of rainfall, as well as during the irrigation season. Few such materials entered the SJR during the fall, between the irrigation season and beginning of the rainfall season. The CVRWQCB identifies Reaches 3, 4 and 5 (See Map CAWG 13-1) and Mud and Salt Sloughes as impaired due to pesticides and "unknown toxicity" (Table CAWG 13-5).

Dubrovski et al. (1998) used fish assemblages to characterize water quality effects in the SJR. An assemblage consisting of mostly exotic fishes dominated the SJR in wetted areas downstream of Highway 41. Based on these results, the investigators concluded that the habitat and water chemistry of this portion of the SJR is impaired. Saiki et al. (1992) determined that survival and growth of juvenile Chinook salmon was reduced when exposed to agricultural drainwater.

Dissolved Oxygen

Summer and autumn depressions in dissolved oxygen in Reach 5 (near the confluence with Mud and Salt Sloughes) and further downstream (i.e., Vernalis, Stockton) can inhibit adult upstream migration (McBain & Trush 2002, citing Hayes and Lee 1998, Hallock et al. 1970). In Stockton, low dissolved oxygen may potentially affect fall-run salmon migration (see Section 4.2.3.1)

4.2.3 CURRENT HABITAT CONDITIONS

4.2.3.1 Migration

Adult Salmon Migration Flows

The US Fish and Wildlife Service (FWS) conducted an instream flow evaluation in 1993 to determine the relationships between instream flow, adult immigration and spawning habitat availability for fall-run Chinook salmon downstream of Friant Dam. Their investigation included hydraulic modeling and simulation of habitat conditions using the Instream Flow Incremental Methodology (IFIM) (FWS 1994).

The FWS study identified two "critical reaches" affecting salmon migration: Sack Dam to the Merced River (Reach 3, 22 miles) and Gravelly Ford to Mendota Pool (Reach 2, 20 miles) (Map CAWG 13-1). The Sack Dam reach was described by FWS (1994) as containing little or no flow during the non-irrigation months (fall-winter), the adult salmon immigration period. They state that "native" San Joaquin water (i.e., water released from Friant Dam) would need to be released and travel all the way to the confluence with the Merced River, if the Chinook salmon are expected to "home" to their natal streams. The flow release would need to achieve a positive, downstream flow "through the maze of sloughs and backwaters below Sack Dam". Unfortunately, the hydraulic conditions within this

reach precluded the use of IFIM PHABSIM to determine what flows are necessary for upstream migration.

The Gravelly Ford Reach is dry during most years (FWS 1994). During extremely wet years, flood releases from Friant Dam into the SJR provide flow through this reach. These flows typically occur in the spring, but cannot contribute to upstream migration of fall-run Chinook salmon due to timing and the Hills Ferry salmon barrier on the San Joaquin River above the Merced River confluence.

Salmon migration requirements were identified for the Gravelly Ford to Mendota Reach (Reach 2) using PHABSIM. Four areas of critical fish passage were evaluated by developing a relationship between flow and the minimum depth, cross section and maximum velocity that allow salmon passage, based on the criteria of Thompson (1972). The results of the evaluation yielded a "qualified" fish passage requirement of 150 cfs. Qualifications identified by FWS included concerns about the dynamics of the channel, the wetted width required to meet the cross section criteria (i.e., at least 25 percent of the total channel width should meet the minimum depth criteria of 0.8 ft), and the length of stream meeting "minimum" depth conditions. The reach is comprised primarily of sand that is easily moved during moderate flow events. Movement of sand can easily create changes in the channel profile, creating impediments to passage that were not present during the evaluation. The wetted width required to meet the cross sectional criteria (based on total channel width) was arbitrarily selected since the channel width in most of the reach is so wide that required flows would be extremely high. As such, the FWS used criteria that required depth conditions to be present in at least 25 percent of the streams wetted cross section occurring at a flow of 250 cfs. The third qualification concerned the ability of salmon to swim through long reaches of shallow water (i.e., minimum depth criteria). FWS concluded that this issue was problematic.

Substantial changes in the channel configuration of the San Joaquin River downstream of Friant Dam have occurred (Section 4.2.2.2), and bypass channels for floodwater have been developed (see following sections). These factors may need to be addressed when developing appropriate passage flows for anadromous fish. Another issue is how restoration flows or restoration of channel connectivity to the lower San Joaquin River could affect salmonid runs in San Joaquin River tributaries.

Juvenile Salmon Migration Flows

Emigration of juvenile Chinook salmon from the SJR tributaries has been correlated with increases in flow (Demko et al. 2000). CDFG believes that pulsed flows that extend to the Delta facilitate migration by concentrating migration to a short period with improved transportation conditions from the river into and through the southern Delta (CDFG 1987). However, if releases from

Friant Dam are too large, depletion of the cold-water pool in Millerton Lake may result in warmer water temperatures in the river.

Migration Barriers and False Pathways

The closure of Friant Dam completely blocked upstream migration of salmon. The Hills Ferry barrier was put in place to prevent salmon upstream migration into dewatered reaches, where fish would be unable to survive and spawn. Historically, Mendota Dam and Sack Dam had functioning fish passage structures, but currently appear to pass upstream migrating adults only during flood releases (NRDC-FWUA 2000). Other significant barriers to migration include:

- A fish barrier (Hills Ferry), operated by CDFG since 1950 to prevent adult salmon from entering the canals and sloughs upstream of the Merced River, which is located just upstream of the Merced River.
- Culverts with slide gates on the SJR at the confluence with the East Side Bypass.
- A drop structure on East Side Bypass at the upper end near the confluence with SJR (SJR RM 138).
- A drop structure on Mariposa Bypass near confluence with SJR (SJR RM 147.2).
- Radial gates on the SJR at Chowchilla Bypass.
- Radial Gates on the upper end of Chowchilla Bypass at the SJR (SJR RM 216).
- Culverts with slide gates on the upper end of Lone Willow Slough at the SJR.
- At least one dirt irrigation dam just downstream of Gravelly Ford (RM 227).
- Culverts on the South River Trail between the gravel mining ponds (RM 253).
- Gravel mining ponds immediately downstream of Friant Dam.

Lack of continual streamflows in Reach 2 and Reach 4 (Map CAWG 13-1, see Section 4.2.2.1), lack of continuous streamflow connectivity among all reaches, as well as infrequent flood control releases that provide full flow routing (and enable fish migration), are limiting factors for steelhead and salmon (McBain & Trush 2002, p. 5-44). For example, the San Joaquin River between Sack Dam (SJR RM 182) and Bear Creek confluence with East Side Bypass (SJR RM 135.8) (Reach 4) is sand bedded and meandering, and is usually dewatered.

Between Sack Dam and the Sand Slough Control Structure (SJR RM 168.5). Flows are usually negligible, but periodically, flood control flows define a channel. The Sand Slough Control Structure diverts all flows into the bypass system, a portion of the river downstream no longer conveys flows, and the channel is poorly defined, filled with dense vegetation, and in some cases is plugged with fill material (McBain & Trush 2002, p. 1-14).

Salmonids may either be passively diverted into false pathways or, when attracted by flow conditions, actively move into the false pathway. Mendota and Sack dams play an important role in diverting water for irrigation purposes. Canals (on the SJR and other rivers) can divert juvenile migratory fish along false pathways, removing individuals from the population (McBain & Trush 2002, p. 7-62 and Figure 7-12). The SJR also has an extensive system of bypasses that divert flood flows from the river. The Chowchilla Bypass is the primary bypass on the river and diverts flood flows from the SJR at Gravelly Ford.

Depending on local conditions, bypasses can provide beneficial habitat or harm migrating salmon. For example, the Yolo Bypass, an engineered floodplain on the Sacramento River, provides substantial benefits to native species, including steelhead and Chinook salmon, while being compatible with agriculture (Sommer et al. 2001). McBain & Trush (2002) suggest that the Chowchilla Bypass, East Side Bypass, and Mariposa Bypass may provide restoration opportunities for juvenile salmonid rearing during winter and early spring (p. 5-43), but caution that the bypasses are largely devoid of habitat and may not be able to support the food base for fish as well as the Yolo Bypass does (p. 5-34). Some bypasses can lead fish away from their required habitat and expose them to higher water temperatures, lower dissolved oxygen, higher dissolved salt concentrations and higher risks of predation, or fish may be stranded if flow entering the bypass is interrupted (McBain & Trush 2002, p. 7-65). Larger irrigation returns (e.g., Mud Slough, Salt Slough) may attract adult and juvenile salmonids, where they become trapped or forced to retrace their path (McBain & Trush 2002). McBain & Trush (2002) list other potential false pathways created by the bypass and levee system, including Salt Slough, Mud Slough, Bear Creek, East Side Bypass, Arroyo Canal, Main Canal, other canals, and Little Dry Creek. Gravel mining pits in the upper reach of the SJR (Reach 1, Map CAWG 13-1) may also be considered false pathways, confusing downstream and upstream migrants, and delaying migration (McBain & Trush 2002).

Riparian Diversions

An extensive CDFG survey between Friant Dam and the mouth of the Merced River (CDFG 2001, cited in McBain & Trush 2002 Table 5-2) documented numerous riparian diversions. Many diversions are either unscreened or do not meet NMFS or CDFG screening criteria for fry or juvenile salmonids.

Delta Migration

Both upstream immigration of adult salmon and downstream emigration of juvenile salmon to and from the SJR are strongly influenced by conditions in the Sacramento-San Joaquin Delta (Hallock et al. 1970, Mesick 2001, Baker and Morhardt 2001). Water diverted at the State Water Project and CVP pumps in the southern Delta causes flow reversal in the lower SJR confusing migrating salmon and causing delays or otherwise contributing to mortality (Kjelson and Brandes 1989, NMFS 1993b, FWS 1995, Baker and Morhardt 2001). Mortality of Chinook salmon smolts, as they pass through the Sacramento-San Joaquin Delta is high, and there are many factors that could be manipulated to attempt to increase survival, including flows, diversions, and water quality (Baker and Morhardt 2001). Smolt survival through the Delta may be influenced by the magnitude of flows from the SJR, (but this relationship has not been well quantified), and export-related smolt mortality is a major problem (Baker and Morhardt 2001). Diversions entrain thousands of young salmon on their way to the ocean. In 1995, the SWRCB adopted a water quality control plan for the Bay-Delta (D-1641) that has resulted in a collaborative effort to improve conditions for juvenile salmon emigrating through the Delta. In 1999, the various stakeholders and management agencies involved with water and fish issues within the Delta and SJR developed the SJR Agreement. The agreement provides a means for accommodating the requirements of D-1641 by adaptively managing flow released into the Delta from the SJR system (Vernalis Adaptive Management Program or VAMP), and construction of a barrier at the head of Old River to protect juvenile salmon migrating through the Delta from being directly induced to swim to the export pumps. The Agreement includes a fish monitoring program to evaluate the success of the actions and allow future modifications, as needed, to improve integration of water management and fish protection.

Export pumping at the SWP and CVP in the fall (primarily October and November) can affect adult Chinook upstream migration. Mesick (2001) suggests that, based on reevaluation of data collected by Hallock and others (1970) and evaluation of CDFG coded-wire-tag data (from 1983 to 1996), adult San Joaquin Chinook salmon stray to the Sacramento River and eastside basins when more than 300 percent of San Joaquin River flow measured at Vernalis is exported over a ten-day period in mid-October.

Poor water quality and anaerobic conditions near the mouth of the SJR (Lee 1999, Lee and Jones-Lee 2003) often temporarily impede adult salmon migration from the Sacramento-San Joaquin Delta to the SJR (Hallock et al 1970, McBain & Trush 2002). The approximately first seven miles of the San Joaquin River Deep Water Ship Channel (DWSC) near the Port of Stockton experiences summer and fall dissolved concentrations below the CVRWQCB Basin Plan water quality objectives (in the DWSC between the Port of Stockton and Turner Cut, 5 mg/L from December through August, 6 mg/l from September through November). Dissolved oxygen depletions below the water quality objective have been documented in the winter in some years (Lee and Jones-Lee 2003). The

low dissolved oxygen conditions are typically eliminated following the first major storm of the year. However, fall-run Chinook salmon typically enter the Delta and ascend the SJR as early as September, with most fish migrating in October (Mesick 2001). Hallock et al.'s (1970) sonic tagging studies (1964 through 1967) documented a migration delay downstream of Stockton. The investigation found that no fall-run Chinook salmon migrated past Stockton until dissolved oxygen had risen to 4.5 mg/l, and that the bulk of migration did not occur until dissolved concentration exceeded 5.0 mg/L. Hallock et al. also noted other contributing factors, such as water temperature. Studies have been implemented to assess the causes and factors influencing DO concentrations in the DWSC, and a San Joaquin River dissolved oxygen total mass daily load (TMDL) master plan is being presented to the Environmental Protection Agency as part of an effort to abate this problem (Lee and Jones-Lee 2001, 2003).

As a continuation of the study by Hallock and others (1970), CDFG has conducted sonic tagging experiments with adult Chinook salmon. Combined with CDFG water quality monitoring and with water quality data collected by the Department of Water Resources (DWR), salmon upstream passage will be evaluated, including passage through the Stockton DWSC (IEP 2001).

4.2.3.2 Spawning

Spawning habitat surveys, primarily riffle-substrate surveys, were conducted from Mendota Pool to Friant Dam in the 1940s and 1950s by CDFG biologists and in 1993 by FWS, as part of an instream flow evaluation of the SJR. In 1995, as part of a master's thesis, Cain (1997) surveyed spawning habitat from Highway 145 (SJR RM 234.1) to Friant Dam (Reach 1, Map CAWG 13-1). In 2000, spawning habitat was surveyed from Highway 99 (SJR RM 243.2) to Friant Dam as part of the NRDC/FWUA evaluation of potential restoration actions within the SJR (NRDC-FWUA 2000). Results of additional spawning surveys reported in McBain & Trush (2002) also are summarized. Gravelly Ford defines the historical transition between the mostly gravel-bedded Reach 1 and the completely sand-bedded Reach 2 (McBain & Trush 2002) (Map CAWG 13-2).

Cain (1997) reports the findings of his study along with those of the previous three surveys (Table CAWG 13-6). He used methods similar to those used by CDFG in 1957, and found that the amount of potential spawning habitat was one-tenth of that identified in 1957. Cain (1997) attributes the decrease in area to effects of Friant Dam, gravel mining and vegetation encroachment. The dam eliminated the upstream supply of sediment. Its regulation of peak flows allowed vegetation to encroach upon the previously alluvial bars, decreasing the amount of gravel mobilized during high flow events. The gravel mining operations

Table CAWG 13-6. Comparison of Potential Spawning Gravel Areas Measured in Studies Between 1940 and 2000 (Cain 1997, NRDC-FWUA 2000, McBain & Trush 2002).

Year	Flow (cfs)	Area (feet^2)	Length (feet)	# of Riffles	Potential # of Salmon	Notes
1943						Conducted by DFG biologist, Don Fry
	350	1,000,000			50,000	
	500	1,225,000			60,000	
1957						Conducted by DFG biologist, Robert Ehlers
	123	3,038,175			151,909	
	350	2,600,000			130,000	
	123	2,126,700			106,335	Ehlers estimated that 70% of above area was usable
	350	1,809,000			90,450	
1993						IFIM study conducted by USFWS (Gravelly Ford to Friant Dam)
	125		5,250	28		Total gravels
	125		3,250	19		Usable area
1995						Survey of total potential spawning habitat by Cain (Hwy 145 to Friant Dam)
	175	302,682	9,430	23	15,140	
	175	252,107	8,175	20	12,600	0% - 75% embeddedness
	175	201,682	6,330	15	10,000	0% - 50% embeddedness

Table CAWG 13-6. Comparison of Potential Spawning Gravel Areas Measured in Studies Between 1940 and 2002 (continued).

Year	Flow (cfs)	Area ($feet^2$)	Length (feet)	# of Riffles	Potential # of Salmon	Notes
2000						Survey conducted for the NRDC-FWUA restoration planning project (Hwy 99 to Friant Dam)
	232	80,300		12	4,000	330,300 sq ft of total riffle area; 125,000 sq ft w/o suitable flow; 81,500 armored; 87,500 veneered, 26,300 cemented, and 9,500 transient
2001		408,000	RM 234.1 to 267.5			Jones and Stokes Assoc./ ENTRIX survey: portion of spawning gravel with less than 40% fines (Hwy 145 Bridge to Friant Dam)
2002						Stillwater Sciences (McBain & Trush 2002)
	350	281,400	RM 255.2 to 267.5	39		Estimate incorporating hydraulic suitability at potential spawning baseflows (Hwy 41 Bridge to Friant Dam)
		357,000	RM 243.2 to 267.5	65		Estimate incorporating hydraulic suitability at potential spawning baseflows (Hwy 99 to Friant Dam)

directly removed gravel from the river, created instream ponds and captured floodplain pits that have degraded or eliminated upstream and downstream spawning habitat through channel incision, and captured gravel moving downstream.

Cain (1997) observed that most of the loss of potential spawning habitat in the 14.2 km (8.8 mi.) reach of the SJR immediately downstream of Friant Dam was due to vegetation encroachment and secondary channel abandonment, while losses in the 19.2 km (11.9 mi.) reach between Highway 41 and the Santa Fe Railroad Bridge (near Highway 99) were mostly due to gravel extraction. While the 1957 CDFG survey did not measure any suitable spawning habitat in the reach between the Santa Fe Railroad Bridge and Highway 145, Cain concluded that increases in spawning gravels in this reach during his survey were probably due to the current absence of instream gravel mining and the flushing effects of prolonged high flows during the spring and summer of 1995. He found sizes of gravels just upstream of Highway 145 (Lanes Bridge) “surprisingly suitable” for Chinook spawning, but the gravels below Highway 145 were heavily silted or embedded. He concluded that even with the dramatic decrease in potential spawning habitat, there still remains a sufficient amount of habitat to support a small run (10,000 to 15,000) of naturally reproducing salmon. Furthermore, he states that with periodic flushing flows to remove fines and reduce embeddedness, the quality of spawning habitat would increase.

A spawning habitat and flow requirement evaluation was conducted in the reach extending from the base of Friant Dam to Gravelly Ford (40 miles) (FWS 1994). The reach was surveyed to identify potential spawning habitat based upon substrate composition and habitat type (salmon prefer to spawn in moderately large gravel and small cobble areas located at the head end of riffles). To facilitate the survey, the reach was divided into four segments. Segment 1, from Gravelly Ford upstream to Highway 145, (6.5 miles) comprised mostly pools and deep, slow runs with a sand substrate that did not contain any potential spawning habitat. Segment 2, from Highway 145 to Fasi Ranch (seven miles) had “extremely limited” potential spawning habitat. Very little riffle habitat existed and substrate was mostly sand-covered, embedded, small gravels. Segment 3, from Fasi Ranch to Lane’s Bridge at Highway 41 (14 miles) contained 1,900 linear feet of riffle habitat distributed among 11 sites with suitably-sized substrate (mostly embedded with sand). This reach was considered to contain potential salmon spawning habitat. Segment 4, from Lanes Bridge to Friant Dam (12.5 miles) contained 1,300 linear feet of riffle habitat distributed among eight sites with relatively large (>six inches) cobble substrate. This reach was considered to potentially provide the best salmon spawning conditions within the study reach.

The relationships between flow and spawning habitat were developed using hydraulic and substrate data collected at three study sites considered to represent the “best” potential spawning habitat (FWS 1994). These sites were located at Ball Ranch, Lanes Bridge, and Islewood (6.5, 12.5 and 21 miles downstream from Friant Dam, respectively). Hydraulic conditions (depth and

velocity) were simulated over a range of flows and compared to salmon spawning criteria obtained from investigations on salmon spawning habitat suitability conducted on the Tuolumne and Stanislaus rivers (FWS 1994). At both the Balls Ranch and Lanes Bridge sites, a flow of 125 to 150 cfs was considered to provide optimum depth and velocity for spawning. A flow of 175 cfs provided optimum spawning conditions at the Islewood site. FWS concluded that the sites closest to the dam (i.e., Ball Ranch and Lanes Bridge) would experience the highest level of spawning activity, based upon the behavior of salmon spawning in other, impounded Central Valley streams, and should be weighted higher than the more distal sites (i.e., Islewood). They determined that a flow of 150 cfs would provide close to optimal spawning conditions at all three sites.

Results of the year 2000 spawning riffle and substrate survey were similar to the FWS (1994) survey results in regards to riffle distribution, characterization of substrates and overall assessment of the location and condition of potential spawning areas (NRDC-FWUA 2000). The riffle survey identified 67 riffles within the 24-mile reach from Friant Dam to Highway 99. Only 12 of these riffles were considered suitable as potential spawning habitat. These potential spawning sites were limited to the upper 15 miles of the survey reach. Suitable riffles were most common between SJR RM 255 and SJR RM 261. The downstream most suitable riffle was located at SJR RM 252. Few riffles were located within close proximity to Friant Dam, a result of the dam blocking recruitment of sediment from the upper basin (Cain 1997).

Spawning gravel surveys conducted in 2000 by Jones and Stokes Associates and ENTRIX, Inc. yielded an estimate of 773,000 square feet of spawning habitat between Friant Dam (SJR RM 267.5) and State Route 145 Bridge (Skaggs Bridge) (SJR RM 234.1), of which 408,000 square feet contained less than 40 percent fines. A 2002 spring survey documented 357,000 square feet of suitable spawning gravel between Highway 99 Bridge and Friant Dam, of which approximately 281,400 square feet occurred between Lanes Bridge and Friant Dam. Thirty-nine riffles were observed in the 12 miles between Lanes Bridge and Friant Dam, and an additional 26 riffles were observed in the 12 miles between Highway 99 and Lanes Bridge. Riffles varied in substrate quality and hydraulic suitability. Many riffles were adjacent to suitable rearing habitat, but few were adjacent to suitable holding habitat (McBain & Trush 2002 p. 7-59).

Flushing flows are periodically needed to provide suitable spawning conditions, to flush fine sediments from the streambed and maintain bar-pool morphology. McBain & Trush (2002, p. 3-94) calculate that because the channel slope is relatively low in the gravel-bedded reach below Friant Dam (one-half to one-third as steep as the gravel-bedded reaches of San Joaquin River tributaries such as Merced, Tuolumne, and Stanislaus Rivers), the threshold for bed mobility (12,000 cfs to 16,000 cfs or greater) is likely equal to or larger than the bankfull discharge (approximately 10,000 cfs). This corresponds to the pre-Friant Dam 1.5 year flood of 10,200 cfs. The gradual slope of the channel also results in water

velocities lower than those preferred by adult salmonids, reducing the value of these reaches for spawning habitat. Bed scour would require an even larger flood event, perhaps near 45,000 cfs. In the gravel- and cobble- bed portion of the reach, the channel bed is armored for the range of commonly occurring flows (McBain & Trush 2002).

McBain & Trush (2002 p.3-125) conclude that instream and floodplain aggregate extraction has had a major impact on Reach 1, extracting much greater volumes of sediment than would have been delivered to the San Joaquin River under unimpaired conditions. They also conclude that this impact is greater now that all sediment supply from the upper watershed is blocked. McBain & Trush (2002 p. 3-125) say that the impact of this reduced coarse sediment supply is mitigated to a large degree by the reduction of peak flows capable of transporting sediment and by the naturally low slope in Reach 1 (small coarse sediment transport capacity). Augmentation of spawning gravels and sediment transport modeling/analysis of necessary flows and conditions may be necessary for restoration efforts in this reach.

4.2.4 Current Habitat and Population Conditions in the Tributary Streams

At the time Friant Dam was authorized, the California Water Rights Board issued the water rights permit, D-935, for the project, recognizing that the salmon fishery below Friant would be eliminated.[1] The federal government identified the need to increase salmon production within the three major SJR tributaries (Smith, F. pers. comm.). Under President Harry Truman's administration, a goal was established to increase salmon production in the tributaries to an average 40,000 to 50,000 salmon per stream per year to offset the SJR losses. At that time, the salmon populations in the tributaries were well below historical levels and far from the goals set by the Administration. Currently, the salmon populations in the tributaries are quite variable, subject to natural fluctuations in flow, and heavily reliant upon the occurrence of wet years and a propagation program at the Merced River Fish Facility (a salmon and steelhead hatchery located on the Merced River) (Lindleh, NMFS unpubl data).

[1] Parties in NRDC et al. v. Roger Patterson et al. (2004) have differing views as to whether D-935 allows elimination of the fishery. The recent Karlton decision of the U.S. District Court (NRDC et al. v. Roger Patterson et al. 2004) concluded that SWRCB D-935 does not preclude the application of California Fish and Game Code 5937. It also concluded that the USBR has violated Section 5937 of the California Fish and Game Code as applied to it by virtue of Section 8 of the Reclamation Act of 1902. (Section 5937 provides that "The owner of any dam shall allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around or through the dam, to keep in good condition any fish that may be planted or exist below the dam.") The question of (reasonable) remedy is reserved for a subsequent phase of the litigation. The Karlton decision is likely to be the subject of an appeal.

4.3 LIMITING FACTORS

This section discusses limiting factors for anadromous fish downstream of Friant Dam. Limiting factors in the San Joaquin River downstream of Friant Dam identified during a review of the available literature are included in Section 4.3.1 of this report. Physical aspects of the Big Creek Project that may have the potential to affect anadromous fish downstream of Friant Dam are identified in Section 4.3.2.

4.3.1 LIMITING FACTORS OF ANADROMOUS SALMONIDS DOWNSTREAM OF FRIANT DAM

Alterations to the SJR downstream of Friant Dam have been dramatic and factors limiting salmon and steelhead populations are varied and numerous. Essentially every life history requirement of salmon has been impacted (Table CAWG 13-7). Adult spawning migration has been adversely affected by water quality and flow conditions in the Delta. There are barriers to upstream migration, insufficient and discontinuous flow, false pathways, and degraded water quality conditions, which can negatively impact the health of fish and may impede homing from the confluence of the Merced River to Friant Dam. Spawning conditions have been affected by reductions in available habitat (riffles and gravel composition). Emigrating juveniles face degraded water quality, entrainment both along the SJR and in the Delta, and conditions that favor an assemblage of predators exacerbated by the introduction of exotic fishes (Brown and Moyle 1987, Brown 1996, McBain & Trush 2002).

Table CAWG 13-7. Summary of factors limiting salmon populations within the San Joaquin River from Friant Dam to the Sacramento-San Joaquin Delta (NRDC-FWUA 2000, FWUA.org).

Life Stage	Limiting factor	Description
Adult Migration	Water Quality	Periodic anaerobic conditions in Stockton ship channel temporarily impeding upstream migration in fall (Sep to Oct) (Hallock et al. 1970, Lee and Lee-Jones 2003).
	Temperature	High water temperatures may limit upstream migration during the early fall (McBain & Trush 2002, p. 5-44).
	Diversion	Reduced flow into Delta impedes attraction and upstream migration of salmon to lower SJR; intensifies water quality related blockage (Hallock et al. 1970, Mesick 2001).
	Barriers	Numerous low flow barriers (identified above) block passage under typical fall flow conditions (see Section 4.2.3.1).
	False Pathways	Numerous sloughs, canals and dead end channel conditions lead fish to unsuitable, lethal areas of drainage (see Section 4.2.3.1).
	Discontinuous Flow	Dry stream reaches prevent upstream migration except during flood releases that typically occur too late to support fall-run migrations (see Section 4.2.3.1, FWS 1994).
	Insufficient Flow	Combined impediments to upstream migration listed above appear to be overcome during high, fall flows – typically flows that are much higher than would be needed given the absence of these other conditions.
Spawning	Insufficient Flow	Fall flows are typically low within the spawning reach (Lanes Bridge to Friant Dam).
	Temperature	May not be limiting in spawning reach / higher temperatures downstream could affect egg viability (McBain & Trush 2002, p. 7-60).
	Substrate	Somewhat large and embedded in spawning reaches(see Section 4.2.3.2).
	Channel Morphology	Sufficient to sustain low levels of spawning.

Table CAWG 13-7. Summary of factors limiting salmon populations within the San Joaquin River from Friant Dam to the Sacramento-San Joaquin Delta (NRDC-FWUA 2000, FWUA.org) (continued)

Life Stage	Limiting factor	Description
Rearing	Insufficient Flow	Flows suitable for rearing should be provided during the salmon rearing period (January through June, with peak rearing period February through mid-March for fall-run Chinook salmon [McBain & Trush 2002]).
	Temperature	Temperatures in spawning reach and downstream are suitable during the salmon early rearing period, warming at its end (see Section 4.2.2.3).
	Channel Morphology	Suitable rearing conditions with moderate complexity and diversity of channel (i.e., habitat types and structure) exists within spawning reach.
Juvenile Migration	Flow	Flows are typically discontinuous and possibly too low within the migration corridor that would be needed for emigration (CDFG 1987, McBain & Trush 2002).
	Temperature	Warmer water temperatures may affect downstream migration during the mid- to late spring (McBain & Trush 2002).
	Diversion	Delta diversions and irrigation diversions entrain and disorient emigrating juvenile salmon (see Section 4.2.3.1).
	False Pathways	As was described for adult migration / false pathways, juvenile downstream migration is affected by the numerous false pathways, which can lead juvenile fish away from both suitable habitats and passage to the ocean, and into unsuitable or lethal areas (McBain & Trush 2002, see Section 4.2.3.1).

4.3.2 Potential Effects of the Big Creek Project on Anadromous Salmonids Downstream of Friant Dam

One of the goals of the CAWG 13 Study Plan was to identify whether there was any limiting factor(s) for anadromous fish that may potentially be affected by operations and maintenance (O&M) of the Big Creek Project. The Big Creek Project may affect physical conditions in the upper river and potentially downstream of the Big Creek 4 Project. This section identifies Project (O&M) effects and what factors may potentially be affected downstream of Friant Dam, but does not evaluate the likelihood, the amount, nor the precise mechanism for such linkage. Much of this material would be discussed in later and not yet completed study elements (see below).

The Big Creek Project may affect the timing and magnitude of flow reaching Millerton Lake, may affect the temperature of water delivered to Millerton Lake during the summer and fall, and may affect the movement of sediment in the San Joaquin River and tributaries upstream of Dam 7. The potential factors that could affect anadromous fish are flow-related habitat amount, water temperature, and effects on spawning habitat (reduction in gravel supply or embedding of gravels), or water quality.

The potential to affect anadromous fish would be related to the following factors of Big Creek O&M. First, storage of peak spring flows in the upper watershed and higher releases of flow during the summer and fall may affect water available at Millerton Lake for potential use or release downstream. In other words, some of the peak runoff flows are captured and delivered to Millerton Lake later in the summer and fall, instead of primarily in the spring and early summer. Cooler water than might be naturally available during the summer and fall, diverted from storage by deep intakes in thermally stratified Project reservoirs and discharged through Powerhouse 4 may be available to Millerton Lake later into the year. This water would have probably been warmer without the current Big Creek system in place. After depletion of the hypolimnetic water or mixing of the stratified reservoirs, water temperatures would tend to be warmer than without-Project temperatures in the early fall (SCE 2004). Project dams and reservoirs may block the movement of bedload sediments. These would largely consist of granitic materials and erosional products such as coarse sand. However, some gravel and larger material would be stored, as well. However, these materials would likely be blocked by other structures downstream of the Big Creek Projects.

Big Creek Powerhouse 4, located upstream of the Pacific Gas and Electric (PG&E) Kerckhoff Reservoir, is the downstream-most Big Creek Project feature on the San Joaquin River. The presence of Friant Dam and Millerton Lake, as well as the PG&E's Kerckhoff and Crane Valley Projects, may have their own effects, as well as influence potential effects of the Big Creek Project on anadromous salmonids downstream of Friant Dam.

In analyzing cumulative effects of the Big Creek system for the Big Creek No.4 (BC4) environmental impact statement, FERC (2002) stated:

> *Millerton Reservoir has sufficient storage capacity to control the timing of discharge from Friant dam regardless of the timing of inflows. All available conservation water outflows from Friant dam are currently used every year (Bureau, 2000). Therefore, any shifts in the timing or volume of flows from Friant dam are under the control of the Bureau, and not directly related to the operation of BC#4 (although downstream water rights and agreements influence the delivery of flow from the BCS).* (FERC 2002 p. 30).

FERC (2002) also stated that

> *The BCS as a whole may cause relatively minor shifts in the timing and magnitude of releases to downstream locations. BC#4 Project operations consist primarily of serving as a conduit in which flows from upstream projects are passed downstream with relatively little ability to alter the overall timing or magnitude of these releases. However, the overriding capacity of Millerton Reservoir to store large volumes of water and the commitment of nearly all releases to irrigation and other consumptive uses would make any possible shift in BCS operations irrelevant downstream of Friant Dam.* (FERC 2002, p. 82).

These statements have not been evaluated by SCE and may not be relevant to the Big Creek ALP relicensing decision. Study elements 4 and 5, which would provide relevant information, have not yet been implemented (Table CAWG 13-1). Additional information is being developed, which may help to assess the likelihood of potential effects of the Big Creek Project on anadromous salmonids downstream of Friant Dam and whether the effects are likely to be beneficial, adverse, or neutral.

Information developed from the CAWG 6 Hydrology, and/or CAWG 12 Water Use studies would be needed to assist in the evaluation of potential effects of the Big Creek Project on anadromous fish downstream of Friant Dam. The proposed Project alternative operations developed by the ALP for relicensing would need to be evaluated by tools identified as part of the CAWG 12 study.

In order to evaluate these issues fully, additional information from USBR studies of Millerton Lake would be needed. USBR is in the process of developing temperature modeling for Millerton Reservoir. This effort will focus on understanding the inter- and intra-annual hydrodynamic and thermal characteristics in determining if Friant Dam operations can meet future San Joaquin River restoration objectives. USBR also has established a monitoring program to continuously measure inflow temperatures, reservoir temperature and water quality profiles, and Friant Dam release temperatures. This study may

provide future information that can be used to assess the potential effects of thermal stratification and the cold water supply in Millerton Lake on summer water temperatures in downstream reaches of the San Joaquin River.

Information developed in the PM&E phase of the ALP, CAWG 6 Hydrology, and CAWG 12 Water Use studies also will be used to assist in evaluating the potential contribution Big Creek Project alternatives may make to other projects, programs, and initiatives in the watershed for anadromous salmonids and their habitats. Potential opportunities to benefit anadromous salmonids and their habitats may be identified at that time.

4.4 RESTORATION ACTIONS

Restoration activities targeting salmon and steelhead within the Central Valley have substantially increased in numbers and funding during the past 15 years. Laws, programs, and actions that have both directed and supported restoration include:

- Enactment of the Salmon, Steelhead Trout, and Anadromous Fisheries Program Act. This law took effect late in 1988 as urgency legislation. It provided the basis for the current CDFG salmon and steelhead restoration program. The act is codified in sections 6900-6924 of the Fish and Game Code of California.

- Enactment of the California Wildlife, Coastal, and Park Land Conservation Act of 1988 (Proposition 70). California voters approved this initiative in 1988. Among its numerous provisions was appropriation of $10 million to the CDFG for salmon stream restoration and enhancement in accordance with recommendations of the California Advisory Committee on Salmon and Steelhead Trout and the Commercial Salmon Trollers Advisory Committee. Over the past 10 years, numerous projects throughout California, have been recommended, including over $2 million in projects and equipment for restoration in the Central Valley. All Proposition 70 funds have been recommended for expenditure and most projects have been completed.

- Enactment of the Federal Central Valley Project Improvement Act (Title 34 of Public Law 102-575). This act became law by signature of President George Bush late in 1992, and a draft Programmatic Environmental Impact Statement was released in 2003. The act provides funding, through assessment of a surcharge on water deliveries made to water contractors served by the Central Valley Project, for, among other things, salmon and steelhead restoration in areas of the Central Valley affected by operations of the Central Valley Project.

- Establishment of CALFED Bay Delta Program. State and federal agencies with management and regulatory responsibility in the Bay-Delta

Estuary formalized state-federal cooperation with a Framework Agreement signed in June 1994. Dedicated to restore the Central Valley ecosystem and sustain a secure water supply for California

- Enactment of Proposition 204. This initiative measure was approved in 1996. It provides significant funding through general obligation bond sales, to enable California to meet its cost-share requirement for implementation of projects authorized under the Central Valley Project Improvement Act.

- FERC proceedings have contributed to salmon restoration efforts on other rivers (i.e., Penobscot River, Ross, Gorge, and Diablo (Skagit River) projects, Alder/LaGrande (Nisqually River) project, Mokelumne River, Eel River, etc.), and more recently the Cowlitz River decision.

- California Fish and Game Code § 5937 requires the owner and operator of any dam to release enough water to keep fish in good condition below the dam. (See Section 4.2.4).

Anadromous fish restoration actions within the SJR system have primarily occurred within the three major tributaries. The actions include salmon spawning and rearing habitat restoration (Stanislaus, Tuolumne and Merced rivers), water quality improvement (throughout the drainage including the Delta), diversion screening (SJR), land acquisition (SJR) and restoration planning and implementation (SJR).

Opportunities for restoration planning and implementation that would directly address conditions in the SJR downstream of Friant may become available due to ongoing litigation over management of Friant Dam. The absence of adequate instream flows downstream of Friant Dam has been a contentious issue since before the dam went into operation in 1942. Since 1988, in an attempt to provide suitable flows for salmon and steelhead and restore other aspects of salmonid habitat below Friant Dam, the NRDC has filed several suits against the USBR. In 1988, the NRDC sued the USBR claiming that water contract renewals were illegally approved without identifying the consequences to instream resources, including Chinook salmon. The suit targeted long-term CVP renewal contracts for the nearly two dozen Friant Division agencies. NRDC cited what it alleged were violations of the National Environmental Policy Act (NEPA), the Endangered Species Act, and California Fish and Game Code § 5937 as reasons why the contracts should be invalidated. In 1997, the courts invalidated these contracts and in 2001, a new set of contracts was signed.

The FWUA and its member districts and NRDC and its coalition had been conducting settlement negotiations since 1999. The mutual goals for this process include the following.

- Restore natural ecological processes to the San Joaquin River below Friant Dam, including naturally-reproducing, self-sustaining populations of Chinook salmon.
- Avoid adverse impacts on sufficiency, reliability and cost of water to Friant users.
- These are goals, not guarantees.

The process included complex studies to investigate the necessary conditions for restoration of the anadromous fish in the San Joaquin River without harming the water users. The negotiations ended in early 2003 before the restoration study for the river between Friant Dam and the confluence of the Merced River could be completed. However, a water supply study outlining ways to provide the water needed for restoration (URS Corporation 2002) and a background report detailing the historic and existing conditions of the river (McBain & Trush 2002) were completed. The parties are now back in active litigation.

The USBR is currently conducting investigations in the lower river. In July 2004, DWR and USBR also committed to undertake a scientifically-based study of fish restoration feasibility, including anadromous fish, and development of a range of implementable restoration strategies on the San Joaquin River.

The San Joaquin River Resources Management Coalition (RMC), a group of local stakeholders, is developing a conceptual restoration plan for the San Joaquin River, funded in part through the U.S. Environmental Protection Agency (EPA). The initial phase, completed in August 2003, described conditions in the river from Friant Dam to the confluence with the Merced River. The next phase will identify actions required to attain desired ecosystem conditions, as well as constraints to implementation of actions.

The Anadromous Fish Restoration Program (AFRP) is one of the programs originating from the CVPIA legislature of 1992. The USFWS has assumed lead responsibility for the AFRP. Several other activities are designed to increase smolt survival in the lower San Joaquin River and Delta, including reoperation of the State and Federal pumps at Tracy and flow management during the smolt outmigration period (e.g., the Vernalis Adaptive Management Program).

An annotated list of the major restoration actions, including targeted issues relative to factors affecting SJR salmon and steelhead is presented in Table CAWG 13-8.

4.5 FUTURE PROGRAMS AND PROJECTS

Future actions that would potentially influence anadromous salmonids within the San Joaquin River, if implemented, include the completion and implementation of SJR restoration plans, which may include increased water storage, or its

functional equivalent, and may include measures designed to improve water quality.

4.5.1 INCREASED WATER STORAGE

The Upper San Joaquin River Basin Storage Investigation (Investigation) is a joint feasibility study by USBR and DWR (USBR 2003). The Investigation is to be conducted in accordance with the CALFED Programmatic Environmental Impact Statement / Environmental Impact Report (EIS/EIR) Record of Decision (ROD), for the purpose of evaluating water storage in the upper San Joaquin River basin, or their functional equivalent, to "contribute to restoration of and water quality for the San Joaquin River and to facilitate additional conjunctive management and exchanges that improve the quality of water deliveries to urban areas" (CALFED 2000).

Table CAWG 13-8. Summary of Restoration Activities Conducted in the San Joaquin River Drainage (1990 to 2003) (NPRI 2003).

Project Title	Project Description	Targeted Stressor	Targeted spps/life stage	Drainage	Status	Cost ($)
San Joaquin River TMML	Implement a total maximum monthly load model developed for the SJR and determine the success that drainers have in meeting waste load allocations set out in the model by using bmps of on irrigated land	Water quality/agricultural drainwater	All/migration	SJR – Mendota Pool to Vernalis	Completed	218,400
SJR Restoration Project	Lead a broad coalition in the development of a restoration plan for the SJR, subject to court settlement	All	CS/all	SJR	Ongoing since 1999	30,000
SJR National Wildlife Refuge Project	Acquire riparian lands along SJR	Water quality, instream habitat conservation	CS/migration	SJR	Completed	10,647,000
SJR Real-time Data Project	Increase efficiency of monitoring salinity objectives to save water to increase SJR basin streamflow	Flow/water availability and temperature	CS/migration	SJR	na	932,000
SJR Dissolved Oxygen Management Program	Create and implement plan to achieve dissolved oxygen standards in lower SJR	Water quality/dissolved oxygen	CS/migration	SJR/lower	Ongoing	na
Habitat analysis, surveying and engineering services	Assessment of salmon and steelhead in Central Valley streams	Channel modification	CS-SH/spawning	SJR drainage	Ongoing	99,820

Table CAWG 13-8. Summary of Restoration Activities Conducted in the San Joaquin River Drainage (1990 to 2003) (NPRI 2003) (continued)

Project Title	Project Description	Targeted Stressor	Targeted spps/life stage	Drainage	Status	Cost ($)
East San Joaquin Valley Irrigated Cropland	Reduce discharge of contaminants	Water quality	CS/migration	SJR	Ongoing	na
Merced River salmon habitat enhancement SJR RM 40-40.5	Isolate gravel pit from Merced River and restore channel habitat	Channel modification	CS-SH/all	Merced	Ongoing	4,913,000
Merced River Salmon Habitat Enhancement – Robinson Ranch	Isolate gravel pit, reconfigure and restore channel habitat	Channel modification	CS/all	Merced	Ongoing	4,867,518
Merced River Land Project	Acquire land. Protect riparian and instream habitats, develop gravel source for restoration from dredge piles	Channel modification	CS/spawning	Merced	Ongoing	658,000
Merced River Corridor Restoration Plan	Develop restoration plan for Merced River (SJR RM 0-52)	All	All	Merced	Ongoing	300,000
Merced River-Lower Western Stone Restoration Site	Isolate gravel pit, reconfigure and restore channel habitat	Channel modification	CS-SH/all	Merced	Ongoing	130,000
Tuolumne River Salmon Habitat Enhancement – Ruddy Project	Spawning and rearing restoration	Channel modification	CS-SH/all	Tuolumne	Completed/damaged by high flows	na

Table CAWG 13-8. Summary of Restoration Activities Conducted in the San Joaquin River Drainage (1990 to 2003) (NPRI 2003) (continued)

Project Title	Project Description	Targeted Stressor	Targeted spps/life stage	Drainage	Status	Cost ($)
Tuolumne River mining reach restoration	Restore channel	Channel modification	CS/all	Tuolumne	Completed	2,801,000
Tuolumne River mining reach restoration	Restore channel	Channel modification	CS/all	Tuolumne	Completed	2,353,100
Tuolumne River gravel introduction at Basso Bridge	Gravel replenishment	Sediment recruitment	CS/spawning	Tuolumne	Ongoing	250,975
Tuolumne River Run Pool 10 Restoration	Eliminate pond conditions restore channel habitats	Channel modification	CS-SH/all	Tuolumne	Ongoing	521,000
SJR Restoration Project	Develop and implement long term restoration plan pending court decision	All	All	SJR	Ongoing	18,700,000
Knights Ferry Gravel Replenishment Project	Gravel replenishment	Sediment recruitment	CS/spawning	Stanislaus	Ongoing	536,410
Stanislaus River salmon/steelhead spawning gravel enhancement	Gravel replenishment	Sediment recruitment	CSSH/spawning	Stanislaus	Completed	46,620

Table CAWG 13-8. Summary of Restoration Activities Conducted in the San Joaquin River Drainage (1990 to 2003) (NPRI 2003) (continued)

Project Title	Project Description	Targeted Stressor	Targeted spps/life stage	Drainage	Status	Cost ($)
SJR and Fish Screen Project	Fish screen installation	Entrainment	CS/migration	SJR/RM 63.5	Ongoing	938,875
Lower SJR and South Delta – Adult fall-run Chinook salmon movement	Evaluate adult migration including impediments and effects of temporary barriers	Water quality, water diversion	CS/migration	SJR	Ongoing	285,000

CS = Chinook salmon

SH = Steelhead

Na = not available

4.5.2 IMPROVED WATER QUALITY

The CVRWQCB adopted a Water Quality Control Plan (Basin Plan) in 1998 for the Sacramento and San Joaquin river basins, which includes fishery migration and spawning as one of the beneficial uses of the lower San Joaquin River. The Basin Plan is undergoing a triennial review for beneficial use and water quality standard updates. The current Federal CWA Section 303(d) list (1998) identifies Mud and Salt sloughs and the San Joaquin River from Mendota Pool downstream to Vernalis as impaired water bodies (see Section 4.2.2.3). The CWA requires development of a total maximum daily load (TMDL) for each listing. The Basin Plan will include a TMDL allocation. Although future water quality objectives may be more restrictive, the Investigation is currently using existing water quality objectives. A San Joaquin River dissolved oxygen master plan also is being developed as part of an effort to abate low dissolved oxygen in the lower river (SJR Deep Water Ship Channel) near Stockton (see Section 4.2.3.1). Efforts to improve water quality in the lower San Joaquin River (Reaches 3 through 5, as well as reaches downstream of the Merced River confluence), include reduction in effluents from treatment plants and dairies/feedlots, and wetland restoration efforts, as well as other programs which may help reduce these loadings (McBain & Trush 2002, p. 5-43).

5.0 SUMMARY

Historically, the SJR supported what was reportedly one of the largest, spring-run Chinook salmon population in North America. Fall-run Chinook and steelhead trout also were present. Spring-run Chinook salmon have been extirpated and fall-run Chinook salmon and steelhead now only occur in the lower reaches of the SJR's three major tributaries, the Stanislaus, Tuolumne and Merced rivers.

Factors currently limiting anadromous salmonid populations within the SJR include discontinuous flow within much of its course during most of the year, very poor water quality throughout most of the lower reaches, severely modified channels including numerous dead-end sloughs, secondary channels and similar conditions that trap fish and inhibit migrations, reductions in gravel availability and channel structure necessary for spawning, and insufficient flows for migration, rearing and spawning. A short reach of potential habitat that exists just downstream of Friant Dam is essentially isolated from salmon except during rare periods of flood releases during the late fall.

Beginning in the early 1990s, restoration actions in the Central Valley have intensified following enactment of the CVPIA and associated Anadromous Fisheries Restoration Program, and the establishment of CALFED. Issues concerning flow management both at Friant Dam, the major downstream tributaries, and within the lower SJR and Delta have resulted in more intensive investigation of the factors limiting salmon in the lower SJR and identifying management actions that might restore salmon to that part of the river. Much of the salmonid habitat restoration effort within the Central Valley has occurred within the SJR system – mostly within the Stanislaus, Merced, and Tuolumne rivers. VAMP is being conducted to evaluate and improve conditions for salmonids outmigrating from the SJR system. Efforts also are ongoing to develop and eventually implement a restoration plan for the mainstem lower SJR. In July 2004, DWR and USBR also committed to undertake a scientifically-based, fish restoration feasibility study, including anadromous fish, and development of a range of implementable restoration strategies on the San Joaquin River.

Future actions that would influence anadromous salmonids within the SJR, if implemented, include the completion and implementation of the SJR restoration plan. USBR has been authorized by Congress to pursue a phased evaluation of the Upper San Joaquin River Storage project to identify additional water storage opportunities, or their functional equivalent, within the SJR basin to provide opportunities for restoration without jeopardizing existing water uses.

This report implements Study Elements 1, 2, and 3 of the CAWG 13 Study Plan. Elements to be implemented in the future include: "4) Use information obtained from reviews of existing information and developed from CAWG 12 Water Use

and CAWG 6 Hydrology study plans to describe likely direct, indirect, and cumulative effects of the existing SCE Projects and Project alternatives on anadromous salmonids and their habitats," and "5) Use existing studies and existing models to evaluate any SCE proposed Project alternatives with other projects, programs, and initiatives in the watershed to minimize Project effects on anadromous salmonids and their habitats. Identify opportunities to benefit anadromous salmonids and their habitats." Those study elements will be implemented when additional information is developed later in the ALP during the cumulative impact and PM&E portions of the process.

Information related to this topic is being developed by other parties. The USBR is developing temperature modeling for Millerton Reservoir and has established a monitoring program to continuously measure inflow temperatures, reservoir temperature and water quality profiles, and Friant Dam release temperatures. This investigation may provide information on potential effects of upstream operations on Millerton Reservoir. If information developed through this investigation, CAWG 6, CAWG 12, and/or Land-3 Cumulative Effects Analysis shows the Big Creek Project affects anadromous fish or their habitat downstream of Friant Dam, effects would subsequently be evaluated. Flow routing and temperature considerations would be components of this evaluation.

6.0
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MAP

Placeholder for Map

Map 13-1. San Joaquin River (Overall Map of Study Area)

Non-Internet Public Information

This Map has been removed in accordance with the Commission regulations at 18 CFR Section 388.112.

This Map is considered Non-Internet Public information and should not be posted on the Internet. This information is provided in Volume 4 of the Application for New License and is identified as "Non-Internet Public" information. This information may be accessed from the FERC's Public Reference Room, but is not expected to be posted on the Commission's electronic library, except as an indexed item.

APPENDIX A

CONSULTATION DOCUMENTATION

Big Creek Collaborative

Combined Aquatic Resources Working Group

May 10, 2001

Draft Meeting Notes

Time:	4:00 AM to 5:00 PM	**Moderator:**	Wayne Lifton
Location:	Courtyard by Marriott Clovis, CA	**Facilitator**:	Bill Pistor
Teleconference No.:	1-800-569-0883	**Recorder**:	Martin Ostendorf
Teleconference Name:	Aquatic Wkg. Grp.	**Spokesperson:**	

Attended By:

Wayne Lifton	ENTRIX, Inc.
Bill Pistor	Kearns & West
Martin Ostendorf	ENTRIX, Inc (Recorder)
Geoff Rabone	SCE
Steve Rowan	SCE
Sharon Stohrer	SWRCB
Julie Means	CDFG
Ed Bianchi	ENTRIX
Larry Lockwood	SAMs
Jen Carville	USBR
Holly Eddinger	
Rick Hopson	
Earl franks	
Janelle Nolan Summers	
Lonnie Schardt	

Telephone Participants

Chuck Bonham

Handouts distributed to the group during the meeting (distributed 4/18/01):

- Study Plan CAWG 13 and CAWG 2
- Comment letter from Steve Edmonson and Larry Naney

Draft Detailed Study Plan Review

Comments

CAWG-13 Anadramous Fish

The marked edits reflect Steve Edmonsons comments and conversation with him. What Steve wanted in the plans

PAGE 5
Sharon need to include consideration of water temperature in the analysis section. Add CAWG 5 water temperature to the Coordination Needs Section

Chuck – Comment the crucial focus of this study is on Habitat.

Habitat is a consistent crucial concern for this study.

Larry – What is the limit of how far downstream that we will go. Recent studies ,NRDC publication, have gone downstream about 10 to 20 miles. This is hazy because we are not sure of the availability of data

Can we approve of this plan without Steve on the phone. Steve can way in the 30 day comment period. Rick is uncomfortable approving it without Steve on the phone.

The CAWG approved the plan in conjunction with a follow up to Steve ask Steve if he can live with it.

CAWG-2 Geomorphology

Page 2

Rick SMGO #13 Rick is the addition sufficient in, Action item remove the SCE attribution

Page 4
New Bullet

Page 12

Step 5 BLM Strike BLM (Global change)

The Group approved this plan in conjunction with a call to Russ.

Big Creek Collaborative

Combined Aquatic Resources Working Group

July 10, 2001

Meeting Notes

Time:	10:00 AM to 4:30 PM	**Moderator:**	Wayne Lifton
Location:	Piccadilly Inn University Clovis, CA	**Facilitator**:	Bill Pistor
Teleconference No.:	1-800-569-0883	**Recorder**:	Martin Ostendorf
Teleconference Name:	Aquatic Wkg. Grp.	**Spokesperson:**	

Attended By:

Wayne Lifton	ENTRIX, Inc.
Bill Pistor	Kearns & West
Martin Ostendorf	ENTRIX, Inc (Recorder)
Geoff Rabone	SCE
Steve Rowan	SCE
Ed Bianchi	ENTRIX
Holly Eddinger	USFS-SNF
Rick Hopson	USFS-SNF
Janelle Nolan Summers (3PM)	ENTRIX, Inc.
Dan Tormey	ENTRIX, Inc.
Phil Strand	USFS-SNF

Telephone Participants

Russ Kanz	SWRCB
Sharon Stohrer	SWRCB
Steve Edmondson	NMFS
Chuck Bonham	Trout Unlimited
Gary Taylor	USFWS
Debbie Giglio	USFWS
Jesse Wilde	USFWS

Handouts distributed to the group during the meeting (distributed 4/18/01):

- Study Plans: CAWG-2 Geomorphology, and CAWG-4 Chemical Water Quality
- USFWS Service Comment Letter
- R2 (USFS consultants) comments table on the CAWG Study Plans

Steve Edmondson asked if the CAWG would get to the Anadramous Fish Study Plan today. Yes. Later today the CAWG will address comments provided by R2 Resources on this study plan. The National Marine Fisheries Service (NMFS) and the U. S. Bureau of Reclamation (USBR) are working on another proceeding to restore of the San Joaquin River and they would like to incorporate these proceedings into the Big Creek ALP.

CAWG-2 Geomorphology

The CAWG reviewed the most recent edits made to this study plan based on comments received from the CAWG during the July 2nd meeting.

CAWG Comments on the Study Plan

Detailed methodology, Step 5. Paragraph beginning "Studies of the sensitive sites…."

This paragraph identifies activities (V*, Wolman pebble counts, etc.), that will be performed at sensitive sites based on observation of excessive deposition or scour. However, we will not know if there is excessive deposition or scour until we complete these activities. The sequence of events is wrong; we need to do these first.

General observation of deposition and scour will be identified during the reconnaissance phase.

V* and the pebble counts need to be done at all the sites, not only the sensitive sites. This section is written for all sites. The first paragraph of the section refers to "all identified sites," hence we should be doing all these analyses at all the sites.

How are we going to select the sites for detailed analysis? Is everyone ok with the CAWG selecting the sites based on the preliminary information? Yes, because we have an opportunity to go back to site, based on the preliminary data.

The CAWG will choose two types of sensitive sites: 1) detailed sites; and 2) other sites based on land use impacts upon the stream. In addition to these two sites, there also will be reference sites.

Action Item: Rewrite the first, second and fourth paragraphs of this section, based on the discussion above.

> First paragraph: Third sentence, add *(study and reference)*. The sentence should be begin Sites (study and reference)..
>
> Fourth paragraph: Delete the first two sentences and half of the third sentence. The remaining text beginning with "*1) measurement of channel dimensions,…"* will be moved and incorporated into the paragraph beginning with "For all identified transects.".

Paragraph (second to last in section 5) beginning *"The Data from Step 2 and 5…."* delete 2nd sentence from this paragraph. This is the sentence beginning with *"Impacted areas…"*

Remove: "Large Woody Debris" from the list of SCI protocol at sensitive sites, since this will already be done at all sites.

> Add to the end of the second paragraph in Geomorphically-Significant Flows:
> "Flood frequency analysis will be used in conjunction with field indicators to determine bankfull flow. Methods in Hill *et al*. (1991) will be used to guide the assessment of the magnitude, timing, frequency, duration, and rate of change of out-of-channel flows. These data will be used in the Riparian Study Plan (CAWG-11)."

R2 Resources Comments

The following discussion is based on a review of comments prepared in response to comments by R2 Resource in the draft study plans.

It was suggested that since many of the R2 comments are asking for definitions, maybe the study plan package should contain a glossary. One standard glossary, for the study plan package (We will have to identify which plans the studies are referring to). The glossary will be a living document, where we can add definitions as needed. **Action Item** – Build a glossary, Include definitions for "alluvial", and "Rosgen Level I and II", (include year version that is being used).

R2 comment table – Page 14, CAWG-2-28. There was disagreement to the response, which referred the reader to CAWG 11 for details on the assessment of out-of-channel flow requirements. **Action item:** Add the following text as the last sentence of this paragraph, "Flood frequency analysis will be used in conjunction with field indicators to determine bankfull flow. Methods in Hill *et al*. (1991) will be used to guide assessment of the magnitude, frequency, timing, duration, and rate-of-change of out-of–channel flows. These data will be used in the Riparian Study Plan (CAWG-11)."

USFWS Comments

Page 2-17 (USFWS letter). This is a comment to the Stakeholder Management Goal and Objective and is not subject to revision.

Page 2-19 (USFWS letter). This comments stated that Items 8, 9 and 10 in the list of study objectives seem out of place and that 6 and 12 are duplicated. The CAWG has extensively discussed these study objectives and have developed the study objectives to have a broad focus.

Page 2-21 (USFWS Letter). Bullet 6 (The second to last bullet in Step 3, General Approach). We should add a bullet in Step 1 that states, "review and analyze existing data". **Action item:** Add bullet in Step one Historic and current SCE sediment management practices will be reviewed and described.

Page 2-27. (USFWS letter). The new revised plan includes text in Step 6 that address the USFWS comment. The CAWG may also determine that a more detailed study (for example sediment transport model) is required to make this determination.

Do we have enough time to complete this model? Yes we need a spring and a summer to collect the needed data. All the field data needs to be collected in 2002 so that we can bring the data to the CAWG to select additional sites. Then additional data can be collected in 2003. We need to get a special use permit to use a helicopter in the back country so that we can get to the sites during the snow melt since the road will be closed, otherwise we may miss the waning hydrograph. We would only do this if the road is closed. We have already talked with the USFS on the helicopter over the wilderness issue for the amphibian studies. **Action Item**: Initiate discussion with the USFS regarding the special use permit for a helicopter over the wilderness area. (no height restriction if we will not be landing.)

CAWG-2 was approved by the CAWG with the above changes!

CAWG-4: Chemical Water Quality

The CAWG reviewed the most recent edits made to this study plan based on comments received from the CAWG during the July 2nd meeting.

CAWG Comments

The changes made to this study plan were focused on clarification of water quality measurements in reservoirs, and fecal coliform sampling requirements.

Water quality grab samples will be collected monthly during the period of June through September from the large and moderate size reservoirs, concurrently with the reservoir profiling activities.

Fecal coliform sampling activities will be conducted at a screening level during the spring and fall. Additional sampling (five samples over a 30 day-period) will be conducted at sites that do not pass the screening criteria (200/100-ml) and at sites with significant contact recreation, as identified by the CAWG.

USFWS Comments

Clarification on WQ standards. We refer to the California Toxic Rule and the National Toxic Rule; however, the references are not consistent with that presented in the reference section. Need standard nomenclature that is consistent with the reference section.

We also need to identify the water quality plans with the most stringent standards and add a statement that will SCE comply with those standards. **Action Item**: Add a statement "The most stringent standard will be identified……..." Add this to the second paragraph of the Existing Water Quality Standards section.

Action Item: Add the CA Toxic Plan and National Toxic plan to the glossary. Correct citations in the text that refer to these plans.

Action item: When referring to the Basin plan we need to identify which basin the Sacramento or the San Joaquin River.

Is SCE intends to meet the most stringent standards. Yes it is our intent however, some water quality condition that is out of our control may exist which we can not meet the standard, hence we may have to mitigate if we can not meet the standard.

R2 Resources Comments

Have the R2 comments been added to the study plans. No they have not, they will be added only if the CAWG agrees.

The CAWG-4 study plan was approved by the CAWG.

General Discussion

Process question. When the plans go to the Plenary, do they vote on it? Yes we will explain these changes to the plenary and get their approval. Has the Plenary approved any plans? The Plenary has only approved the draft study plans not the final plans.

The SWRCB indicated that they are all right with the remaining study plans. However, they want to participate in the review of the macroinvertebrate study plan. The CAWG will call the SWRCB when the macroinvertebrate study is discussed.

CAWG-9 Entrainment

No comments from the CAWG or the USFWS on this study plan. Three comments were received from R2 Resources on this study plan; the CAWG did not have any comments to the responses that were prepared.

The CAWG-9 study plan was approved by the CAWG.

CAWG-11 Riparian

R2 Resources Comments

R2 Comment, CAWG-11, page 2-121, top of page items 6 and 8. The response to the R2 comments is an assumption that should be added as a footnote to the study plan. **Action Item**: Add this response as a footnote to the study plan.

The CAWG-11 study plan was approved by the CAWG.

CAWG-12 Water Use

R2 Resources Comment

One R2 comment on Study Objective No. 8. No comments were provided by the CAWG on the response that was prepared for this R2 comment. Everyone agreed that the response text should be incorporated into the study plan.

Action Item: The comment response language will be incorporated into the detailed methodology.

The CAWG-12 study plan was approved by the CAWG.

CAWG-13 Anadromous Salmonids

R2 Resources Comments

Page 2-132, Nexus. Plans to reintroduce anadromous fish above Friant Dam. **Action item**: Insert the following text as the last sentence of the Project Nexus Section "There are no active plans currently being implemented to reintroduce anadromous salmonids above Friant Dam and SCE facilities."

Page 2-132, Approach, Item 2. Disagreement with the response to comment. The project may not impact salmonids but it does impact habitat. If the Big Creek Project didn't exist, would there be flow below Friant Dam? **Action Item**: Change response, "One of the goals of the study is to identify limiting factors of anadramous salmonids downstream of Friant Dam that may be affected by operations or maintenance of the Big Creek Projects"

Page 2-134, Analysis. **Action Item**: Change response to comment as follows. "Determine if information is available and the adequacy of limiting factors."

Action item: Email the text changes to Steve Edmondson for approval. Also get CDFG to review this.

The CAWG-13 study plan was approved by the CAWG, contingent on receiving review comments from Steve Edmondson (NMFS) that would need to be addressed.

CAWG-14 Fish Passage

Page 2-138, Objectives. **Action Item**: change response by editing the second sentence to read as follows: "Anadromous fish do not occur in the Project area."

Page 2-140, Passage in Streams. Discussion on the method used to evaluate fish passage. **Action Item**: Change response to read as follows: "An appropriate method such as Thompson or Bovee will be used to determine fish passage, as determined by the CAWG."

Action item: Provide copies of Bovee and Thompson methodologies.

The CAWG-14 study plan was approved by the CAWG

General Discussion

The USFWS (Debbie Giglio and Gary Taylor) joined the meeting by conference call to review their comments on the CAWG study plans.

The CAWG just received the USFWS comments late last week and has not had sufficient time to review comments and prepare response. We are prepared to discuss USFWS comments to understand where the USFWS is coming from.

CAWG-10 Macroinvertebrates

CAWG Comments

Maybe the first thing we should do is explain that the study is based on the California Rapid Bioassessment protocol and we should give a brief overview of the protocol. Will we add our comments to the study plan so that the reader is aware of the protocol? Earlier in the process we decided to remove the detailed protocol. We need to only reference where the protocol is available.

Action item: Add to the text a statement that the CA Rapid Bioassessment is a common protocol and reference where it is available.

The CAWG did not provided comment on the R2 comments.

USFWS Comments

The USFWS has developed an alternative protocol. The USFWS is not sure that the CA Rapid Bioassessment will not provide the data needed to develop the habitat relationship. It does not represents the entire transect reaches across the stream. Would this protocol be in addition to the CA Rapid Bioassessment?

Can we separate the CA Bioassessment from PHABSIM?

What is the alternative protocol? Gore criteria curves analysis using PHABSIM. The USFWS is not objecting to the CA Rapid Biosassessment, they are only recommending that we also do the PHABSIM.

The USFWS is endorsing PHABSIM. Gore has two sets of curves 1) Rocky Mountain high gradient; and 2) some East Coast curves. The USFWS are comfortable with these curves. A placeholder for PHABSIM is included in the CAWG-3 study plan on Page 2-39. The study plan indicates that this is a CAWG decision point. The CAWG can assess the information and

determine its applicability. The CAWG will determine the adequacy and verification of the curves developed.

Action item: Get information on Gore curves (Gary Taylor to send to Wayne).

Site suitability of curves is addressed in CAWG-3; and the CAWG will meet on this.

The CAWG-10 study plan was approved by the CAWG.

CAWG-8 Amphibians

R2 Resources Comments

Page 2-99, Bullet No. 7. Survey protocols. **Action Item**: Change the response to comment to include red-legged frog survey protocol provided by the USFWS.

We should also use the USFS Yosemite Toad Protocol. **Action item**: Add USFS Yosemite Toad Protocol.

USFWS Comments

Action Item: Add the USFWS Stakeholder Management Goal (in their letter) into the synthesized version and into the individual compilation. "Undertake a predator management program for non-native species which affect sensitive native amphibians."

The USFWS has a revised draft of protocol but have not released them to us. We have concerns about a new protocol coming out when we are in mid-study. We do not want to be in mid-stream when or if the protocol changes and we need to begin studies soon so we don't miss critical time periods.

It is our understanding that if there is habitat, then the USFWS assumes species presence and must be mitigated for. If this is the case, why do the more detailed work?

The USFS has an interim protocol. The preliminary surveys have not changed (this is what the studies schedule indicates will be done this summer. The detail survey protocols are what have changed and would effect you. However, the final recovery program will be out by the time you have to do the detailed survey, this winter or next spring.

Due to our very large project area, we want to do aerial fly-overs to do the habitat mapping. This would involve high-resolution false color infrared imagery. The USFWS would like to see the aerial photos before commenting on this. What size pond can you identify using this technology? We can see three-ft diameter ponds. People walking map meso-habitat, backwater areas, and seeps and bogs.

Are we aware of the PG&E work ongoing? **Action item**: Contact Ibis Environmental or Craig Seltonridge (PG&E Biologist Staff) and discuss the problems that have encountered with this technology.

Action item: We will provide examples of the aerial photographs to the USFWS. Janelle will drop this off at their office.

The aerial imagery is one tool to identify potential habitat. We are sure that with the additional methods we will use that we will get good data (i.e., aerial Photos, stream typing, etc.).

ENTRIX will get the most current USFS-SNF site assessment that is available.

Survey forms: The CAWG will develop survey forms before studies are implemented.

The CAWG-8 study plan was approved by the CAWG.

CAWG-6 Hydrology

R2 Resources Comments

The CAWG had no comments on the responses prepared to the R2 Resources comments.

USFWS comment

1) Fifteen-minute data. Needed for unimpaired reference reaches.

Additional gages, where is this described in the detail methodology? **Action item**: Add text **"**in addition for areas with limited or no data a recommendation will be made to the CAWG whether additional gages are needed".

Unimpaired gages – we may not be able to do this since they are in the wilderness. We may be able to get this data by adding the diversion measurement and the instream flow release.

Are they any significant lengths of streams that are effected by Project operations where we need gages to provide flow data? We can synthesize data for such reaches.

The fifteen-minute data will be provided at locations where it is necessary.

2) Indices of Hydraulic Alteration methodology. This methodology doesn't identify the significance of the changes. Other studies identify the significance as stated in the last two sentences of the last paragraph of Detailed Methodology. Response last two sentences of first paragraph on page 2-78 which state: "The IHA indices will supplement hydrographs and exceedence tables, and provided basic hydrologic information to be interpreted in other studies (see coordination needs). IHA will also be run for PM&E measures."

The assumption section also addresses the significance of the hydraulic alteration, last sentence of the assumptions section.

3) IHA studies will be implemented in 2001.

The CAWG-6 study plan was approved by the CAWG.

CAWG-7 Characterize Fish Populations

R2 Resources Comments

Page 2-88, 1st full paragraph, comment on minnow traps. The Response to this comment was that we found minnow traps to be ineffective. **Action Item**: Add reference for minnow traps.

USFWS Comments

There are no specific plans to address non-native species that are favored by habitat conditions in the project. What non-native species the being referred to. This is really trying to address the presence of non-fish predators.

The responses to comment is that amphibian predators (bullfrogs) are being addressed in CAWG–8 and macroinvertebrate relationships are addressed in CAWG-3.

The CAWG-7 study plan was approved by the CAWG.

CAWG-1 Characterize Stream and Reservoir Habitats

CAWG Comments

Is Adit 8 affected by the project? No it is an ephemeral stream?

Will SCE explain how the Project is operated? What if you have an outage? We need to explain how the Project would be operated.

USFWS Comments

Page 2-3, Study Objective No. 3. The USFWS comment states that the study should investigate sediment deposition/composition, shoreline erosion, edgewater habitat, woody debris/nutrient cycling, inflow/current routing and seasonal hypolimnion changes. All of these parameters are addressed in many of the various CAWG studies. **Action Item**: Identify the studies that address these parameters in the response to this comment.

It is unclear in the study plan how habitat for given species or guilds will be characterized within different reservoir strata. The reservoir and stream relation type in different water year types – response is to model physical habitat for a range of conditions in CAWG-3 and water temperature is modeled in CAWG-5. Conditions other than those observed can be simulated through historical meteorology and flow records.

We will be doing a flow study of historical flow in CAWG-6 Hydrology.

The CAWG-1 study plan was approved by the CAWG.

Big Creek Collaborative

Combined Aquatic Resources Working Group

July 11, 2001

Meeting Notes

Time:	2:00 AM to 4:00 PM	**Moderator:**	Wayne Lifton
Location:	Piccadilly Inn University Clovis, CA	**Facilitator:**	Bill Pistor
Teleconference No.:	1-800-569-0883	**Recorder:**	Martin Ostendorf
Teleconference Name:	Aquatic Wkg. Grp.	**Spokesperson:**	

Attended By:

Wayne Lifton	ENTRIX, Inc.
Bill Pistor	Kearns & West
Martin Ostendorf	ENTRIX, Inc (Recorder)
Geoff Rabone	SCE
Ed Bianchi	ENTRIX
Cindi Whelan	USFS-SNF
Steve Rowan	SCE

Telephone Participants

Rick Hopson	USFS-SNF
Julie Means	CDFG
Holly Eddinger	USFS-SNF
Gary Taylor	USFWS
Debbie Giglio	USFWS
Phil Strand	USFS-SNF
Jen Carville	Friends of the River

CAWG-3 Determine Flow-Related Physical Habitat in Bypass Reaches

R2 Comments

Action Item: Insert the following text as the last sentence of the first bullet in the field data collection section on page 2-38, “We will collect sufficient data for utilizing the appropriate stage discharge model including WSP or MANSQ”.

Action Item: Page 2-35, move footnote with clarification to glossary.

Action Item: Copy Table CAWG 1-3 and insert it next to Table CAWG 3-1.

Action Item: Define in the glossary “small Diversions” and “Small Streams”.

Action Item: Page 20 of R2 Resources comment table (handout to the CAWG). Within the response to comment replace the words “it may be possible to do so”, with “they will”. This is in reference to the need for additional transects.

Page 21, CAWG-3, 2-36, 7. Appropriate Suitability Curve, we should get other experts to review the suitability curves. Can we have successfully transfer curves to the Big Creek System? We need an option to have people in the CAWG review curves, and not solely rely on accepted practices in the past.

If transferability testing does not work, will there be enough information to test another method? Yes there will be.

Action Item: Page 21, CAWG-3, 2-36, 7. Appropriate Suitability Curve. Edit the response by deleting the first three sentences. The response should begin with "a preliminary investigation….". Add the following as the last sentence, "The CAWG has the option of 3rd party review as per the protocol".

Action Item: Page 22 CAWG-3, 2-36, time series analysis. Change response to: "We intend to be flexible, please refer to page 2-41, Analysis Section"

Action Item: Page 22 CAWG-3, 2-36, Flow-related habitat for Small Streams. Change the response to the following: CAWG will decide on the protocol for macroinvertebrate suitability curves to PHABSIM and the use of wetted perimeter to describe macroinvertebrate habitat.

Page 24, R2 Resources comment table. We need to clarify the methodologies that we will use at the study transects. Our responses to the 2nd, 3rd and 4th comments on this page are confusing. The following language will be used:

"The study plan addresses habitat variability within project streams by placing transects in each geomorphic channel type present in a given reach (Rosgen 1996). Additionally, two transects are placed within each mesohabitat type within each of the aforementioned channel types. Unique habitats and hydraulic controls may be represented by additional transects. Site and transect selections will be made in collaboration with the CAWG."

"Our field data collection approach is to place additional transects across controls and collect all data to allow us to use the WSP or MANSQ models should the empirically derived stage-discharge relationship not meet the modeling requirements."

Page 25, CAWG-3, 2-40, Wetted perimeter, paragraph 1. Change response to read, "An appropriate method such as Thompson or Bovee will be used to determine fish passage, as determined by the CAWG."

<u>USFWS Comments</u>

Page 2-36, second paragraph, PHABSIM may also be need in the smaller streams. The study plan would use wetted perimeter to evaluate the small streams. The USFWS was asked what information they would like to see, since flows related to the source of a habitat bottleneck in the small streams would generally occur during the period when the small diversions were turned out. In general, the diversion has no direct effect on this bottleneck.

The USFWS has recently lost a battle using the wetted perimeter approach when trying to make an argument on flow versus habitat. The USFWS is uncertain that this method will be adequate. They view the smaller streams as an opportunity for a lot of fauna flora improvement. They are just as important as the larger streams.

In these smaller streams there is a base flow that affects habitat. And geomorphology is affected by the higher flows. Need to determine habitat area and how the geomorphology is affected at the higher flows.

We are talking about very low flow streams. We are talking about base flow from and 1 cfs to 0.1 cfs, however the peak flows are much higher for a short duration. There is a period between the base and peak flows when diversions are turned out. And during these periods will PHABSIM or wetted perimeter be the method to use. The use of PHABSIM for this purpose may not be appropriate.

If we begin data collection next year and then struggle with the data, does this preclude doing something else the following year? Another way to get at this is to go through some pilot exercise. Is there an example of how we have done this in the past, for example from Vermilion? We are currently working up the data. Will the Vermilion example data be useful to the USFWS? Yes it will.

The August site tour will be a good opportunity to get everyone to the small streams. We can discuss the applicability of PHABSIM and wetted perimeter analysis on the small streams during the tour.

Wetted perimeter is not the only tool to complete this analysis of the small streams. The geomorphological information also will be very important.

Action item: Develop a bulleted list to USFWS of the different studies on the small streams PHABSIM and Wetted Perimeter.

Page 2-37, Occurrence of mesohabitat. This was addressed with the R2 comments

Page 2-38, Survey protocols. We don't tie benchmarks together in individual reaches. The USFWS was OK with this. Also it was unclear, which criteria would be used to determine the high flows that will be modeled. This will be determined by the CAWG based on the bankfull determination from the Geomorphology study, etc.

Page 2-39, Adjacent cell velocities – we are not proposing to use adjacent cell velocities in the PHABSIM modeling.

The USFWS thinks it is a valid method that should be used. We are not comfortable using the curves developed for adjacent cell velocities in other location of the country, would rather used the common curves developed here in the west.

The USFWS we will reserve our right to use your data to run the model.

Do you collect the same data and then run the different models in the office? There is no difference in the data collection. There are very large differences in the assumptions that are plugged into the model.

If they go do the HSI curves and they are found to be transferable, will you have sufficient data and curves to run your analysis?

The USFWS indicated that we should not be fearful that they would change the methodology requirement for the study later in the process.

SCE expressed concern, that they are fearful of this, that new methodologies imposed later in the process will result in redoing the studies entirely to obtain data for the new methodologies. We are somewhat fearful that later in the process we may to do the study differently.

The USFWS was asked if they could supply those curves set to us? Yes they can provided these. That would be good, then we would have a common point of discussion.

Page 2-39, Macroinvertebrate criteria. This criteria is addressed in the macroinvetebrate study plan.

The CAWG-3 study plan was approved by the CAWG.

CAWG-5 Water Temperature

CAWG Comments

The CAWG agreed with the R2 comments and responses, and agrees with the USFWS comments.

Modeling is a CAWG decision point. The USFWS is fine with that.

Page 28 of the R2 comments 2-65 to 2-69. There is a dense array of temperature monitoring location and sparse flow data. The temperature data must be much denser than flow data in-order to accurately calibrate the model. While flow data we are mostly interested in the inflow data. We have lots of gage data. We have sufficient flow data and gages on small diversions and medium streams. The South Fork San Joaquin River is the only area where there are only a few gages.

Action Item: Edit the response to this comment to include a statement that we will have sufficient flow data to do the needed temperature modeling.

Is the SWRCB ok with CAWG-5? Pending confirmation from the SWRCB, everyone agrees to approve CAWG-5

Action Item: Follow up with the SWRCB to verify that they will approve the CAWG-5 study plan.

The CAWG-5 study plan was approved by the CAWG.

The CAWG approved all 14 study plans during the July 10th and July 11th meetings.

Big Creek Collaborative
Combined Aquatics Working Group

January 14, 2004

Meeting Notes

Time:	10:00 AM to 4:30 PM	**Moderator:**	Wayne Lifton
Location:	Piccadilly Inn University	**Facilitator**:	Bill Pistor
Teleconference No.:	1-800-556-4976	**Recorder**:	Ryan Bricker
Name:	Combined Aquatics Working Group		

Attended By:	Bill Pistor (Facilitator)	Kearns & West
	Ryan Bricker (Note Taker)	Kearns & West
	Andrew Wyckoff	Kearns & West
	Wayne Lifton	ENTRIX
	Julie Means	CDFG
	Geoff Rabone	SCE
	Wayne Thompson	Federation of Fly Fisherman
	Rick Hopson	USFS
	Julie Tupper	USFS
	A. Britt Fecko	SWRCB
	Phil Strand	USFS
	Lonnie Schardt	Huntington Lake Association
	Monty Schmidt	NRDC
	Roger W. Robb	Friant Water Users Authority
	Larry Wise	ENTRIX
	Wayne Allen	SCE
Phone Participants:	Brian Caruso	ENTRIX
	Debbie Giglio	USFWS
	Mitchell Katzel	ENTRIX
	Woody Trihey	ENTRIX
	Paul Devries	R2 Resource Consultants

Introductions and Agenda

Bill initiated the meeting by introducing Ryan Bricker (Kearns & West) and Andrew Wyckoff (Kearns & West) and then asked for everyone to introduce themselves and the organizations they represent.

Review Action Items/Meeting Notes

The group reviewed and approved the November Meeting Summary and went through the Action Items from the December CAWG meeting.

Action Item #1: Geoff Rabone (SCE), Phil Strand (USFS), and others to check for an email from Jim Canaday (SWRCB) regarding the SWRCB water temperature criteria (from late September or October). If not found, Britt Fecko (SWRCB) to re-craft and provide to Kearns & West for distribution to the CAWG.

Action Item #2: Brian Caruso (ENTRIX) to correct the hydrology table error identified by Rick Hopson (USFS) and provide new Hydrology Packet on CD.

The group then discussed the 2004 CAWG meeting schedule. The group was informed that SCE is considering having all meetings held regularly at the Piccadilly Inn and that it is safe to say that we will be having more meetings this year than in the past.

Action Item #3: CAWG meeting currently scheduled for February 12, 2004 to be adjusted due to State Holiday.

Monty Schmitt (NRDC) was new to the group and asked if he could be given a brief update on the CAWG 12 and CAWG 13 studies. Wayne Lifton (ENTRIX) responded that CAWG 12 "Water Use" is still a little further out. The hydrology must be completed as well as the water routing modeling before "Water Use" can be wrapped up. Right now they are shooting for March for the distribution of CAWG 12 "Water Use." Wayne L. also added that they are just entering the impact analysis phase and they might be a little behind of where they would like to be. CAWG 13 "Anadromous Fish" is one of the 2004 reports coming out in the next month or two and there will be the normal comment period.

Action Item #4: Add NRDC (Monty Schmitt) to CAWG Distribution Lists and Kearns & West to provide contact info to Carla Anthony (SCE).

Britt Fecko (SWRCB) asked for a negotiations scheduling estimate. Negotiations are expected to kick off in March along with a Mutual Gains training session. The goal is to wrap-up settlement in December 2004.

Rick Hopson (USFS) asked if the routing models will be a CAWG decision point. Wayne L. replied that it is in the study plan that CAWG consensus is required.

Britt brought to the group's attention that the February CAWG meeting is currently scheduled for the 12th which is a state holiday and will need to be rescheduled.

The group reviewed past Action Items.

CAWG 6 Hydrology Update:
Wayne L. displayed a PowerPoint presentation on the Big Creek Hydrology Study to the group while Brian Caruso (ENTRIX) narrated from the phone. Brian talked the group through the slides and explained how to read the various graphs and informed the group of the sources of various data. It was mentioned that the graphs presented are going to be distributed on CD with updates made. As they go through the streams and diversions, the spreadsheet has constantly been updated.

Brian continued explaining the data summary tables and what the columns and symbols represented. Rick asked why they were choosing to use twenty year records rather than the entire records. Brian replied that they are looking at the entire record, but in many cases some stations only have data going back to the 80s. In addition, the conditions from the last 20 years may be more valid for the group's purposes than data from the 30s or 40s, because of additional project facilities being constructed since then. Wayne L. added that the reason for looking at the 20 year records is to have "apples to apples"

comparison. Brian agreed, but added that there are still some cases where we don't even have 20 years of data, so the data is not entirely consistent, but they are trying to be as consistent as possible.

Brian went on to further explain the data summary sheet. Britt asked if the tunnel numbers could also be added as well as the names. In other documents and data sheets, sites are referenced by their tunnel numbers. Brian answered that they have found some inconsistency in names from different documents but they can add tunnel numbers.

Action Item #5: Brian Caruso (ENTRIX) to correct Eastwood table, add tunnel numbers to conduit names, and provide annotations to the small diversion hydrographs.

Brian continued to explain the data summary table for small diversions. Rick had a question about Crater Creek and why there was only one gauge. Wayne Allen (SCE) explained the location of the gauge to the group and Wayne L. added for clarification that these are diverted flows. It was explained that it is impossible to tell by just looking at it. It was decided that as an Action Item that Wayne A. would look into this issue.

Action Item #6: Wayne Allen (SCE) to look into why there is only one gauge value for Crater Diversion.

Brian went on to explain why flat peaks were excluded from the statistics while their values were included on the table. He explained that the flat peaks value tells us that it was at least a certain value. He also told the group that in the end less than 2 percent of the data was excluded from analysis. However, even though these are small percentages, the values tended to be located at the extreme ends of the highs and lows and therefore could have an impact on the final results, so this should be talked about in the future.

Where they did see peaks flatten out, they checked for streams below the diversion to look for increased flows there as well. From this they can look to see if measurement devices were working properly. Rick thought that the next step might be to throw the numbers back in and see how sensitive the analysis would be.

Wayne Allen told the group that at Camp 62, where they had flat peaks, vertical shafts were drilled into the tunnel in 2001-2002 and Camp 62 had experienced a problem. It would not accept the water. Wayne A. then suggested that it be added as an Action Item for him to look into this issue further.

Action Item #7: Wayne Allen (SCE) to look into issues regarding Camp 62 and the vertical shafts that were drilled in 2000-2001.

Rick added that this would not explain Hooper or Bolsillo.

Bill asked Brian if the sensitivity analysis suggested by Rick was something that they would already do or if the group should make it an Action Item. Brian responded that it is not something that they would do. Julie Tupper (USFS) added that it is more important to understand the hydrology of the main streams. She thought that the group should figure out if there are more important things that need to be done first. Geoff Rabone (SCE) agreed with Julie and suggested it be added to the bin list.

Bin Item: Brian Caruso (ENTRIX) to consider sensitivity analysis for excluded data for small diversions.

Brian continued with the presentation. One of the slides showed hydrographs for each year at Chinquapin. It was pointed out that there was no data for the years 1996-1997 when the station was knocked out by a flood. Geoff asked if Chinquapin was the one with the flat peak and wanted to look at that. Brian answered that it didn't have a flat peak, but did have a series of low flows very close to 0 (looking at 1992). The graph excluded September which included some of the data they wanted to look at and Brian told the group that it could be included in the final version.

Brian continued to explain the hydrograph slides and data gaps for 1972 through the early 80's. Rick asked if they were planning on doing an unimpaired analysis for these streams. Brian responded that right now the goal is to estimate the unimpaired flows where we have gauges. There are requests for data at flows where there are no gauges and they are looking at those by a case by case basis. Geoff asked if it would be possible to add the vertical lines to the graphs for ease of viewing. Brian answered that they could.

Action Item #8: Brian Caruso (ENTRIX) to add appropriate vertical lines to hydrographs for ease of viewing.

Britt asked if the Bear Creek conduit was just for Bear Creek. Wayne A. answered that it is.

Brian went on to explain the exceedance tables. Julie T. asked when the minimum pool went into effect in Florence Lake. The answer was 1979. Julie T. suggested that it might be nice to use that as our cut-off date.

Action Item #9: Brian Caruso (ENTRIX) to use 1979 (when minimum pool went into effect) as the beginning of modern period for exceedance tables for Florence storage (minimum storage requirement estimates).

Geoff wanted to confirm that the plan was to distribute these graphs on CD. He brought up that it would be difficult to read these graphs in black and white and wanted to make sure it was acceptable to the group if the graphs were in color on CD instead. It was agreed that for now the graphs will continue to be in color and that all stakeholders will have an opportunity to receive a CD.

Brian continued with the presentation. Julie T. brought up that the group has piles of data - so much that it becomes complicated figuring the whats, wheres, and whys of everything that is going on and suggested that a summary be provided to the Working Group.

Action Item #10: Brian Caruso (ENTRIX) to produce a summary list (which, where, and what) for the large volume of data.

Rick mentioned that a table for IHA and Summary Statistics locations was previously provided to the group, but there was never any resolution on what will be done and at

which locations. It would be unfortunate if later in the process people started asking for additional information.

Action Item #11: Brian Caruso (ENTRIX) to present rationale with examples for doing different levels of IHA in different cases. To present at February CAWG.

Phil Strand (USFS) asked about the possibility of making all the data for discharge stations available to the CAWG. Wayne A. answered that all the data used is on the USGS website. Julie T. added that some SCE data was also used and believes that it would helpful if the CAWG could at least be provided with the information that is not on the USGS website

Action Item #12: Brian Caruso (ENTRIX) and Wayne Allen (SCE) to identify what data is being used that is not USGS data.

CAWG 2 Geomorphology Review of Field Notes

Mitchell Katzel (ENTRIX) and Woody Trihey (ENTRIX) joined the meeting by telephone to discuss their responses to the USFS's field inspection draft summary comments. Mitchell told the group that one of the points discussed was that Big Creek below Huntington has undergone a great deal of change. He believes that they will need to work with the channel as it is (currently first order status) rather than attempt to change it to a fourth order channel, which is probably what it used to be. But for Big Creek below Huntington, if the group is not happy with the first order status maybe it will have to be changed to a fourth order channel. Rick replied that the Forest Service was not proposing a fourth order channel, but thought that there needs to be a discussion on whether a fourth order channel was needed. Phil added that they did have a discussion out in the field and it was suggested there to think about it as a first order channel, but no decisions were made.

Mitchell asked the group if they thought that it needs to be added to the memo that further discussion is needed. Rick replied that he thought so. He also added that Mitchell and Woody should also include this as one of their recommendations, but maybe present it as a decision point. It was also suggested that the memo be revised using a single text technique. Julie T. added that everyone needs to be cautious when writing these memos to make sure they are presenting data rather than making decisions. Someone who wasn't involved in this discussion could pick this up and think that a decision had been made. It was agreed that it would be better to phrase the memo as a proposal.

Action Item #13: Mitchell Katzel (ENTRIX) to revise field trip memo as recommendations rather than a decision and distribute for approval by the CAWG. (Future Decision Point)

Rick asked when the quantitative data and would be available. Mitchell answered that it will be coming out, but he couldn't give a date. But it will be part of the 2003 DTSR.

Britt said that, referring to Mitchell's response on measuring the channel, she thought it might be necessary to evaluate the quantitative results then reevaluate on whether it will be necessary to make measurements based on what the channel naturally was. Mitchell agreed that the current study plan will provide some information but may not have all the

information that the CAWG needs to make decisions. This means that sometimes additional information gathering will be needed. We may need hard data with test flows.

Woody told the group that if they are going to work with the existing channel they could look at the type of movement from the fine sediment in the channel. If they were thinking of changing the channel type, there are some considerations that need to be taken into account. Information could be used from cross-sections for determining what the channels used to be like and if it was decided to release water, think of the debris that would flow down to dam one. There are lots of other factors to look at and the group might not even want to go there. They have got a lake and a first order flow regime and might want to work with what currently exists rather than what used to be there. Bill added that it sounded like the discussion was important, but might be needed later in the PM&E stage. Wayne L. agreed that this is a discussion for down the road after the reports have been distributed.

The Group took a lunch break.

CAWG 3 Instream Flow – HSC Update

Larry Wise (ENTRIX) went through the Stanislaus River HSC with the group and discussed what they will be using for the meeting on the 28th and 29th. He explained that on the Stanislaus River, they took their observations and developed a generic trout criteria similar in concept to the total trout criteria (adults + juveniles) the CAWG discussed at their previous meeting. The original intent had been to verify criteria using transferability testing, as we were doing here. They were unable to verify curves and ended up developing site specific curves from the smaller transferability data set. Generally substantially more observations are required to develop site specific criteria. The group began to review the different curve sets.

Phil asked about the difference between the Stan 1 and Stan 2 curves. Larry replied that they ran two different sets of criteria in the Stanislaus relicensing process. He added that for adult trout velocity, one of the things they looked at was bioenergetics when they developed Stan 1. Phil asked to know how they arrived at that and if they used habitat runs. Larry replied that he talked to Mark Allen to get his information and beyond that he didn't have all the answers. Britt told the group that Russ Kanz might be able to fill everyone in. Julie T. told the group that they might be able to get Craig Addley to come talk to the group about the Stanislaus River Criteria.

Geoff noted that the Stan curves were developed on a fairly low number of observations compared to SCE's. Larry agreed that those numbers would be considered low if you were developing criteria. Julie M. said that she could get a copy of the final report for everyone.

A stakeholder asked about UARP criteria. Larry responded that they had already talked about the UARP. Geoff asked about information on the hardhead specifically, but this information was not on the slides. Larry went on to explain the UARP hardhead criteria to the group. He added that the UARP hardhead criteria have not been approved by Peter Moyle yet so everything should be considered preliminary. UARP only had adult hardhead criteria. They couldn't find any criteria for juvenile hardhead.

Action Item #14: Britt Fecko (SWRCB), Julie Tupper (USFS), and Julie Means (CDFG) to give Larry Wise (ENTRIX) a copy of the SPLAT Validation Study Report. ENTRIX to distribute to the CAWG.

The group moved on to Passage Analysis. It was proposed that 10 percent contiguous width criterion be dropped from the analysis. Larry explained to the group that by the time you get to your 25 percent total you almost always get your 10 percent contiguous. The 10 percent contiguous width requires a substantial amount of work, as is not output directly by the RHABSIM or PHABSIM programs. Rather you have to manually go through reams of output to determine the flow at which the 10 percent contiguous width is met.

It was asked if this was separate from barrier analyses and the answer was yes. In PHABSIM there are transects in representative riffles. There are physical barriers (falls, culverts, etc.) identified in CAWG 1 that will be included in the barrier report, along with the typical passage flows from the passage analysis described above. Wayne continued to explain that what Larry was suggesting has been done on many larger rivers. It's hard to get the 10 percent contiguous values from the data and it is very labor intensive

Geoff said that he would say to go ahead, because it seems like the Thompson's 0.4 foot depth criteria is based on the physical dimensions of a trout, velocity on swimming speed, and width would be based on the physical dimensions of a trout as well. Ten percent of the width of most streams is much larger than the typical width of an adult trout.

Britt asked what exactly they are trying to get at with this study. The answer was that they are trying to identify the flows in the larger streams in which passage may be obstructed. They are picking representative riffles and calculating a representative passage flow. For each transect they look to see what flow is needed to achieve the minimum passage criteria over at least 25 percent of the stream width. Britt asked what they are trying to get at with the contiguous. It was Larry's opinion that the contiguous is supposed to be big enough for the fish to find and the 25 percent is intended to allow the fish to find its way from one area of passage within a unit to another, as the thalweg of the channel is not always contiguous. Paul asked if this was going to be applied to both high and low flows? Larry replied that it would be applied mostly to low flows. Phil concluded that this meant that they are mostly going to be looking at depth as the main issue.

It was stated that they are not asking for approval at this point but will likely ask for approval at the next meeting. The CAWG was asked to please forward questions to Kearns & West and they will forward them to ENTRIX. It would be nice to get a sense from everyone if this seems like an acceptable approach.

Future Decision Point: Use of Thompson's Criteria for Passage Analysis.

Larry handed out a packet that included the Stanislaus and UARP criteria in addition to what was handed out at the previous meeting. He went through the tables with the group and explained what the codes meant. Larry agreed to provide the group with a legend to accompany the packet.

Action Item #15: Larry Wise (ENTRIX) to produce page of glossary keys/legend for abbreviations, symbols, line width, etc.

Action Item #16: Ryan Bricker (Kearns & West) to email location info for Modesto HSC meeting to the CAWG.

Action Item #17: ENTRIX to distribute HSC meeting agenda to the CAWG early next week.

Phil asked if the background materials from Julie M. could be provided to the group before the next meeting. Julie M. answered that if it was small enough she could make copies.

There was no more business on HSC and the group moved on to discuss responses to CAWG 5.

Discussion of CAWG 5 Report Comments and Responses

All comments received on CAWG 5 have been entered into the table accompanied by the response.

Referring to her comment that included replacing the words "warm" and "cold" in the report with numeric values, Britt said that she agrees that it is easier to read "warm" and "cold" and can live with it, even though it is a technical report.

Britt's next issue had to do with natural warming in comparison to warming resulting from the diversion of flows. She stated that the EPA is very specific about what natural waters are and suggested that rather than saying increase temperatures "due to natural warming" it may be better to say "warming is due to absence of flow." She also offered to provide Geoff with the EPA definition that the SWRCB follows.

Action Item #18: Britt Fecko (SWRCB) to provide Geoff Rabone (SCE) with citation for the EPA's definition of natural warming, anthropogenic effect, etc.

Britt also had a concern with the data gap for Big Creek Upstream of Huntington Lake resulting from vandalism. The following year experienced a dramatic temperature jump. She said that there has to be some other reference stream in comparison to Big Creek Downstream. Wayne L. replied that they do have some. Home Creek and Line Creek are examples. Britt added that it may be helpful to provide comments or footnotes where there are data gaps or jumps in the graphs. Wayne L. replied that they have been modifying the text and it will be footnoted on the graphs.

Phil had a comment regarding using the 24 degree Celsius criteria as a baseline before the CAWG has accepted what the effects might be. Wayne L. replied that they also have data for 22 degrees Celsius and 23 degrees Celsius. The main reason for using 24 was to conservatively identify reaches for modeling. All the data for different temperatures will be appended to the report. A stakeholder told the group that there was NOAA fisheries temperature data that they could use. Wayne L. told the group that they have referred to the EPA issue paper #5. Jim Canaday pointed this out when it first came out and they have been watching it. There is a lot of good stuff that they have compiled, but there are also many differences in the species and strains of fish that are

being evaluated in the Pacific Northwest as opposed to what we find in California, the southern portion of the range for many of these species.

Wayne L. told the group that the rewrite will be significant in terms of edits with all the tables being entered in. The executive summary table will have the reference streams that Britt wanted to see. He added that they will try to make it as painless as possible, but with all the changes it will be pretty complex

Monty said that while looking at the 2001 study plans, one of the things that he was interested in was trying to understand how the issue of restoration of Anadromous fish downstream was being looked at. It has been unclear for years how to look at water temperature as a connected element. Wayne L. replied that temperature and other variables downstream of the Project area are only addressed in terms of biological effects in the Anadromous fish report and only as they have been identified to date. It is a summary of project potential effects and proposed projects (in addition to Big Creek) that may affect this project in terms of cumulative impacts. Potential downstream effects of the Big Creek system will be noted in the report, but basically no actions will be suggested until something is proposed as a suitable project or PM&E.

Monty told the group that he was still trying to figure out what it would take to restore Anadromous fish below Friant dam. He is looking at anything that would have to do with timing of flows and providing suitable temperatures downstream at different times of the year. There is a draft restoration study in the works. The SCE studies are further along than their research downstream, but they are just trying to get a handle on it to see if temperature is an issue.

Monty told the group that it would help to look at some of SCE's data. Bill suggested that Monty talk to Wayne L. Monty asked if there was a modeling of outflows as part of Big Creek No. 4. Temperature models would be helpful since it is the end of the SCE project. Wayne L. and Geoff responded that it was a long time ago, but that they could look at the Big Creek No. 4 license application.

Action Item #19: Geoff Rabone (SCE) to provide Monty Schmitt (NRDC) with a copy of the Big Creek 4 temperature portion of the license application.

Geoff brought up a comment made by Britt where she talked about the effects of temperatures and "species of concern". He told Britt that when he thinks about "management species," he thinks of things like trout or frogs, but when he read in her comments about "species of concern," he was a bit troubled. He wanted to know if she was looking at something else that was not being currently considered in the study plans. Britt responded that it was just a generic term that she used.

There were no further issues and the Group Reviewed Action Items and adjourned.

Action Item #1: Geoff Rabone (SCE), Phil Strand (USFS), and others to check for an email from Jim Canaday (SWRCB) regarding the SWRCB water temperature criteria (from late September or October). If not found, Britt Fecko (SWRCB) to re-craft and provide to Kearns & West for distribution to the CAWG.
Action Item #2: Brian Caruso (ENTRIX) to correct the hydrology table error identified by Rick Hopson (USFS) and provide new Hydrology Packet on CD.

Action Item #3: CAWG meeting currently scheduled for February 12, 2004 to be adjusted due to State Holiday.
Action Item #4: Add NRDC (Monty Schmitt) to CAWG Distribution List and Kearns & West to provide contact info to Carla Anthony (SCE).
Action Item #5: Brian Caruso (ENTRIX) to correct Eastwood table, add tunnel numbers to conduit names, and provide annotated hydrographs to the data summary tables.
Action Item #6: Wayne Allen (SCE) to look into why there is only one gage value for Crater Diversion.
Action Item #7: Wayne Allen (SCE) to look into issues regarding Camp 62 and the vertical shafts that were drilled in 2000-2001.
Action Item #8: Brian Caruso (ENTRIX) to add appropriate vertical lines to hydrographs for ease of interpreting.
Action Item #9: Brian Caruso (ENTRIX) to use 1979 (when minimum pool went into effect) as the beginning of modern period for exceedance tables for Florence storage (minimum storage requirement estimates).
Action Item #10: Brian Caruso (ENTRIX) to produce a summary list (which, where, and what) for the large volume of data.
Action Item #11: Brian Caruso (ENTRIX) to present rationale with examples for doing different levels of IHA in certain cases. Present at February CAWG.
Action Item #12: Brian Caruso (ENTRIX) and Wayne Allen (SCE) to identify what data is being used that is not USGS data.
Action Item #13: Mitchell Katzel (ENTRIX) to revise field trip memo to sound like a record of the trip with recommendations rather than decisions and distribute for approval by the CAWG. (Future Decision Point)
Action Item #14: Britt Fecko (SWRCB), Julie Tupper (USFS), and Julie Means (CDFG) to give Larry Wise (ENTRIX) a copy of the SPLAT Validation Study Report. ENTRIX to distribute to the CAWG.
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Action Item #18: Geoff Rabone (SCE) to provide Monty Schmitt (NRDC) with a copy of the Big Creek No. 4 temperature portion of the license application.

Bin Items and Future Decision Points
Bin Item: Brian Caruso (ENTRIX) to consider sensitivity analysis for excluded data for small diversions.
Future Decision Point: Use of variation of Thompson's Criteria for Passage Analysis.

Big Creek Collaborative
Combined Aquatics Working Group
Conference Call

May 11, 2004

Final Conference Call Notes

Time:	1:00 AM to 2:00 PM	**Moderator:**	Wayne Lifton
Location:	Piccadilly Inn University	**Facilitator**:	Bill Pistor
Teleconference No.:	1-800-556-4976	**Recorder**:	Andrew Wyckoff
Access Code:	271911		

Phone Participants:	Bill Pistor	Kearns & West
	Andrew Wyckoff	Kearns & West
	Wayne Lifton	ENTRIX
	Julie Means	CDFG
	Geoff Rabone	SCE
	Mario Santoyo	FWUA
	Roger Robb	FWUA
	Marsha Wolf	FWUA
	Monty Schmitt	NRDC
	Phil Strand	USFS
	Rick Hopson	USFS
	Larry Wise	ENTRIX
	Ruth Sundermeyer	ENTRIX
	Wayne Allen	SCE
	Kelly Catlett	FOR
	Mark Gard	USFWS
	Paul Devries	R2 Resource Consultants
	Dudley Reiser	R2 Resource Consultants
	Tony Buelna	USBR
	Chuck Hanson	FWUA
	Irwin Van	USBR
	Dale Mitchell	CDFG
	Valerie Curley	USBR
	Steve Chedester	Exchange Contractors Water Authority

Introductions, April Meeting Notes and Agenda

The conference call was initiated and stakeholders introduced themselves and specified which organization they represented. There was a brief discussion regarding the April 14, 2004 meeting notes. Paul Devries (R2) had submitted a comment clarifying a statement/conversation that was attributed to R2 in the draft meeting notes. After brief discussion, it was agreed that Paul's comments would be placed as a footnote in the meeting notes and a new sentence would be inserted to reference the conversation between Larry Wise (Entrix) and Paul. The CAWG agreed and the April 14, 2004 meeting notes were approved. Bill Pistor (Kearns &West) then laid out the meeting agenda and asked if anyone had any additions to the agenda. Wayne Lifton (Entrix) asked that an additional topic of discussion be added—Larry Wise's zero velocity intercept and winter criteria rationales, which were distributed to the group following the last CAWG meeting.

April Action Item Review
Bill ran through all of the outstanding Action Items from the previous CAWG meeting and asked for the status of each one. All Action Items had been completed.

HSC Discussion
Geoff Rabone (SCE) said that Wayne Lifton had recently spoken with Jim Canaday (SWRCB) and Jim said he was still in agreement with all the CAWG HSC curves except for the hardhead—he still wanted to hear Peter Moyle's input regarding hardhead. Larry mentioned that he had heard back from Peter Moyle and that Peter mostly felt that in general, the hardhead criteria captured things well. Peter expressed that these criteria reflected habitat preference during the summer low flow period, however, and did not reflect habitat during the winter season or when spawning and early life history occur. Larry indicated that he has recently emailed Peter asking for greater clarification re: hardhead criteria. Bill asked Larry if he would distribute these emails to the CAWG (see Action Item (AI) #1 below). Dale Mitchell (CDFG) also mentioned an email exchange he had with Peter Moyle re: Big Creek 4. He said he would forward this email to the CAWG (see AI #2 below).

The conversation then switched over to the Mark Gard's work using Rubin et al. At the request of the conference call participants, Mark Gard described the process he went through to derive the curve sets which he had previously distributed to the CAWG via Kearns & West. Using the raw data collected from the Upper American River Project relicensing, Mark applied an approach, he developed for criteria development, which included a logistic regression on depth and velocity data. Mark mentioned that he had revised the original curves he previously sent out. The original curves' bimodal distribution for depth. Mark felt it was reasonable to connect the two peaks because after a certain depth, depth does not matter. Geoff said he did not agree with arbitrarily connecting the two peaks. Mark said that part of the reason he revised the work was because he had gone back and used more data points in generating the second set of curves. Dudley Reiser (R2) said that the CAWG previously discussed these depth considerations and wanted to steer the conversation toward the velocity curves, focusing on the ascending limbs. Dudley mentioned that Larry had provided frequency histograms for availability of velocities on the Big Creek system and Mark said he had done the same thing. He asserted that fish would select faster velocities if they were available. Several CAWG members (including Wayne, Paul DeVries (R2), Geoff, and Larry) expressed reservations with the Rubin et al approach, and further with the alterations to the Rubin et al approach that Mark had made in this treatment. Mark reiterated that the Fish and Wildlife Service was still not in agreement with the CAWG curves and that they would run their own curves and develop their Section 10(j) recommendations from those.

Phil Strand (USFS) asked for a sensitivity analysis to be completed. Dudley said the sensitivity analysis would provide further clarity on the ascending limb and help the USFS determine whether they needed to reassess the criteria agreed upon at the last meeting. Wayne and Larry said they would get back to the group on the scheduling for a sensitivity analysis (see AI #3 below).

CAWG 13 Schedule Discussion
Mario Santoyo (FWUA) asked what the schedule process was for reviewing the CAWG 13 Draft Technical Study Report. Wayne reminded the group that stakeholders had a 30-day comment period following the distribution of a report and that ideally, these comments would be collected and responses provided within a few weeks. Geoff reminded the group that they were already behind schedule and that the goal for right now was to get out factual records to be used during the next stage—evaluating impacts. Bill mentioned that the next Plenary meeting was scheduled for September and that this meeting is supposed to be the kickoff date for negotiations. Mario then asked if there was a cutoff date for those stakeholders who have yet to submit comments (most notably NOAA and USFWS). Geoff said he would check with NOAA and USFWS representatives at an upcoming conference as to whether they intended to submit comments on

CAWG 13 (see AI #4 below)The group then agreed upon a cutoff date of close of business day May 18th for stakeholder comments on CAWG 13 (see AI #5 below).

CAWG 13 Discussion

Bill indicated that comments on CAWG 13 had been received from USFS, NRDC, FOR, CDFG & FWUA. In order, he asked for general comments from each stakeholder who has submitted comments. Phil Strand (USFS) felt that the Forest's comments on some of the judgments and decisions laid out in the report needed to be withheld until the completion of draft technical study reports CAWG 6 & 12. He also mentioned the inconsistency throughout the report of the language, for example, "the biggest" versus "one of the biggest" salmon runs in the country.

Monty Schmitt (NRDC) indicated that because the San Joaquin River (SJR) was such a large, complex river, he would like to see greater clarification in the report as to which segment or section of the river was being discussed at particular times during CAWG 13. The next item he expressed concern over was the statement that the timing and outflow below Friant Dam was unaffected by the Big Creek system operations. Wayne pointed out that this statement was a conclusion of FERC's in the Big Creek 4 license issued in December 2004. Monty felt this topic alone would be worthy of a conference call or additional meetings. He reiterated that his priority is understanding how upper system operations affect flows into Millerton.

Dale Mitchell (CFDG) would like an in-person meeting to discuss the report. He feels there are some material flaws in the correctness of the report and that CDFG is very invested in CAWG 13. He did indicate that the majority of the CDFG comments may be policy-related at this time, but that more technical comments may come later. Mario Santoyo (FWUA) then responded to a CDFG comment in CAWG 13 re: the determination of downstream flows. He felt the purpose of CAWG 13 was not to determine flows for downstream fisheries. Dale responded saying that temperature was more important to him and how Big Creek operations affect anadromous fish downstream. Mario concurred. Dale indicated he would update/revise CDFG comment #3 (see AI #6).

Geoff (SCE) responded saying that the ability to connect information/data between upstream and downstream flows is a difficult thing to do. He emphasized that the relicensing is heavily time-driven and that this issue may be difficult to address at this time. Dale said an out-of-the-box solution may need to be found.

Mario Santoyo and Roger Robb (FWUA) felt CAWG 13 should strictly focus on Big Creek impacts on the downstream anadromous fisheries. A particular concern was not including recent reports prepared for the FWUA. FWUA, then suggested that the report be withdrawn and be replaced by a reading list.

Valerie Curley (USBR) said she had not had a chance to review the report but that she would submit comments by the comment deadline. It was requested that Steve Chedester, Paula Landis and Valerie Curley be added to the CAWG distribution list (see AI #7 below).

Wayne then said if the group was contemplating changing the objectives of CAWG 13, as identified in the approved study plan, a decision should be made prior to spending more time discussing the current version. Wayne identified that "available" information was to be used in the report according to the study plan and asked stakeholders to submit current, applicable reference materials for group review, If such materials were now available. The group agreed that more current reference material did exist and that it would be provided for the group (see AI #8 below). Monty Schmitt said he would deliver a copy of the SJR background report to Kearns & West for distribution to Entrix and SCE (see AI #9 below). The group then decided to have a CAWG 13 subgroup meeting on June 1, 2004 at 1:00 PM—whether this meeting would be in person or a conference call will be determined by May 20, 2004 (see AI #10 below).

CAWG 1 Discussion

Phil (USFS) was the only stakeholder to submit comments on CAWG 1. He indicated that his comment was related to woody debris and a resolution it referred to. Wayne (Entrix) said he would amend the report with direct edits incorporating Phil's comments.

CAWG 10 Discussion

Wayne said stakeholder comments submitted for CAWG 10 were reviewed in January and the appropriate edits were made for further stakeholder review. No comments had been received after the abovementioned edits were made by Entrix. Wayne asked to have the CAWG 10 Report approved. Bill asked if anyone objected to approving the report. There were no objections and the report was approved.

Phil then brought up a RIVPAC approach which the USFS had recently been using and indicated that it might possibly yield better information for CAWG 10. Wayne asked if Phil had a write-up for this RIVPAC model which might help the group make a more informed decision. Phil said he would forward RIVPAC PowerPoint and PDF documents to Andrew Wyckoff for distribution to the CAWG (see AI #11 below).

Finally, two stakeholders asked for an updated Draft Technical Study Report Review and Approval Timeline so that they could better manage their report review and comment workload (see AI #12 below).

Bill then reviewed the meeting's action items with the group and the conference call was adjourned.

Decisions

CAWG 10 Macroinvertebrate Report was approved.

May 11, 2004 Action Items

AI #1: Larry Wise (Entrix) to forward to the CAWG his emails with Peter Moyle re: hardhead.
AI #2: Dale Mitchell(CDFG) to forward to the CAWG the email from Peter Moyle re: Big Creek 4.
AI #3: Wayne Lifton and Larry Wise (Entrix) will inform the CAWG of the schedule and process for the HSC sensitivity analysis.
AI #4: At the May 12th & 13th conference in Sacramento, Geoff Rabone (SCE) will ask NOAA and USFWS whether they are going to submit comments for CAWG 13. Geoff will then inform K&W of their answers. K&W will follow up if Geoff does not make contact.
AI #5: Final stakeholder comments on CAWG 13 are due to K&W by close of business day on May 18th. This includes Dale Mitchell's (CDFG) revision of previously submitted CDFG comments.
AI#6: Dale Mitchell (CDFG) to edit/revise CDFG comment #3 and resubmit to Kearns & West.
AI #7: Andrew Wyckoff (K&W) to add Valerie Curley, Paul Landis, and Steve Chedester to the CAWG distribution list.
AI #8: CAWG members will provide the most recent reports, analyses and information related to CAWG 13 to ENTRIX and SCE. Copies of these documents or citations will be provided at the CAWG 13 subgroup meeting. (K&W will determine whether these can be put on CD).
AI #9: Monty Schmitt (NRDC) will deliver a copy of the San Joaquin River background report to K&W for distribution to Entrix and, pending the document size, to SCE and interested stakeholders.
AI #10: A CAWG 13 subgroup meeting will be held on June 1st. By May 20th, it will be later determined whether this meeting will be in person or a conference call.
AI #11: Phil Strand will provide a copy of the RIVPAC Power Point presentation to Andrew Wyckoff, of Kearns & West for distribution to the Working Group.
AI #12: Entrix will update the DTSR Review and Approval Timeline in order to better assist stakeholders track their workload.

Big Creek Collaborative
Combined Aquatics Working Group
Conference Call

June 8, 2004

Final Meeting Notes

Time:	9:00 AM to 11:00 AM	**Moderator:** **Facilitator**:	Wayne Lifton Bill Pistor
Teleconference No.: **Access Code:**	1-800-556-4976 271911	**Recorder**:	Andrew Wyckoff

Participants:	Bill Pistor	Kearns & West
	Andrew Wyckoff	Kearns & West
	Wayne Lifton	ENTRIX
	Julie Means	CDFG
	Geoff Rabone	SCE
	Debbie Giglio	USFWS
	Roger Robb	FWUA
	Phil Strand	USFS
	Rick Hopson	USFS
	Wayne Allen	SCE
	Madelyn Martinez	NOAA

Introductions and Agenda

The meeting was initiated and stakeholders introduced themselves and specified which organization they represented. Bill Pistor (Kearns &West) then laid out the meeting agenda.

CAWG Schedule Update

The group was given a quick update on the schedule for CAWG-13. Final stakeholder comments are due to Kearns & West by close of business on June 8th and outside reports need to be provided to Entrix and SCE at stakeholders' convenience. However, ENTRIX will not be able to respond to reports that are not made available. Wayne Lifton (ENTRIX) pointed out that only available material is to be included in CAWG 13. Once these things occur then a CAWG-13 meeting/conference call will be arranged. Wayne Lifton then gave a quick update on the distribution schedule of other CAWG Draft Technical Study Reports (DTSRs). He indicated that CAWG-2, CAWG-3, CAWG-6 and CAWG-8 should be distributed to the group within the next ten days. Wayne then reminded meeting participants that June 30th was the due date for comments on CAWG-4, which had already been distributed to the group.

May Action Item (AI) & Draft Meeting Notes Review

The group then reviewed the action items from the May CAWG meeting. All action items had been completed with the exception of the following two, which are ongoing:

AI: Larry Wise (Entrix) to forward to the CAWG his emails with Peter Moyle re: hardhead.
AI: Dale Mitchell (CDFG) to forward to the CAWG the email from Peter Moyle re: Big Creek 4.
AI: Wayne Lifton and Larry Wise (Entrix) will inform the CAWG of the schedule and process for the HSC sensitivity analysis.

Julie Means (CDFG) said she would contact Dale Mitchell regarding his action item and Wayne Lifton said he would check with Larry on the status of his Peter Moyle email action item. There may have been an email problem that prevented it from getting out. Wayne also indicated that Larry was finishing up the HSC sensitivity analysis and it should be going out to the CAWG as a set of sides, shortly.

Roger Robb (FWUA) had some comments on the May draft meeting notes. He quickly ran through the his comments with the group and said he would email his comments to Andrew Wyckoff (Kearns & West) for revision (see AI #1 below).

CAWG-14 Discussion

Wayne L indicated that Phil Strand (USFS) was the only stakeholder to provide comments on CAWG-14. Wayne said that a comment table was being developed and would be distributed to the CAWG when it was finished. Wayne and Phil discussed the comments and Entrix's responses to the USFS comments. They agreed on the revisions that would be made. Phil then asked for clarification on whether Hooper Creek has one or two channels. He indicated that there was a discrepancy between USGS topographic maps and the text of the report. Wayne L said he would look into the issue by contacting Mitchell Katzel (Entrix) who conducted field work on Hooper Creek (see AI #2 below).

Madelyn Martinez (NOAA) asked Wayne what the term "low flow" meant and whether there was a particular cfs range for the waters designated as low flow. Wayne explained that the term was a general one describing the condition of many streams in this watershed after the Spring-Summer snow-melt runoff has subsided. A site specific value would depend on the depth and width of the channel and the size and other characteristics of the sub-watershed. Bill then proposed providing Madelyn with the Big Creek IIP and the 2002 Technical Study Report (TSR) package (see AI #3 below). Phil then suggested that it may be a good idea to get Madelyn into the field in order to familiarize her with the Big Creek facility and project area. He felt this was an effective way to introduce new stakeholders to the project. Debbie Giglio (USFWS), Rick Hopson (USFS) and Julie Means (CDFG) also expressed interest. Geoff Rabone (SCE) and Wayne Allen (SCE) said they were currently looking into possible summer dates for such a visit (see AI #4 below).

Julie Means said she needed to check with her colleague, Stan Stephens (CDFG), to see if he had any additional comments to CAWG-14 (see AI #5 below).

A brief discussion then ensued between Phil, Wayne L and Julie about the swimming speeds of hardhead and the northern pikeminnow. Wayne said he would provide Phil and Julie with a citation re: the swimming speed of hardhead (see AI #6 below).

CAWG-1 Discussion

Phil Strand was the only stakeholder to provide a comment for this report. The comment table went out and the necessary revision was made. Bill then asked if anyone else had comments. Nobody responded and then Bill asked if the CAWG was ready to approve CAWG-1. The group approved CAWG-1.

CAWG-5 Discussion

Wayne Lifton indicated that CAWG-5 had been distributed in fall 2003 and that stakeholder comments had been offered and incorporated into the report. This revised report was then redistributed to the CAWG. Phil Strand (USFS) was the only stakeholder to submit additional comments by the established deadline. Wayne indicated that a comment table was nearly finished and would be sent to the group upon completion. Roger Robb (FWUA) said he had some comments on CAWG-5 and that he would send his comments to Andrew Wyckoff (Kearns & West) (see AI #7 below).

A stakeholder then requested that if heavily marked-up, revised reports were to be distributed that one clean version was sent along with the marked-up, edited version (see AI #8 below). Another stakeholder then asked for clarification on how to submit comments to Kearns & West. Should they be single text edits according to the Communications Protocol or should they be "Track Changes". Kearns & West will email CAWG re: the format (single text or track changes) in which they prefer to receive report comments (see AI #9 below).

Madelyn Martinez then asked Wayne L to provide clarification on why most of the discussion in CAWG-5 used Celsius temperatures and the discussion of warming was in Fahrenheit. Wayne said that the Basin Plan specified 5°F over natural warming and that the language was carried over. He offered to further clarify that, if needed.

Decisions
The CAWG-1 DTSR was approved by the CAWG.

Bill then reviewed the meeting's action items with the group.

June 8, 2004 Action Items
AI #1: Roger Robb (FWUA) will email his edits on the May CAWG draft meeting notes to Andrew Wyckoff (Kearns & West) for revision.
AI #2: Wayne Lifton (Entrix) to check with Mitchell Katzel (Entrix) re: the issue of one or two channels on Hooper Creek.
AI #3: Kearns & West will send Madelyn Martinez (NOAA) a copy of the Big Creek IIP and the 2002 TSR package.
AI #4: SCE to arrange a summer field visit for stakeholders. Debbie Giglio (USFWS), Rick Hopson (USFS), Julie Means (CDFG), Phil Strand (USFS) and Madelyn Martinez (NOAA) all expressed interest in participating.
AI #5: Julie Means (CDFG) to check with Stan Stephens (CDFG) to see if he had reviewed CAWG-14 and if he had any comments on the report.
AI #6: Wayne Lifton (Entrix) to provide Julie Means (CDFG) and Phil Strand (USFS) with the citation re: the swimming speed of hardhead.
AI #7: Roger Robb (FWUA) will email his comments on CAWG-5 to Andrew Wyckoff (Kearns & West).
AI #8: If heavily marked-up, revised reports are to be distributed make sure to provide one clean version along with the marked-up, edited version. (Entrix, Kearns & West)
AI #9: Kearns & West will email CAWG re: the format (single text or track changes) in which they prefer to receive report comments.

Ongoing Action Items from May
AI: Larry Wise (Entrix) to forward to the CAWG his emails with Peter Moyle re: hardhead.
AI: Dale Mitchell (CDFG) to forward to the CAWG the email from Peter Moyle re: Big Creek 4.
AI: Wayne Lifton and Larry Wise (Entrix) will inform the CAWG of the schedule and process for the HSC sensitivity analysis.

Big Creek Collaborative
Combined Aquatics Working Group
Conference Call

July 14, 2004

Meeting Notes

Time:	10:00 AM to 12:00 AM	**Facilitator**:	Bill Pistor
Teleconference No.:	1-800-556-4976	**Recorder**:	Andrew Wyckoff
Access Code:	271911		

Participants:	Bill Pistor	Kearns & West
	Andrew Wyckoff	Kearns & West
	Wayne Lifton	ENTRIX
	Julie Means	CDFG
	Geoff Rabone	SCE
	Debbie Giglio	USFWS
	Roger Robb	FWUA
	Phil Strand	USFS
	Rick Hopson	USFS
	Claire Hsu	USBR
	Madelyn Martinez	NOAA
	Rodney Wittler	USBR
	Martin Ostendorf	ENTRIX
	Larry Wise	ENTRIX
	Monty Schmitt	NRDC
	Erwin Van Nieuwenhuyse	USBR

Introductions and Agenda

The meeting was initiated and stakeholders introduced themselves and specified which organization they represented. Bill Pistor (Kearns &West) then laid out the meeting agenda.

June Action Item (AI) & Draft Meeting Notes Review

The group reviewed the action items from the June CAWG meeting. All action items had been completed with the exception of the following:

AI: Dale Mitchell (CDFG) to forward to the CAWG his correspondence with Peter Moyle re: Big Creek 4.

Julie Means (CDFG) and Andrew Wyckoff (Kearns & West) said they would both contact Dale Mitchell regarding his action item.

Bill then asked for the group's approval of the May and June draft CAWG meeting notes. Roger Robb (FWUA) noted that one of the participant's names was misspelled. Pending this correction being made, the group approved the May and June draft meeting notes.

CAWG Schedule Update

Wayne Lifton (Entrix) reviewed the CAWG report distribution schedule with the group. A PDF file titled "July 14 2004 CAWG Schedule Summary" was distributed to the group prior to the meeting and can be used as a reference for stakeholders as they are receiving and reviewing reports.

CAWG-13 Discussion

Wayne informed the group that final stakeholder comments on CAWG-13 were still being collected and once all comments were in he would create a revised comment table to be distributed to the CAWG. A meeting will then be scheduled to discuss the submitted comments (see AI #1 below). Monty Schmitt (NRDC) expressed concern that CAWG-13 was falling behind schedule. He then said that he was hesitant to approve CAWG-5 (on the agenda as a decision/approval item) because of related temperature elements which are unanswered from CAWG-13. The main question, according to Monty, was whether the Big Creek system had operational impacts on Millerton reservoir, especially with regards to temperature.

Another stakeholder reminded the group that the purpose of the CAWG-5 Temperature Monitoring report approval was for the CAWG to determine if the elements of the approved study plans had been carried out or not.

Rod Wittler (USBR), new to the CAWG, introduced his agency's interest in CAWG-13. He said the Bureau of Reclamation was currently in the process of implementing a temperature modeling program in Millerton Reservoir and below Friant dam. It was his belief that any information available from the temperature modeling and monitoring conducted during both the Big Creek ALP and the Big Creek 4 relicensing would help reduce uncertainty from his agency's work. He added that after reading the CAWG-13 Executive Summary he was primarily concerned with the fact that conclusions were being drawn without supporting information.

CAWG-5 (Temperature Monitoring) Discussion

Wayne reminded the group that the CAWG-5 report being discussed during this conference call was the CAWG-5 Temperature Monitoring report, not the Temperature Modeling report. The CAWG-5 Temperature Modeling report was distributed to the group on July 12, 2004 and comments are due by August 10, 2004.

Bill reminded the group that approving a 2004 study report does not mean that it is the end of the discussion. If necessary, stakeholders can readdress these issues with the Plenary or during the development of the PM&Es. He then asked the group if they were ready to approve the CAWG-5 Temperature Monitoring report. Geoff Rabone (SCE) stated that he had recently spoken with Jim Canaday (SWRCB) who had told Geoff that he had to respond to a request from the Board and couldn't participate in today's call, but to go ahead with approval of the CAWG-5 Temperature Monitoring report. He would most likely have comments on the CAWG-5 Temperature Modeling report. Monty added that he could approve the report with the note that the informational needs to resolve CAWG-13 require information that is not currently available in CAWG-5. Bill then asked for tentative agreement of CAWG-5 Temperature Monitoring pending confirmation of the SWRCB's approval and the inclusion of Monty's note for additional information. The group agreed to tentatively approve the report with those stipulations.

CAWG-4 Update

Martin Ostendorf (Entrix) explained that comments on the report had been received from the CDFG and the USFS. He continued, saying that the comments had not been resolved yet but that he anticipated completing a revised comment table and revised text by the end of the week. Once this was completed, the materials would be distributed to the CAWG. A stakeholder asked for the most recent version of the CAWG-4 working text and Andrew said he would distribute it to the CAWG following the conference call (see AI #2 below). The USBR requested that a copy of the 2003 Water Quality Report be distributed to Valerie Curley (USBR) (see AI #3 below). CAWG-4 will be discussed and considered for approval at the August CAWG meeting.

CAWG-3 Discussion

Larry Wise (Entrix) said comments on the report had been received from the USFS. A comment table was sent out to the CAWG last week. Larry then asked if any other stakeholders were going to submit comments. Deb Giglio (USFWS) said she might have comments and, if so, she would submit them to Andrew and Entrix by July 23, 2004 (see AI #4 below). Next, Larry reviewed each comment and the suggested response/correction. Phil Strand (USFS) was satisfied with each of Larry's changes and felt his comments had been properly addressed. Bill then asked the group for tentative approval of the report if Deb Giglio does not submit comments. The group agreed to approve the report.

CAWG-14 Discussion

Wayne indicated that the question regarding whether there are one or two channels in Hooper Creek had been resolved. There was a second channel, however it was dry at the time of the survey. The wetted channel was not correctly located on the USGS topo and Wayne said that a revised map showing the actual wetted channel was to be distributed on CD to the Plenary. Bill asked the group if they would approve CAWG-14 and the group unanimously gave their approval.

Decisions

The CAWG-3 DTSR was tentatively approved by the CAWG, becoming final approval if Debbie Giglio does not submit comments by July 23rd.

The CAWG-14 DTSR was approved by the CAWG.

July 14, 2004 Action Items

AI #1: Wayne Lifton (Entrix) will prepare a schedule for CAWG-13. It will include the creation of a comment table and revised text and a meeting date to reconvene and discuss the proposed changes.
AI #2: Andrew Wyckoff (Kearns & West) will distribute the most recent version of the CAWG-4 working text to the CAWG.
AI #3: Kearns & West will send Valerie Curley (USBR) a copy of the 2003 Water Quality report.
AI #4:.Deb Giglio (USFWS) to review CAWG-3 by July 23rd and if she has comments she will submit them to Andrew Wyckoff and Entrix.

Ongoing Action Items from May/June

AI: Dale Mitchell (CDFG) to forward to the CAWG the correspondence from Peter Moyle re: Big Creek 4.

Big Creek Collaborative
Combined Aquatics Working Group

September 9, 2004

Meeting Notes

Time:	9:00 AM to 3:00 PM	**Facilitator**:	Bill Pistor
Teleconference No.:	1-800-556-4976	**Recorder**:	Andrew Wyckoff
Access Code:	271911		

Participants:	Bill Pistor	Kearns & West
	Andrew Wyckoff	Kearns & West
	Wayne Lifton	ENTRIX
	Julie Means	CDFG
	Geoff Rabone	SCE
	Roger Robb	FWUA
	Phil Strand	USFS
	Lonnie Schardt	Kokanee Power
	Monty Schmitt	NRDC
	Mario Santoyo	FWUA
Phone Participants:	Valerie Curley	USBR
	Claire Hsu	USBR
	Chuck Bonham	Trout Unlimited
	Ruth Sundermeyer	ENTRIX
	Kelly Catlett	Friends of the River

Introductions and Agenda
The meeting was initiated and stakeholders introduced themselves and specified which organization they represented. Bill Pistor (Kearns &West) then laid out the meeting agenda. Bill reminded the group that the CAWG 13 report is to focus on the study objectives agreed upon by the CAWG. The report consists of publicly available information and the elements already completed. Bill also indicated that the NRDC and the FWUA had provided additional materials, portions of which were incorporated into the report. Finally, Bill acknowledged the August 27, 2004 court ruling regarding Friant Dam operations. He encouraged meeting participants involved in the court case to separate their concerns regarding the case from their concerns regarding the CAWG 13 study report. The meeting participants agreed to do so.

CAWG-13 Anadromous Fish Discussion
First, Roger Robb (FWUA) requested that the group review the CAWG 13 study objectives. Wayne Lifton (ENTRIX) projected the study objectives onto the screen and read through objectives 1 through 5. Wayne stated that objectives 4 and 5 are not currently implemented. He stated that objectives 1, 2 and 3 are implemented with 2 implemented to the extent that all available existing information is being used.

Wayne then indicated that if the group collectively agrees upon the changes made during the meeting then a revised version of the text would be distributed to the group for its review.

Next, Wayne began reviewing the CAWG-13 Response to Comments Table with the meeting participants. The first sixteen comments of the table pertained to text in the Executive Summary portion of the report. Mario Santoyo (FWUA) expressed his reservations over the Millerton Lake statement attributed to a FERC 2002 document (see working text footnote #2). He stressed that just because the words were extracted from a FERC document, they are not necessarily true. He cautioned drawing conclusions from this statement. Valerie Curley (USBR) concurred with Mario saying that she felt the statement should be removed from the report since it cannot be verified. Bill Pistor (Kearns & West) asked Geoff Rabone (SCE) for his thoughts on the matter and Geoff suggested that in the Executive Summary we only review information, not present conclusionary statements, and add a roadmap and status of the elements to be covered. The group agreed to remove the first three sentences of the paragraph, which contained the abovementioned sentences from the Executive Summary. Valerie said she would appreciate that. The fourth sentence of the paragraph would be sent to the study objectives, and a reference would be made to what objectives have or have not been implemented. Valerie then said she would provide additional operational information and language to clarify the USBR's temperature modeling efforts (see Bin Item #1 below).

Wayne asked Mario for clarification on his comment regarding steelhead (see working text footnote #9). Mario's concern was that there was no factual information to support the statement. Mario indicated that hearsay or narrative history should be deleted and only documented information be included. Wayne responded that he had gotten the information from the National Marine Fisheries Service (NMFS) and will make the appropriate citation in this section.

Mario then wanted to discuss working text footnote #15. The comment/edit was submitted by Monty Schmitt (NRDC). Mario was concerned about eliminating the statement about the current USBR and FWUA activities. Wayne assured Mario that the same statement was made later in the main body of the report. Chuck suggested that it be indicated where in the report future restoration opportunities are listed. It was suggested that the RMC conceptual restoration plan and the Bureau's Fisheries Investigation be included. Wayne reiterated that the report was developed with only available, existing information. He asked working group participants to provide additional information/reports if they had any and wanted to see them incorporated into the CAWG 13 report.

The next discussion revolved around comments/footnotes #25. Wayne stated that the report was strictly trying to address the limiting factors downstream of Friant Dam. Mario said that if that was the intention, then he did feel it was clearly stated in the report. Monty shared Mario's confusion over this topic. He asked whether the CAWG was to identify all limiting factors or only those affected by Big Creek. He suggested that there should be a list of potential factors in the upstream area. Monty added that it is unknown whether there is an effect or the extent, and therefore it is difficult to connect to limiting factors. We need specificity of how the second part of the sentence is to be carried out. He felt that each report was pointing to the other reports saying that they will contain the information. His fear is that, in the end, the last report will then have to bear the burden of having to answer all of the unresolved matters. Monty continued saying he did not feel it was the Big Creek ALP's job to perform water temperature modeling. What he would like to see, however, in one of the reports is the statement that hydrology and water temperature upstream are connected to the San Joaquin River system below the Big Creek project. The effects may be negative, positive or neutral.

Roger Robb (FWUA) suggested that if there is any logical connection between Big Creek and downstream activities then the connection should be stated. Wayne then asked if the edit to comment/footnote #25 should be to make a list of factors upstream of Friant Dam that may affect the San Joaquin downstream of Friant Dam and identify what information is needed to evaluate them (e.g. CAWG 6, 12, or studies that may be undertaken by other parties in the future).

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Wayne added that how the outflow of the system affects stratification in Millerton Lake should not be part of this process. Hydrology and temperature upstream at the bottom of the study area should be done. Valerie felt this one change would go a long way toward resolving her concerns over of the CAWG 13 report. Mario agreed and affirmed that he would like to see all of the limiting factors identified in the report. He then stated that he did not expect SCE to do a full blown temperature model or that analysis needed to be done for the CAWG 13 to be approved. Geoff and Wayne said the potential limiting factors would be listed in the revised version of the report. The group was pleased with this resolution.

Wayne agreed to generate a list to be included in CAWG 13. He indicated the impact analysis phase is yet to be implemented. The bottom boundary for hydrology analysis is the top of Redinger Lake. For cumulative effects, it unclear where the boundary would be.

Monty reiterated that his focus was very narrow—where in the CAWG reports is the connection between the Big Creek Projects and downstream activities going to be made. He said he felt it was obvious that storage in the upper system has hydrologic effects on downstream areas. He is only concerned with the cumulative effects of the temperature and the hydrology at the bottom of the Big Creek system. Geoff agreed and said he now had a clearer view of what Monty was looking for.

Claire Hsu (USBR) made a request that SCE provide any hydrology information they had so that the USBR could use it for their upcoming temperature modeling project. Roger suggested that the USBR should be involved in the Big Creek 4 Adaptive Management Technical Review Group. Valerie Curley agreed this would be a good idea and said she would determine who the most appropriate USBR representative would be (see AI #1 below).

The next discussion focused on comment/footnote #38. Monty Schmitt had submitted direct edits to a sentence discussing the irrigation diversions located downstream of Kerckhoff Dam. Mario expressed his reservations over Monty's use of the word "temporary". Mario preferred using he word "seasonal". The group worked together to establish language that was acceptable to all involved and the agreed upon language will be included into the revised version of the report.

Comment/footnote #47/48, submitted by the USBR, was the next comment discussed at length. Monty pointed out the flows below Stevenson and Friant are from different sources of water. He wanted to see this distinction made in the text, where the water comes from and what the relative flow is. The USBR had no objections to this and Wayne said he would make this distinction in the revised version of the text.

Mario then raised his reservation over the use of the phrases "turbid backwaters" and "poor water quality", which were used in a direct edit Monty made to the report. Monty responded that his changes and the wording he used were based on information from a report. Mario asked for this report to be cited following the statement.

The group then discussed which reports had been used to create the CAWG-13 report. Julie Means (CDFG), Phil Strand (USFS) and Roger Robb (FWUA) all requested a copy of the McBain & Trush San Joaquin River Restoration Study Background report (see AI #2 below).

For comment #56, it was noted that there is a channel in Reach 4, and McBain and Trush will be cited.

The next discussion concerned the direct edit made by Monty Schmitt re: the Yolo Bypass. Monty requested that Wayne call Ted Sommer of the Department of Water Resources (DWR) to discuss Monty's suggestion and get a citation for the information (see AI #3 below).

Monty then questioned the verity of comment/footnote #62 re: the Cain study. Monty asked Wayne to check the San Joaquin River Restoration Study report and see if the information in both reports is the same.

Comment # 68 was discussed. Wayne suggested with the recent U.S. District Court Decision (NRDC et al. v. Roger Patterson, etc., et al. 2004), both views be presented in CAWG 13. Valerie indicated she looked forward to how that will be rewritten.

For comment #70/71, the group decided the response should be consistent with the earlier discussion.

Roger then said that he would like to see the word "subsidized" stricken from comment/footnote #78. No group members had objections to this. Roger then asked for citations to be added to the "bullets" submitted by Monty Schmitt. These bullets are in a direct edit located right before comment/footnote #79.

In the direct edit immediately following comment/footnote #79, Geoff requested that the word "adequate" be inserted in the place where the word "required" had been stricken. There were no objections to this addition.

Roger then asked what the information in comment/footnote #82 was referring to. He was unclear as to what reach was being identified. Monty said that the reach mentioned ran from Friant Dam to Highway 99. Wayne said that he would add this information, as well as indicate the time of year, to the revised version of the text.

Roger then asked about the second direct edit following comment/footnote #82. He was wondering if the referenced studies' objectives were to "restore the salmon" or "investigate the restoration of the salmon". The group agreed to change the wording to reflect that it was an investigation of the restoration of the salmon: "…complex studies to investigate the necessary conditions for restoration of the anadromous fish in the SJR."

The group then discussed the documents completed and not completed. The two documents were Water Supply and Strategy. The Background Report was the building block and the other reports should be consistent with it. The Water Supply Report evaluating alternative water supply sources to meet restoration needs was completed (URS Corp. 2002) and is publicly available.

Geoff requested that the word "suppose" be stricken from the direct edit located immediately before comment/footnote #83. The change will be made in the revised version of the text.

There was then a discussion about the second direct edit following comment/footnote #82. It was agreed that changes would be made to indicate the "mutual goals" of the FWUA and the NRDC. Mario asked for further clarification/expansion re: the water supply report mentioned in the passage. It was also agreed upon by the group that the last sentence of the edit/passage would be removed from the revised version of the text: "The resolution of NRDC v. Rodgers may include a flow requirement in the San Joaquin River below Friant Dam."

Wayne indicated Monty's second edit in Section 4.5.1 would be implemented.

Monty then asked if there was a more recent reference than the one used in the USBR direct edit immediately following comment/footnote #92. He noted that the reference used was roughly twenty years old.
Wayne then made an overall reference to the General Comments section found at the end of the text. He said that the majority of the information submitted in the General Comments had been covered earlier in this CAWG-13 discussion/meeting. He said that when he was revising the overall text he would make sure to adequately respond to each stakeholder's general comments.

The group then reviewed the meetings action item and adjourned.

September 9, 2004 Action Items & Bin Items

AI #1: Valerie Curley (USBR) to determine what USBR representative will participate in the Big Creek 4 Technical Review Group.

AI #2: K&W to send Julie Means (CDFG), Phil Strand (USFS) and Roger Robb (FWUA) a copy of the McBain & Trush San Joaquin River Restoration Study report.

AI #3: Wayne Lifton (ENTRIX) to check with Ted Sommer (DWR) to obtain a citation for the Yolo Bypass information.

Bin Item #1: Valerie Curley (USBR) will provide additional operational information based on recent studies and language to be used in the CAWG 13 report in order to provide greater clarity and verity to USBR activities. She will check with USBR staff and let Andrew know the schedule by Monday 9/13/04.

Big Creek Collaborative
Combined Aquatics Working Group

October 13, 2004

Meeting Notes

Time:	9:00 AM to 2:30 PM	**Facilitator**:	Bill Pistor
Teleconference No.:	1-800-556-4976	**Recorder**:	Andrew Wyckoff
Access Code:	271911		

Participants:	Bill Pistor	Kearns & West
	Andrew Wyckoff	Kearns & West
	Wayne Lifton	ENTRIX
	Julie Means	CDFG
	Geoff Rabone	SCE
	Roger Robb	FWUA
	Phil Strand	USFS
	Wayne Thompson	Fly Fishers
	Mike Henry	FERC
	Larry Wise	ENTRIX
	Valerie Curley	USBR
Phone Participants:	Monty Schmitt	NRDC
	Dudley Reiser	R2
	Paul DeVries	R2
	Ruth Sundemeyer	ENTRIX

Introductions and Agenda

The meeting was initiated and stakeholders introduced themselves and specified which organization they represented. Bill (Kearns &West) then laid out the meeting agenda.

CAWG 3 PHABSIM Discussion

Both the USFWS and the USFS submitted comments on CAWG 3 PHABSIM. Larry Wise from ENTRIX addressed these comments. The USFS comments had been received a week and a half prior to the meeting and Larry noted that he had not had time to fully address each comment, but he had looked at them and was able to address them generally.

The first four USFWS comments focused on the appendices containing the BICEP model review and model calibration summary tables. Larry (ENTRIX) stated their comments on the BiCEP Model Review would have been more timely back in 2002 when the Review was conducted and approved by the CAWG. The USFWS comment's on the BiCEP Model Review focused on the models for Lower Big Creek (downstream of Dam 4). These models were not used in the ALP PHABSIM modeling. Larry noted the comments would not affect the ALP modeling and no revisions would be made to the report regarding these comments. Larry addressed the comments. No USFWS representatives were present at the October 13, 2004 CAWG meeting to discuss the Agency's comments.

Larry then began addressing the additional comments concerning the ALP PHABSIM from the USFWS and the USFS. Both agencies commented that, in some places, there were inconsistencies in the reported stage of zero flow (STZ) at adjacent transects and that it was difficult to tell which transects were tied together (tied to the same elevation benchmark). Larry said that ENTRIX would provide clarification about which transects were tied together and explained that some of the STZ discrepancies were due to the way the RHABSIM software works. Mike (FERC) and Larry discussed how the model adjusts as it goes along, which lead to some of the errors in the report. However, Larry said that most of the changes are in hundredths of a foot, not tenths of a foot. Mike agreed that this change was not dramatic. Larry went on to explain that a few incorrect STZ elevations were found. He projected some slides demonstrating how these changes would affect the WUA function for specific transects and for reaches as a whole. The most pronounced effect is observed at the level of the individual transect, and these changes were small. When the difference was carried upward to the entire reach, the changes in WUA were nearly undetectable.

One of the USFS comments was that a table showing surveyed headpin elevations at each measured flow level would be useful for the administrative record. Geoff was amenable to providing these tables, and this table will be included in the final report.

Another issue that was raised in the comments was that of transects with atypical VAF patterns. Larry explained that VAF is generally expected to increase with flow. The model holds channel roughness constant, although it generally decreases with flow. To compensate for this, the model uses the VAF to increase velocities. However there are circumstances in which roughness does increase with flow and where one would find a decreasing VAF pattern, such as areas with downstream flow constrictions or vegetation overhanging the stream or growing in the channel. Larry then reviewed photographs of some transects where VAFs decreased as flows increased. Mike noted that when selecting PHABSIM transects, we try to be representative of the habitat and not to select areas where the model will provide good hydraulic simulations. As such, it is expected that there are going to be some transects that do not perform perfectly. We have to accept this in using PHABSIM or any other hydraulic model.

Larry addressed some of the notation in the model calibration QC notes. A “bad transect” means that a particular transect did not meet all of the internal calibration standards and that this could not be corrected. However, the transect still met the “cookbook” standards and was used in the final WUA runs. Geoff (SCE) said that because the transects were selected to represent habitat as best as possible, some difficult to represent transects were most likely selected. Paul (R2) concurred that these calibration issues often occur, but can sometimes be corrected using alternative modeling techniques. Larry stated that, in general, the transects and calibration came out satisfactory, and the “bad transect” designation really applied to higher internal standards.

A second QC comment was “not worth it”. This comment applied in a similar manner to that above, except that there was less deviation from the standard. This designation was used if an attempt was made to improve a model, but the effort did not result in the desired improvement.

One of the comments received from the USFS was that it would be helpful to see how well the high flow models were doing at predicting habitat at low flows. Larry did some comparisons between the low and high flow calibration models for three reaches representing upper and lower basin streams and large and mid-sized streams. There were minor deviations between the WUAs for the low and high flow models and the overall shapes were very similar. Deviations between the two models occurred in the range of flows that one would expect the low flow models to begin falling apart at. Mike said that this analysis lends credence to the high flow decks.

Larry indicated these analyses show that the high flow models are doing a good job at predicting WUA over the entire range of flows. As a result, he did not propose to calibrate low flow models for all reaches. Phil (USFS) did not foresee any problems with this however he does want R2 to review the slides before he makes his final decision. R2 should contact Larry prior to the October

28th meeting if they have questions (see AI #1). Any additional discrepancies will be discussed at the October 28th meeting. Phil complimented Larry on his presentation and suggested that it be included in the final report.

At the conclusion of his presentation, Larry said there were a few problems, generally minor, and that they would be corrected. In each reach there were roughly 30 transects and only one or two transects in each reach required minor corrections. Larry said that in the transects corrected to date, the changes had not made any significant differences in the WUA function. Overall, Larry did not expect that there would be significant differences after all of the corrections had been made.

CAWG 13 Anadromous Fish Discussion

Wayne said that after the thorough group review of CAWG 13 at the September 9th CAWG meeting, the agreed upon edits were made to the report and the revised version was redistributed to the group on October 1st.

The Executive Summary (ES) changed considerably. The ES emphasizes that the report is based on publicly available information and elaborates on the report study elements. In addition, the references were bolstered so that readers can more easily identify where information or citations can be located. In Section Two, the study elements were clarified. Controversial language in study elements 4 & 5 was removed. In Section Three, language was added as requested by stakeholders. In Section Four, citations were added where needed. In Table 13-2, additional language was added for clarification.

The group then reviewed the revised text and discussed minor edits. Some minor wording changes were discussed and agreed upon by the group. Wayne made the revisions to the text as they were being discussed by the group. Julie requested that a copy of the marked-up version of the CAWG 13 report, which was made during the October 13th CAWG meeting, be sent to the CAWG (see AI #2 below).

After this discussion and the direct edits made to the text, Bill asked the CAWG if they were ready to approve the CAWG 13 draft study report. The group approved CAWG 13.

Decisions and Approvals

The group unanimously approved the CAWG 13 Anadromous Fish study report.

The group then reviewed the meetings action item and adjourned.

October 13, 2004 Action Items & Bin Items

AI #1: R2 will contact Larry Wise (ENTRIX) if they have additional questions prior to the October 28th CAWG meeting.

AI #2: Wayne Lifton (ENTRIX) will distribute the marked-up version of CAWG 13, which was created during the October 13, 2004 CAWG meeting, to the CAWG.