# Upper American River Project, FERC No. 2101 Chili Bar Hydroelectric Project, FERC No. 2155 Rationale Report for Relicensing Settlement Agreement

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## Introduction

On July 11, 2001, the Sacramento Municipal Utility District (SMUD) filed a request with the Federal Energy Regulatory Commission (FERC) to follow the procedures of the Alternative Licensing Process (ALP), as specified in FERC regulations (18 CFR Section 4.34(I)) to relicense the Upper American River Project (UARP), FERC No. 2101. FERC noticed the request in the Federal Register on July 19, 2001, and approved the request on August 29, 2001. On July 28, 2006, FERC (1) accepted SMUD's Applicant-Prepared Environmental Assessment; (2) solicited motions to intervene and protests; (3) solicited comments; and (4) requested recommendations, terms, conditions, and prescriptions for the UARP. On November 16, 2006, FERC issued a notice providing a new deadline of February 1, 2007, for filing recommendations, terms, conditions, and prescriptions for the UARP. On November 16, 2006, FERC issued a notice providing a new deadline of February 1, 2007, for filing recommendations, terms, conditions, and prescriptions for the UARP. The existing license for the UARP expires on July 31, 2007. The existing license for the UARP project expires on July 31, 2007. The UARP is a 688-megawatt project that consists of eleven reservoirs and eight powerhouses, located on the Rubicon River and its tributaries and the South Fork American River (SFAR) and its tributaries. In May 2003, SMUD decided to include the construction and operation of a new development – the proposed Iowa Hill Pumped Storage Project – in its relicensing proposal.

Concurrent with the UARP relicensing process, a separate relicensing process has been underway for the Chili Bar Hydroelectric Project, FERC Project No. 2155, which is owned and operated by Pacific Gas & Electric Company (PG&E). The existing license for the Chili Bar Hydroelectric Project expires on the same date as the UARP license, July 31, 2007. On July 28, 2006, FERC (1) noticed the Chili Bar Project as being ready for environmental analysis; (2) solicited comments; and (3) requested recommendations, terms, conditions, and prescriptions for the Chili Bar Project. On November 16, 2006, FERC issued a notice providing a new deadline of February 1, 2007, for filing recommendations, terms, conditions, and prescriptions for the Chili B ar Project. The Chili Bar Hydroelectric Project is a 7-megawatt hydroelectric facility that largely operates on water delivered by the UARP immediately upstream during the summer regulated-flow period. Its primary function is to operate as a regulating reservoir, with water discharging from the UARP's White Rock Powerhouse flowing directly into Chili Bar Reservoir. The combined operations of the UARP and the Chili Bar Hydroelectric Project affect the 20-mile reach of the SFAR between Chili Bar Reservoir Dam and Folsom Reservoir. SMUD and PG&E have worked cooperatively on the two relicensings as Chili Bar operations depend on inflow from the UARP and there are overlapping issues between the two projects.

In October 2006, the seven resource agencies filed terms, conditions, and recommendations with FERC for the UARP and Chili Bar Hydroelectric Projects. Concurrently, the resource agencies filed a comprehensive alternative that had been developed among the agencies and several non-governmental organizations as well as a Rationale Report supporting the comprehensive alternative. The resource agencies and organizations were:

- California Department of Fish and Game (CDFG)
- California State Water Resources Control Board (SWRCB)
- California State Department of Parks and Recreation (CDPR)
- USDA Forest Service (FS)
- USDI Bureau of Land Management (BLM)
- USDI Fish and Wildlife Service (FWS)
- USDI National Park Service (NPS)
- American River Recreation Association & Camp Lotus
- California Outdoors
- California Sportfishing Protection Alliance
- Friends of the River
- American Whitewater
- Hilde Schweitzer, Private Boater

After this information had been filed with FERC, the resource agencies and non-governmental organizations met with the licensees for the UARP and Chili Bar Hydroelectric Projects and reached an Agreement in Principle, which was filed with FERC on November 16, 2007. Since that date, a final settlement agreement has been completed. The resource agencies support the settlement agreement; however, agencies with independent decision-making responsibility retain authority to make final decisions on license conditions within their respective jurisdictions.

This Rationale Report provides supporting documentation and the rationale used in developing the settlement agreement as well as revised terms, conditions, and recommendations that are being submitted concurrently with this Rationale Report for consideration by FERC in its environmental analysis for the UARP and Chili Bar Hydroelectric Projects. The Rationale Report includes descriptions of the relationship between the supporting information and the resulting PM&E measures. However, the Rationale Report does not constitute the entire record supporting the PM&E measures nor does it detail every source of information used and every consideration made in developing the PM&E measures. Rather, the Rationale Report should be considered in conjunction with the balance of the record supporting the application for new license.

## Resource Objectives

The following resource objectives were developed from agency mandates, with consideration of licensee and NGO goals. It is recognized that factors beyond the licensees' control could affect attainment of these objectives and that some or all of the objectives may not be achievable within the PM&E measures. The following objectives encompass FS's Eldorado National Forest Land and Resource Management Plan (Forest Plan) direction BLM's Management Framwork Plan Amendment and BLM's The South Fork American River: A Management Plan direction (BLM Plan); however, more specific existing desired conditions are described in the following sections.

## Aquatic Biota Objectives

Populations of native aquatic biota, including fish, benthic macroinvertebrates, and riparian species are viable with adequate habitat consistent with species' needs. Maintain, enhance, or restore all life stages of native aquatic species.

- Maintain, recover, and restore riparian resources, channel condition, and aquatic habitat.
- Maintain, recover, and restore streamflow regime sufficient to sustain desired conditions of native riparian, aquatic, wetland, and meadow habitats.
- Protect aquatic systems to which species are uniquely adapted.

## Fisheries Objectives

### Use of Native Species and Fish Terminology

The resource agencies use the terms "native species" and "native fish" to define those species native to California and its waters. California Fish and Game Code Section 711.7 states that the fish and wildlife resources are held in trust for the people of the state by and through the Department of Fish and Game.

The Mission Statement of the California Department of Fish and Game reads:

> The Mission of the Department of Fish and Game is to manage California's diverse fish, wildlife, and plant resources, and the habitats upon which they depend, for their ecological values and for their use and enjoyment by the public. The Department of Fish and Game maintains native fish, wildlife, plant species and natural communities for their intrinsic and ecological value and their benefits to people. This includes habitat protection and maintenance in a sufficient amount and quality to ensure the survival of all species and natural communities. The department is also responsible for the diversified use of fish and wildlife including recreational, commercial, scientific and educational uses.

The resource agencies have used rainbow trout and hardhead as surrogate species for the other native species within the watersheds affected by the UARP and Chili Bar Hydroelectric Project due to their life history strategies of spawning in the spring/early summer, rearing/nursery stages in the early/mid-summer, juvenile/adult stages in the mid/late summer fall periods, which are indicative of the natural hydrograph in these watersheds. Rainbow trout and hardhead life history strategies evolved under snowmelt/spring high flow runoff patterns with lower summer baseflows and fall/early winter flows that increased in volume as the rainfall patterns increase with the approaching winter period. The inclusion of disturbance flows to the overall flow regime will benefit, to some degree, those species that co-evolved under those conditions (Minckley and Mefee 1987). The riparian vegetation, geomorphic processes, and macroinvertebrate communities also evolved under these natural hydrologic patterns, and therefore, it is entirely appropriate to use surrogates to develop a flow regime pattern that will be inclusive of the needs for the other native species and processes.

It is recognized that above 6,000 feet in elevation trout were not present historically, but below that elevation there is speculation as to the extant of their distribution. To use current identified fish barriers is ignoring geologic processes and events within the Sierra Nevada and is assuming that a barrier that is present today was present 10,000 to 100,000 years ago, which may not be the case. Resident rainbow populations throughout the Sierra Nevada are currently being examined for genetic similarities to Central Valley anadromous steelhead. It may be that there will be populations that are identified as upstream progenitors of these anadromous populations. Until there is more definitive information, what is known is that the baseline conditions include resident populations of rainbow trout (identified as a California native species using CDFG Strategic Plan definitions outlined by the licensee in SPDEA Section 5.3.3.1) within the UARP-affected watersheds.

If we were to go back in time, the construction of large reservoirs and dams throughout the UARP-affected watersheds has had serious impacts upon the native species indigenous to the watersheds. In the absence of these reservoirs, anadromous salmon and steelhead could still migrate up the reaches of the South Fork and Middle Forks of the American River and foothill yellow-legged frogs could be abundant throughout the mainstem and large tributaries of the watershed. The resource agencies are seeking to simulate important natural patterns that allow restoration of some of the ecological processes important to these species while still addressing the important hydroelectric needs of the state. These natural processes have been noted in numerous peer reviewed journal articles (Stanford et.al 1996, Poff et. al 1997, Gore 1994, Heede and Rinne 1990) that describe the natural hydrologic processes and the co-evolution of biota and riparian vegetation within those processes.

Fish Community Assessment Metrics

The utilization of the Fish Community Assessment Metrics is a new concept that was presented in the UARP Alternative Licensing Process aquatic technical working groups. The resource agencies took the initial approach of using rainbow trout biomass as the measurable objective that would be evaluated to determine whether there were measurable benefits from the proposed streamflow regime. Biomass (pounds/surface acre) is currently being used in the monitoring of two other major hydroelectric projects in central Sierra Nevada watersheds (El Dorado Hydroelectric Project, FERC No. 184 and the Mokelumne Hydroelectric Project, FERC No. 137).

Average biomass numbers from Gerstung (1973) were used in the Mokelumne Hydroelectric Project to establish baseline numbers that would be compared to subsequent monitoring results after a period of acclimation to the new flows established in the license. Biomass numbers that were established from multiple years of sampling prior to license issuance were used in the El Dorado Hydroelectric Project. The biomass numbers in the El Dorado Hydroelectric project were determined to be higher in many cases than those established in Gerstung (1973) and were therefore used as the baseline against which comparisons would be made as a result of post-license monitoring. In both cases, a single target species (rainbow trout) was used as a management indicator species.

Biomass is one of the metrics that is identified in Moyle's Fish Community Assessment Metrics. The other metrics are:

- Individual Level Metrics
  - Condition factor (Fulton's K)
  - Evidence of disease or deformity
  - Growth rate

- Population Level Metrics
  - Biomass (lbs/acre)
  - Density (trout/acre)
  - Catchable trout (trout/mile >152 mm TL)
  - Age class structure

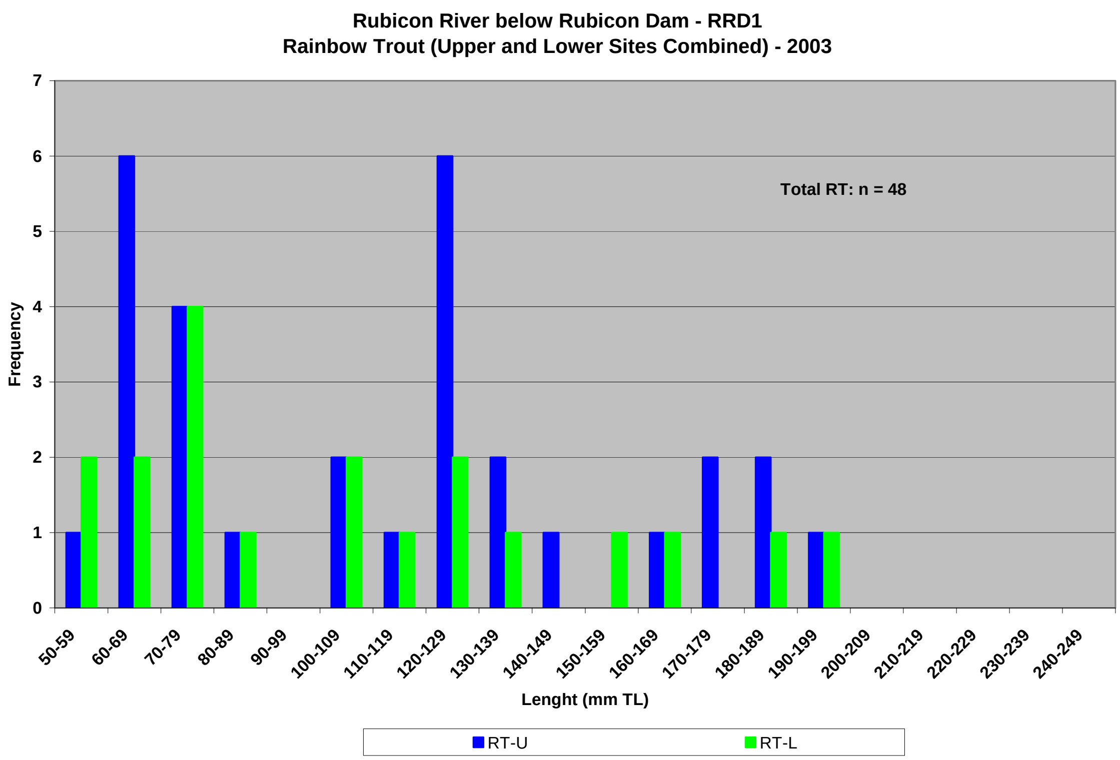
- Community Level Metrics
  - Fish community species composition

It is anticipated that the use of these multiple factors will result in a holistic approach to fish community health and condition; however, use of these multiple factors can also lead to philosophical differences of interpretation. Some examples of interpretation differences are (1) whether to combine species in biomass numbers establishment, (2) whether to use only adult trout in population estimates, and (3) whether to use other species than management indicator species for indicators of fish health.

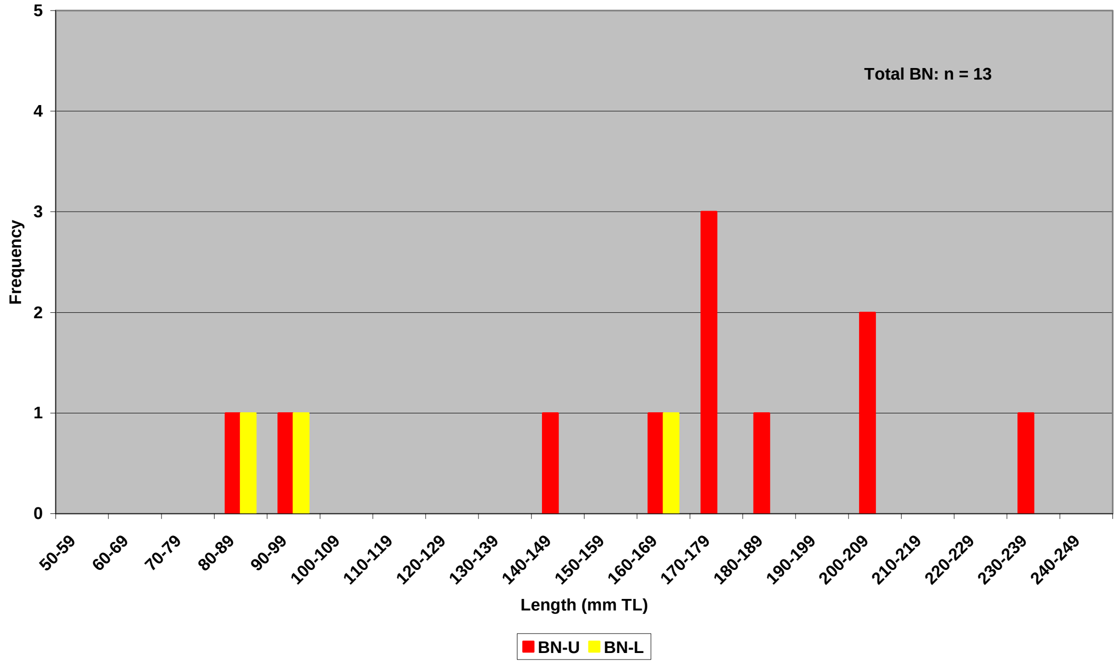
The Rubicon River reach downstream of Rubicon Reservoir Dam is a prime example of the conflicts that can and will arise over interpretation of data sets. The licensee's SPDEA (SMUD 2006), contains forceful arguments that the combination of rainbow and brown trout should be used for fish biomass, density, and catchable trout (>152mm TL) population estimates. In addition, the licensee evaluates California roach, speckled dace, and Sacramento suckers and postulates that these species are in good condition based upon the parameters outlined in the Fish Community Assessment Metrics. The final and most obvious difference between the licensee's analysis and the resource agencies' analysis is the argument that the Rubicon River was historically fishless; therefore, there is no native fish community to evaluate. The resource agencies have defined rainbow trout (even though they historically were not present in this particular reach) as a native surrogate species for the aquatic biota that are and were historically present in the Rubicon River reach.

Rubicon Reservoir Dam and Buck Island Reservoir have significantly altered the historical hydrologic regime by capturing a majority of the peak runoff flow events (Devine Tarbell & Associates and Hannaford 2005a). Mountain yellow-legged frogs, western toads, and pacific tree frogs were the dominant aquatic vertebrates in this stream reach prior to European influences in the last century. Mountain yellow-legged frogs are found in a tributary to Rockbound Lake, and western toads and pacific tree frogs are still found in many areas of the watershed. The resource agencies are not promoting a return to pre-Project conditions but do believe ecological benefits will occur if the streamflows are designed to simulate the natural hydrograph as much as possible during important times of the year. Species that would benefit are those that are cued to spring/early summer snowmelt runoff patterns, lower base flows in the late summer/early fall, and winter flows that would provide habitat in most years except those of extreme freeze events (Moyle and Marchetti 1998, Moyle and Light 1996).

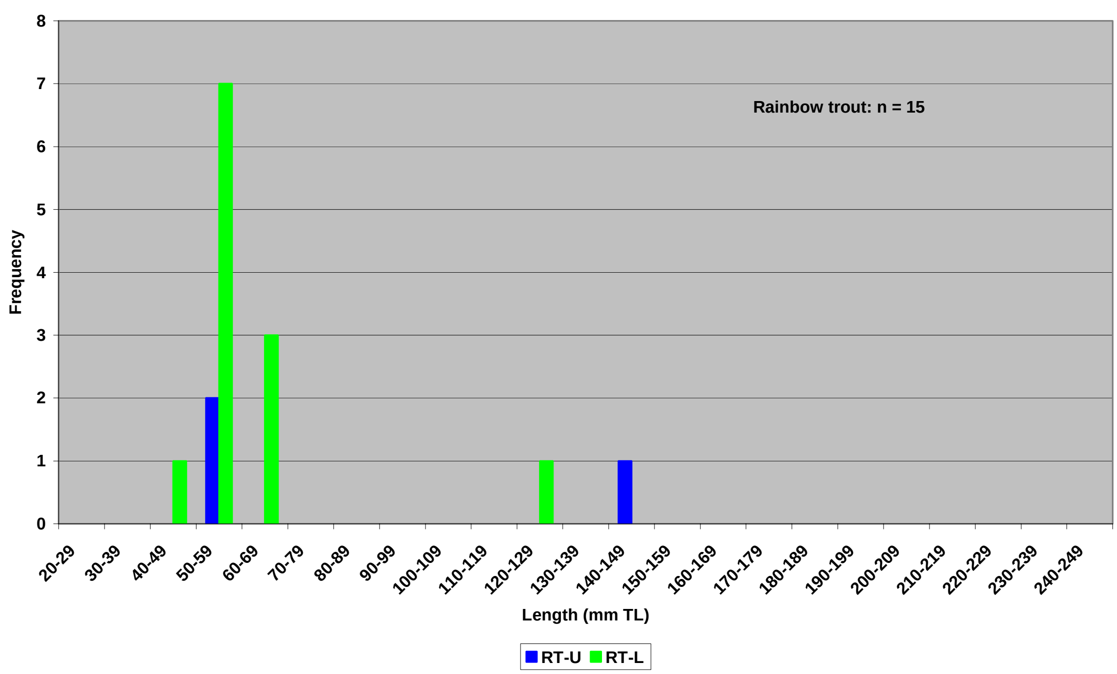
For example, the combination of fish population data for both sites RRD-F1 and F2 depict a fishery that has components that are not at a maximum potential for biomass, density, or catchable trout, and age class structure. The licensee's SPDEA Section 5.3.3 (SMUD 2006) states that the differences between RRD1 and RRD2 are most likely due to habitat differences that are not dependent upon water quality and flows. The licensee's analysis states that deep pools found in RRD1 promulgate larger adult trout and that the shallower run habitat types found in RRD2 have less potential for adult fish (see following figures). The resource agencies' interpretation of these data are that the lack of channel maintenance and lack of higher spring base flows similar to a natural flow regime has led to water quality and habitat degradation that does not promote maximum habitat potential for either rainbow or brown trout.

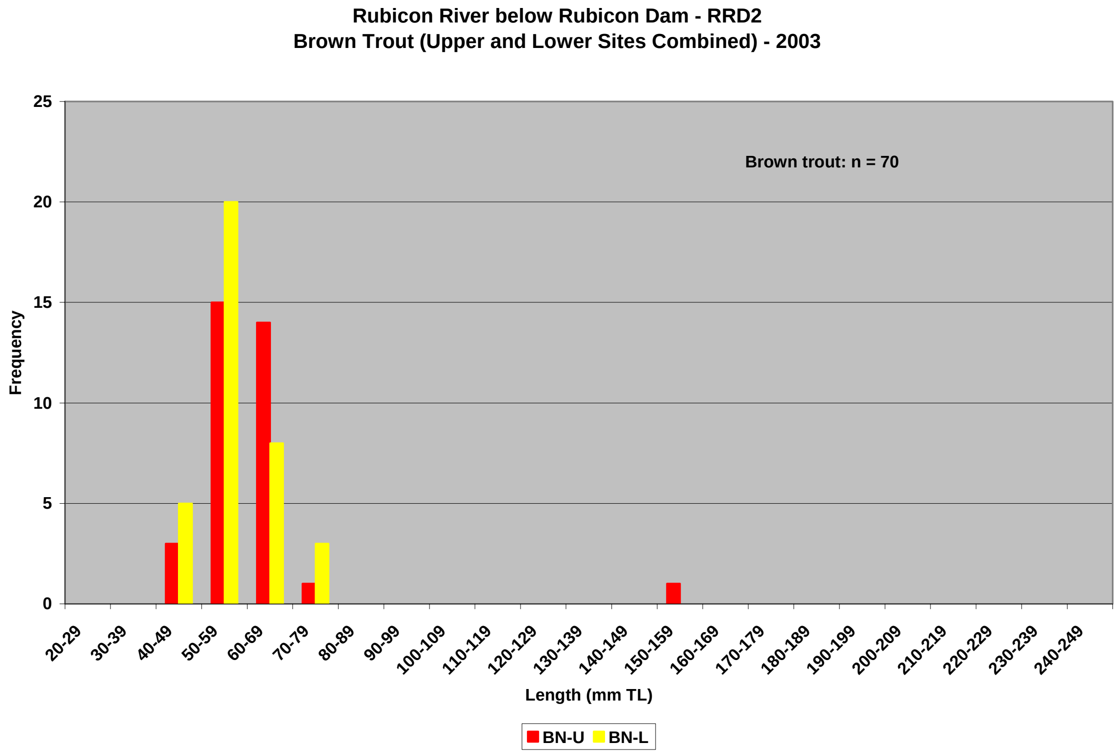


**Rubicon River below Rubicon Dam - RRD1**
**Brown Trout (Upper and Lower Sites Combined) - 2003**

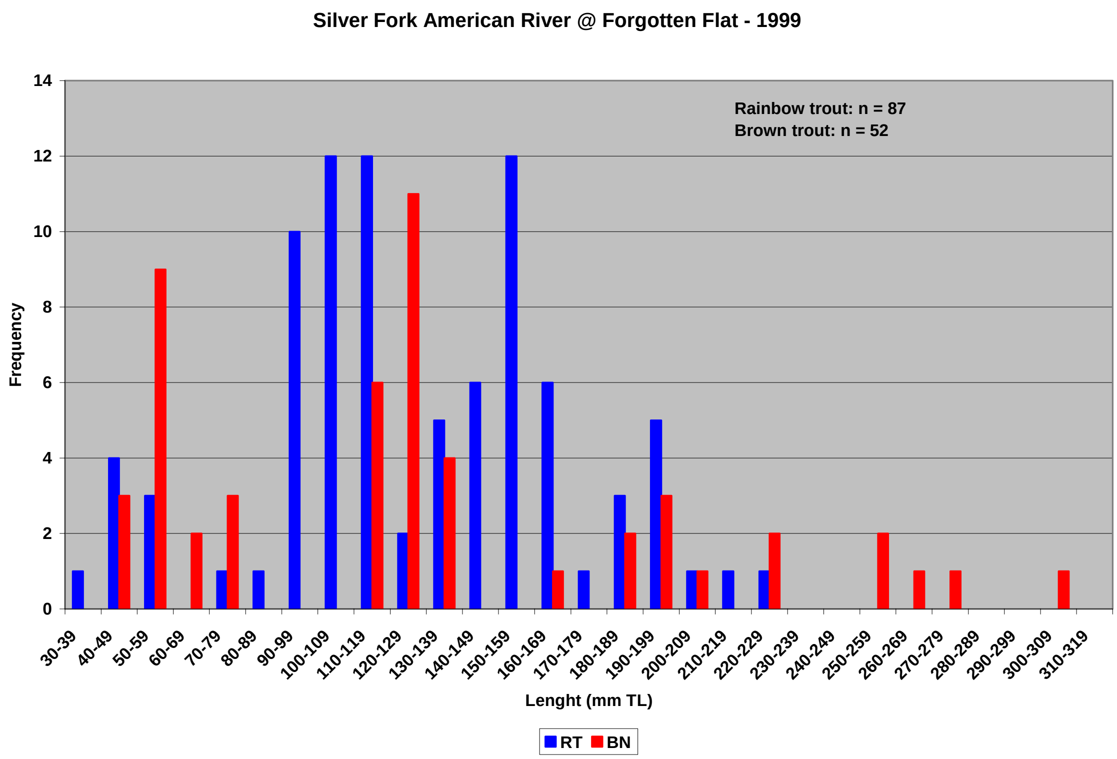



**Rubicon River below Rubicon Dam - RRD2**
**Rainbow Trout (Upper and Lower Sites Combined) - 2003**






Similar channels in the Silver Fork American River watershed show populations of both rainbow and brown trout that have higher densities, biomass, catchable trout, and better age class structure than those found in the Rubicon River below Rubicon Reservoir Dam as shown in the photo below. Age class structure shows that there are higher numbers of adult fish and better age class distribution for both species in this watershed (see following figure). The Silver Fork American River at Forgotten Flat has a watershed area of 23.5 square miles, and the Rubicon River has a watershed area that is slightly less than 31.6 square miles at RRD1 and slightly more than 31.6 square miles at RRD2 (USGS Gage Site 11428000 metadata). Both the Silver Fork American River and Rubicon River fish sample sites are located at comparable sites in terms of elevations; the Silver Fork American River is approximately 6,020 feet above mean sea level, and RRD1 and RRD2 are between 6,030 and 6,070 feet above mean sea level.




Silver Fork American River at Forgotten Flat

Fishery surveys in the Silver Fork American River downstream of Silver Lake also found a single speckled dace present (likely a downstream migrant out of Silver Lake), but no speckled dace were found at downstream fish sampling locations (Forgotten Flat). The licensee's contention that there should be large numbers of speckled dace present and their presence is not an indicator of an imbalance in the community structure (SMUD 2006) is not reflected in the Silver Fork American River fishery data. The presence of large numbers of speckled dace and California roach and limited numbers of Sacramento suckers are indicative of warm water temperatures and quiescent stream flows (Moyle 2002). The resource agencies contend that given the Silver Fork American River and Rubicon River are similar watershed areas and stream channels, the fish populations should be similar if habitat is driving the difference in the populations in terms of the population statistics and community structure.

The Silver Fork American River downstream of Silver Lake has been subjected to a minimum flow regime of 4 cfs or the natural flow year-round, though there were accretion flows out of Oyster Creek that added as much as 18 cfs to the flow during the spring snowmelt runoff. The fishery has both rainbow and brown trout, and the combined mean biomass estimates for the Forgotten Flat site for the years 1998, 1999, 2001, and 2002 were 19.7 and 21 pounds per surface acre for rainbow and brown trout, respectively. The combined mean biomass estimates are nearly 10 pounds per surface acre greater than the mean combined biomass estimates for both rainbow and brown trout at the Rubicon River site RRD1 and are 35 pounds per surface acre greater than RRD2. In the El Dorado Hydroelectric Project (FERC Project No. 184) the resource agencies used rainbow trout as the management indicator species, and the biomass estimate was used to give an indication as to whether the minimum flow recommendations were maintaining or improving the population dynamics of the fishery.

The brown trout were an ancillary beneficial species that was able to utilize the habitat available, most likely due to the high fall release flows that were a result of hydroelectric operations and dam safety requirements. Brown trout and brook trout (fall spawners) are able to exploit high fall flows at the expense of rainbow trout (spring spawners) (Moyle and Light 1996). Additionally, high flows during times when salmonid eggs are in the gravels can be a factor in low recruitment for the following year. If high flows occur after eggs have hatched, larval fish are able to take refuge from scouring flow events that can cause destruction of eggs still in the gravels (Seegrist and Gard 1972).

The resource agencies have recommended pulse flows during the appropriate time of the year when they would have occurred pre-Project in certain reaches. In some years these flows may occur after some of the rainbow trout individuals have spawned, though it is likely that others will spawn after the high flow event has passed. The peak minimum flow event in May and June will benefit the spring spawners by increasing available habitat and allowing greater juvenile habitat later in the summer until flows approach base flows in August and September. The establishment of a flow regime that mimics the natural variation and timing will be to the benefit of the species complex (native California species per resource agencies definition of native) the resource agencies are seeking to improve (Moyle and Light 1996 and Marchetti et. al. 2004)

The resource agencies used Gerstung's 1973 biomass numbers as a target objective from which a comparison could be made against the mean biomass estimates for the two Rubicon River sites and was not intended to extend to the entire Rubicon River reach downstream of Rubicon Reservoir as is implied in Appendix C of the licensee's SPDEA (SMUD 2006). The biomass estimates were only intended to be compared to sites RRD1 and RRD2. The biomass data would be utilized with the other population and community metrics to determine whether the fish population and species complex were moving in the direction set forth in the management objectives. Additionally, catchable trout numbers were five times greater at the Silver Fork American River site than those found in the combined sites at RRD1 and 35 times greater than those found at RRD2 where no rainbow trout greater than 152 mm total length were captured. Brown trout were also found in greater numbers at the Silver Fork American River site versus RRD2 (CDFG 2006d).

The characterization by the licensee in their SPDEA that Rubicon River was historically fishless prior to European influences; therefore, there is no native fish community to evaluate, ignores the resource agencies' objectives for management indicator species and the fact that there are species present that would not be there if water quality (temperatures and flow quantity) was more reflective of pre-Project conditions. The community matrix that should be evaluated is the native fish (rainbow trout) and amphibian species, which is the community matrix the resource agencies are managing for.

Biomass Indices

Maintain, restore, or recover favorable ecological conditions for all life stages of rainbow trout and other native fishes and desired non-native fishes in their appropriate range and habitat through meeting the components articulated in the "Fish Community Assessment Metrics" (SMUD 2004a). Biomass metrics are included in the components assessed within the fish community metrics. The goal for biomass metrics is to maintain or improve existing mean biomass numbers for rainbow trout (and brown trout in Gerle Creek) and, if existing biomass numbers are less than expected Northern Sierran trout biomass numbers (according to Gerstung 1973), improve mean biomass to move closer to those numbers. Rainbow trout are a Management Indicator Species (USDA Forest Service 1989).

The following table compares existing rainbow trout biomass (and brown trout on some reaches) by reach, survey reach number, and measured stream width from 2002-2004 SMUD surveys with trout biomass goals taken from Gerstung (1973).

| Reach Name | Objective | Survey Reach number | Existing Mean Biomass for Rainbow Trout (lb/surface acre) | Stream Width - combined (where applicable) (ft) | Rainbow Trout Biomass Goal (Gerstung 1973) (lb/surface acre) |
|---|---|---|---|---|---|
| **Rubicon River Below Rubicon Dam** | **Increase RT** | **RRD-F1** | **11.3** | **28** | **24** |
| | **Increase RT** | **RRD-F2** | **0.9** | **20** | **33** |
| **Little Rubicon River Below Buck Island Dam** | **Reduce or eliminate golden shiners and increase RT** | **BID-F1 (upper)** | **0** | **25** | **Reduce or eliminate golden shiners and move toward 33 RT** |
| **Gerle Creek Below Loon Lake Dam** | **Increase RT and maintain BN** | **LLD-F1** | **19.5** | **27** | **Combined biomass of RT and BN – 24** |
| | **Increase RT and maintain BN** | **LLD-F2** | **40** | **34** | **Combined biomass of RT and BN - 24** |
| **Gerle Creek Below Gerle Dam** | **Increase RT and maintain BN** | **GCD-F1** | **11.5** | **36** | **Combined biomass of RT and BN - 24** |
| **SF Rubicon Upstream of Robbs Dam** | **Increase RT** | | **7** | **16** | **33** |
| **SF Rubicon Below Robbs Dam** | **Increase RT and maintain BN** | **RPD-F1** | **23** | **40** | **Combined biomass of RT and BN - 24** |
| **Reach Name** | **Objective** | **Survey Reach number** | **Existing Mean Biomass for Rainbow Trout (lb/surface acre)** | **Stream Width - combined (where applicable) (ft)** | **Rainbow Trout Biomass Goal (Gerstung 1973) (lb/surface acre)** |
| **SF Silver Below Ice House Dam** | **Increase RT** | **IHD-F1** | **10.6** | **27** | **RT – 24** |
| | **Increase RT** | **IHD-F2** | **3** | **29** | **24** |
| **Silver Creek Below Junction Dam** | **Increase RT** | **JD-F1** | **7.5** | **37** | **24** |
| | **Increase RT** | **JD-F2** | **Use "Fish Community Assessment Metrics" (SMUD 2004)** | | |
| **Silver Creek Below Camino Dam** | **Increase RT** | **CD-F1** | **Use "Fish Community Assessment Metrics"** | **45** | **278 catchable trout per mile (Gerstung 1973)** |
| **Brush Creek** | **Increase RT** | **BCD-F1** | **14.7** | **15** | **35** |

| Reach Name | Objective | Survey Reach number | Existing Mean Biomass for Rainbow Trout (lb/surface acre) | Stream Width - combined (where applicable) (ft) | Rainbow Trout Biomass Goal (Gerstung 1973) (lb/surface acre) |
|---|---|---|---|---|---|
| **Below Brush Dam** | | | | | |
| **SFAR Below Slab Dam** | **Provide for healthy age class distribution of a transitional fishery (coldwater to warmwater)** | **SCD-F2 (previous electrofishing reach) and snorkeling Mosquito Rd bridge downstream for 1000 m** | **4.65 RT; Age class distribution that represent a healthy pop. of hardhead (use "Fish Community Assessment Metrics"** | **41** | **13 RT Use both snorkeling and electrofishing for hardhead** |
| **SFAR Below Chili Bar Dam** | **Provide for healthy age class distribution of a transitional fishery (coldwater to warmwater)** | **CB-F1 and F4** | **For both RT and hardhead "Use Fish Community Assessment Metrics"** | | |

**RT = rainbow trout**
**BN = brown trout**

Mean biomass indices for rainbow trout and brown trout were determined from all years surveyed for each reach from 2002 through 2004. Rainbow trout and hardhead were chosen as fish indicators of habitat quality because guidance in the Forest Plan directs focus to maintain, enhance, and restore habitat to support viable native species. Though rainbow trout were not present in parts of the area pre-settlement, they were present in the area pre-project. Trout are also a FS Management Indicator Species. Hardhead is a FS Sensitive Species.

Gerstung (1973) sampled 289 study sections on 102 coldwater streams within the northern Sierra Nevada to determine mean trout biomass of streams by stream width. From all the streams sampled, Gerstung computed a mean of 41 pounds/acre but found the mean trout biomass of streams to decrease as stream width increased. Table 3 in Gerstung's report displays the relationship between stream width and biomass that is being used as a trout biomass goal for each stream sampling site with this project.

Fish Passage

Ensure fish passage for brown trout during their spawning season upstream out of Gerle Creek Reservoir into Gerle Creek.

Native Species

Maintain, enhance, or restore all life stages of native aquatic species. In Gerle Creek below Loon Lake Reservoir Dam, manage for desired (brown trout) non-native species.

Entrainment

Minimize the effects of stream diversions or other flow modifications from hydroelectric projects on threatened, endangered, and sensitive species. Minimize entrainment at the outlets of the reservoirs. Ensure downstream migrating rainbow trout on the South Fork Rubicon River are not being entrained at Robbs Peak Afterbay.

Fish Stocking

Ensure fish stocking in Loon Lake Reservoir, Union Valley Reservoir, and Ice House Reservoir is adequate to compensate for entrainment in the facilities at these reservoirs.

**Macroinvertebrate Objective**

Macroinvertebrate indices (metrics) in Project-affected stream reaches shall be comparable to reference reaches located within and outside the SFAR and Rubicon River drainages. Numerical objectives based on the collection and review of additional benthic macroinvertebrate data will be developed.

**Natural Hydrograph Objective**

Ensure water use achieves seasonal discharge fluctuations that simulate the shape of the natural hydrograph in duration, magnitude, rate of change, and frequency to the extent necessary to obtain the aquatic resource objectives.

**Flow Fluctuations Objective**

Minimize Project-caused flow fluctuations uncharacteristic of the natural hydrograph to protect biota and maintain public safety.

**Dry Season Aquatic Habitat Objective**

Maintain flows for aquatic habitat that would otherwise dry up during the mid-summer/fall period.

**Channel Morphology Objective**

Maintain or restore channel integrity. Maintain, improve, or restore fluvial processes to provide for balanced sediment transport, channel bed material mobilization and distribution, and channel structural stability that contribute to diverse aquatic habitat and healthy riparian habitat.

**Sediment Transport Objective**

Ensure delivery and transport of sediment are balanced so that stream channels are not excessively aggrading or degrading over time, and particle size distribution allows for diverse bed form within the stream channel.

**Stream Channel and Floodplain Objective**

Ensure stream channels have appropriate cross-section size (width to depth) and stable stream banks, and floodplains and flood-prone areas have connectivity to the stream channel.

**Large Woody Debris Objective**

Ensure that the level of large woody debris is within the range of natural variability in terms of frequency and distribution and is sufficient to sustain stream channel physical complexity and stability. If characteristics are outside the range of natural variability, implement mitigation measures and short-term restoration actions as needed to prevent further declines or cause an upward trend in condition.

**Riparian Habitat Objectives**

- Maintain riparian vegetation in proper functioning condition.
- Maintain or restore riparian resources.
- Maintain or restore streamflow regime sufficient to sustain desired conditions of native riparian, aquatic, wetland, and meadow habitats.

**Water Quality Objective**

Ensure compliance with the water quality objectives, such as temperature, to fully protect the designated beneficial uses as designated in the Central Valley Regional Water Quality Control Board Basin Plan (Basin Plan).

**Water Temperature Objective**

Ensure that flows are protective of the designated beneficial uses of cold freshwater habitat and warm freshwater habitat as appropriate, and do not adversely affect water temperatures for local aquatic- and riparian-dependent species assemblages.

**Streamflow and Reservoir Storage Gaging Plan Objective**

Develop a streamflow and reservoir storage gaging plan to evaluate compliance and resource responses to changes in streamflows. The plan may include installation of additional gaging stations.

**Threatened, Endangered, and Sensitive Species and Management Indicator Species Objective**

Ensure that PM&E measures are consistent with any applicable FS biological evaluation for sensitive species or any applicable biological opinion issued under the federal or state Endangered Species Act. Ensure that PM&E measures comply with the Forest Plan and BLM Plan. Minimize the effects of stream diversion or other flow modifications from hydroelectric projects on threatened, endangered, or sensitive species.

**Invasive Weed Control Objective**

Reduce and, where possible, reverse the spread of invasive weeds.

**Coordinated Operations Objective**

Ensure that operations between the UARP and Chili Bar Hydroelectric Projects are coordinated so streamflows and reservoir levels are more consistent and predictable.

**Reservoir Levels Objective**

Maintain reservoir levels in Project reservoirs to protect beneficial uses. Maintain reservoir levels sufficient to ensure that aesthetic, recreational, ecological, and power production needs are addressed.

**Visual Resources Objective**

Ensure that visual quality meets appropriate management area direction.

**Recreation Management Objective**

Provide for quality day use and overnight recreation opportunities associated with the Project and ensure that other resources are not adversely impacted by this recreational use.

**Recreation Design Objective**

Ensure Project-related facilities meet current FS, BLM, and CDPR design standards and standards for accessibility.

**Wilderness and Wild and Scenic River Objective**

Ensure wilderness values and outstandingly remarkable wild and scenic river values are maintained or enhanced.

**Recreational Streamflow Objective**

Provide streamflow regime to optimize recreational opportunities, including stream angling, swimming, waterplay, boating, and other recreational beneficial uses that are consistent with ecosystem capabilities, that minimize user and ecological conflicts, that consider hydropower operations, and that maintain a high degree of user satisfaction as determined by user surveys, with due consideration for lake levels and levels of quality lake-based recreation.

## Lake Fishing Objective

Protect and enhance lake-fishing opportunities in Loon Lake, Union Valley, Ice House, and Slab Creek Reservoirs consistent with overall lake-based recreation and lake level goals.

## Recreational Access Objective

Provide river recreation facilities that are consistent with Recreation Opportunity Spectrum (ROS) class (or equivalent), physical, social, and ecological carrying capacity of the resource and demand levels, with the possibility of adjustment based on user satisfaction.

## Streamflow and Reservoir Level Information Objective

Provide streamflow and lake level information for Project-affected reaches and lakes that is available to the general public and is adequate for river and lake recreation use.

## Transportation and Facilities Management Objective

Ensure appropriate level of maintenance on Project-related roads and trails. Ensure roads and trails are maintained to FS standards. Ensure Project-related facilities are appropriately identified and maintained.

## Special-Use Authorization Objective

Ensure that Project-related special-use authorizations are up to date and address current permitted use.

## Vegetation Management and Fire Prevention Objective

Ensure appropriate vegetation management for Project-related activities. Minimize loss of resources from Project-related fires.

## Hydropower Operations Objective

The Project continues to be a competitive source of low cost, reliable, and flexible hydroelectric generation.

## Consistency with Plans

Ensure that hydropower operations are consistent with the Forest Plan and BLM Plan and with the reasonable protection of other beneficial uses of water as identified in the Basin Plan.

### Cultural Resources Objectives

- Evaluate heritage resources that may be affected by the Project, and protect/conserve significant resources, or mitigate effects to those resources.
- Conduct, as part of Section 106 compliance, on-going consultation with the appropriate Native American tribe(s) as defined by the FS.
- Ensure full compliance of Section 106 through a Programmatic Agreement.

## Ecosystem Attributes

The following ecosystem matrices were used to relate streamflow (magnitude, timing, and duration) to the suite of ecosystem attributes selected to represent the condition of the ecosystem (i.e., water temperature; channel maintenance; fisheries; amphibians; other threatened, endangered, or sensitive species; riparian resources; macroinvertebrates; and water quality). Based on the life stage requirements of aquatic species and their physiologic dependence on seasonal variations in the annual hydrograph, the relative importance of each ecosystem attribute was identified by Project reach and by season. By determining relative importance seasonally, a streamflow regime could be developed that would provide the appropriate magnitude, timing, and duration of streamflow and thus favorable biotic response.

The following matrices were developed for each reach; the matrices were used to indicate important resource responses that occur seasonally and should be considered as “drivers” for setting the flow regime. There were two steps in this matrix process: (1) important attributes that could potentially be dominant for each month were identified (marked by “X”), and (2) the season of greatest importance for each ecosystem attribute was identified (marked by **“XX”**).

### Rubicon River Below Rubicon Reservoir Dam

| Ecosystem Attribute | | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Quality** | Constituents/Parameters | X | X | X | X | X | X | X | X | X | X | X | X |
| | Water Temperature | | | | | | | | | | X | X | |
| **Channel Morphology** | Stream Channel/Floodplain | | | | | | | X | **XX** | **XX** | X | | |
| | Sediment Transport | | | | | | X | X | **XX** | **XX** | X | | |
| | Woody Debris | | | | | | | X | **XX** | **XX** | X | | |
| | Riparian Vegetation (3) | | | | | | | X | **XX** | **XX(2)** | **XX(2)** | X | |
| **Benthic Macroinvertebrates** | Undefined | X | | | | | | | X | **XX(1)** | **XX(1)** | **XX(1)** | **XX(1)** |
| **Rainbow Trout** | Spawning Habitat | | | | | | | X | **XX** | **XX** | X | | |
| | Fry Habitat | X | | | | | | | | X | X | X | X |
| | Juvenile Habitat | **XX** | X | X | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** |
| | Adult Habitat | **XX** | X | X | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** |
| | Passage | | | | | | | | X | X | | | |
| **Mountain Yellow-Legged Frog** | | X | X | X | X | X | X | X | X | X | X | X | X |

(1) Based on hatches.
(2) Germination.
(3) Riparian habitat to include riparian wildlife utilization.

## Little Rubicon River Below Buck Island Reservoir Dam

| Ecosystem Attribute | | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Quality** | Constituents/Parameters | **XX** | X | X | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** |
| | Water Temperature | | | | | | | | | | X | X | X |
| **Channel Morphology** | Stream Channel/Floodplain | | | | | | | X | **XX** | **XX** | X | | |
| | Sediment Transport | | | | | | X | X | **XX** | **XX** | X | | |
| | Woody Debris | | | | | | | X | **XX** | **XX** | X | | |
| | Riparian Vegetation (3) | | | | | | | X | **XX** | **XX(2)** | **XX(2)** | X | |
| **Benthic Macroinvertebrates** | Undefined | X | | | | | | | X | **XX(1)** | **XX(1)** | **XX(1)** | **XX(1)** |
| **Rainbow Trout** | Spawning Habitat | | | | | | | X | **XX** | **XX** | X | | |
| | Fry Habitat | X | | | | | | | | X | X | X | X |
| | Juvenile Habitat | **XX** | X | X | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** |
| | Adult Habitat | **XX** | X | X | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** |
| **Mountain Yellow-legged Frog** | | X | X | X | X | X | X | X | X | X | X | X | X |

(1) Based on hatches.
(2) Germination.
(3) Riparian habitat to include riparian wildlife utilization.

## Gerle Creek Below Loon Lake Reservoir Dam

| Gerle Creek Below Loon Lake Reservoir Dam | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ecosystem Attribute** | | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** |
| **Water Quality** | Constituents/Parameters | **XX** | X | X | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** |
| | Water Temperature | X | | | | | | | | **X(4)** | **X(4)** | **X(4)** | **X(4)** |
| **Channel Morphology** | Stream Channel/Floodplain | **XX(5)** | | | | | X | **XX** | **XX** | **XX** | **XX(5)** | **XX(5)** | **XX(5)** |
| | Sediment Transport | | | | | | X | **XX** | **XX** | **XX** | X | | |
| | Woody Debris | | | | | | X | **XX** | **XX** | **XX** | X | | |
| | Riparian Vegetation (3) | **XX(5)** | | | | | X | **XX** | **XX** | **XX(2)** | XX(2) | XX(5) | XX(5) |
| **Benthic Macroinvertebrates** | Undefined | **XX(1)** | | | | | X | XX(1) | XX(1) | XX(1) | XX | X | XX(1) |
| **Rainbow Trout** | Spawning Habitat | | | | | | | X | XX | XX | X | | |
| | Fry Habitat | X | | | | | | | | X | X | X | X |
| | Juvenile Habitat | **XX** | X | X | X | X | X | X | X | XX | XX | XX | XX |
| | Adult Habitat | **XX** | X | X | X | X | X | X | X | XX | XX | XX | XX |
| | Passage | | | | | | | X | XX | XX | X | | |
| **Brown Trout** | Spawning Habitat | XX | XX | | | | | | | | | X | X |
| | Fry Habitat | X | | | | | | | X | X | X | X | X |
| | Juvenile Habitat | XX | X | X | X | X | X | X | X | XX | XX | XX | XX |
| | Adult Habitat | XX | X | X | X | X | X | X | X | XX | XX | XX | XX |
| | Nursery | | | XX | XX | XX | XX | | | | | | |
| | Passage | XX | XX | | | | | | | | | X | X |
| **Mountain Yellow-legged Frog** | | X | X | X | X | X | X | X | X | X | X | X | X |

(1) Based on hatches.
(2) Germination.
(3) Riparian habitat to include riparian wildlife utilization.
(4) Note that releases from dam are 8-12°C.
(5) Consider reducing flows for stream channel restoration.

## Gerle Creek Below Gerle Reservoir Dam

| Gerle Creek Below Gerle Reservoir Dam | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ecosystem Attribute** | | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** |
| **Water Quality** | Constituents/Parameters | **XX** | X | X | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** |
| | Water Temperature | X | | | | | | | | **XX** | **XX** | **XX** | X |
| **Channel Morphology** | Stream Channel/Floodplain | | | | | | X | **XX** | **XX** | **XX** | X | | |
| | Sediment Transport | | | | | | X | **XX** | **XX** | **XX** | X | | |
| | Woody Debris | | | | | | X | **XX** | **XX** | **XX** | X | | |
| | Riparian Vegetation (3) | | | | | | X | **XX** | **XX** | **XX(2)** | **XX(2)** | **XX** | |
| **Benthic Macroinvertebrates** | Undefined | **XX(1)** | | | | | X | **XX(1)** | **XX(1)** | **XX(1)** | **XX** | X | **XX(1)** |
| **Rainbow Trout** | Spawning Habitat | | | | | | | **XX** | **XX** | **XX** | X | | |
| | Fry Habitat | X | | | | | | | | X | X | X | X |
| | Juvenile Habitat | **XX** | X | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** | **XX** |
| | Adult Habitat | **XX** | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** |
| **Mountain and Foothill Yellow-legged Frog** | | X | X | X | X | X | X | X | X | X | X | X | X |

(1) Based on hatches.
(2) Germination.
(3) Riparian habitat to include riparian wildlife utilization.

## South Fork Rubicon River Below Robbs Reservoir Dam

| South Fork Rubicon River Below Robbs Reservoir Dam | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ecosystem Attribute** | | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** |
| **Water Quality** | Consituents | X | X | X | X | X | X | X | X | X | X | X | X |
| | Water Temperature | X | | | | | | | | **XX** | **XX** | **XX** | X |
| **Channel Morphology** | Stream Channel/Floodplain | | | | | | X | **XX** | **XX** | X | | | |
| | Sediment Transport | | | | | X | X | **XX** | **XX** | X | | | |
| | Woody Debris | | | | | | X | **XX** | **XX** | X | | | |
| | Riparian Vegetation (3) | | | | | | X | **XX** | **XX(2)** | **XX(2)** | X | | |
| **Benthic Macroinvertebrates** | Undefined | X | | | | | | | **XX(1)** | **XX(1)** | **XX(1)** | **XX(1)** | **XX(1)** |
| **Rainbow Trout** | Spawning Habitat | | | | | | | **XX** | **XX** | **XX** | X | | |
| | Fry Habitat | X | | | | | | | | X | X | X | X |
| | Juvenile Habitat | X | X | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** | **XX** |
| | Adult Habitat | X | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** |
| | Passage | | | | | | | | | | | | |
| **Foothill Yellow-legged Frog** | | | | | | | | | X | X | X | X | X |
| **Mountain Yellow Legged Frog** | | X | X | X | X | X | X | X | X | X | X | X | X |

(1) Based on hatches.
(2) Germination.
(3) Riparian habitat to include riparian wildlife utilization.

## South Fork Silver Creek Below Ice House Reservoir Dam

**South Fork Silver Creek Below Ice House Reservoir Dam**

| Ecosystem Attribute | | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Water Quality | Constituents/Parameters | X | X | X | X | X | X | X | X | X | X | X | X |
| | Water Temperature | X | | | | | X | X | X | XX | XX | XX | X |
| Channel Morphology | Stream Channel/Floodplain | | | | | | | X | XX | XX | X | | |
| | Sediment Transport | | | | | | X | X | XX | XX | X | | |
| | Woody Debris | | | | | | | X | XX | XX | X | | |
| | Riparian Vegetation (3) | | | | | | | X | XX | XX(2) | XX(2) | X | |
| Benthic Macroinvertebrates | Undefined | X | | | | | | | X | XX(1) | XX(1) | XX(1) | XX(1) |
| Rainbow Trout | Spawning Habitat | | | | | | | X | XX | XX | XX | X | |
| | Fry Habitat | X | | | | | | | | X | X | X | X |
| | Juvenile Habitat | XX | X | X | X | X | X | X | X | XX | XX | XX | XX |
| | Adult Habitat | XX | X | X | X | X | X | XX | XX | XX | XX | XX | XX |
| | Passage | | | | | | | | | | | | |
| Foothill Yellow-legged Frog | | | | | | | | | X | X | X | X | X |
| Mountain Yellow-legged Frog | | X | X | X | X | X | X | X | X | X | X | X | X |

(1) Based on hatches.
(2) Germination.
(3) Riparian habitat to include riparian wildlife utilization.

## Silver Creek Below Junction Reservoir Dam

**Silver Creek Below Junction Reservoir Dam**

| Ecosystem Attribute | | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Water Quality | Constituents/Parameters | X | X | X | X | X | X | X | X | X | X | X | X |
| | Water Temperature | X | | | | | | | X | XX | XX | XX | X |
| Channel Morphology | Stream Channel/Floodplain | | | | | | | X | XX | XX | X | | |
| | Sediment Transport | | | | | | X | X | XX | XX | X | | |
| | Woody Debris | | | | | | | X | XX | XX | X | | |
| | Riparian Vegetation (3) | | | | | | | X | XX | XX(2) | XX(2) | X | |
| Benthic Macroinvertebrates | Undefined | XX(1) | | | | | | | X | XX(1) | XX(1) | XX(1) | XX(1) |
| Rainbow Trout | Spawning Habitat | | | | | | | XX | XX | XX | | | |
| | Fry Habitat | X | | | | | | | | X | X | X | X |
| | Juvenile Habitat | XX | X | X | X | X | X | X | X | X | XX | XX | XX |
| | Adult Habitat | XX | X | X | X | X | X | XX | XX | XX | XX | XX | XX |
| | Passage | | | | | | | | | | | | |
| Foothill Yellow-legged Frog | | | | | | | | | XX | XX | XX | XX | XX |

(1) Based on hatches.
(2) Germination.
(3) Riparian habitat to include riparian wildlife utilization.

## Silver Creek Below Camino Reservoir Dam

**Silver Creek Below Camino Reservoir Dam**

| Ecosystem Attribute | | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Quality** | Constituents/Parameters | X | X | X | X | X | X | X | X | X | X | X | X |
| | Water Temperature | X | | | | | | | X | **XX** | **XX** | **XX** | X |
| **Channel Morphology** | Stream Channel/Floodplain | | | | | | | X | **XX** | **XX** | X | | |
| | Sediment Transport | | | | | | X | X | **XX** | **XX** | X | | |
| | Woody Debris | | | | | | | X | **XX** | **XX** | X | | |
| | Riparian Vegetation (3) | | | | | | | X | **XX** | **XX(2)** | **XX(2)** | X | |
| **Benthic Macroinvertebrates** | Undefined | X | | | | | | | X | **XX(1)** | **XX(1)** | **XX(1)** | **XX(1)** |
| **Rainbow Trout** | Spawning Habitat | | | | | | | **XX** | **XX** | **XX** | **XX** | | |
| | Fry Habitat | X | | | | | | | | X | X | X | X |
| | Juvenile Habitat | **XX** | X | X | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** |
| | Adult Habitat | **XX** | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** |
| | Passage | | | | | | | | | | | | |
| **Foothill Yellow-legged Frog** | | | | | | | | | **XX** | **XX** | **XX** | **XX** | **XX** |

(1) Based on hatches.
(2) Germination.
(3) Riparian habitat to include riparian wildlife utilization.

## Brush Creek Below Brush Creek Reservoir Dam

| Ecosystem Attribute | | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Quality** | Constituents/Parameters | X | X | X | X | X | X | X | X | X | X | X | X |
| | Water Temperature | | | | | | | | | | | | |
| **Channel Morphology** | Stream Channel/Floodplain | | | | | | | | | | | | |
| | Sediment Transport | | | | | **XX** | **XX** | X | | | | | |
| | Woody Debris | | | | | | | | | | | | |
| | Riparian Vegetation (2) | | | | | **XX** | **XX** | **XX** | | | | | |
| **Benthic Macroinvertebrates** | Undefined | **XX(1)** | | | | | | **XX(1)** | **XX(1)** | **XX(1)** | **XX(1)** | **XX(1)** | **XX(1)** |
| **Rain bow Trout** | Spawning Habitat | | | | | | | **XX** | **XX** | **XX** | | | |
| | Fry Habitat | X | | | | | | | | X | X | X | X |
| | Juvenile Habitat | **XX** | X | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** | **XX** |
| | Adult Habitat | **XX** | X | X | X | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** |
| | Passage | | | | | | | | | | | | |
| **Foothill Yellow-legged Frog** | | | | | | | | | X | X | X | X | X |

(1) Based on hatches.
(2) Riparian habitat to include riparian wildlife utilization.

## South Fork American River Below Slab Creek Reservoir Dam

| Ecosystem Attribute | | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Quality** | Constituents/Parameters | X | X | X | X | X | X | X | X | X | X | X | X |
| | Water Temperature | | | | | | | | | **XX** | **XX** | **XX** | X |
| **Channel Morphology** | Stream Channel/Floodplain | | | | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | | |
| | Sediment Transport | | | | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | | |
| | Woody Debris | | | | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | | |
| | Riparian Vegetation (3) | | | | | | | **XX(2)** | **XX(2)** | **XX(2)** | **XX(2)** | X | |
| **Benthic Macroinvertebrates** | Undefined | **XX(1)** | | | | | | | X | **XX(1)** | **XX(1)** | **XX(1)** | **XX(1)** |
| **Rainbow Trout** | Spawning Habitat | | | | | | | **XX** | **XX** | **XX** | | | |
| | Fry Habitat | X | | | | | | | | X | X | X | X |
| | Juvenile Habitat | X | X | X | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** |
| | Adult Habitat | **XX** | **XX** | X | X | X | X | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** |
| | Passage | | | | | | | | | | | | |
| **Foothill Yellow-legged Frog** | | | | | | | | | | **XX** | **XX** | **XX** | **XX** |
| **Hardhead** | Spawning Habitat | | | | | | | | **XX** | **XX** | **XX** | **XX** | |
| | Fry Habitat | X | | | | | | | | X | X | X | X |
| | Juvenile Habitat | X | X | X | X | X | X | X | X | X | **XX** | **XX** | **XX** |
| | Adult Habitat | **XX** | **XX** | X | X | X | X | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** |
| | Passage | | | | | | | | | | | | |
| **Western Pond Turtle** | | | | | | | | | | **XX** | **XX** | **XX** | **XX** |

(1) Based on hatches.
(2) Germination.
(3) Riparian habitat to include riparian wildlife utilization.

**South Fork American River Below Chili Bar Reservoir Dam**

| South Fork American River Below Chili Bar Reservoir Dam | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ecosystem Attribute** | | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sept** |
| **Water Quality** | Water Temperature | X | X | X | X | X | X | X | X | **XX(1)** | **XX(1)** | **XX(1)** | X |
| | Water Chemistry | X | X | X | X | X | X | X | X | X | X | X | X |
| | Bacteria | X | X | X | X | X | X | X | X | **XX(2)** | **XX(2)** | **XX(2)** | **XX(2)** |
| **Channel Morphology** | Sediment Transport | | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | X | | | |
| | Stream Channel/Floodplain | X | X | **XX** | **XX** | **XX** | X | X | X | X | X | X | X |
| | Large Wood | | | **XX** | **XX** | **XX** | | | | | | | |
| **Benthic Macroinvertebrates** | | **XX(3)** | X | | | | **XX(3)** | **XX(3)** | **XX(3)** | X | X | X | **XX(3)** |
| **Riparian Vegetation** | | **XX(5)** | | | | | X | **XX(4)** | **XX(4)** | X | X | **XX(5)** | **XX(5)** |
| **Rainbow Trout** | Spawn/Egg | | | | | **XX** | **XX** | **XX** | **XX** | **XX** | | | |
| | Nursery | | | | | | **XX** | **XX** | **XX** | **XX** | **XX** | X | |
| | Adult | X | X | X | X | X | X | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** |
| | Stranding | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** | **XX** |
| | Passage | | | | | **XX** | **XX** | **XX** | **XX** | **XX** | | | |
| **Foothill Yellow-legged Frog** | | | | | | | | **XX** | **XX** | **XX** | **XX(6)** | **XX(6)** | |
| **California Red-legged Frog** | | | | | | | | **XX** | **XX** | **XX** | **XX(6)** | **XX(6)** | |
| **Western Pond Turtle** | | | | | | | | **XX** | **XX** | **XX** | **XX** | **XX** | |

(1) Watch in CD and SD Years.
(2) XX based on swimmer exposure.
(3) Based on hatches.
(4) Germination.
(5) Flushing out riparian vegetation.
(6) Dessication and predation of tadpoles.

Results from the Ecosystem Attributes matrices were used to assist in developing streamflow regimes, which included minimum streamflows, pulse flows, and adaptive management streamflow and non-flow measures. The streamflow and non-flow measures were incorporated into the PM&E measures for each reach.

## Rationale for Protection, Mitigation, and Enhancement Measures - Upper American River Project and Chili Bar Hydroelectric Project

The following section describes the scientific information and the rationale for the specific protection, mitigation, and enhancement measures in the settlement agreement.

### ECOLOGICAL RESOURCES

#### Applicable Articles

- Articles 1-1 and 2-1, Minimum Streamflows
- Article 1-2, Pulse Flows
- Article 1-3 and Article 2-2, Ramping Rates
- Article 1-4 and Article 2-3, Coordination with Chili Bar Licensee and Coordination with UARP Licensee
- Articles 1-5 and 2-4, Monitoring Program
- Articles 1-6 and 2-5, Adaptive Management Program
- Article 1-7, Gerle Creek Channel Stabilization
- Article 1-8, Fish Passage at Gerle Creek
- Articles 1-9 and 2-7, Large Woody Debris
- Articles 1-10 and 2-8, Streamflow and Reservoir Elevation Gaging
- Article 1-11, Preferred Canal Drainage Structure and Release Points
- Article 1-12 and 2-9, Wildlife and Plant Protection Measures
- Articles 1-13 and 2-10, Vegetation and Invasive Weed Management Plan
- Article 1-14 and 2-11, Annual Review of Ecological Conditions
- Article 1-40, Aquatic Resources
- Article 1-41, Terrestrial Resources
- Article 1-42, Water Quality and Water Pollution
- Article 1-43, Groundwater
- Article 1-50, Future Revisions to the Iowa Hill Pumped Storage Development

## Existing Conditions

General

- Project operation and maintenance activities have the potential to affect habitat for or create disturbance during the breeding season for one or more sensitive species or management indicator species, including California spotted owl, northern goshawk, pallid bats, and Townsend's big-eared bats.
- Current streamflows do not create sufficient reward or enticement for repeated use by more than a handful of anglers (SMUD 2003a).
- Reference reaches on Big Silver Creek, unimpaired tributary to Union Valley Reservoir, and on Silver Fork American River showed healthier macroinvertebrate populations than most of the impaired stream reaches surveyed in the UARP (Aquatic Bioassessment Technical Report (Devine Tarbell & Associates, Stillwater Sciences 2005b).
- There are occurrences of noxious weeds in the Project area. Yellow starthistle exists in and around several facilities in the Camino Powerhouse and Slab Creek Reservoir Dam areas; spotted knapweed occurs in South Fork Silver Creek reach between Ice House Reservoir and Junction Reservoir.
- New occurrences of sensitive plant species have been discovered in the Project area.

Rubicon River Below Rubicon Reservoir Dam

- California roach and speckled dace are the dominant fish species in the lower half of the reach.
- Fish populations do not meet biomass and other fish metrics objectives.
- There is mountain yellow-legged frog habitat in this area and mountain yellow-legged frogs exist in Highland Creek.
- There are elevated aluminum levels in Rubicon Reservoir, which potentially could cause deleterious aquatic effects.
- The stream channel has a high sediment supply, a high width-to-depth ratio, and the channel is aggrading. Spills are occurring but not at the appropriate magnitude, duration, or time of year.
- Most large woody debris is in the upper portion of the reach and is not being distributed downstream.
- Freezing in the reservoir may affect overwintering fish. Ice thickness could range from 3 to 4 feet during the winter in reservoirs.
- The downstream macroinvertebrate bioassessment site has relatively poorer water/habitat quality as defined by the composite metric scores and comparisons with reference sites.

Little Rubicon River Below Buck Island Reservoir Dam

- Golden shiners, an exotic species, dominate the reach.
- There is mountain yellow-legged frog habitat in this reach.
- Fish populations do not meet biomass and other fish metrics objectives.

Gerle Creek Below Loon Lake Reservoir Dam

- Brown trout, a non-native but desirable fish species, are abundant in this reach.
- Rainbow trout, a native fish species, also occur in this reach but not in desired biomass numbers.
- Aquatic species passage upstream from Gerle Reservoir into Gerle Creek needs to be maintained for brown trout spawning.
- This reach includes one of three identified alluvially controlled response reaches in the Project.
- The stream channel is aggrading and has lateral scour pools.
- The stream banks are highly unstable, contributing a high amount of fine material in the stream channel system.
- Inundation of low terraces and flood-prone areas is infrequent during the growing season.
- Lack of high-velocity flows within the bankfull channel results in encroachment.
- Temperatures below Loon Lake Reservoir Dam are somewhat reflective of natural conditions until July and August, when releases from Loon Lake cool the water in this reach to temperatures that are not reflective of natural conditions.
- There is macroinvertebrate bioassessment impairment immediately downstream of the Loon Lake Reservoir Dam; however, there is recovery of composite metric scores farther downstream in the reach.
- An occurrence of Stebbin's phacelia is located near the dam at the west edge of Loon Lake Reservoir.
- Fish populations do not meet biomass and other fish metrics objectives.

Gerle Creek Below Gerle Reservoir Dam

- There is potential mountain yellow-legged frog habitat in this reach.
- Streamflow gaging in this reach is inadequate to determine actual flows.

South Fork Rubicon River Below Robbs Peak Reservoir Dam

- There are mountain yellow-legged frog and foothill yellow-legged frog habitats are in this reach.
- Large woody debris is lacking in this reach.
- There is potential entrainment of fish in Robbs Peak Powerhouse turbines. Rainbow trout above the Robbs Peak Afterbay are not present in desired biomass numbers and may be affected by this entrainment.
- Streamflow gaging in this reach is inadequate to determine actual flows.
- This reach includes one of three identified alluvially controlled response reaches in the Project, a short segment about one-half mile from the dam.
- Indian rhubarb plants grow abundantly in the channel, as well as algae that was not flushed out after winter flows, indicators that higher spring flows are needed to maintain channel health.

South Fork Silver Creek Below Ice House Reservoir Dam

- There is foothill yellow-legged frog habitat in this reach.
- There is substantial bedload in this reach that has not been moved due to limited peak flows since the construction of Jones Fork Powerhouse.
- Out-of-bank flows that inundate lower terrace and flood-prone areas needed to maintain the riparian ecosystem and keep the banks stabilized are not occurring.
- This reach includes one of three identified alluvially controlled response reaches in the Project. South Fork Silver Creek has a hedge of alder not currently being disturbed by high flows that may cause future channelization and discontinuity.
- Large woody debris is not being distributed throughout the reach.
- Temperatures are extremely cold in the upper part of the reach from July through October, which may inhibit foothill yellow-legged frog breeding. Temperatures are warm enough at the bottom of the reach that they may adversely affect rainbow trout. Temperatures do not follow seasonal warming trends.
- The macroinvertebrate bioassessment showed impairment immediately downstream of the Ice House Reservoir Dam; however, there is recovery of composite metric scores farther downstream in the reach.
- Rainbow trout do not occur in desired biomass numbers.
- There are scattered infestations of spotted knapweed along this reach.
- Fish populations do not meet biomass and other fish metrics objectives.

Silver Creek Below Junction Reservoir Dam

- There is a high dominance of macroinvertebrate organisms in the upper reach that are highly tolerant of less than optimal water quality conditions.
- There is a strong appearance of unidentified algae in this reach; the species composition may be indicative of less than optimal water quality conditions.
- The substrate/benthos conditions for rainbow trout in this reach are not optimal. Gravels are not being moved through system and reset.
- There is foothill yellow-legged frog habitat in this reach.
- There is currently not connectivity of flows from SF Silver Creek below Ice House Reservoir Dam through Silver Creek below Junction Reservoir Dam.
- Large woody debris is lacking in this reach.
- Rainbow trout do not occur in desired biomass numbers.
- Two occurrences of Pleasant Valley mariposa lily are adjacent to Junction Reservoir.
- Several scattered occurrences of Stebbin’s phacelia are within the Project boundary at Junction Reservoir.
- Fish populations do not meet biomass and other fish metrics objectives.

Silver Creek Below Camino Reservoir Dam

- Foothill yellow-legged frogs are present in this reach.
- There is a high dominance of macroinvertebrate organisms in the lower part of this reach that are highly tolerant of less than optimal water quality conditions.
- There is currently not connectivity of flows from SF Silver Creek below Ice House Reservoir Dam through Silver Creek below Junction and Camino Reservoir Dams.

- Large woody debris is lacking in this reach.
- Substrate is cobble-dominated, with the medium- and fine-grained sediment component mostly absent, probably as a result of dredging Camino Reservoir.
- Approximately half of this reach is low gradient, less than 2 percent; there are opportunities for large woody debris and medium- to fine-grained materials to settle out and improve habitat complexity.
- Several scattered occurrences of Stebbin's phacelia are within the Project boundary along South Fork Silver Creek just above Camino Reservoir.
- A large occurrence of Pleasant Valley mariposa lily is adjacent to Camino Reservoir above the access road. Another Pleasant Valley mariposa lily occurrence is above the reservoir under a transmission line.
- Yellow starthistle and rush skeletonweed are scattered on the bank and along Poho Ridge Road at various licensee facilities north of the SFAR.

<u>Brush Creek Below Brush Creek Reservoir Dam</u>

- There is foothill yellow-legged frog habitat in this reach.
- Fish populations do not meet biomass and other fish metrics objectives.

<u>South Fork American River Below Slab Creek Reservoir Dam</u>

- Foothill yellow-legged frogs are present in this reach. The current flow regime does not provide appropriate magnitude or timing of flows to trigger breeding.
- Hardhead are present in this reach and in Slab Creek Reservoir. The principle habitats of hardhead are in the same reaches that are favored for building dams, so their populations have become fragmented. They have become abundant in a few reservoirs (but are absent from most) and will thrive in regulated streams under certain conditions. However, many populations seem to have disappeared or declined in recent years, especially where smallmouth bass have invaded altered habitats, such as in the Kings River and South Yuba River.
- Western pond turtle are present in this reach.
- This reach has the most extreme temperature fluctuations of all reaches in the Project. The Slab Creek reach is designated with both cold and warm freshwater beneficial uses and should support a transition of species with cold water needs to those with warm water needs.
- There is currently not connectivity of flows from SFAR above Slab Creek Reservoir Dam and SFAR below Slab Creek Reservoir Dam.
- The frequency, timing, and magnitude of peak flows in this reach are affected by the Project, potentially causing reduced channel capacity and encroachment of riparian vegetation.
- Large woody debris is lacking in this reach.
- There is a decrease in the overall macroinvertebrate bioassessment composite metric score moving downstream, suggesting potential impairment at the lower end of the reach.
- There is riparian encroachment in the channel in the lower part of the reach.

- Approximately 75 percent of this reach is low gradient, less than 2 percent; there are opportunities for large woody debris and medium- to fine-grained materials to settle out and improve habitat complexity, although these elements are lacking.
- Scattered small infestations of Scotch broom and yellow starthistle exist near Slab Creek Reservoir within the Project boundary.
- Fish populations do not meet biomass and other fish metrics objectives.

South Fork American River Below Chili Bar Reservoir Dam

- Foothill yellow-legged frogs are present in tributaries to this reach.
- Western pond turtles are present in this reach.
- Hardhead are present in Chili Bar Reservoir.
- The frequency, timing, and magnitude of peak flows in this reach may contribute to overall channel incision, although there is also evidence of aggradation of bedload and overwidening of the stream channel in low gradient areas at the lower end of the reach.
- Anecdotal accounts of *Didymosphenia geminata* (diatomaceous algae) have been noted in this reach, which may indicate less than optimal water quality.
- The fluctuating flow regime may be affecting cottonwood age structure.
- Fluctuating flows may contribute to fish stranding and may affect connectivity (fish passage) from SFAR to tributary streams in this reach.
- Large woody debris is lacking in this reach.
- In various locations in the SFAR downstream of Chili Bar Reservoir Dam, the channel is incised and lacking the sediment necessary to be in proper functioning condition.

## Desired Conditions

General

- Ensure that threatened, endangered, and sensitive species and their habitat are adequately protected, including mountain yellow-legged frog, foothill yellow-legged frog, hardhead, western pond turtle, Pleasant Valley mariposa lily, Stebbins phacelia, and serrated-leaf lewisia.
- Ensure that native fish populations are protected and maintained. Improve habitat capability for native trout.
- Maintain medium to high capability habitat for management indicator species.
- Ensure the Project does not adversely affect water temperatures necessary for aquatic-dependent assemblages. Maintain or improve selected habitats for coldwater and warm-water species.
- Maintain water quality adequate to protect beneficial uses and meet state water quality standards.
- Ensure plant communities in riparian areas and wetlands are diverse and healthy and provide essential ecological functions.
- Maintain channels in a healthy, functioning condition.
- Prevent and eradicate populations of noxious weeds.

- Monitor to ensure objectives are met. Include adaptive management measures that may be implemented if objectives are not met.
- Provide habitat for healthy macroinvertebrate populations.

<u>Rubicon River Below Rubicon Reservoir Dam</u>

- Provide habitat for healthy rainbow trout populations and conditions less conducive for California roach and speckled dace.
- Provide habitat for healthy mountain yellow-legged frog populations.
- Attempt to address elevated aluminum levels in Rubicon Reservoir.
- Provide cold freshwater habitat.
- Move sediment through system at appropriate time of year.
- Distribute large woody debris throughout reach.
- Minimize winter fish kill in Rubicon Reservoir.
- Provide good water/habitat quality resulting in improved bioassessment composite metric scores, particularly in the lower reach.

<u>Little Rubicon River Below Buck Island Reservoir Dam</u>

- Provide habitat for healthy rainbow trout populations and conditions less conducive for golden shiners.
- Provide habitat for healthy mountain yellow-legged frog populations.
- Provide cold freshwater habitat.

<u>Gerle Creek Below Loon Lake Reservoir Dam</u>

- Provide habitat for healthy rainbow trout and desired non-native brown trout populations.
- Provide aquatic species passage upstream out of Gerle Reservoir to provide for brown trout spawning.
- Provide habitat for healthy mountain yellow-legged frog populations.
- Provide cold freshwater habitat.
- Move sediment through system to improve channel condition in Gerle Meadow area.
- Rehabilitate the stream channel and improve stream bank stability.
- Ensure low terraces and flood-prone areas are inundated during the growing season.
- Provide flows to reduce riparian encroachment.

<u>Gerle Creek Below Gerle Creek Reservoir Dam</u>

- Ensure streamflow gaging is adequate to determine actual flows in this reach.
- Provide habitat for healthy mountain yellow-legged frog populations.
- Provide cold freshwater habitat.

South Fork Rubicon River Below Robbs Peak Reservoir Dam

- Provide habitat for healthy mountain yellow-legged frog and foothill yellow-legged frog populations.
- Provide cold freshwater habitat.
- Ensure adequate large woody debris occurs in this reach.
- Minimize entrainment of fish in Robbs Peak Powerhouse turbines, potentially increasing trout biomass above Robbs Peak Afterbay.
- Ensure streamflow gaging is adequate to determine actual flows in this reach.
- Protect wildlife from entering the Gerle Canal. Ensure there are adequate canal crossings.

South Fork Silver Creek Below Ice House Reservoir Dam

- Provide habitat for healthy foothill yellow-legged frog populations.
- Provide peak flows to ensure bedload is moved through this reach.
- Provide out-of-bank flows to inundate lower terrace and floodplain to maintain the riparian ecosystem and keep the banks stabilized.
- Ensure distribution of large woody debris throughout the reach.
- Provide temperatures that allow for management of native coldwater fish species and improve habitat conditions for foothill yellow-legged frogs.
- Improve rainbow trout biomass so it is closer to the expected Northern Sierra trout biomass (Gerstung 1973).

Silver Creek Below Junction Reservoir Dam

- Provide habitat for healthy macroinvertebrate populations in the entire reach.
- Provide habitat for health foothill yellow-legged frog populations.
- Reduce or eliminate water quality conditions that encourage algae growth in this reach.
- Improve substrate/benthos conditions for rainbow trout by moving gravels through the system and resetting them.
- Provide conditions that improve habitat conditions for foothill yellow-legged frogs.
- Provide connectivity of flows from SF Silver Creek below Ice House Reservoir Dam through Silver Creek below Junction Reservoir Dam.
- Provide temperatures that allow for management of native coldwater fish species and improve habitat conditions for foothill yellow-legged frogs.
- Ensure adequate large woody debris occurs in this reach.
- Improve rainbow trout biomass so it is closer to the expected Northern Sierra trout biomass (Gerstung 1973).

Silver Creek Below Camino Reservoir Dam

- Provide habitat for healthy macroinvertebrate populations in the entire reach.
- Provide habitat for healthy foothill yellow-legged frog populations.
- Provide connectivity of flows from SF Silver Creek below Ice House Reservoir Dam through Silver Creek below Junction and Camino Reservoir Dams.
- Provide temperatures that allow for management of native fish and improve habitat conditions for foothill yellow-legged frogs.
- Ensure adequate large woody debris occurs in this reach.
- Provide good water/habitat quality, resulting in improved bioassessment composite metric scores, particularly in the lower reach.

Brush Creek Below Brush Creek Reservoir Dam

- Provide habitat for healthy macroinvertebrate populations in the entire reach.
- Provide habitat for healthy foothill yellow-legged frog populations.

South Fork American River Below Slab Creek Reservoir Dam

- Provide habitat for healthy foothill yellow-legged frog populations. The current flow regime does not provide appropriate magnitude or timing of flows to trigger breeding.
- Provide habitat for healthy hardhead populations in this reach and in Slab Creek Reservoir.
- Provide habitat for healthy western pond turtle populations.
- Provide temperatures that allow for management of native fish and improve habitat conditions for foothill yellow-legged frogs and hardhead.
- Provide connectivity of flows from SFAR above Slab Creek Reservoir Dam and SFAR below Slab Creek Reservoir Dam.
- Ensure adequate large woody debris occurs in this reach.
- Provide good water/habitat quality, resulting in improved bioassessment composite metric scores, particularly in the lower reach.
- Reduce riparian encroachment.

South Fork American River Below Chili Bar Reservoir Dam

- Provide habitat for healthy foothill yellow-legged frog populations.
- Provide habitat for healthy hardhead populations in Chili Bar Reservoir.
- Provide habitat for healthy western pond turtle populations.
- Distribute sediment throughout the reach.
- Determine if the fluctuating flow regime is affecting cottonwood age structure.
- Minimize effects of fluctuating flows on fish stranding and connectivity (fish passage) from SFAR to tributary streams in this reach.
- Reduce or eliminate water quality conditions that encourage algae growth in this reach.
- Ensure adequate large woody debris occurs in this reach.
- Maintain the channel in proper functioning condition.

## Minimum Streamflows

### Objectives Addressed by Minimum Streamflows

Aquatic Biota
Fisheries
Macroinvertebrates
Water Temperature
Target Lake Levels
Water Quality
Natural Hydrograph
Geomorphology
Riparian Habitat
Threatened, Endangered, and Sensitive Species and Management Indicator Species
Hydropower Operations
Recreational Streamflows
Connectivity
Visual Resource
Wilderness and Wild and Scenic River

### Information Used to Establish Minimum Streamflows

The following information was used to analyze streamflows: (a) regulated streamflow data from several licensee and United States Geological Survey (USGS) gages in the basin**,** (b) Hydrology Technical Report (Devine Tarbell & Associates and Hannaford 2005a), (c) Amphibians and Aquatic Reptiles Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005a), (d) Amphibian and Habitat Test Flow Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004a), (e) Aquatic Bioassessment Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005b), (f) Channel Morphology Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005c), (g) Chili Bar Reservoir Sediment Deposition Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005d), (h) Fish Passage Barriers Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004b), (i) Flow and Fluctuation in the Reach Downstream of Chili Bar Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005e), (j) Iowa Hill Turbidity Analysis Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004c), (k) PHABSIM Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004d), (l) Reservoir Fisheries Technical Report (Devine Tarbell & Associates, Stillwater Sciences 2004e), (m) Reservoir Shoreline Habitat Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005g), (n) Stream Habitat Mapping Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005i), (o) Iowa Hill Fish Entrainment Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005f), (p) Shallow Water Entrainment Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005h, (q) Stream Fisheries Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005j), (r) Deepwater Intake Entrainment Technical Report (Devine Tarbell & Associates 2004g), (s) Iowa Hill Wetlands Technical Report (Devine Tarbell & Associates 2004p), (t) Project Sources of Sediment Technical Report (Devine Tarbell & Associates 2005c), (u) Riparian Vegetation and

Wetlands Technical Report (Devine Tarbell & Associates 2004t), (v) Iowa Hill Water Temperature Technical Report (Devine Tarbell & Associates and EES Consulting 2005a), (w) Water Quality Technical Report (Devine Tarbell & Associates 2005d), (x) literature related to amphibian life cycles (Hayes and Jennings 1988, Kupferberg 1996, Lind et al. 1996, FWS 2000, Kupferberg 2006, Mount et al. 2006), (y) other pertinent literature (for example, Klingeman 1985, Leopold et al. 1964, Gerstung 1973, Trush et al. 2005, Castelli et al. 2000, Power et al. 1995, Poff et al. 1997, Moyle et al. 1998, Moyle and Light 1996, Moyle and Vondracek 1985, Hunter 1992, McBride and Strahan 1984, USDI 1999, Annear et al. 1994, Needham and Jones 1959, Cushman 1985, Coutts 1982, Chun et al. 2005), (z) Sierra Nevada Forest Plan Amendment Record of Decision (USDA 2004a), (aa) Basin Plan (CVRWQCB 1998), (bb) HEC-Res-Sim Model Runs (CDFG 2007), (cc) Water Temperature Technical Report (Devine Tarbell & Associates 2005e), (dd) Inland Fishes of California (Moyle 2002), (ee) 2005 California Roach (CDFG 2005), (ff) Predicted Water Temperatures from South Fork Silver Creek below Ice House Reservoir Dam, Silver Creek below Camino Reservoir Dam, and SFAR below Slab Creek Reservoir Dam (R2 Resource Consultants 2004a), (gg) Simulated Maximum and Minimum Daily Temperatures in the SFAR Below Slab Creek Reservoir (R2 Resource Consultants 2004b), (hh) PHABSIM Analysis for Rubicon River Below Rubicon Reservoir Dam (CDFG 2006b), (ii) Operations Modeling Assumptions – Base Case (SMUD 2004), and (jj) SMUD Drawing for Rubicon Reservoir Bathymetry (SMUD 1976), (kk) CDFG communication from Dave Lentz to Stafford Lehr (CDFG 2005c), (ll) USGS 2005, (mm) Supplemental Preliminary Draft Environmental Assessment for UARP (SMUD 2006), (nn) Composite WUA Analysis for Gerle Creek below Loon Lake Dam and SF Silver below Ice House Dam (CDFG 2006a), and (oo) Stream Angler Focus Group Technical Report (Devine Tarbell & Associates and Louis Berger Group 2004f.

**Rationale for Minimum Streamflows**

The approach for evaluating and developing minimum streamflows for all Project-affected stream reaches included the following steps, focused on the needs of the aquatic-dependent biota (primarily fish, amphibians, macroinvertebrates, and riparian vegetation): (a) establishment of resource objectives for each reach, (b) evaluation of ecosystem conditions under regulated and unimpaired streamflows, (c) review of the ecosystem matrices (which are based on the resource objectives for each reach) to determine which attributes are important at different times of the year and where there may be limiting factors, (d) review of study results to develop a minimum streamflow regime for the months of below normal (BN) (or average) water years supported by study results, (e) development of minimum streamflows for the remainder of the BN water year type based on review of the natural hydrograph and study results, (f) development of streamflow regimes for other water year types using a similar process, and (g) re-evaluation of the resulting minimum streamflows and adjustments to meet the interests of other parties, in particular, the hydroelectric generation interests.

Streamflow is strongly correlated with many critical physicochemical characteristics of rivers, such as channel geomorphology, water temperature, and habitat diversity, and can be considered a “master variable” that limits the distribution and abundance of riverine species (Power et al. 1995 and Poff et al. 1997). The natural, unregulated flow regime plays a critical role in sustaining native biodiversity and ecosystem integrity in rivers

(Poff et al. 1997). Higher spring flows are essential for maintaining resident native fishes in good condition for spawning and rearing (Moyle et al. 1998).

The following sections describe the minimum streamflow approach with the specific process for each reach.

Evaluation of Aquatic Ecosystem Conditions Under Regulated and Unimpaired Streamflows

Aquatic ecosystem conditions under existing minimum streamflows were evaluated for each Project-affected stream reach, based on a comparison with unimpaired conditions and with conditions in similar unaffected stream reaches both within the Rubicon and SFAR Basins and elsewhere in the Sierra Nevada mountains. Knowledge of existing and historical conditions was primarily based on: (a) studies conducted in 2002-2003 related to hydrology, geomorphology, fish populations, fish habitat, amphibians, macroinvertebrates, water quality, and water temperature; (b) personal field observations; (c) pertinent literature; (d) information from other hydroelectric relicensings, and (e) professional judgment. Existing fish population data from Project-affected stream reaches were compared between sampling sites and reaches, and with existing data from similar unaffected reaches in the drainage, historical data from the same reaches, and a compilation of historical data from several Sierra Nevada mountain drainages (Gerstung 1973). Macroinvertebrate data from Project-affected stream reaches were compared between sampling sites and reaches and with data from similar unaffected reaches in the drainage.

Comparison of Regulated and Unimpaired Streamflow Data

Regulated streamflow data were compared with unimpaired streamflow data for Project-affected stream reaches over a 27-year period to determine how hydrological conditions have been affected by Project operations on a seasonal basis. The average monthly streamflow was evaluated for each stream reach. The frequency, magnitude, and duration of peak flow events were also evaluated.

Review of Ecosystem Matrices and Identification of Potential Limiting Factors

Based on review of the ecosystem matrices and hydrology data, potential limiting factors for aquatic biota (primarily fish, amphibians, and macroinvertebrates) were identified under both unimpaired and regulated streamflow conditions. Examples of limiting factors include: low summer streamflows under unimpaired conditions, water temperatures that are too warm or too cold (according to the Basin Plan), flow fluctuations caused by Project operations, reduced winter/spring streamflows, and delayed or lack of spring runoff under Project operations. Potential improvements were identified to restore the aquatic ecosystem as close as possible to a natural condition while addressing hydroelectric generation interests. The following factors were considered while developing minimum streamflows: (a) a resource management emphasis on native species (particularly rainbow trout, mountain yellow-legged frogs, foothill yellow-legged frogs, western pond turtles, and hardhead) and desired non-native species (brown trout in Gerle Creek below Loon Lake Reservoir Dam), (b) the importance of mimicking the natural hydrograph for the protection of overall ecosystem function and individual target biota (for example, amphibians and riparian vegetation), (c) maintenance of cold water and transitional habitats where appropriate, (d) maintenance of beneficial water quality conditions, (e) connectivity of flows above and below Project features, (f) recreational opportunities, (g) hydroelectric operations, and (h) other resource objectives listed above.

Development of a Range of Minimum Streamflows to Protect Aquatic Resources in Below Normal Water Years

Minimum streamflows were developed on a seasonal and monthly basis to protect aquatic resources, recognizing that higher flows than the minimum streamflows (including natural peak flow events) may occur at times due to tributary accretion, storm runoff, fall releases, and snowmelt runoff. Results of the various studies listed above were used as tools in developing the minimum streamflows. Generally, because spring is a very important time of year for breeding, spawning, and other ecosystem processes, results of the various streamflow studies were used to establish springtime minimum streamflows. The springtime flows were usually predicted to provide habitat levels near 100 percent of optimum weighted usable area (WUA) for the various life stages of rainbow trout, although this varied at times due to the importance of other ecological objectives occurring within specific reaches. Once springtime flows were developed, emphasis was placed on developing streamflow regimes that mimicked the natural hydrograph for overall protection of the aquatic ecosystem, although this was not always followed due to the importance of other ecological objectives or other objectives within specific reaches.

After the BN water year streamflow regime was developed, a critically dry (CD) water year flow regime was developed, following a pattern similar to the BN water year but generally providing habitat levels near 80 percent of optimum WUA for the various life stages of rainbow trout. A Dry water year flow regime was developed, interpolating between the CD and BN water year type streamflow regimes. Above normal (AN) and Wet water year type flow regimes were developed following a similar pattern but with increased flows in wetter water years. However, there are several reaches where AN and Wet water years do not have flows increased over the BN water year type in an effort to meet hydroelectric generation or reservoir level objectives in specific reaches. In all cases, there may be variations in this process due to ecological objectives within a specific reach.

As streamflows were developed for each reach, strong consideration of the streamflows in the reach above and contributions from other hydroelectric projects in the basin were considered, and connectivity between streamflows above and below Project facilities was maintained wherever possible.

The following steps describe how minimum streamflows were developed for each season.

High Flow Spring Period: Primary considerations during this period included spawning rainbow trout, channel maintenance, sediment and large woody debris transport, and riparian habitat conditions. Spring is a critical time for fisheries reproduction and setting the stage for amphibian life stage activity for reproduction in late spring and early summer. During spring months it is important to have adequate flow and water temperatures for trout and hardhead spawning. Existing streamflows during non-spill periods are substantially less than unimpaired conditions, potentially affecting aquatic biota and fluvial geomorphology processes. Increased minimum streamflow levels were included in the new streamflow regimes based on providing improved rainbow trout spawning and rearing at the 80-100 percent range of optimum WUA and for riparian habitat. The concept of providing pulse flow events (see Rationale for Pulse Flows) in combination with minimum streamflows and naturally occurring peak flows to provide for channel maintenance, sediment and large woody debris transport, and riparian habitat was included as part of the PM&E measures.

Late Spring/Early Summer: The late spring and early summer is a critical period for continued fisheries reproduction and initiating amphibian life stage activity for reproduction during late spring and early summer. The decline of the natural hydrograph, in combination with warmer water temperatures, is an important cue for foothill yellow-legged frog breeding and egg-laying. The minimum streamflow regime includes a declining limb of the hydrograph. Once the hydrograph has declined, it is important to maintain a stable, even flow for foothill yellow-legged frog egg laying, tadpole rearing, and rearing of trout fry. When this occurs and water temperatures rise to 10°C for rainbow trout, and 12°C for foothill yellow-legged frogs, reproductive behavior is stimulated. The streamflows were designed to provide improved rainbow trout rearing at the 80-100 percent range of optimum WUA.

Late Summer and Early Fall: The relatively low streamflows that naturally occur during this period create limiting factors to aquatic biota such as reduced living space and potentially warm water temperatures. In reaches with upstream storage reservoirs, existing minimum streamflows provided by the licensee vary from base flow over unimpaired conditions in most water year types. In reaches without upstream storage, new minimum streamflows will allow for a closer representation of unimpaired base flow conditions. In general, where deemed necessary, the existing minimum streamflows (or flows of at least a similar magnitude) during late summer/early fall were included in the new streamflow regimes based on overall augmentation/maintenance values relative to unimpaired conditions, rearing suitability for rainbow trout, temperature control, and metamorphosing foothill yellow-legged frog tadpoles. It is important through the end of September to maintain a stable, even flow (without ramping) for foothill yellow-legged frog tadpole rearing and successful metamorphosis.

Late Fall/Winter: The remainder of the year was considered a transition period between the low-flow late summer/early fall period and the high-flow spring period. Existing streamflows during the late fall/winter are less than unimpaired conditions and lack the typical transition pattern provided by the natural hydrograph. Minimum streamflows for this transition period were included to bridge the gap between low-flow and high-flow periods in a step-wise fashion and thus mimic the pattern of the natural hydrograph, although there are variations in some reaches to meet other objectives. Development of minimum streamflows during the transition period also took into consideration the occurrence of accretion flows (including peak flow events). Flows at this time are important to provide overwintering habitat for trout. Trout are known to feed in winter, and actively catch macroinvertebrates, even when water is between 32º and 33ºF (Needham and Jones 1959).

Hydrology Evaluation for Minimum Streamflows

The information in hydrologic data bases provided by the licensee (Devine Tarbell & Associates and Hannaford 2005a) was used as baseline information for comparison of daily average impaired and regulated streamflows for the 27-year period from water year 1975 through water year 2001. Annual streamflow hydrographs were constructed for each Project-affected reach using the daily average streamflow data generated by the licensee. Components of the hydrograph (spring, summer, fall, and winter baseflow; fall and winter storm runoff; and ascending and descending limbs of the snowmelt hydrograph) that related to each of the ecosystem attributes listed above were examined for: (a) comparison of the regulated and unimpaired streamflows and (b) indications of the typical magnitude of high and low streamflows for each time of the year.

The resource agencies developed a reservoir simulation model of the UARP and Chili Bar Hydroelectric Projects to help evaluate and understand the effects of various streamflow and reservoir elevation target alternatives. The model was developed using HEC-Res-Sim, which is a public domain software package developed by the U.S. Army Corps of Engineers. HEC-Res-Sim is relatively easy to use and offers great flexibility in representing reservoir systems and operating scenarios. The model was initially developed using publicly available information and was further refined with data provided by the utilities, including the Hydrology Technical Report (Devine Tarbell & Associates and Hannaford 2005a). The licensees also provided detailed information on the physical features and operating criteria for each of their respective Project facilities. To the extent feasible, the HEC-Res-Sim model of the UARP and Chili Bar Hydroelectric Projects was aligned with the CHEOPS$^{tm}$ model developed by the licensees. Using the model, the resource agencies were able to view the impacts of the streamflow and reservoir elevation target alternatives within the bounds of the historic natural water balance in the system.

Aquatic Ecosystem Re-Evaluation of Minimum Streamflows

Once the minimum streamflows were reviewed using the HEC-Res-Sim model, adjustments were made to individual values to address site-specific considerations at various locations and to balance the minimum streamflows with other objectives, including hydroelectric generation, angling opportunities, lake levels, and recreational streamflows.

***Rubicon River Below Rubicon Reservoir Dam***

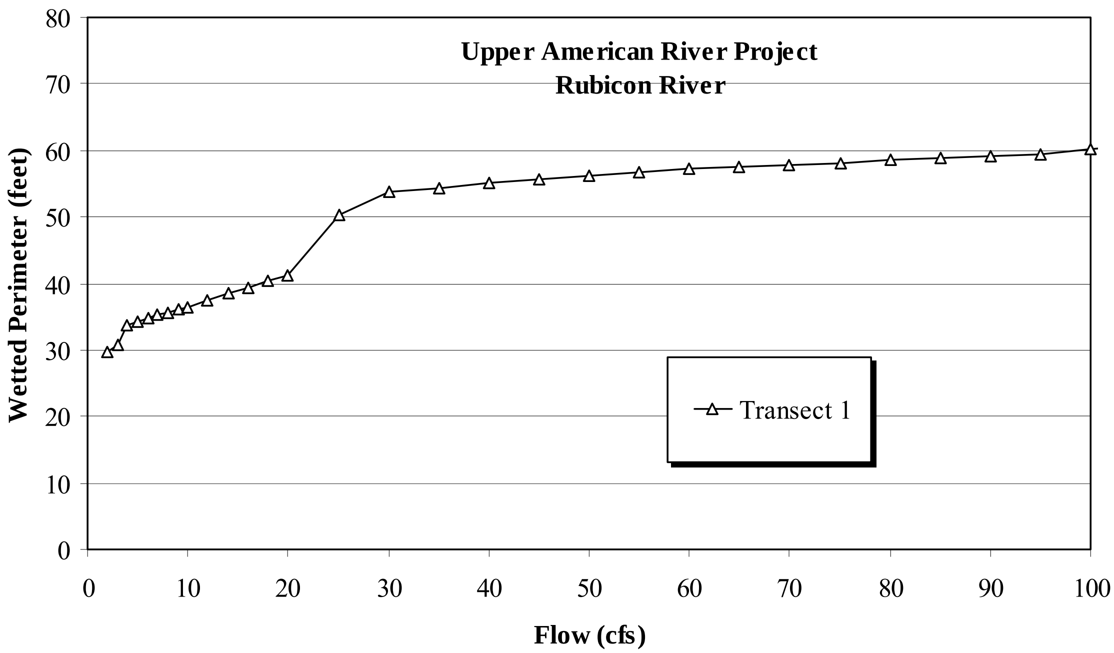
The primary objectives for the Rubicon River below Rubicon Reservoir Dam are to emphasize rainbow trout habitat and de-emphasize California roach and speckled dace habitat (Devine Tarbell & Associates and Stillwater Sciences 2005j) and to attempt to reduce elevated aluminum levels that may cause deleterious aquatic effects (Devine Tarbell & Associates 2005d). Refer to the fish community metrics discussion above, under Resource Objectives, for discussion of Rubicon River fisheries objectives. Rainbow trout were uncommon at site RRD-F2. During the 2002 fish sampling, no rainbow trout were found in the upper segment of the site and only one young-of-the-year fish was found in the lower segment at the site. During 2003, only two rainbow trout were captured at the upper segment (one young-of-the-year and one age 1+) and twelve were captured in the lower segment (13 young-of-the-year and two age 1+) (Devine Tarbell & Associates and Stillwater Sciences 2005j). Trout biomass estimates for the entire site ranged from 5.60 pounds per acre in 2002 to 4.80 pounds per acre in 2003 (Devine Tarbell & Associates and Stillwater Sciences 2005j). A substantial amount of spawning gravel was observed in this reach, the second highest of all UARP streams, with 11,059 square feet of spawning gravel total and 1,908 square feet spawning gravel per mile (Devine Tarbell & Associates and Stillwater 2005j). Lower bioassessment scores in the lower reach site are also indicative of the relatively poorer water/habitat quality as defined by the composite metric scores and comparisons with reference sites (Devine Tarbell & Associates and Stillwater Sciences 2005b).

To establish minimum streamflows for Rubicon River below Rubicon Reservoir Dam and to address the primary objectives described above, the Agencies/NGOs determined that some similarity to an unimpaired hydrograph was important, especially during the spring spawning period. Based on the ecosystem attributes for the Rubicon River, May was determined to be important for rainbow trout spawning. May is also the peak of the hydrograph according to the hydrology report (Devine Tarbell & Associates and Hannaford 2005a). To set the minimum streamflow for May in a BN water year, a PHABSIM analysis was completed by the resource agencies (CDFG 2006b). The analysis was started by developing a hydraulic model using the three cross sections surveyed for the geomorphic study of this reach. Based on this analysis, 100 percent of the WUA for rainbow trout spawning was equal to 60 cfs, and 84 percent of the WUA for rainbow trout spawning was equal to 35 cfs (CDFG 2006b).

Additionally, a wetted perimeter analysis was completed based on the three cross-sections surveyed for the geomorphic study of this reach. A wetted perimeter analysis should only be applied to riffle mesohabitat types (Annear et al. 2004). Transect 1, which was in a riffle, was selected for use in the wetted perimeter analysis. Based on this analysis, there is substantially more habitat above 30 cfs than below 30 cfs. According to Annear et al. (2004), wetted perimeter analysis is generally used to establish the low flow standard.

Based on the transect site photographs (Devine Tarbell & Associates and Stillwater Associates 2005c), the margin habitat is heavily vegetated by mature woody shrub species and does not appear to have suitable spawning habitat. The transect is located approximately 1.5 miles downstream of the Rubicon Reservoir Dam, and the change in flow from 35 cfs in May to 15 cfs in June would be attenuated gradually over this distance, thereby reducing the potential for stranding of fish that would be using the margin habitats of the channel.

Transect 1

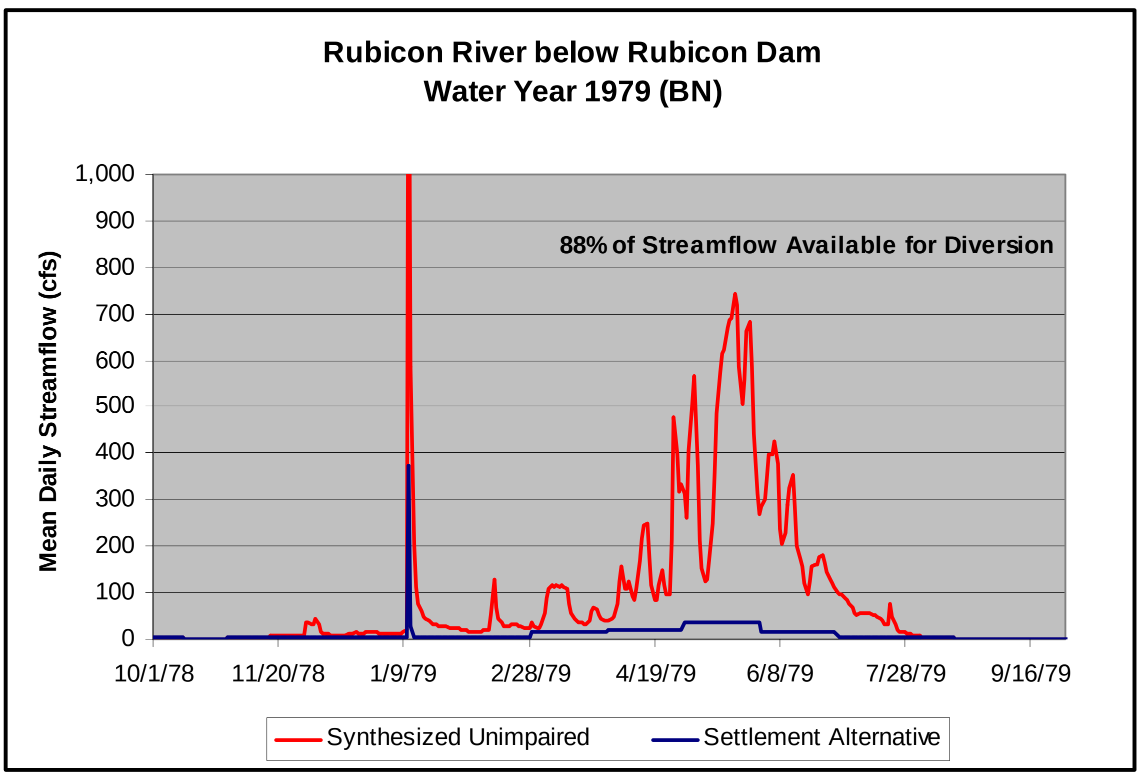



To meet the licensee's interest in maximizing diversions from Rubicon River for power generation and because the Rubicon watershed would not support a low flow standard of 35 cfs during summer months, the May flow in a BN water year (beginning of rainbow trout spawning) was set at 35 cfs, which is 84 percent of the maximum WUA for rainbow trout spawning and provides 40 to 55 feet of wetted perimeter.

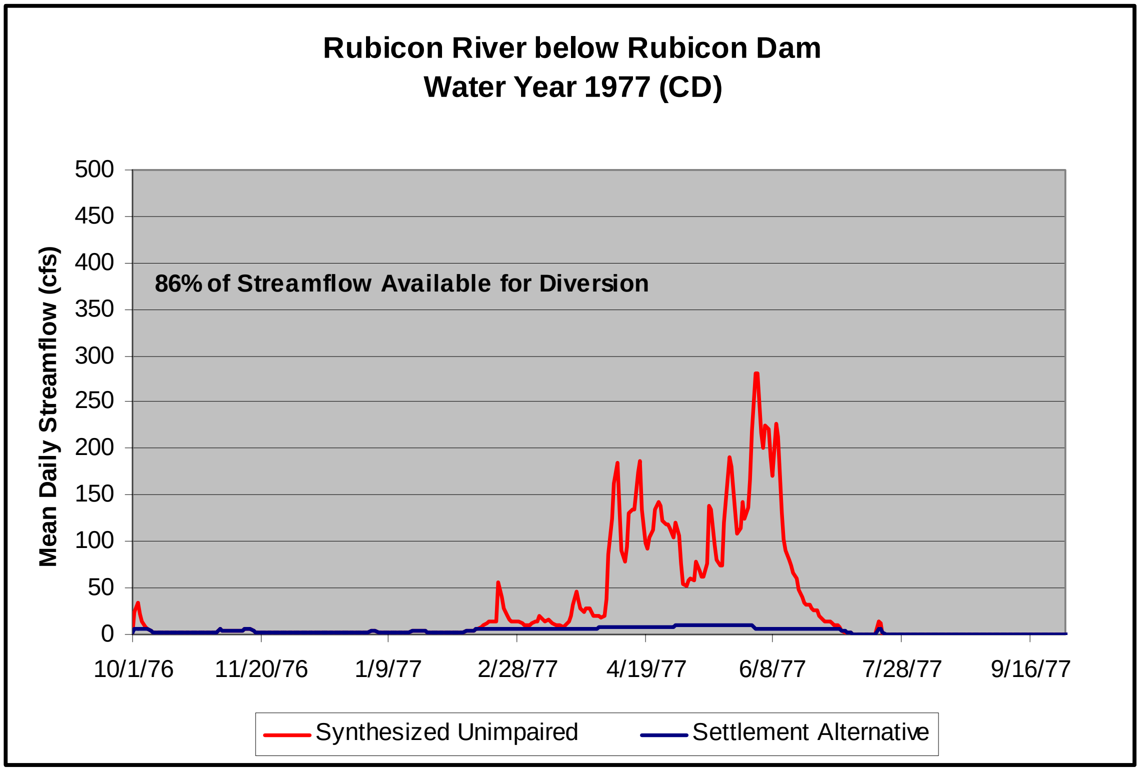
Once the May minimum streamflow was set at 35 cfs, some semblance of a hydrograph was developed before and after May (March through June) and then stepped down to the July through October minimum streamflows of 6 cfs or less. The wetted perimeter analysis was reviewed to determine whether the streamflows would decrease the potential that redds (spawning gravel sites) would be stranded during June as the hydrograph decreased from 35 cfs to 15 cfs. Outside of the spring period, the minimum streamflows are set at 6 cfs or natural flow (whichever is less) to follow the unimpaired hydrograph.

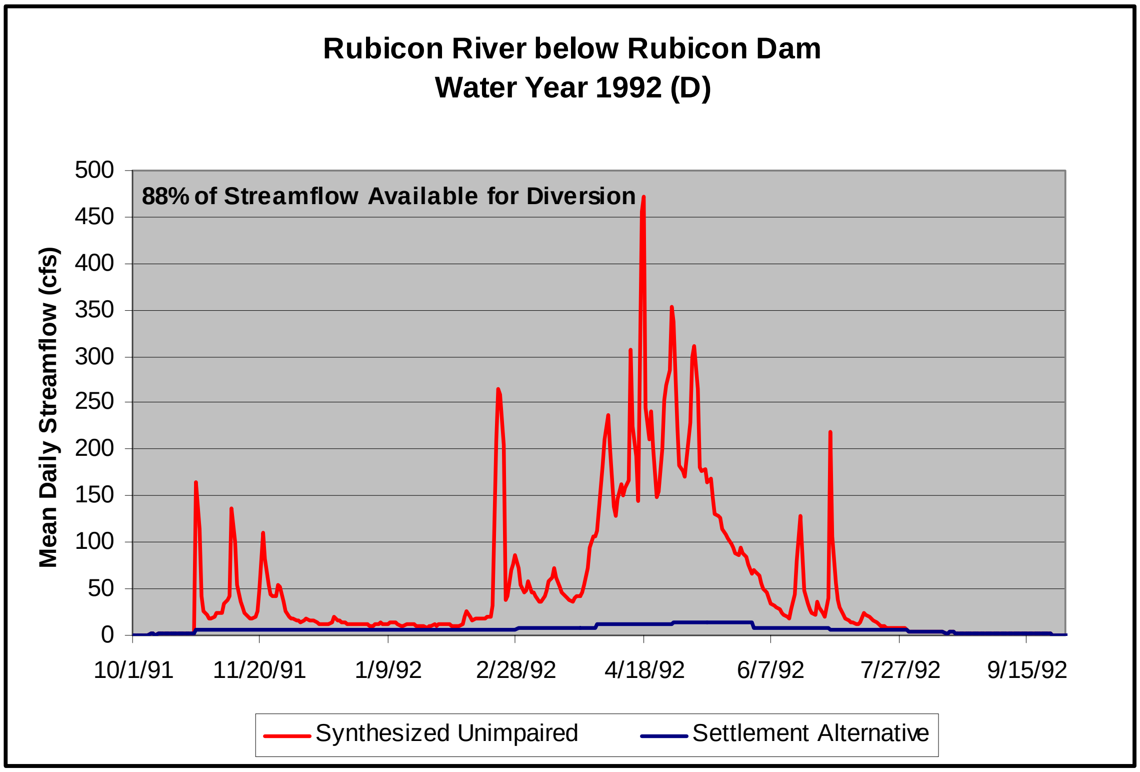
California roach and speckled dace are more common than trout in this reach. This occurrence is indicative of the warm, slow moving water, particularly in the lower half of the reach. Higher flows are expected to improve the trout fishery overall. California roach of the Sacramento region are typically found in small, warm intermittent mid-elevation foothill streams (CDFG 2005, Moyle 2002). In the Clear Lake region, for instance, they are tolerant of relatively high temperatures and low oxygen levels and prefer slow water with little canopy cover (CDFG 2005). It is suspected they were introduced to the Rubicon River as fishing bait.  The higher minimum streamflows are expected to provide more favorable habitat for rainbow trout spawning than the current flow regime (6 cfs year-round) and should de-emphasize habitat for California roach and speckled dace.

According to the licensee, the water coming from Rubicon River into the UARP is the most valuable water in the Project because it can run through every powerhouse in the Project except the Jones Fork Powerhouse. To address the licensee's interest in maintaining as much water as possible, minimum streamflows were not set at 100 percent of WUA, or 60 cfs (the resource agencies original proposal), in May of a BN water year. The following chart displays an example of the water available for diversion for hydroelectric operations in a representative BN water year type with implementation of the settlement.

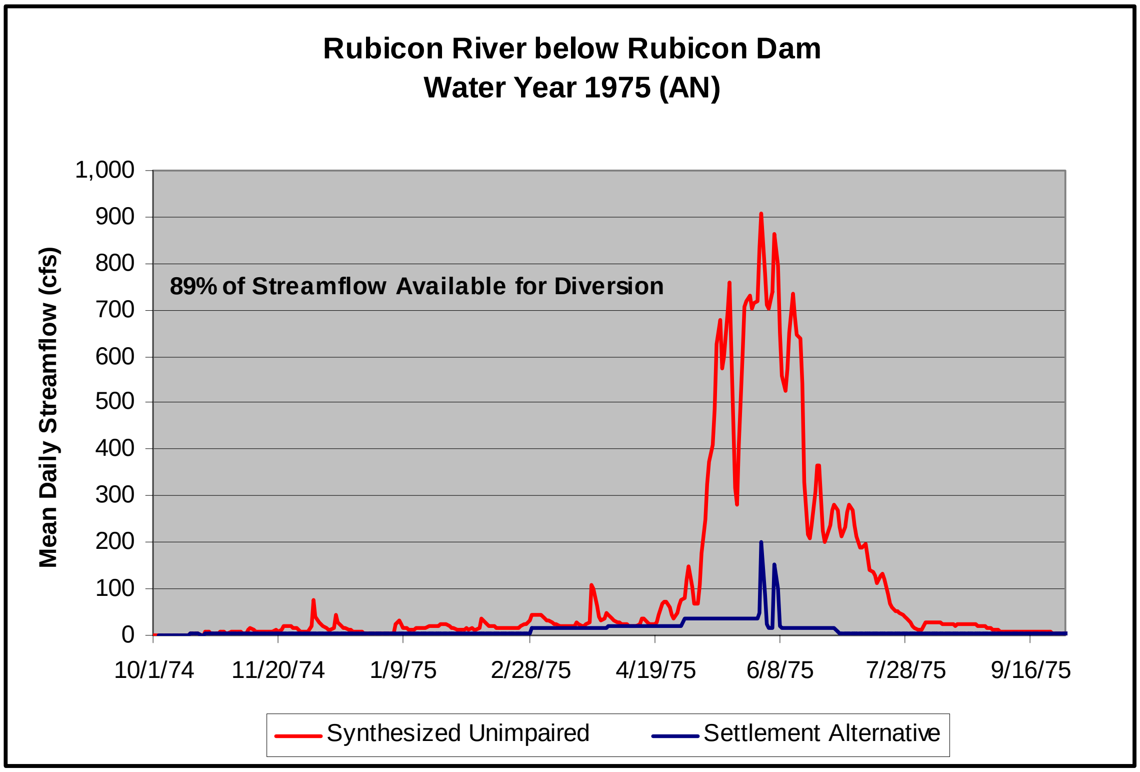


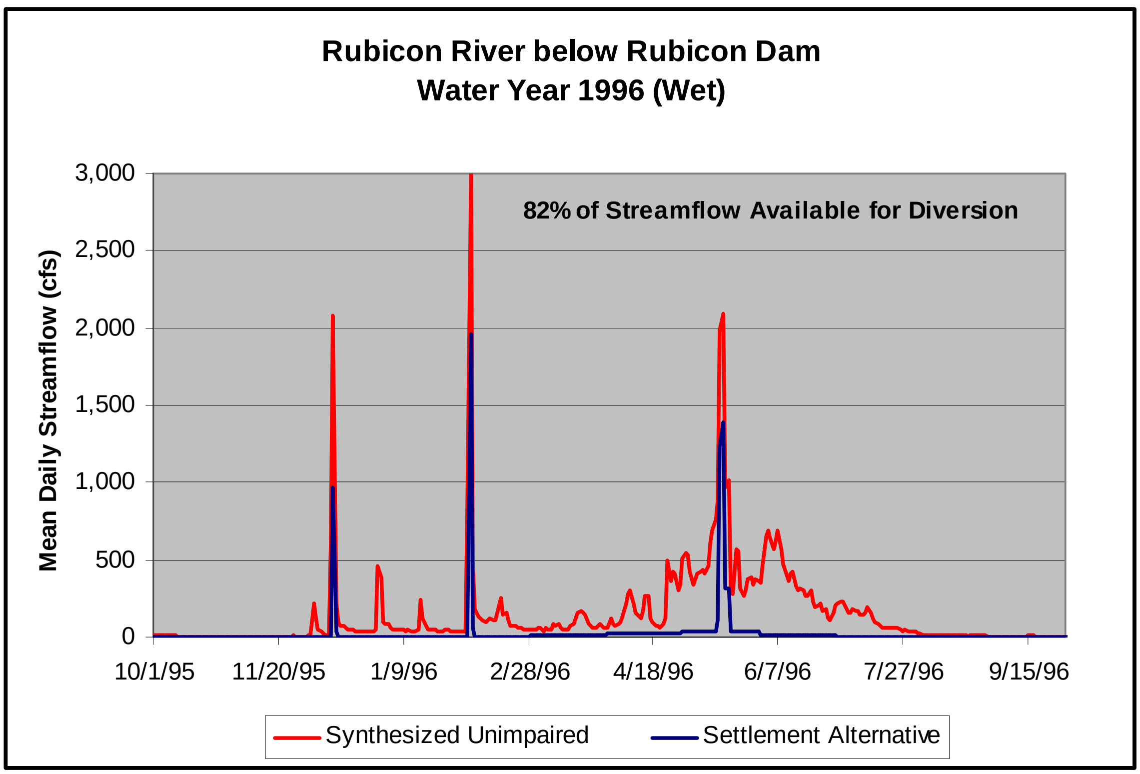

For CD water years, the minimum streamflow in May was set at 48 percent WUA, recognizing that in natural conditions the fish would have had less habitat in these very dry years. Similar to the BN water year, the focus of the CD water year was to form some similarity to a natural hydrograph around the month of May and then set the flow at 6 cfs or natural flow (whichever is less) to follow the unimpaired hydrograph.  Minimum streamflows in Dry water years were developed by interpolating between the CD and BN water year minimum streamflows. The May minimum streamflow in a Dry water year is set at 60 percent WUA, again recognizing that in natural conditions the fish would have had less habitat than in normal and wetter water years. If the minimum streamflows go below 1 cfs, the minimum streamflow shall be 1 cfs to meet the Dry Season objective described in the Resource Objectives, above. The following charts display examples of the water available for diversion for hydroelectric operations in representative CD and Dry water year types, respectively, with implementation of the settlement.



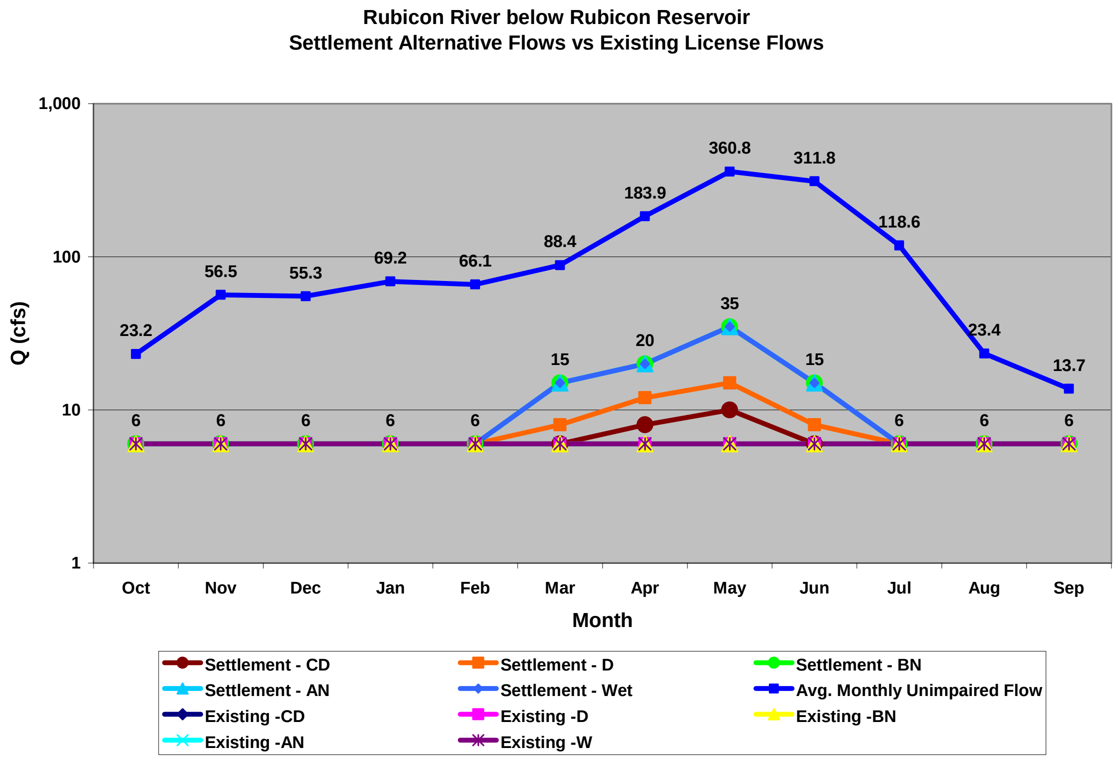



In an effort to further address the licensee's interests, the minimum streamflows were not increased in representative AN and Wet water years but were kept the same as the minimum streamflows in BN water years. The following charts display examples of the water available for diversion for hydroelectric operations in AN and Wet water year types, respectively, with implementation of the settlement.


Rubicon River below Rubicon Dam
Water Year 1975 (AN)
89% of Streamflow Available for Diversion
Mean Daily Streamflow (cfs)
1,000
900
800
700
600
500
400
300
200
100
0
10/1/74
11/20/74
1/9/75
2/28/75
4/19/75
6/8/75
7/28/75
9/16/75
Synthesized Unimpaired
Settlement Alternative


Rubicon River below Rubicon Dam
Water Year 1996 (Wet)
82% of Streamflow Available for Diversion
Mean Daily Streamflow (cfs)
3,000
2,500
2,000
1,500
1,000
500
0
10/1/95
11/20/95
1/9/96
2/28/96
4/18/96
6/7/96
7/27/96
9/15/96
Synthesized Unimpaired
Settlement Alternative

The following chart displays a comparison of the settlement and existing license flows for each water year type for the Rubicon River below Rubicon Reservoir Dam.




The following table depicts the recommended minimum streamflows.

| Rubicon River Below Rubicon Reservoir Dam | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| Month | Minimum Streamflow by Water Year (cfs) | | | | | |
| | | CD | DRY | BN | AN | WET |
| OCT | | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* |
| NOV | | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* |
| DEC | | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* |
| JAN | | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* |
| FEB | | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* |
| MAR | | 6 or NF* | 8 | 15 | 15 | 15 |
| APR | | 8 | 12 | 20 | 20 | 20 |
| MAY | | 10 | 15 | 35 | 35 | 35 |
| JUNE | | 6 or NF* | 8 | 15 | 15 | 15 |
| JULY | | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* |
| AUG | | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* |
| SEPT | | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* | 6 or NF* |

*If Natural Flow (NF) measured in the Rubicon River above Rubicon Reservoir is below 1 cfs, the minimum streamflow shall be 1 cfs. In CD water year types, if the useable storage in Rubicon Reservoir is less than 60 acre-feet and the licensee cannot maintain 1 cfs due to lack of NF into and storage in Rubicon Reservoir, the licensee shall notify FS, CDFG, FWS, and SWRCB at least 30 days prior to not meeting the streamflow. After notification of FS, CDFG, FWS, and SWRCB, the licensee may reduce minimum flows below 1 cfs, but at no time shall the minimum streamflow be less than the NF into Rubicon Reservoir, until sufficient water is available to resume prescribed minimum streamflow releases.

The overwintering pool was established using the bathymetric information (SMUD 1976) and the area capacity curve (SMUD 2004).

The original Rubicon River minimum streamflows proposed by the resource agencies (see following table) also made an effort to address the licensee's interests by not increasing minimum streamflows in AN and Wet water years; however, this alternative did not adequately meet the licensee's interest in diverting as much water as possible (due to its value) that comes into the UARP from Rubicon River. Therefore, the original minimum streamflows were substantially reduced to meet the licensee's interests.

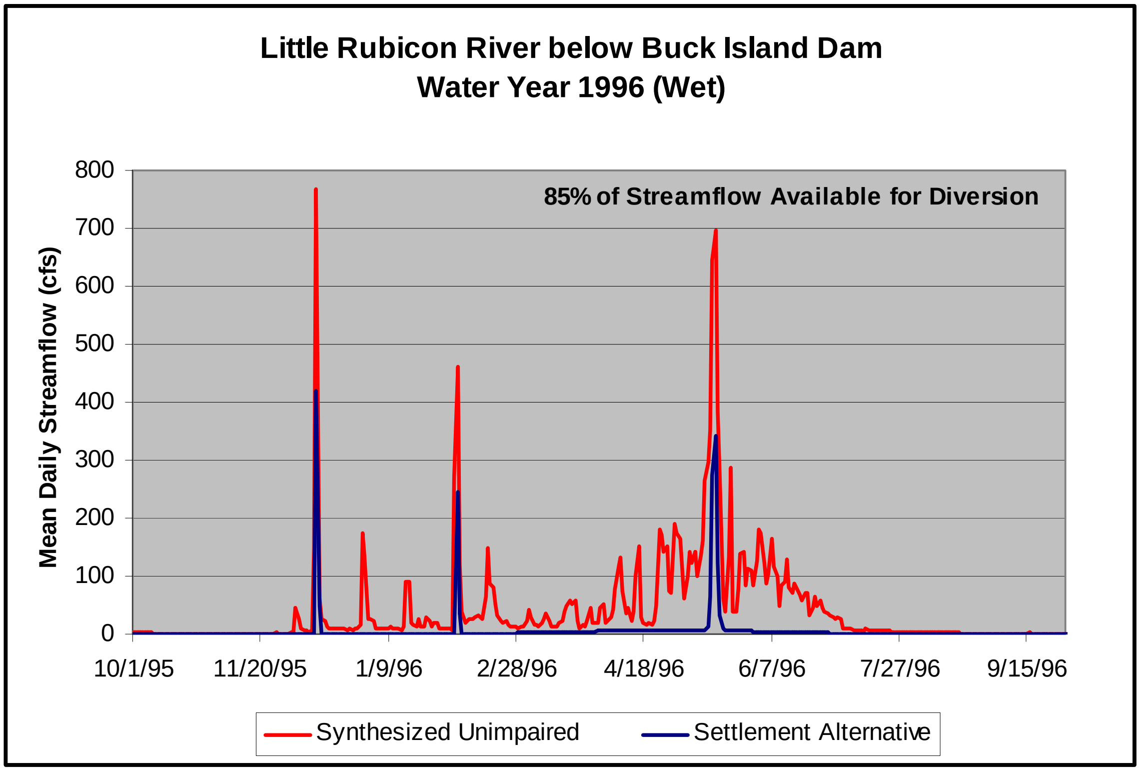
| **Rubicon River Below Rubicon Reservoir Dam** | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | **Month** | | **Minimum Streamflow by Water Year (cfs)** | | | | |
| | | | CD | DRY | BN | AN | WET |
| | **OCT** | | 2 or NF* | 4 or NF* | 6 or NF* | 6 | 6 |
| | **NOV** | | 2 or NF* | 4 or NF* | 6 or NF* | 6 | 6 |
| | **DEC** | | 2 or NF* | 4 or NF* | 6 or NF* | 6 | 6 |
| | **JAN** | | 6 | 8 | 12 | 12 | 12 |
| | **FEB** | | 6 | 8 | 12 | 12 | 12 |
| | **MAR** | | 12 | 16 | 24 | 24 | 24 |
| | **APR** | | 12 | 16 | 24 | 24 | 24 |
| | **MAY** | | 25 | 40 | 60 | 60 | 60 |
| | **JUNE** | | 12 | 16 | 24 | 24 | 24 |
| | **JULY** | | 6 or NF* | 6 or NF* | 6 | 6 | 6 |
| | **AUG** | | 6 or NF* | 6 or NF* | 6 | 6 | 6 |
| | **SEPT** | | 6 or NF* | 6 or NF* | 6 | 6 | 6 |

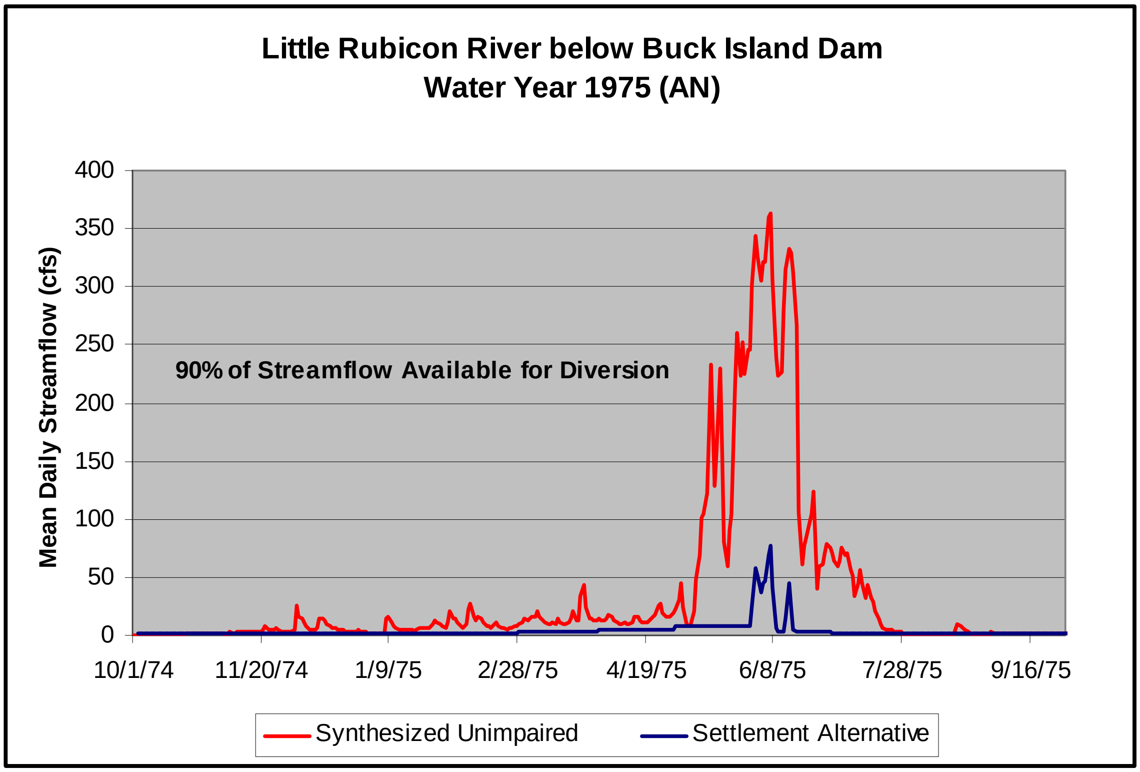
### *Little Rubicon River Below Buck Island Reservoir Dam*

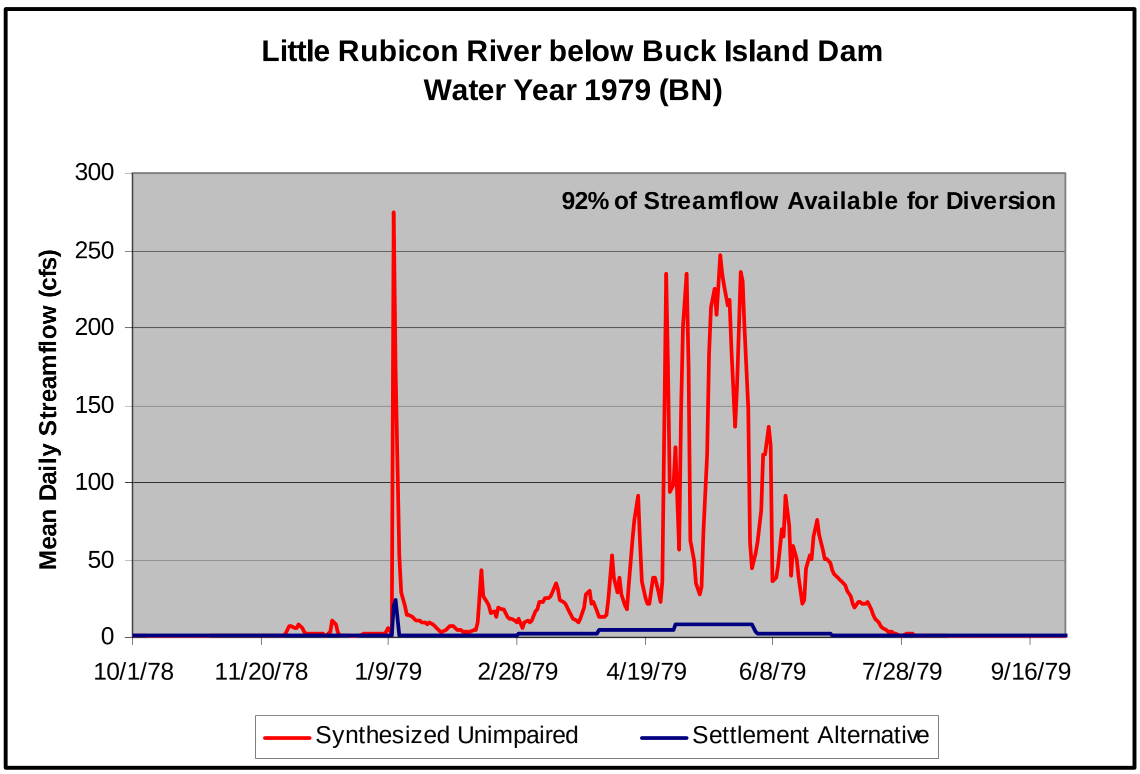
The fish community in the Little Rubicon River below Buck Island Reservoir Dam is severely perturbated based on (1) rainbow trout numbers are severely depressed for most of the population metrics outlined from Moyle's Fish Community Assessment (Moyle et al. 1998) and (2) golden shiners (an exotic species) dominates the reach. . Refer to the fish community metrics discussion above, under Resource Objectives, for discussion of fisheries objectives. This species was most likely brought in as fish bait and thrived in the warm water, low flow conditions of the Little Rubicon River. They can reduce zooplankton populations, thus reducing growth and survival of trout (Moyle 2002). Normally, introduced golden shiner populations seem to be largely eliminated by predatory fishes (Moyle 2002), but in the Little Rubicon River, there appear to be few predators. The proposed flow regime would restore some semblance of normalcy to the hydrograph, and there are indications that it will benefit those species with life history cues closely aligned with the spring snowmelt, such as rainbow trout (Moyle and Light 1996, Moyle and Marchetti 1998). Any improvement in trout habitat would improve trout populations and would be expected to reduce the golden shiners.

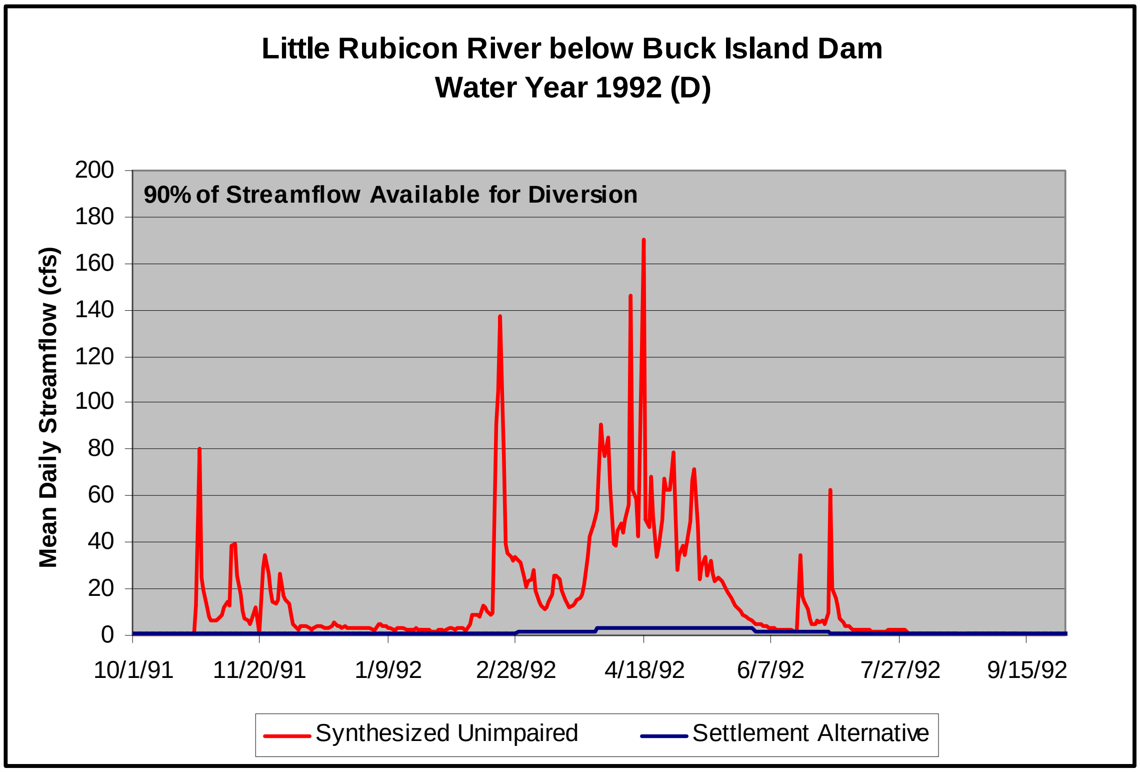
Because minimal information was available for this reach, the minimum streamflows were developed by taking the Rubicon River minimum streamflows and adjusting them by watershed area. There are approximately 26.5 square miles in the Rubicon River watershed and 6 square miles in the Little Rubicon River watershed, so the minimum streamflows from Rubicon River were divided by 4.4 to determine the Little Rubicon River minimum streamflows. However, if the minimum streamflows go below 1 cfs, the minimum streamflow was set to 1 cfs to meet the Dry Season objective.

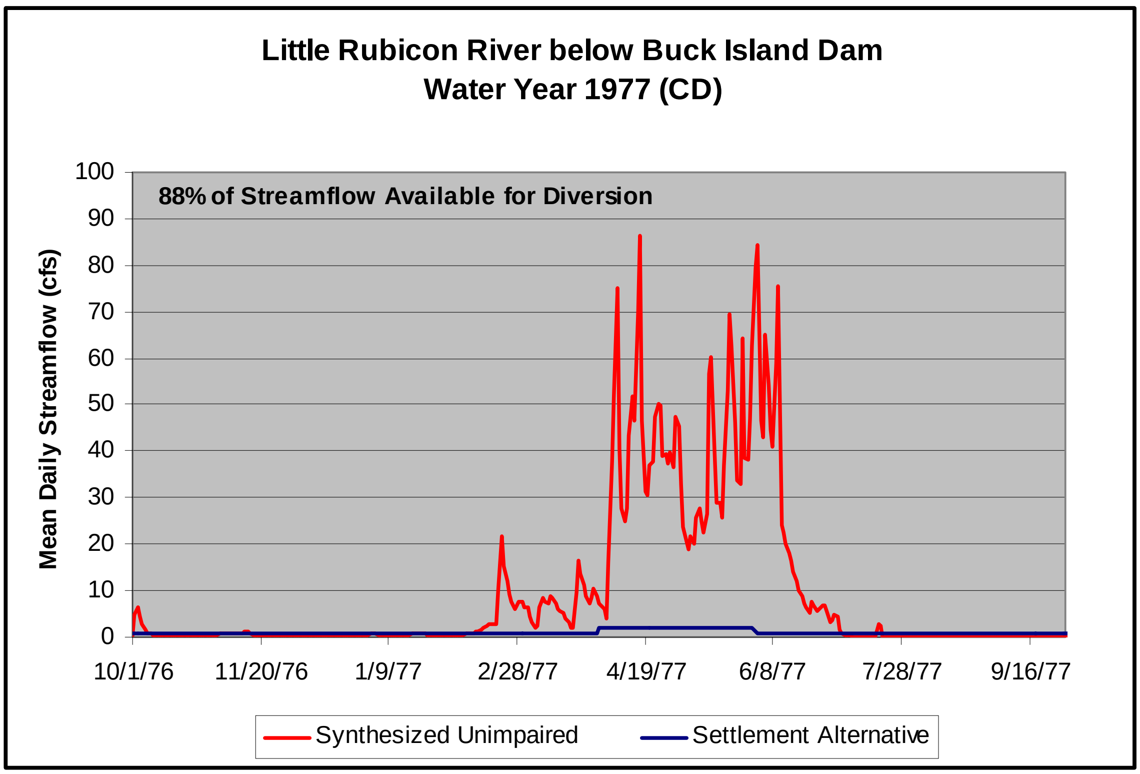
The following charts display examples of the water available for diversion for hydroelectric operations in representative years of the five water year types with implementation of the settlement.




Little Rubicon River below Buck Island Dam
Water Year 1975 (AN)
Mean Daily Streamflow (cfs)
400
350
300
250
200
150
100
50
0
10/1/74
11/20/74
1/9/75
2/28/75
4/19/75
6/8/75
7/28/75
9/16/75
90% of Streamflow Available for Diversion
Synthesized Unimpaired
Settlement Alternative


Little Rubicon River below Buck Island Dam
Water Year 1979 (BN)
Mean Daily Streamflow (cfs)
300
250
200
150
100
50
0
10/1/78
11/20/78
1/9/79
2/28/79
4/19/79
6/8/79
7/28/79
9/16/79
92% of Streamflow Available for Diversion
Synthesized Unimpaired
Settlement Alternative


Little Rubicon River below Buck Island Dam
Water Year 1992 (D)
90% of Streamflow Available for Diversion
Mean Daily Streamflow (cfs)
200
180
160
140
120
100
80
60
40
20
0
10/1/91
11/20/91
1/9/92
2/28/92
4/18/92
6/7/92
7/27/92
9/15/92
Synthesized Unimpaired
Settlement Alternative


Little Rubicon River below Buck Island Dam
Water Year 1977 (CD)
88% of Streamflow Available for Diversion
Mean Daily Streamflow (cfs)
100
90
80
70
60
50
40
30
20
10
0
10/1/76
11/20/76
1/9/77
2/28/77
4/19/77
6/8/77
7/28/77
9/16/77
Synthesized Unimpaired
Settlement Alternative

The following table depicts the recommended minimum streamflows.

| Little Rubicon River Below Buck Island Reservoir Dam | | | | | | |
|---|---|---|---|---|---|---|
| Month | | Minimum Streamflow by Water Year (cfs) | | | | |
| | | CD | DRY | BN | AN | WET |
| OCT | | 1* | 1* | 1* | 1* | 1* |
| NOV | | 1* | 1* | 1* | 1* | 1* |
| DEC | | 1* | 1* | 1* | 1* | 1* |
| JAN | | 1* | 1* | 1* | 1* | 1* |
| FEB | | 1* | 1* | 1* | 1* | 1* |
| MAR | | 1* | 2 | 3 | 3 | 3 |
| APR | | 2 | 3 | 5 | 5 | 5 |
| MAY | | 2 | 3 | 8 | 8 | 8 |
| JUNE | | 1* | 2 | 3 | 3 | 3 |
| JULY | | 1* | 1* | 1* | 1* | 1* |
| AUG | | 1* | 1* | 1* | 1* | 1* |
| SEPT | | 1* | 1* | 1* | 1* | 1* |

*If Natural Flow (NF) measured in Highland/Rockbound Creek above Buck Island Reservoir is below 1 cfs, the minimum flow shall be 1 cfs. In CD water year types, if the useable storage in Buck Island Reservoir is less than 60 acre-feet and the licensee cannot maintain 1 cfs due to lack of NF into and storage in Buck Island Reservoir, the licensee shall notify FS, CDFG, FWS, and SWRCB at least 30 days prior to not meeting the streamflow. After notification of FS, CDFG, FWS, and SWRCB, the licensee may reduce minimum flows below 1 cfs, but at no time shall the minimum streamflow be less than the NF into the Buck Island Reservoir, until sufficient water is available to resume prescribed minimum streamflow releases.

***Gerle Creek Below Loon Lake Reservoir Dam***

The primary objectives in Gerle Creek below Loon Lake Reservoir Dam are to emphasize native (rainbow trout) and desired non-native (brown trout) fisheries, re-introduce some similarity to the natural hydrograph to restore ecosystem processes that have been altered by Project operations, and inundate banks to a greater degree than present to improve riparian condition and move fines.

The Loon Lake Reach of Gerle Creek was identified in the Angler Focus Group as having the greatest potential of any reach in the UARP, and the stream fisheries study showed the highest population of trout in one of the segments in the lower transect (Devine Tarbell & Associates and Stillwater Sciences 2005j). As a result, recreational angling in this reach was given substantial emphasis. Refer to the fish community metrics discussion above, under Resource Objectives, for discussion of fisheries objectives. In this reach, as opposed to other reaches, the resource objectives recognize the importance of the recreational brown trout fishery. Rainbow trout is used as a management indicator species for native species life history cues (benthic macroinvertebrates, amphibians, and riparian vegetation); however, the streamflow regime includes higher fall flows than would have occurred in a natural hydrograph pattern to provide spawning habitat for the brown trout in this reach.

The existing combined biomass for rainbow trout and brown trout for the upper and lower sample sites in this reach (LLD-F1 and LLD-F2) are 19.5 and 40 pounds per surface acre, respectively. The upper site (LLD-F1) is below a combined biomass objective of 24 pounds per surface acre, but the lower site (LLD-F2) is above the desired objective. The proposed flow regime is designed to increase instream habitat to improve the biomass at LLD-F1 and move it closer to the biomass objective. A large amount of spawning gravel, the highest of all UARP streams, was observed in this Project reach, with 36,474 square feet of spawning gravel, and 3,932 square feet spawning gravel per mile (Devine Tarbell & Associates and Stillwater Sciences 2005j). The majority of the spawning gravel was located between river miles 4.0 through 7.0 (Devein Tarbell & Associates and Stillwater Science 2005j). It is important to provide flows to wet these areas for both brown trout and rainbow trout spawning.

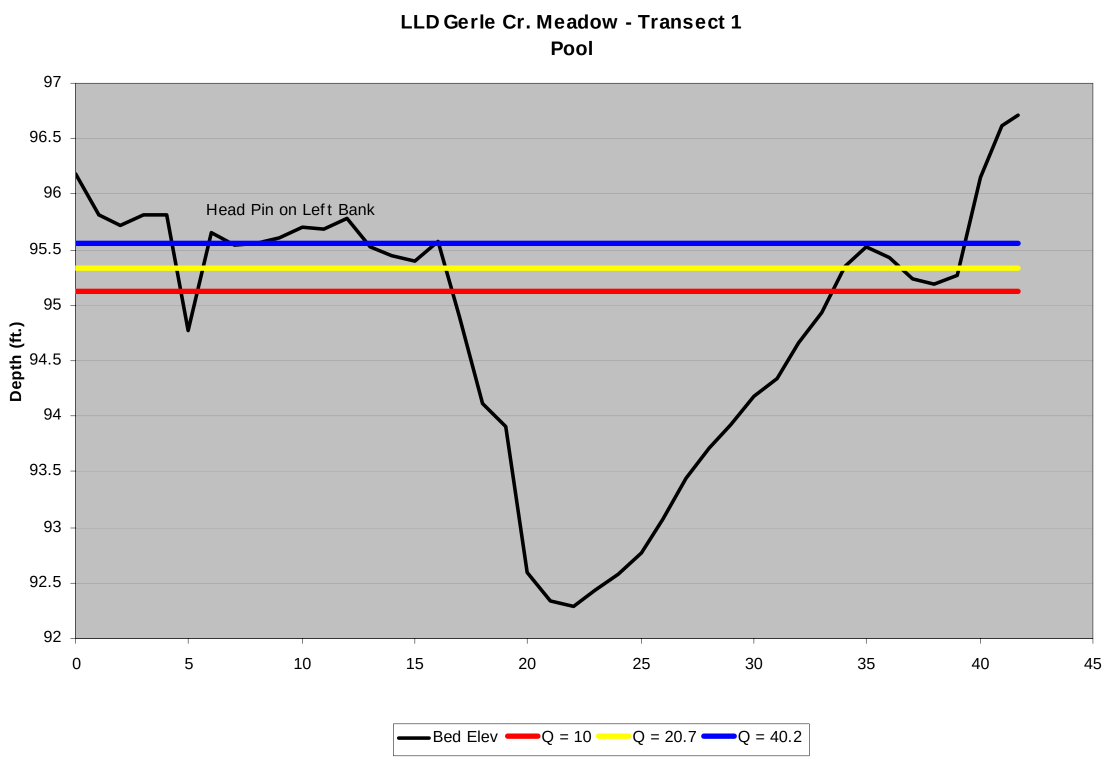
Beginning with the BN water year, the PHABSIM results were reviewed to establish an appropriate flow for brown trout spawning (Devine Tarbell & Associates and Stillwater Sciences 2004d). A flow of 16 cfs represents 98 percent of the WUA based on a composite analysis of the three study sites within the reach (CDFG 2006a). Based on this analysis, the flow was set at 16 cfs for October and November during brown trout spawning. Although the fall streamflows are augmented when compared to unimpaired streamflows (Devine Tarbell & Associates and Hannaford 2005a), they provide optimal spawning habitat for brown trout, which was targeted as a management species in this reach for its recreational value. The composite analysis showed that 100 percent of WUA is achieved at 19-20 cfs (CDFG 2006a); however, this flow results in even more augmentation when compared with the natural hydrograph (Devine Tarbell & Associates and Hannaford 2005a), so it was not chosen for the October and November flow.

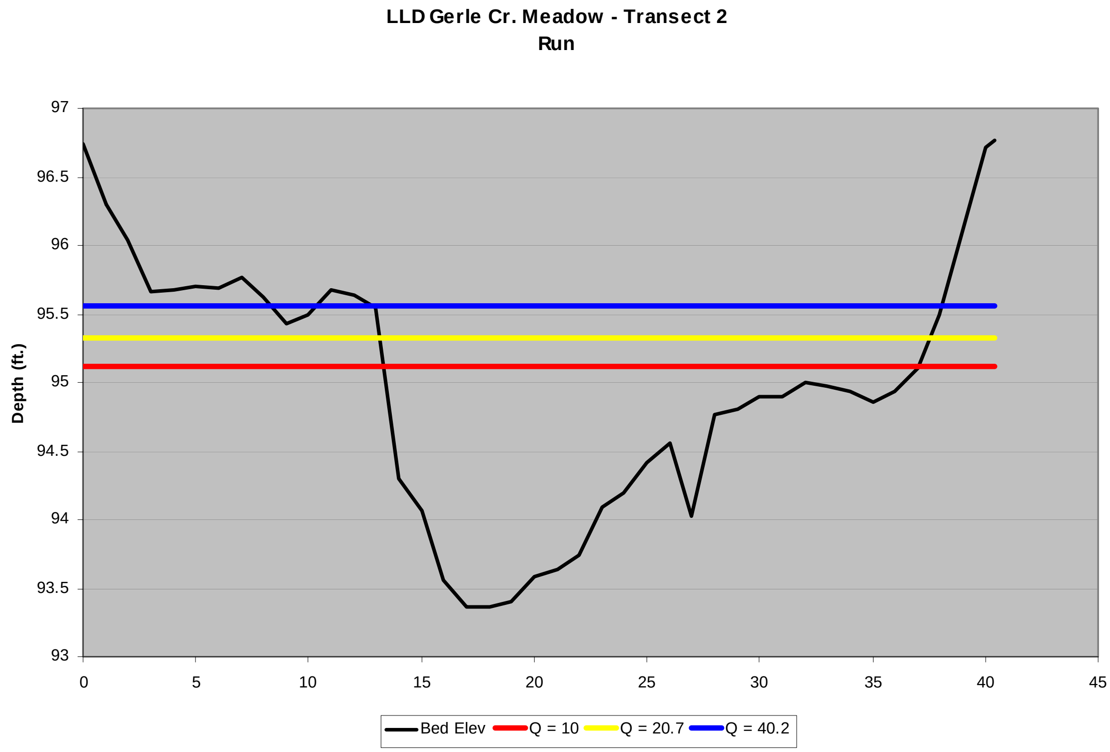
Once the October and November flows were established, the PHABSIM results were reviewed for the month of May to determine the appropriate flow for rainbow trout spawning (Devine Tarbell & Associates and Stillwater Sciences 2004d), since this reach is being managed for both species of trout. A flow of 40 cfs represents 94 percent of the WUA based on a composite analysis of the three study within the reach (CDFG 2006a). Based on this analysis, a review of the shape of the natural hydrograph (Devine Tarbell & Associates and Hannaford 2005a), and a review of the flow necessary to inundate some of the benches in the reach to address riparian objectives (see figures below), the flow was set at 40 cfs for May during rainbow trout spawning.

The inundation of stream margin habitats and primary flood terraces is an attempt at replicating the inundation that would have occurred under the unimpaired flow regime. Many riparian species have life cycle emergence phenologies that require higher flows at the appropriate time of year to assist in maintaining high species diversity (Poff et al. 1997). The seasonal variation in minimum streamflows and the introduction of pulse flow events is expected to re-introduce mortality agents that have been shown to benefit diverse riparian communities (USDI 1999).

Riparian vegetation plays a critical role in maintaining riparian ecosystem function by promoting stream bank stability and water quality, reducing the potential for erosion, increasing the storage of nutrients and water, and providing forage and habitat for wildlife. In riparian ecosystems in the western United States, water supply is a function of both instream flows and ground-water available from springs and seeps. Stream diversion, development of springs and seeps, and ground-water pumping can result in both direct and indirect effects on riparian water tables. Water-table declines can cause shifts in plant composition from mesic to xeric species and decreases in the overall extent of riparian ecosystems. The loss of riparian vegetation can affect stream channel stability by increasing bank erosion and resulting in channel degradation or aggradation (Rosgen 1996).

It is expected that riparian vegetation will be enhanced by returning a semblance of natural hydrograph to the channel. Obligative and facultative wetland species are expected to be favored over upland facultative species. Low banks in the riparian reaches are expected to overflow and saturate areas during the critical spring growing period, which should favor the expansion of riparian species into a wider channel area. Benefits to mesic and hydric riparian species are expected to occur over a wider channel area due to the deposition of fine soil particles that will provide nutrients/substrates for plans that require a fine-textured, moisture retentive soil (Castelli et al. 2000). The saturation for longer periods of time may in fact cause the colonizing lodgepole pines (*Pinus contorta*) to reduce their encroachment to the primary flood terraces adjacent to the active stream channel due to primary root mortality as a result of depleted soil oxygen levels (Coutts 1982).





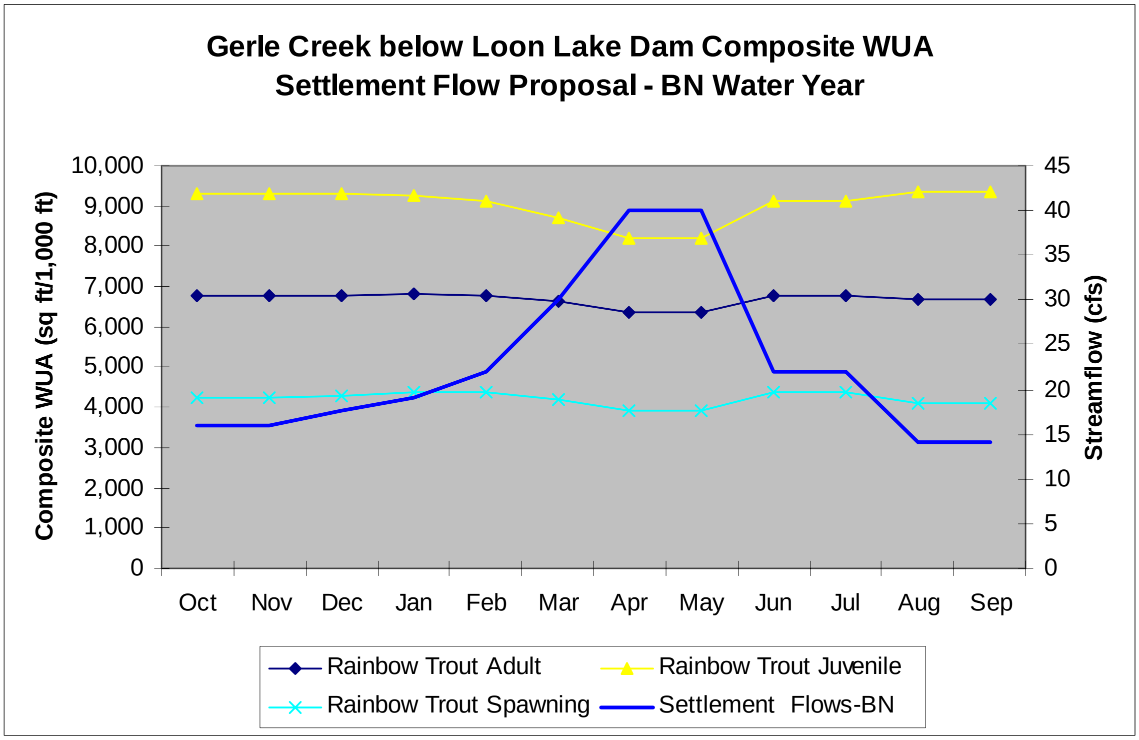

Once the May flow was established, the PHABSIM results were reviewed (Devine Tarbell & Associates and Hannaford 2005a) to determine an appropriate flow for rainbow trout juveniles. Based on the composite analysis (CDFG 2006a), a flow of 22 cfs provides 98 percent of the WUA for rainbow trout juveniles during June and July. This flow also provides a stepping down of the hydrograph to provide some similarity to the shape of a natural hydrograph.

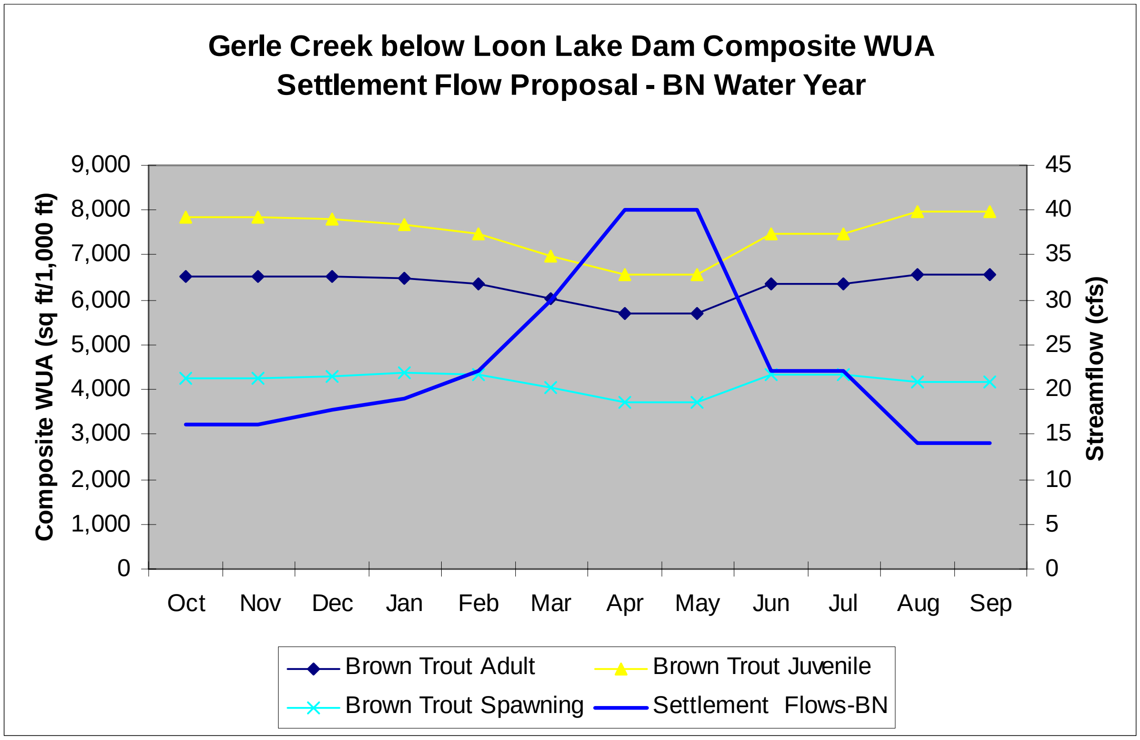
For August and September, the PHABSIM results were reviewed (Devine Tarbell & Associates and Hannaford 2005a) to determine an appropriate flow for rainbow trout and brown trout adults. Based on the composite analysis (CDFG 2006a), a flow of 14 cfs provides 100 percent of the WUA for brown trout adults and 98 percent for rainbow trout adults. This flow also provides a continued stepping down of the hydrograph to provide some similarity to the shape of a natural hydrograph.

For December through March, the natural hydrograph was (Devine Tarbell & Associates and Hannaford 2005a) reviewed as well as the composite analysis (CDFG 2006a). The goal was to gradually increase the hydrograph to the spring peak of 40 cfs while addressing brown trout juveniles. For December, a flow of 18 cfs provides 94 percent WUA for brown trout juveniles. For January, a flow of 19 cfs provides 93 percent of WUA for brown trout juveniles. For February, 22 cfs provides 90 percent of WUA for brown trout juveniles. For March, 30 cfs provides 85 percent WUA for brown trout juveniles. This spring flow regime is expected to restore some of the ecosystem processes that have been altered as a result of the Project.

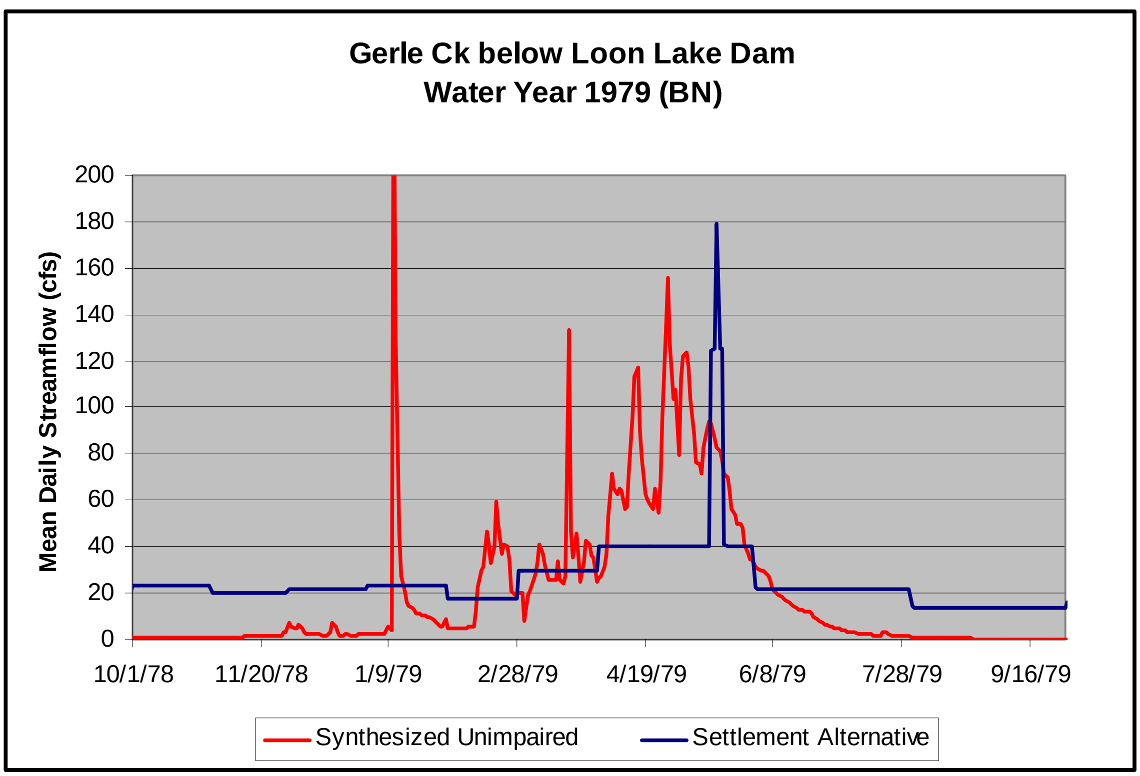
The most dramatic improvement in stream angling opportunities in the Project is expected to be in Gerle Meadows and in the meadows upstream. Access is difficult through swampy areas alongside the stream, where fish have little cover and lack undercut banks and deep pools. Re-establishment of the channel as a result of pulse flows and higher spring minimum streamflows, in combination with mechanical restoration efforts is expected to create a promising resource for anglers.

The following charts depict the WUA from the Settlement for rainbow trout and brown trout in a BN water year type, based on the composite analysis (CDFG 2006a).






The following chart displays an example of the water available for hydroelectric operations in a representative BN water year type with implementation of the settlement. Note that the unimpaired flows do not include the water that is diverted from the Rubicon River.



For CD water years, the PHABSIM results were reviewed to establish a flow that would address brown trout spawning (Devine Tarbell & Associates and Stillwater Sciences 2004d). A flow of 7 cfs represents 72 percent of the WUA for brown trout spawning based on a composite analysis of the three study sites within the reach (CDFG 2006a). Based on this analysis, the flow was set at 7 cfs for October and November during brown trout spawning. Although the fall streamflows are augmented when compared to unimpaired streamflows (Devine Tarbell & Associates and Hannaford 2005a), they provide moderate spawning habitat for brown trout, which was targeted as a management species in this reach for its recreational value.

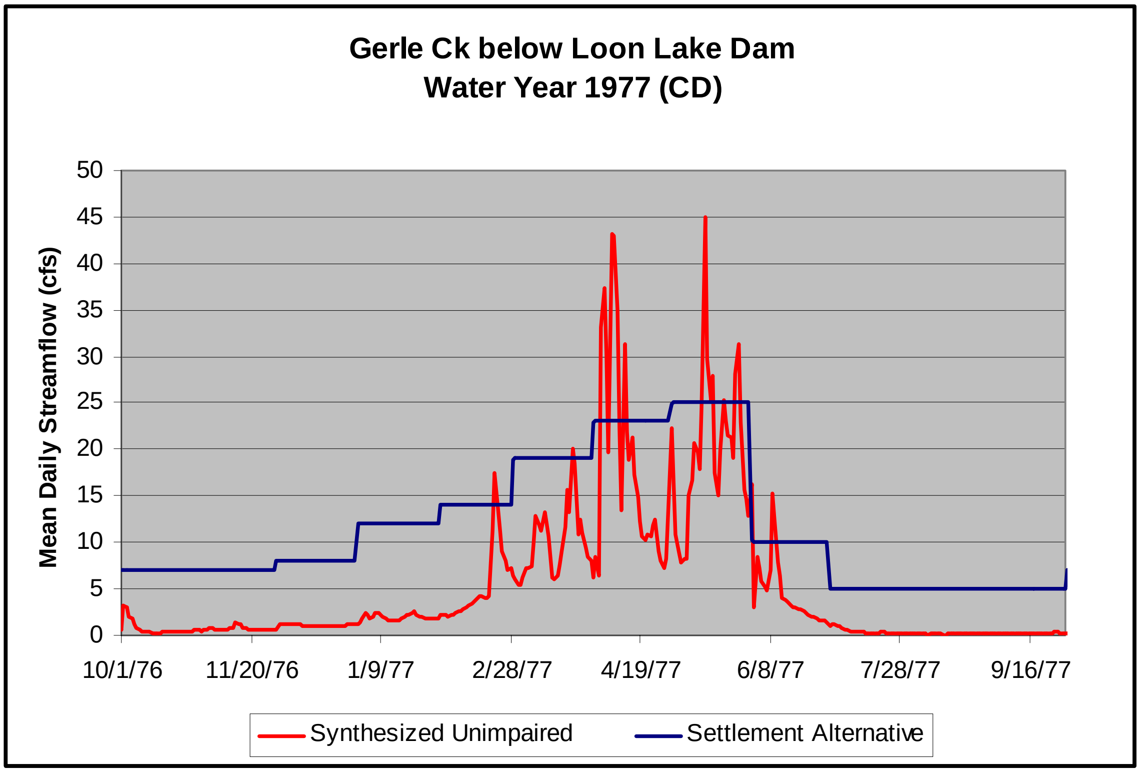
Once the October and November flows were established for CD water years, the PHABSIM results were reviewed for the month of May to determine the appropriate flow for rainbow trout spawning (Devine Tarbell & Associates and Stillwater Sciences 2004d), since this reach is being managed for both species of trout. A flow of 25 cfs represents 100 percent of the WUA based on a composite analysis of the three study sites within the reach (CDFG 2006a). Based on this analysis and a review of the shape of the natural hydrograph (Devine Tarbell & Associates and Hannaford 2005a), the flow was set at 25 cfs for May during rainbow trout spawning.

Once the May flow was established, the PHABSIM results were reviewed to determine an appropriate flow for rainbow trout juveniles (Devine Tarbell & Associates and Stillwater Sciences 2004d). Based on the composite analysis (CDFG 2006a), flows of 10 cfs in June and 5 cfs in July provide 100 percent and 94 percent of the WUA, respectively, for rainbow trout juveniles during these months. This flow also provides a stepping down of the hydrograph to provide some similarity to the shape of a natural hydrograph.

For August and September, the PHABSIM results were reviewed to determine an appropriate flow for rainbow trout and brown trout adults (Devine Tarbell & Associates and Stillwater Sciences 2004d). Based on the composite analysis (CDFG 2006a), a flow of 5 cfs provides 80 percent of the WUA for brown trout adults and 67 percent for rainbow trout adults. This flow also provides a continued stepping down of the hydrograph to provide some similarity to the shape of a natural hydrograph.

For December through March, the natural hydrograph (Devine Tarbell & Associates and Hannaford 2005a) was reviewed, as well as the composite analysis (CDFG 2006a). The goal was to gradually increase the hydrograph to the spring peak of 25 cfs while addressing brown trout juveniles. For December, a flow of 8 cfs provides 100 percent WUA for brown trout juveniles. For January, a flow of 12 cfs provides 93 percent of WUA for brown trout juveniles. For February, 14 cfs provides 97 percent of WUA for brown trout juveniles. For March, 19 cfs provides 93 percent WUA for brown trout juveniles. This spring flow regime is expected to restore some of the ecosystem processes that have been altered as a result of the Project.

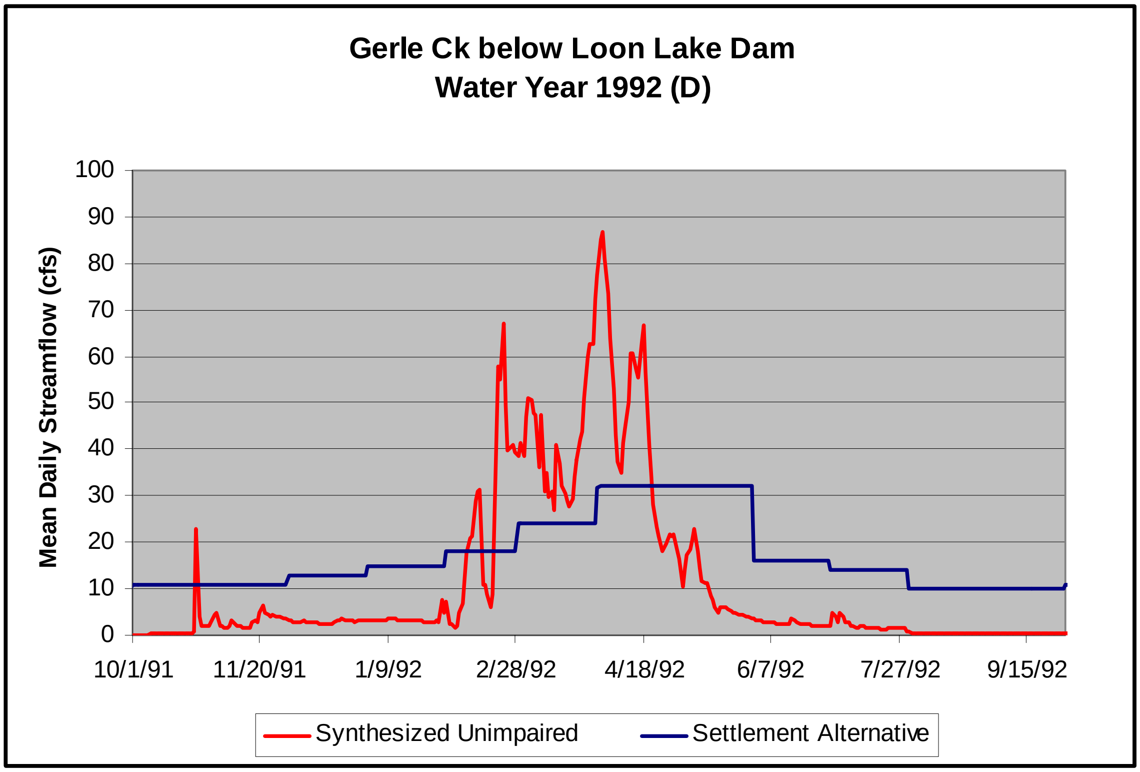
The following chart displays an example of the water available for hydroelectric operations in a representative CD water year type with implementation of the settlement.




Minimum streamflows in Dry water years were developed by interpolating between the CD and BN water year minimum streamflows. Dry water year minimum streamflows were cross-checked with PHABSIM results for rainbow and brown trout to ensure that adequate WUA was provided at the appropriate times of year. The chart below displays composite percent WUA for Dry, AN, and Wet water year types for rainbow trout and brown trout (CDFG 2006a) for Gerle Creek below Loon Lake Reservoir Dam. The percent WUA for Dry years ranges between 89-97 percent.

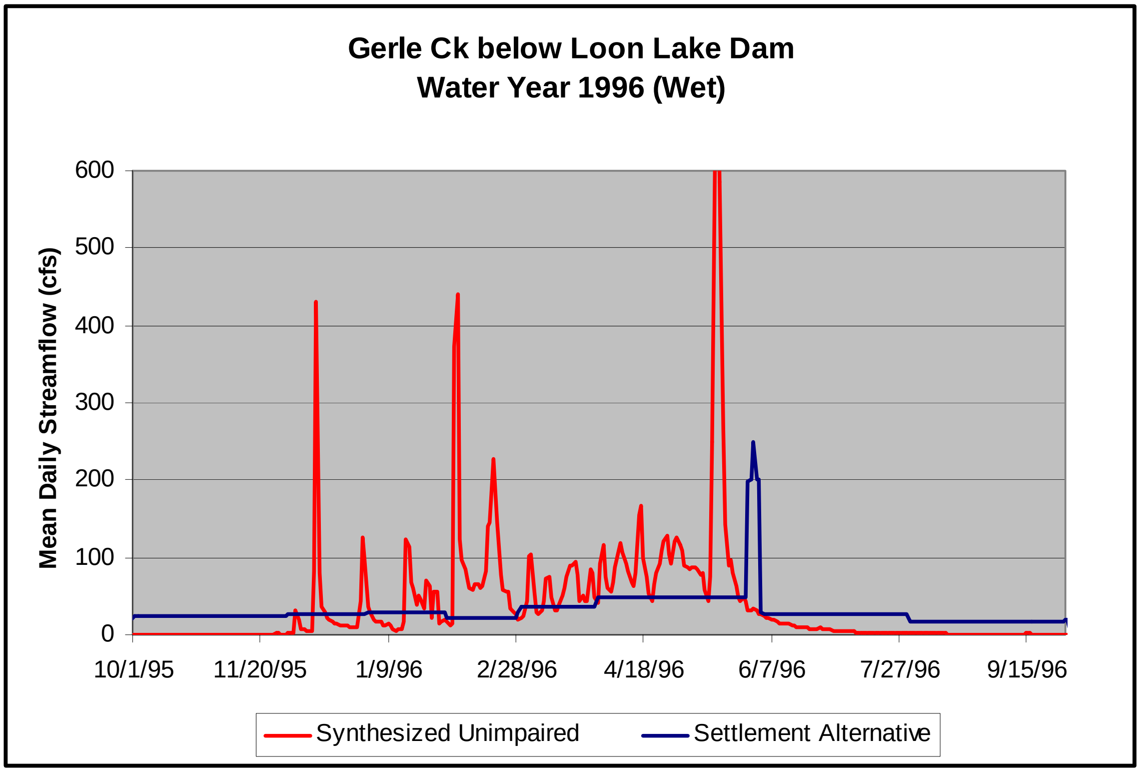
| Month | Water Year Type | Flow Range | Percent WUA | Benefitting Life stage |
|---|---|---|---|---|
| October/November | Dry | 11 | 89 | Brown trout spawning |
| | AN | 20 | 100 | Brown trout spawning |
| | Wet | 23 | 99 | Brown trout spawning |
| December through March | Dry | 13-24 | 90-97 | Brown trout juveniles |
| | AN | 22-37 | 81-90 | Brown trout juveniles |
| | Wet | 26-44 | 78-87 | Brown trout juveniles |
| April/May | Dry | 32 | 95/92 | Rainbow trout spawning/juveniles |
| | AN | 49 | 84 | Rainbow trout spawning and juveniles |
| | Wet | 58 | 76/82 | Rainbow trout spawning/juveniles |
| June/July | Dry | 14-16 | 100 | Rainbow trout juveniles |
| | AN | 27 | 95 | Rainbow trout juveniles |
| | Wet | 32 | 92 | Rainbow trout juveniles |
| August/September | Dry | 10 | 92/96 | Rainbow/brown trout adults |
| | AN | 17 | 99-100 | Rainbow and brown trout adults |
| | Wet | 20 | 98-100 | Rainbow and brown trout adults |

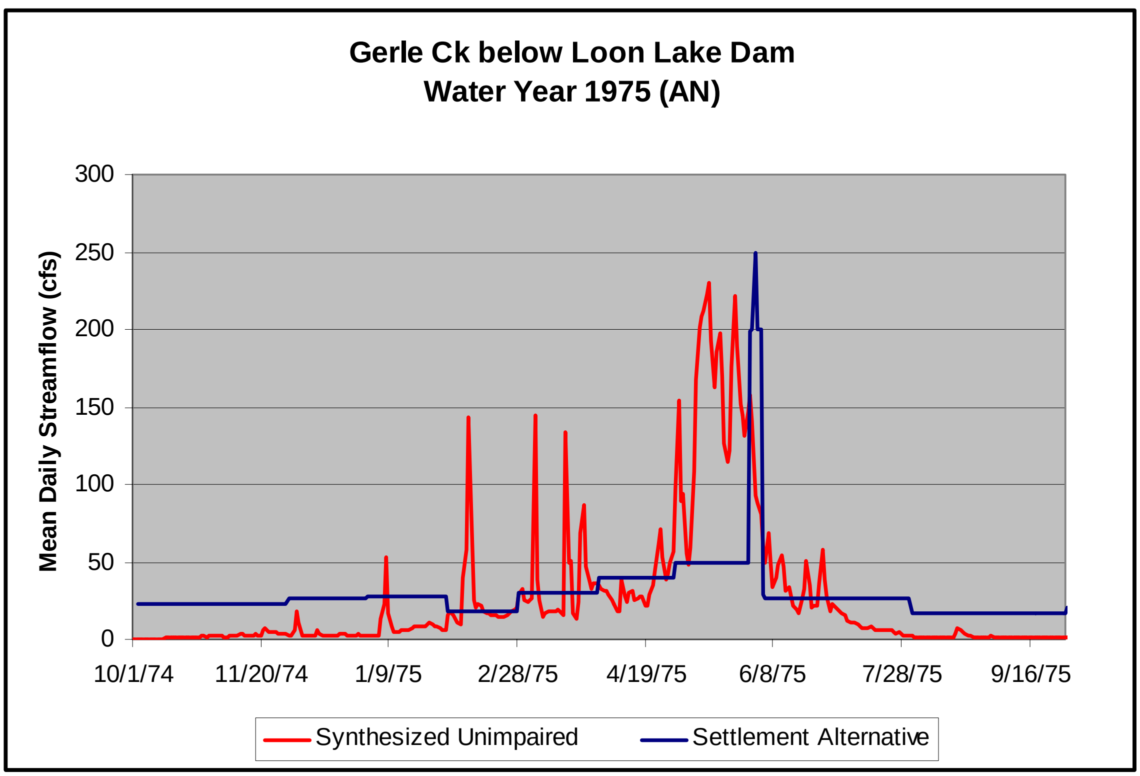
The following chart displays an example of the water available for hydroelectric operations in a representative Dry water year type with implementation of the settlement. Note that the unimpaired flows do not include the water that is diverted from the Rubicon River.



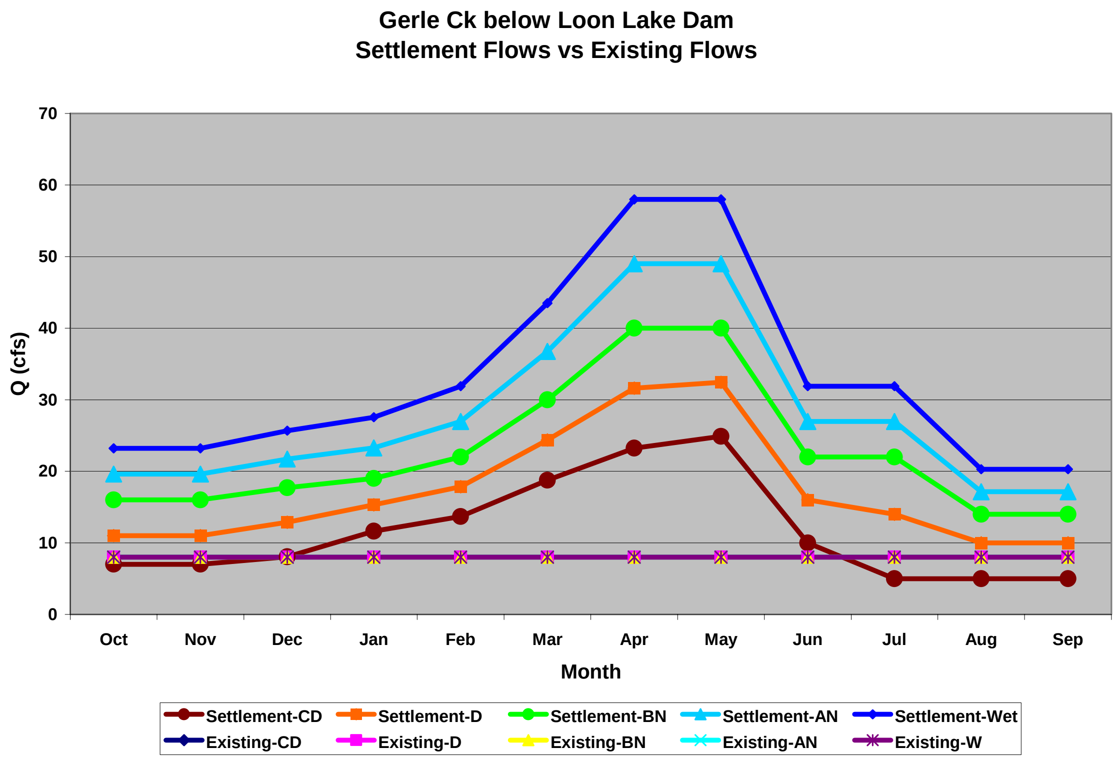

To develop minimum streamflows for Wet water years, the percent difference between the runoff of the driest Wet water year in the period of record (1996) (Devine Tarbell & Associates and Hannaford 2005a) and the average annual runoff was calculated. The BN water year minimum streamflows were increased by this percentage to obtain the minimum streamflows for the Wet water year. Minimum streamflows in AN water years were developed by interpolating between the BN and Wet water year minimum streamflows. The Wet and AN water year minimum streamflows were cross-checked with PHABSIM results for rainbow and brown trout to ensure that adequate WUA was provided at that appropriate times of year. Refer to the chart above for composite percent WUA Dry, AN, and Wet water year types (CDFG 2006a). The percent WUA for AN years ranges between 81-100. The percent WUA for Wet years ranges between 76-100.

The following charts display examples of the water available for hydroelectric operations in representative Wet and AN water year types, respectively, with implementation of the settlement. Note that the unimpaired flows do not include the water that is diverted from the Rubicon River.



The following chart displays a comparison of the settlement flows and licensee flows for each water year type for the Gerle Creek below Loon Lake Reservoir Dam.




Proposed minimum streamflows will offer increased channel size and wetted perimeter downstream of the meadow section of Loon Lake Reach of Gerle Creek, where channel mapping showed that increased flow would add habitat along the sides of the stream to serve as a nursery for juvenile trout. Pulse flows in the stretch will help reduce riparian vegetation that is encroaching in the channel, which will benefit fish and other aquatic species. Pulse flows sort and clean spawning gravel, increase depth of pools by scour, and form exposed bar features, which are important for aquatic habitat (Trush et al. 2005, Poff et al. 1997).

The following table depicts the recommended minimum streamflows.

| Gerle Creek Below Loon Lake Reservoir Dam | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | Month | | Minimum Streamflow by Water Year (cfs) | | | | |
| | | | CD | DRY | BN | AN | WET |
| | **OCT** | | 7 | 11 | 16 | 20 | 23 |
| | **NOV** | | 7 | 11 | 16 | 20 | 23 |
| | **DEC** | | 8 | 13 | 18 | 22 | 26 |
| | **JAN** | | 12 | 15 | 19 | 23 | 28 |
| | **FEB** | | 14 | 18 | 22 | 27 | 32 |
| | **MAR** | | 19 | 24 | 30 | 37 | 44 |
| | **APR** | | 23 | 32 | 40 | 49 | 58 |
| | **MAY** | | 25 | 32 | 40 | 49 | 58 |
| | **JUNE** | | 10 | 16 | 22 | 27 | 32 |
| | **JULY** | | 5 | 14 | 22 | 27 | 32 |
| | **AUG** | | 5 | 10 | 14 | 17 | 20 |
| | **SEPT** | | 5 | 10 | 14 | 17 | 20 |

***Gerle Creek Below Gerle Reservoir Dam***

The focus in Gerle Creek below Gerle Reservoir Dam was on managing for native aquatic species, though there was recognition that brown trout, a non-native species, would be present in this reach due to management for brown trout upstream in Gerle Creek below Loon Lake Reservoir Dam. Refer to the fish community metrics discussion above, under Resource Objectives, for discussion of fisheries objectives. The objectives allow brown trout biomass to contribute to the fisheries biomass objective in this reach. The settlement also took into consideration the fact that water released for ecological objectives can no longer be used by the licensee, as it leaves the system that is under its control. The licensee placed a high value on this water similar to the Rubicon River water released from Rubicon Reservoir. Therefore in an attempt to balance amongst beneficial uses, monthly streamflows during the late fall and winter months have been reduced to levels that fall below 80 percent WUA (50 to 70 percent of WUA) benchmark criteria that have been used as a starting point for indices of habitat availability in many reaches.

Minimum streamflows for this reach and the South Fork Rubicon River below Robbs Peak Reservoir Dam are currently combined and measured below the confluence of Gerle Creek and South Fork Rubicon River. This settlement includes specific minimum streamflows (and compliance gages) for each reach to ensure aquatic species are adequately protected.

The existing combined biomass for rainbow trout and brown trout for this reach is 11.5 pounds per surface acre (Devine Tarbell & Associates and Stillwater Sciences 2005j). This is well below a combined biomass objective of 24 pounds per surface acre. The proposed flow regime is designed to increase instream habitat to improve the biomass and move it closer to the objective.

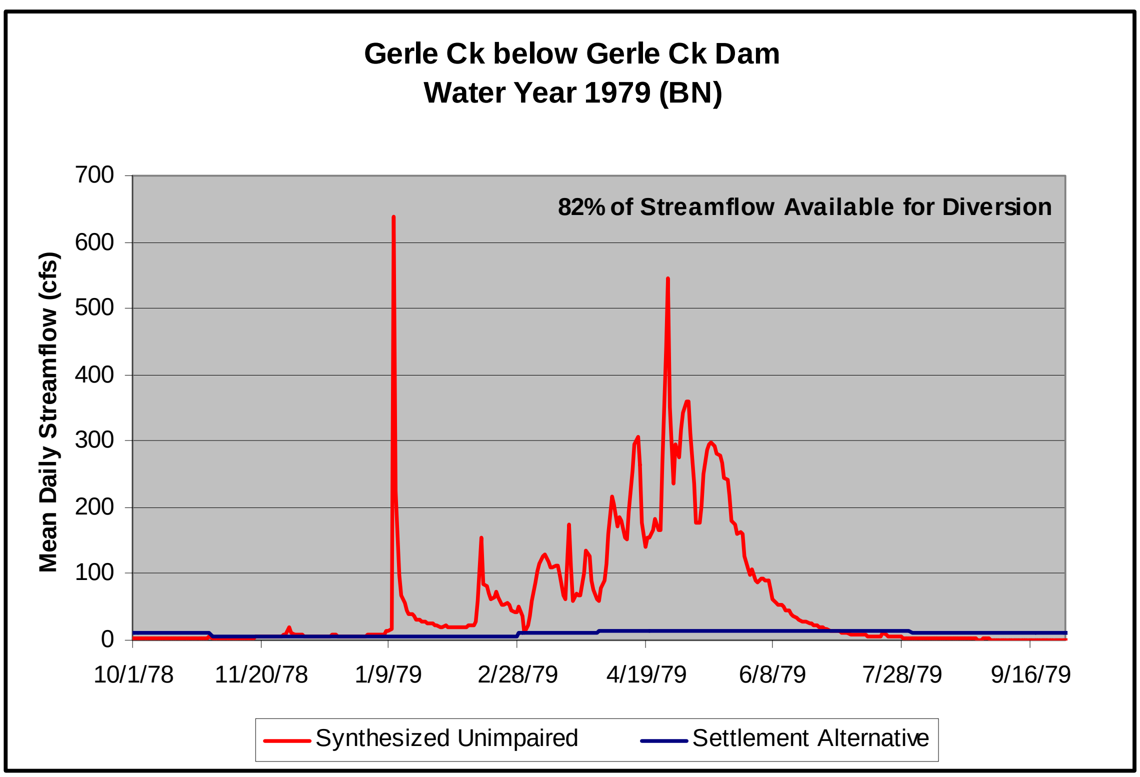
For the month of May, important ecosystem attributes are habitat for rainbow trout spawning and adults as well as riparian inundation. Based on these attributes, the May flow in a BN water year (beginning of rainbow trout spawning) was set at 15 cfs, which is 95 percent WUA for rainbow trout spawning and 100 percent of the WUA for rainbow trout adults (Devine Tarbell & Associates and Stillwater Sciences 2004d). Additionally, based on the Riparian Vegetation and Wetlands Technical Report (Devine Tarbell & Associates 2004t), riparian vegetation on the upper banks was defined as narrow and surmised to be dependent upon seasonal seepage. The higher May streamflow is intended to provide longer duration saturation and input nutrient materials to this upper bank riparian zone (McBride and Strahan 1984).

After the May minimum streamflow was established, the remainder of the streamflows for the water year were established by using the shape of the unimpaired hydrograph as much as possible, varying from the shape to meet specific objectives. For example, the settlement varied from shape of the hydrograph during the months of July through October when important ecosystem attributes of water quality and rainbow trout juvenile and adult habitat were considered important. The BN water year minimum streamflows were cross-checked with PHABSIM results (Devine Tarbell & Associates and Stillwater Sciences 2004d) for rainbow trout to ensure that adequate WUA was provided at the appropriate times of year (for example, September and October, which are critical periods for rainbow trout juveniles, were set just below 100 percent WUA for rainbow trout juveniles). The chart below displays the percent WUA for all water year types for rainbow trout for Gerle Creek below Gerle Reservoir Dam (Devine Tarbell & Associates and Stillwater Sciences 2004d).

| **Month** | **Water Year Type** | **Flow Range** | **Percent WUA** | **Benefitting Life stage** |
|---|---|---|---|---|
| October | CD | 5 | 58/83 | Adult/juvenile rainbow trout |
| | Dry | 9 | 83/96 | Adult/juvenile rainbow trout |
| | BN | 10 | 86/97 | Adult/juvenile rainbow trout |
| | AN | 10 | 86/97 | Adult/juvenile rainbow trout |
| | Wet | 10 | 86/97 | Adult/juvenile rainbow trout |
| Nov to Feb | CD | 4-5 | 51-58 | Adult rainbow trout |
| | Dry | 4-6 | 51-66 | Adult rainbow trout |
| | BN | 6 | 66 | Adult rainbow trout |
| | AN | 6 | 66 | Adult rainbow trout |
| | Wet | 6 | 66 | Adult rainbow trout |
| March | CD | 7 | 73 | Adult rainbow trout |
| | Dry | 10 | 86 | Adult rainbow trout |
| | BN | 12 | 92 | Adult rainbow trout |
| | AN | 9 | 83 | Adult rainbow trout |
| | Wet | 9 | 83 | Adult rainbow trout |
| April | CD | 9 | 83/99 | Adult/spawning rainbow trout |
| | Dry | 12 | 92/98 | Adult/spawning rainbow trout |
| | BN | 15 | 100/95 | Adult/spawning rainbow trout |
| | AN | 9 | 83/99 | Adult/spawning rainbow trout |
| | Wet | 9 | 83/99 | Adult/spawning rainbow trout |
| May thru June | CD | 9 | 83/99 | Adult/spawning rainbow trout |

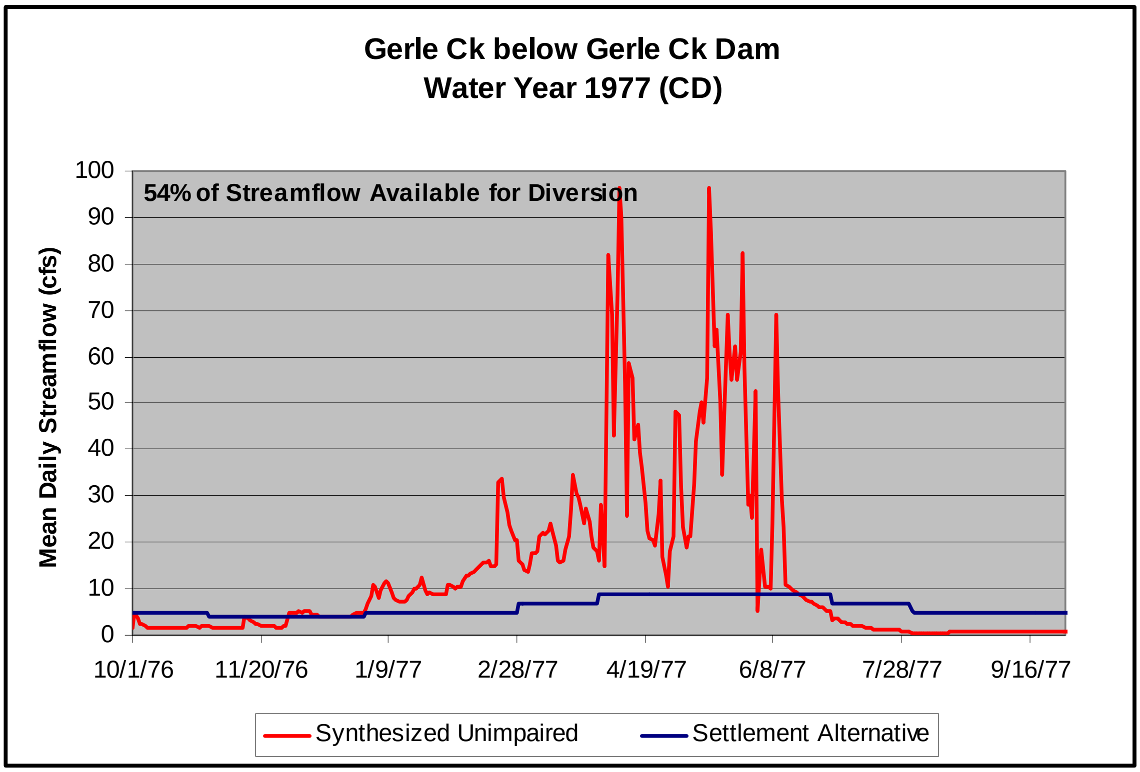
| Month | Water Year Type | Flow Range | Percent WUA | Benefitting Life stage |
|---|---|---|---|---|
| | Dry | 12 | 92/98 | Adult/spawning rainbow trout |
| | BN | 15 | 100/95 | Adult/spawning rainbow trout |
| | AN | 15 | 100/95 | Adult/spawning rainbow trout |
| | Wet | 15 | 100/95 | Adult/spawning rainbow trout |
| July | CD | 7 | 73/93 | Adult/juvenile rainbow trout |
| | Dry | 10 | 86/97 | Adult/juvenile rainbow trout |
| | BN | 13 | 95/100 | Adult/juvenile rainbow trout |
| | AN | 15 | 100/99 | Adult/juvenile rainbow trout |
| | Wet | 15 | 100/99 | Adult/juvenile rainbow trout |
| August | CD | 5 | 58/83 | Adult/juvenile rainbow trout |
| | Dry | 9 | 83/96 | Adult/juvenile rainbow trout |
| | BN | 12 | 92/100 | Adult/juvenile rainbow trout |
| | AN | 12 | 92/100 | Adult/juvenile rainbow trout |
| | Wet | 12 | 92/100 | Adult/juvenile rainbow trout |
| September | CD | 5 | 58/83 | Adult/juvenile rainbow trout |
| | Dry | 9 | 83/96 | Adult/juvenile rainbow trout |
| | BN | 10 | 86/97 | Adult/juvenile rainbow trout |
| | AN | 10 | 86/97 | Adult/juvenile rainbow trout |
| | Wet | 10 | 86/97 | Adult/juvenile rainbow trout |

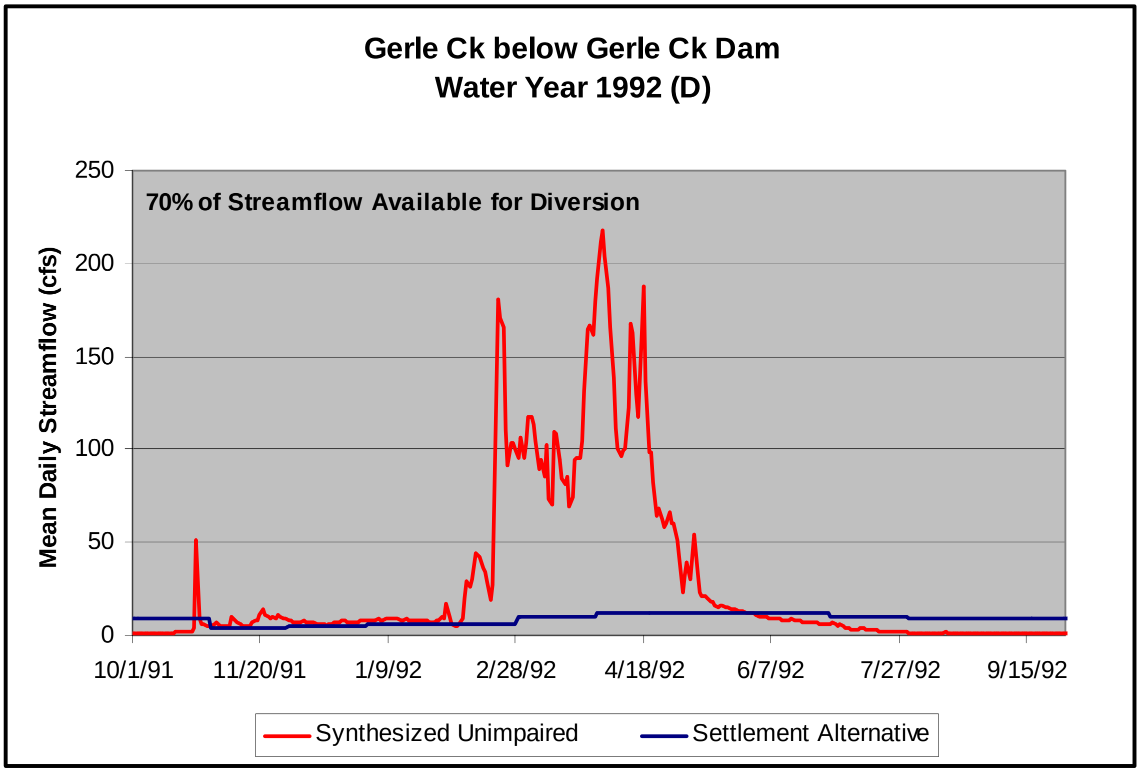
The following chart displays an example of the water available for hydroelectric operations in a representative BN water year type with implementation of the settlement.



For CD water years, PHABSIM results were reviewed (Devine Tarbell & Associates and Stillwater Sciences 2004d), and 83 percent WUA for adult rainbow trout was provided during its spawning period in April through June, and the remainder of the streamflows for the CD water year were shaped as closely as possible to an unimpaired hydrograph with variances similar to the BN water year. Minimum streamflows in Dry water years were developed by interpolating between the CD and BN water year minimum streamflows. Dry water year minimum streamflows were cross-checked with PHABSIM results (Devine Tarbell & Associates and Stillwater Sciences 2004d) for rainbow trout to ensure adequate WUA was provided at the appropriate times of year.

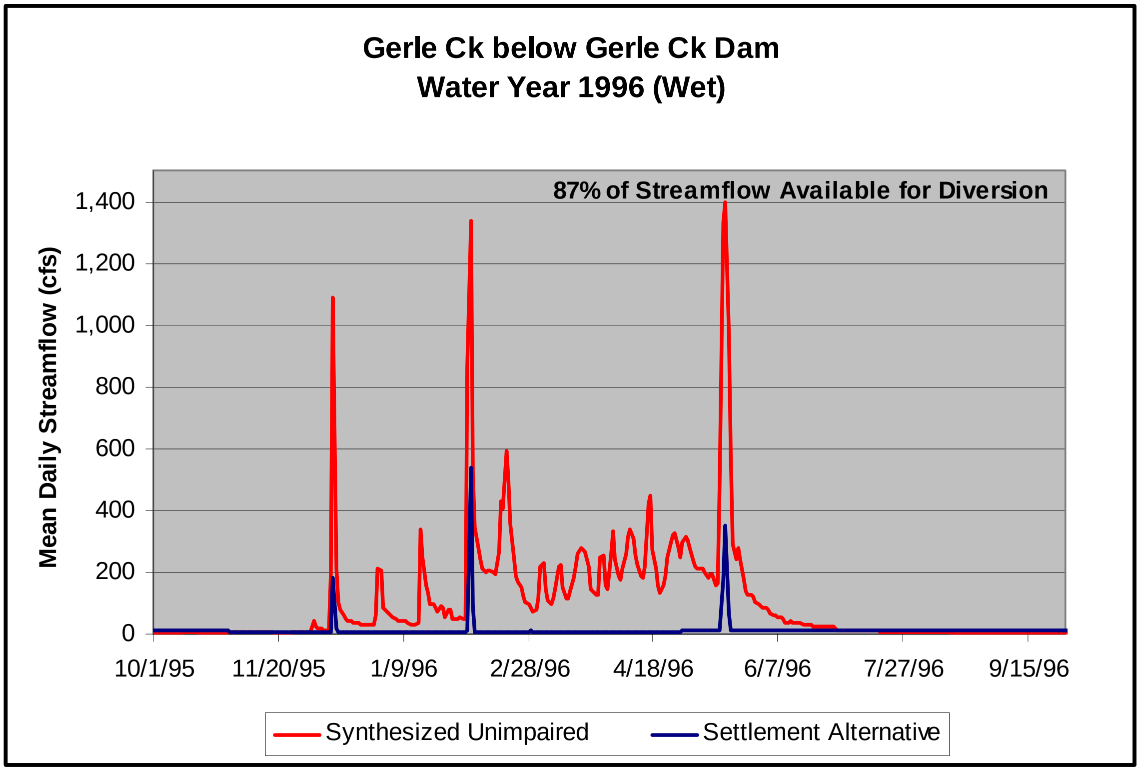
The following charts display examples of the water available for hydroelectric operations in representative CD and Dry water year types, respectively, with implementation of the settlement.

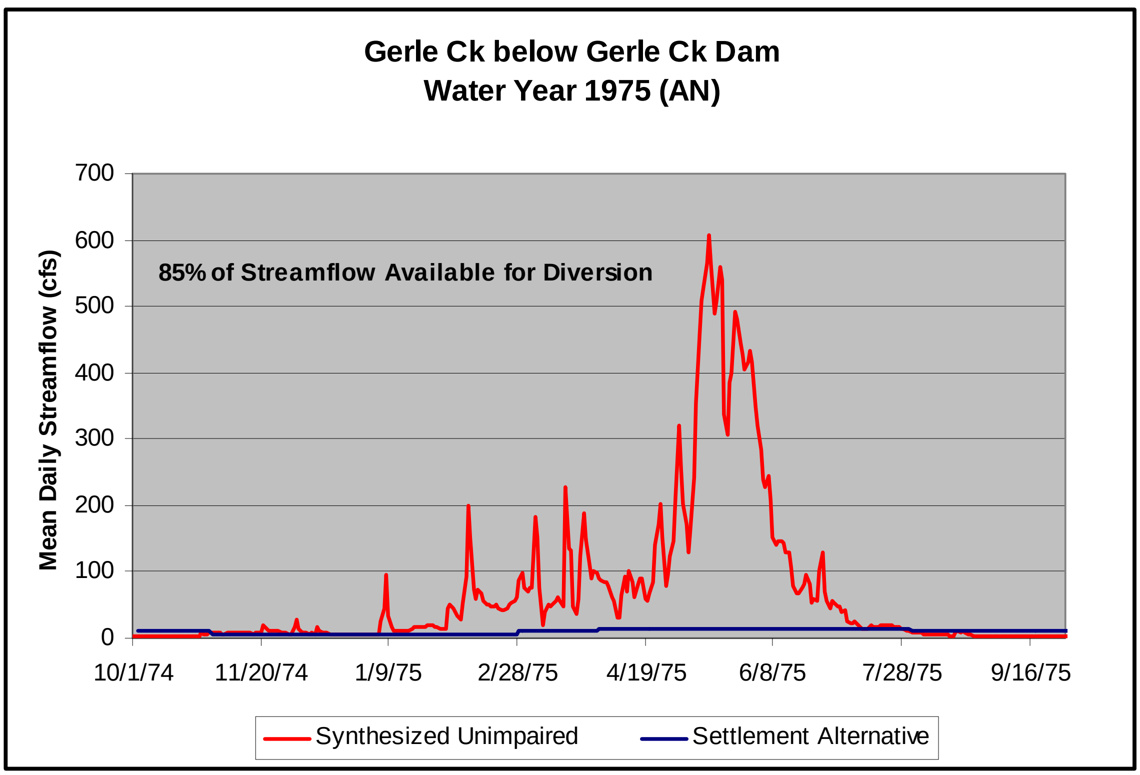




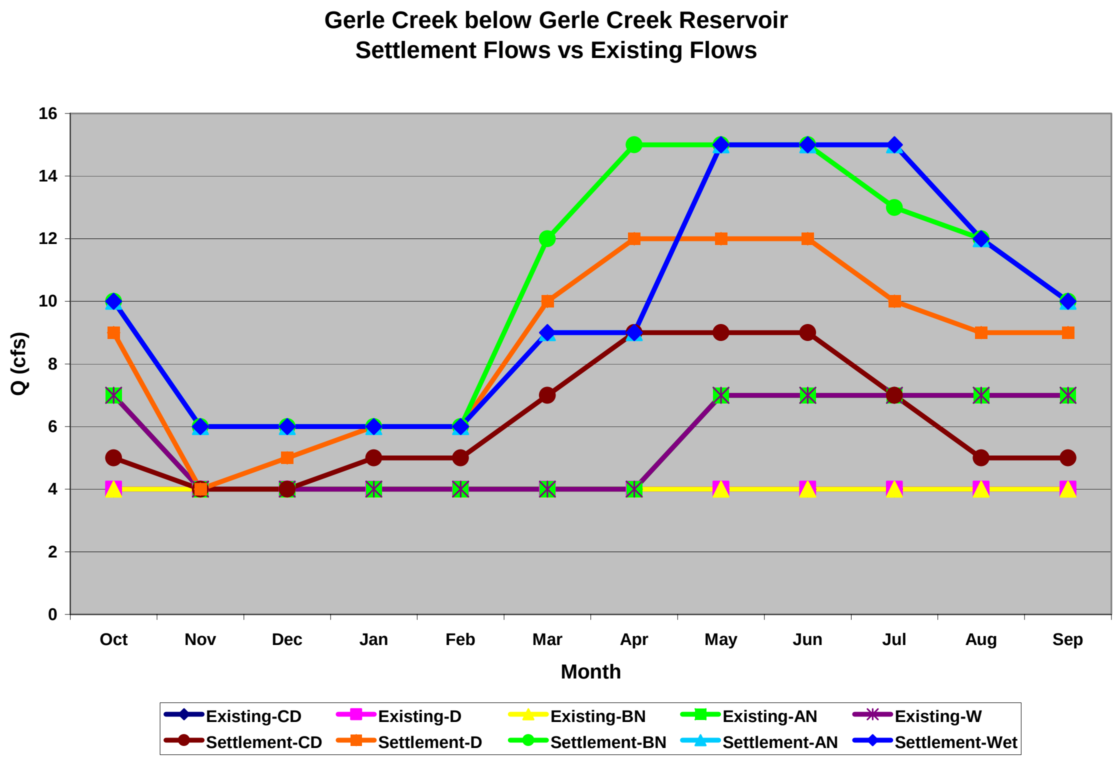

To develop minimum streamflows for Wet water years, the percent difference between the runoff of the driest Wet water year in the period of record (1996) (Devine Tarbell & Associates and Hannaford 2005a) and the average annual runoff was calculated. The BN water year minimum streamflows were increased by this percentage to obtain the minimum streamflows for the Wet water year. Minimum streamflows in AN water years were developed by interpolating between the BN and Wet water year minimum streamflows. Wet and AN water year minimum streamflows were cross-checked with PHABSIM results for rainbow trout to ensure that adequate WUA was provided at that appropriate times of year. Once this was completed, the Wet and AN water year types were adjusted to provide higher spawning flows at a later time in the year so anglers could access the reach. Ecologically, these adjustments were expected to provide salmonid spawning habitat at an appropriate time of year and were expected to be acceptable for FYLF life cycles should they occur in South Fork Rubicon River.

The following charts display examples of the water available for hydroelectric operations in representative Wet and AN water year types, respectively, with implementation of the settlement.



The following chart displays a comparison of the settlement flows and licensee flows for each water year type for the Gerle Creek below Gerle Creek Reservoir Dam.




The following table depicts the recommended minimum streamflows.

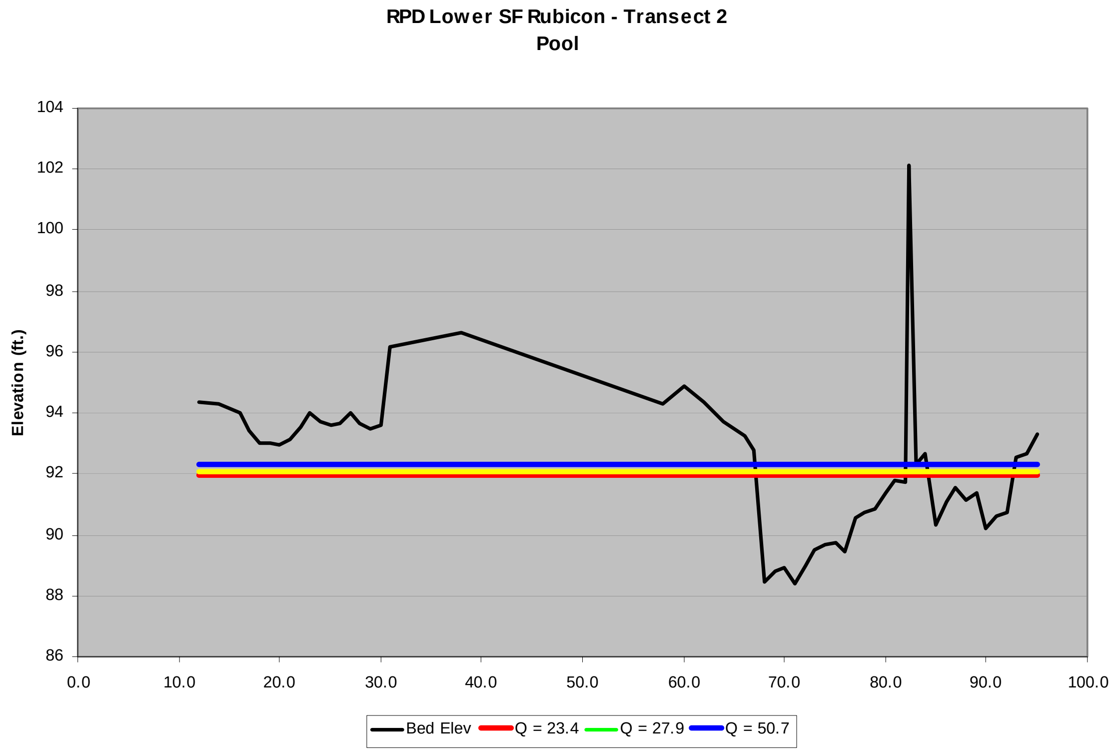
| Gerle Creek Below Gerle Reservoir Dam | | | | | | | |
|---|---|---|---|---|---|---|---|
| | Month | | Minimum Streamflow by Water Year (cfs) | | | | |
| | | | CD | DRY | BN | AN | WET |
| | OCT | | 5 | 9 | 10 | 10 | 10 |
| | NOV | | 4 | 4 | 6 | 6 | 6 |
| | DEC | | 4 | 5 | 6 | 6 | 6 |
| | JAN | | 5 | 6 | 6 | 6 | 6 |
| | FEB | | 5 | 6 | 6 | 6 | 6 |
| | MAR | | 7 | 10 | 12 | 9 | 9 |
| | APR | | 9 | 12 | 15 | 9 | 9 |
| | MAY | | 9 | 12 | 15 | 15 | 15 |
| | JUNE | | 9 | 12 | 15 | 15 | 15 |
| | JULY | | 7 | 10 | 13 | 15 | 15 |
| | AUG | | 5 | 9 | 12 | 12 | 12 |
| | SEPT | | 5 | 9 | 10 | 10 | 10 |

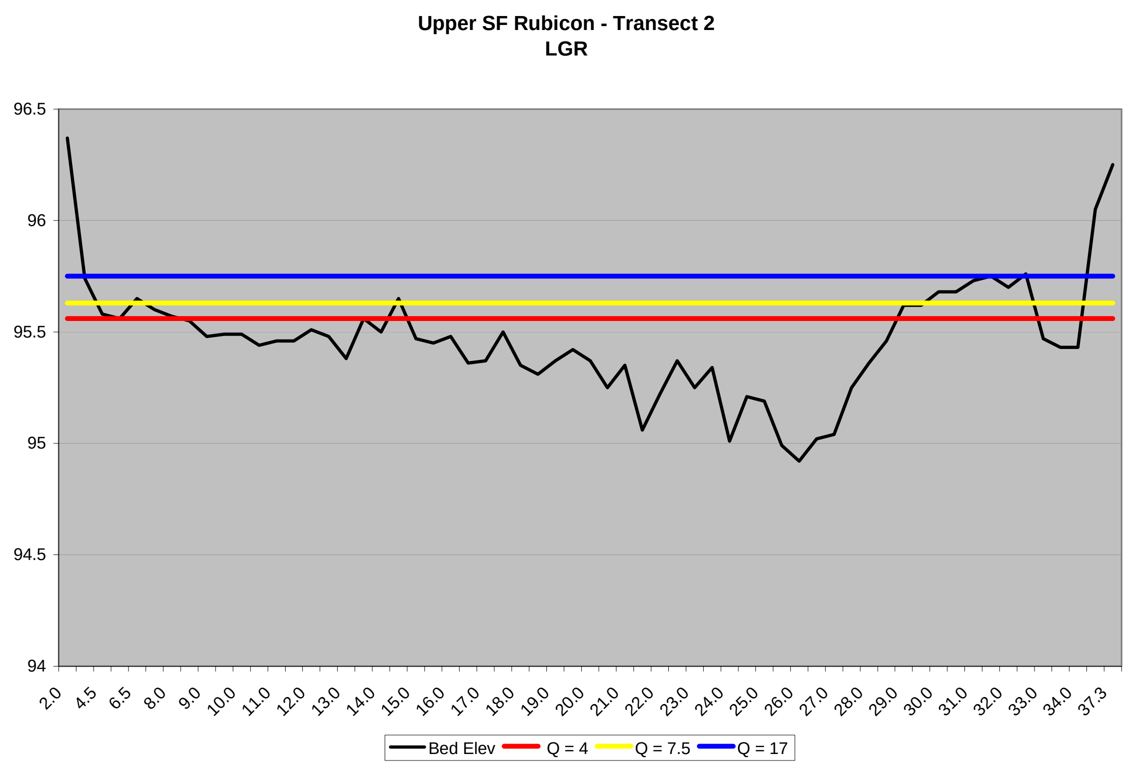
### *South Fork Rubicon River Below Robbs Peak Reservoir Dam*

The focus in South Fork Rubicon River below Robbs Peak Reservoir Dam was on managing for native aquatic species, though there was recognition that brown trout, a non-native species, would be present in this reach due to management for brown trout upstream in Gerle Creek below Loon Lake Reservoir Dam. Refer to the fish community metrics discussion above, under Resource Objectives, for discussion of fisheries objectives. The objectives allow brown trout biomass to contribute to the fisheries biomass objective in this reach. Minimum streamflows for this reach and Gerle Creek below Gerle Reservoir Dam are currently combined and measured below the confluence of Gerle Creek and South Fork Rubicon River. The settlement includes specific minimum streamflows (and compliance gages) for each reach to ensure aquatic species are adequately protected.

The existing combined biomass for rainbow trout and brown trout for this reach is 23 pounds per surface acre (Devine Tarbell & Associates and Stillwater Sciences 2005j); however, the rainbow trout mean biomass is only 10 pounds per surface acre. This is well below the biomass objective of 24 pounds per surface acre. The proposed flow regime is designed to increase instream habitat to improve the rainbow trout biomass and move it closer to the objective, while allowing the licensee to benefit from the brown trout biomass.

For the month of May, the most important ecosystem attribute is rainbow trout spawning due to the potential for entrainment at the Robbs Peak Powerhouse tunnel. Based on this attribute, the May flow in a BN water year (beginning of rainbow trout spawning) was set at 13 cfs, 100 percent of the WUA for rainbow trout spawning. Thirteen cfs also represents 87 percent of the WUA for rainbow trout adults (Devine Tarbell & Associates and Stillwater Sciences 2004d). The goal in this reach is to maximize recruitment due to the potential for entrainment of fish from upstream reaches. If this is not determined to be successful based on monitoring results, the adaptive management program described in Section 6 includes but is not limited to a partial flow fish screen, located in the South Fork Rubicon River upstream of Ice House Road, or other appropriate mitigation measures that are approved by FS, CDFG, and SWRCB. Water surface elevations for the different flows as modeled in the PHABSIM study (Devine Tarbell & Associates and Stillwater Sciences 2004d) were used to confirm that the May minimum streamflow of 13 cfs inundated some areas of the primary flood terrace, which is anticipated to benefit the riparian vegetation component during the appropriate time of year. The following chart displays an example of the inundation that would occur under these flows.



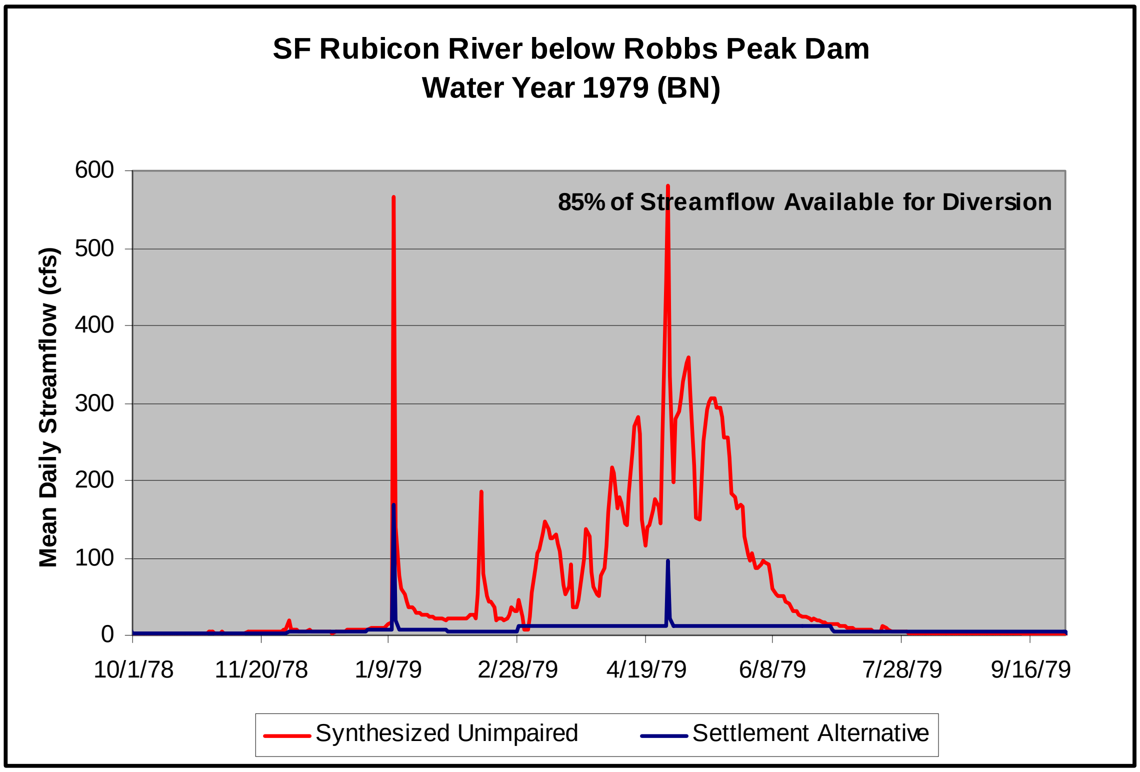




After the May minimum streamflow was established, the remainder of the streamflows for the water year were established by using the shape of the unimpaired hydrograph (Devine Tarbell & Associates and Hannaford 2005a) as much as possible, varying from the shape to meet specific objectives. For example, the settlement varied from shape of the hydrograph during the months of June through October when important ecosystem attributes of water quality and rainbow trout juvenile and adult habitat were considered important. The BN water year minimum streamflows were cross-checked with PHABSIM results for rainbow trout to ensure adequate WUA was provided at appropriate times of the year (Devine Tarbell & Associates and Stillwater Sciences 2004d). The chart below displays the percent WUA for all water year types for rainbow trout for South Fork Rubicon River below Robbs Peak Reservoir Dam (Devine Tarbell & Associates and Stillwater Sciences 2004d).

| **Month** | **Water Year Type** | **Flow Range** | **Percent WUA** | **Benefitting Life stage** |
|---|---|---|---|---|
| October to Dec | CD | 1-3 | 53-86 (no phabsim for 1) | Adult rainbow trout |
| | Dry | 2-3 | 53-86 | Adult rainbow trout |
| | BN | 3-4 | 86-93 | Adult rainbow trout |
| | AN | 3-4 | 86-93 | Adult rainbow trout |
| | Wet | 3-4 | 86-93 | Adult rainbow trout |
| Jan to March | CD | 2-3 | 53-86 | Adult rainbow trout |
| | Dry | 5-7 | 98 | Adult rainbow trout |
| | BN | 7-11 | 80-98 | Adult rainbow trout |
| | AN | 7-9 | 90-98 | Adult rainbow trout |
| | Wet | 7-9 | 90-98 | Adult rainbow trout |
| April | CD | 4 | 93/85 | Adult/spawning rainbow trout |
| | Dry | 9 | 90/98 | Adult/spawning rainbow trout |
| | BN | 13 | 69/100 | Adult/spawning rainbow trout |
| | AN | 10 | 85/99 | Adult/spawning rainbow trout |
| | Wet | 10 | 85/99 | Adult/spawning rainbow trout |
| May to June | CD | 4 | 93/81/100 | Adult/spawning/juvenile rainbow trout |
| | Dry | 9 | 90/98/90 | Adult/spawning/juvenile rainbow trout |
| | BN | 13 | 69/100/82 | Adult/spawning/juvenile rainbow trout |
| | AN | 13 | 69/100/82 | Adult/spawning/juvenile rainbow trout |
| | Wet | 13 | 69/100/82 | Adult/spawning/juvenile rainbow trout |
| July | CD | 3 | 86/72/99 | Adult/spawning/juvenile rainbow trout |
| | Dry | 5 | 98/85/99 | Adult/spawning/juvenile rainbow trout |
| | BN | 6 | 100/90/97 | Adult/spawning/juvenile rainbow trout |
| | AN | 13 | 69/100/82 | Adult/spawning/juvenile rainbow trout |
| | Wet | 13 | 69/100/82 | Adult/spawning/juvenile rainbow trout |

| Month | Water Year Type | Flow Range | Percent WUA | Benefitting Life stage |
|---|---|---|---|---|
| August | CD | 3 | 86/99 | Rainbow trout adults/juveniles |
| | Dry | 5 | 98/99 | Rainbow trout adults/juveniles |
| | BN | 6 | 100/97 | Rainbow trout adults/juveniles |
| | AN | 11 | 80/85 | Rainbow trout adults/juveniles |
| | Wet | 11 | 80/85 | Rainbow trout adults/juveniles |
| September | CD | 3 | 86/99 | Rainbow trout adults/juveniles |
| | Dry | 5 | 98/99 | Rainbow trout adults/juveniles |
| | BN | 6 | 100/97 | Rainbow trout adults/juveniles |
| | AN | 6 | 100/97 | Rainbow trout adults/juveniles |
| | Wet | 6 | 100/97 | Rainbow trout adults/juveniles |

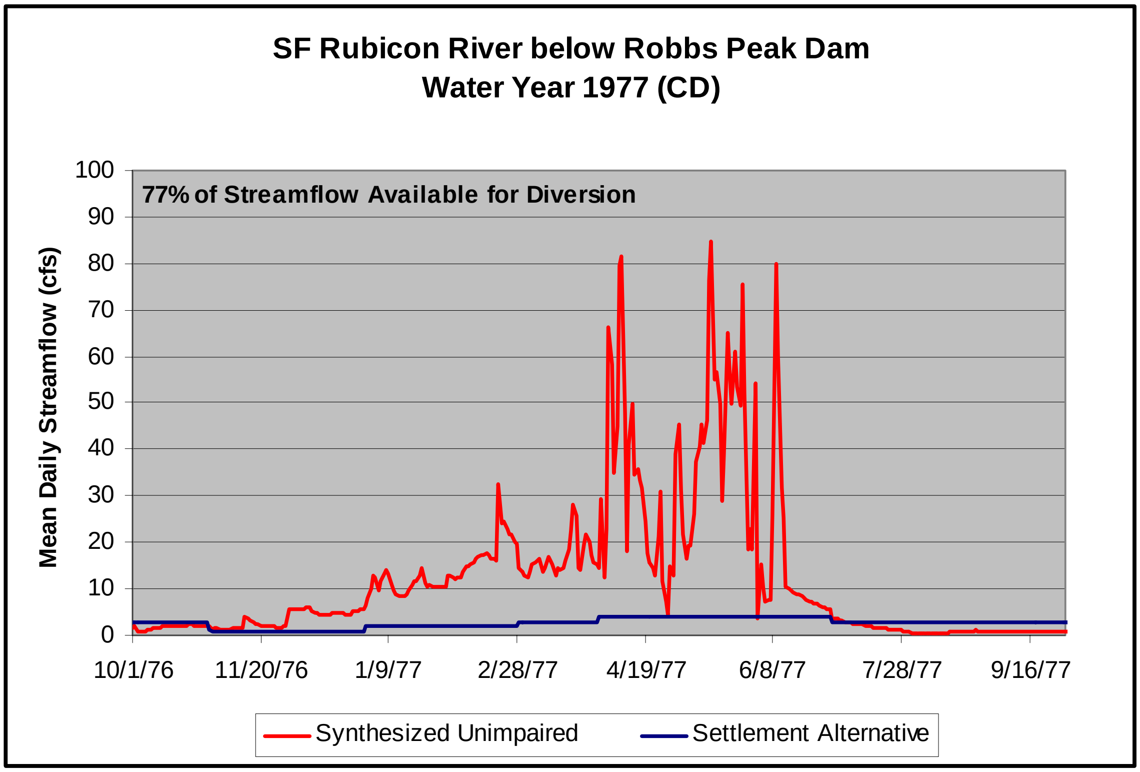
The following chart displays an example of the water available for hydroelectric operations in a representative BN water year type with implementation of the settlement.

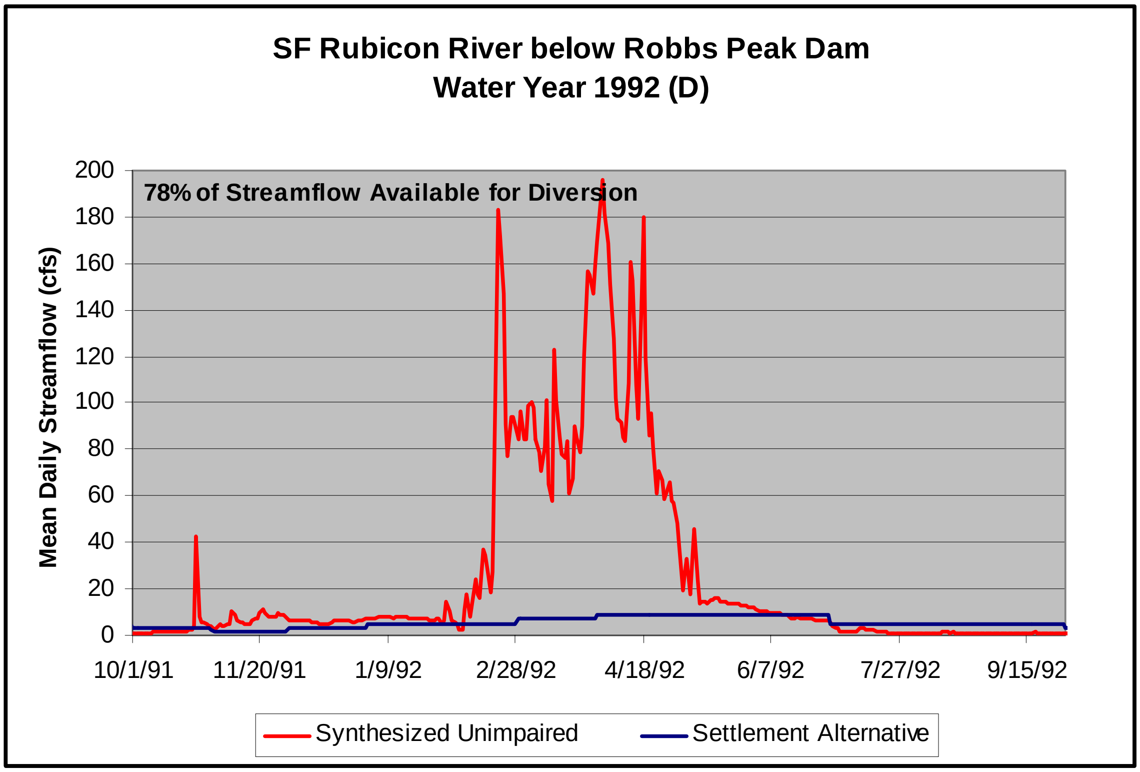



For CD water years, PHABSIM results were reviewed and 81-85 percent WUA for rainbow trout was provided during its spawning period in April through June (Devine Tarbell & Associates and Stillwater Sciences 2004d), and the remainder of the streamflows for the CD water year were shaped as closely as possible to an unimpaired hydrograph with variances similar to the BN water year. Minimum streamflows in Dry water years were developed by interpolating between the CD and BN water year minimum streamflows. Dry water year minimum streamflows were cross-checked with

PHABSIM results for rainbow trout to ensure adequate WUA was provided at appropriate times of the year.

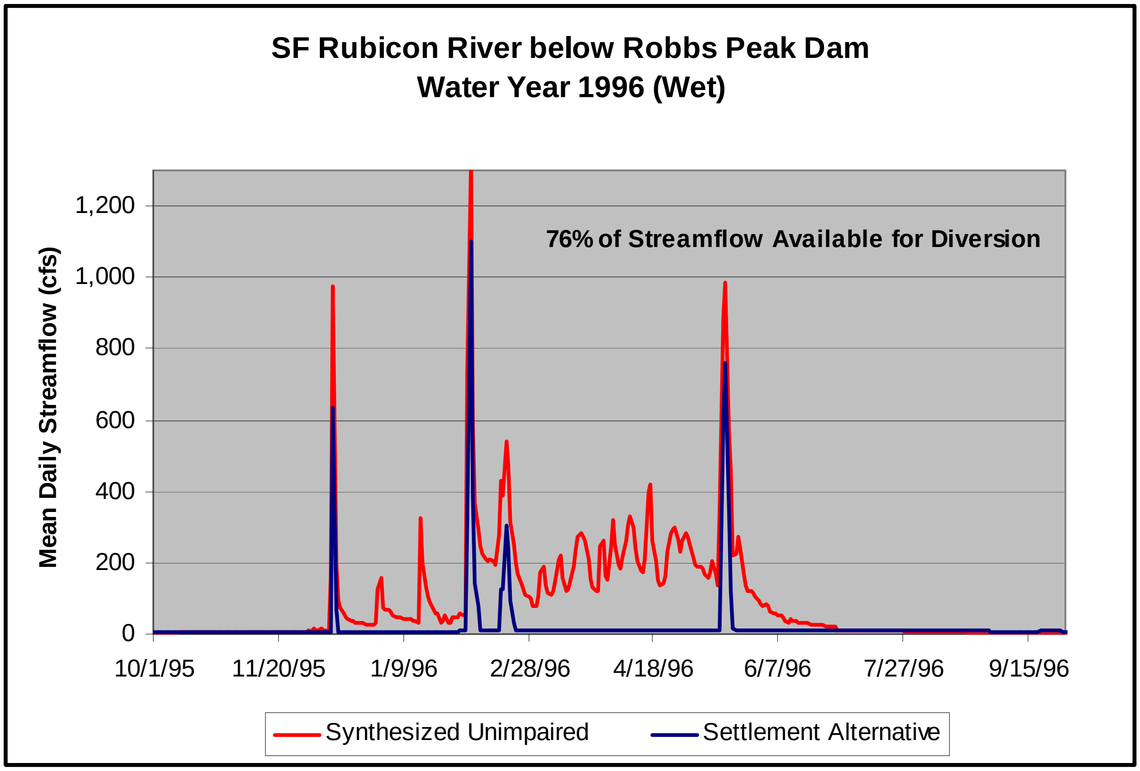
The following charts display examples of the water available for hydroelectric operations in representative CD and Dry water year types, respectively, with implementation of the settlement.

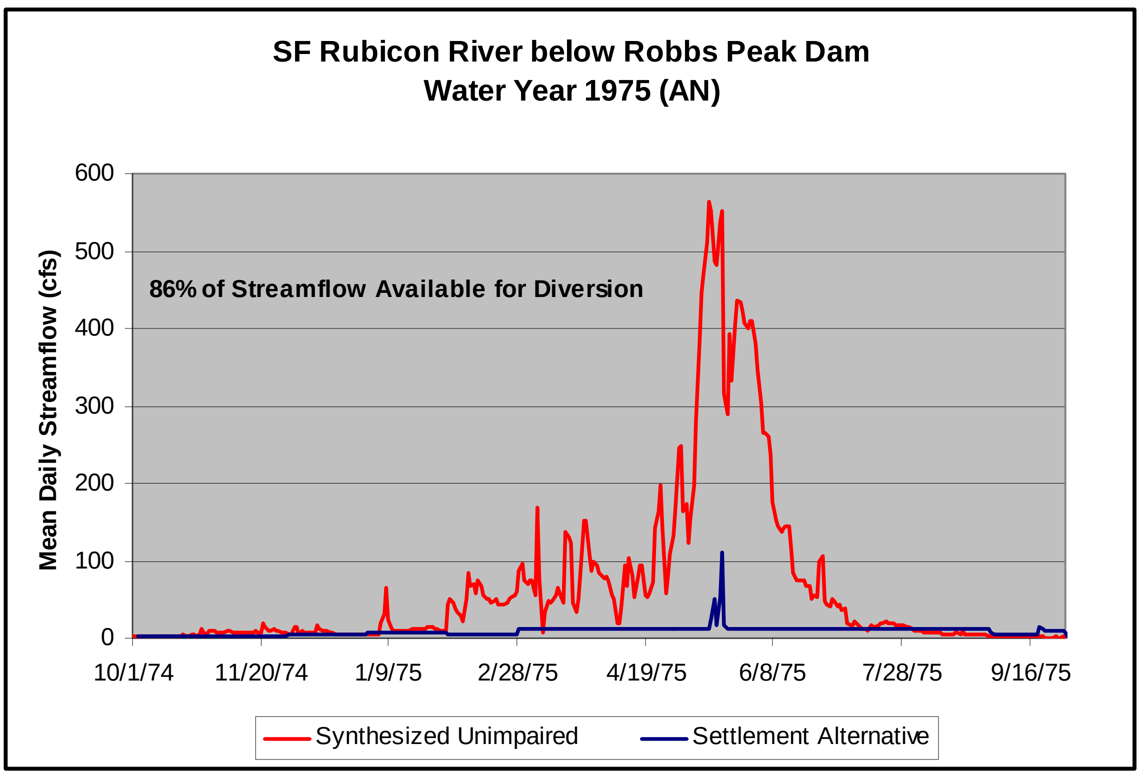





Water in this reach is very valuable to the licensee because water leaving this reach leaves the licensee's control area. To maintain as much water as possible in this reach, minimum streamflows were not increased in AN and Wet water years but were kept the same as the minimum streamflows in BN water years. However, Wet and AN water year types were adjusted to provide higher spawning flows later in the year so anglers could access the reach. Ecologically, these adjustments were expected to provide additional spawning and adult habitat at an appropriate time of year and were expected to be acceptable for FYLF life cycles should they occur in South Fork Rubicon River.

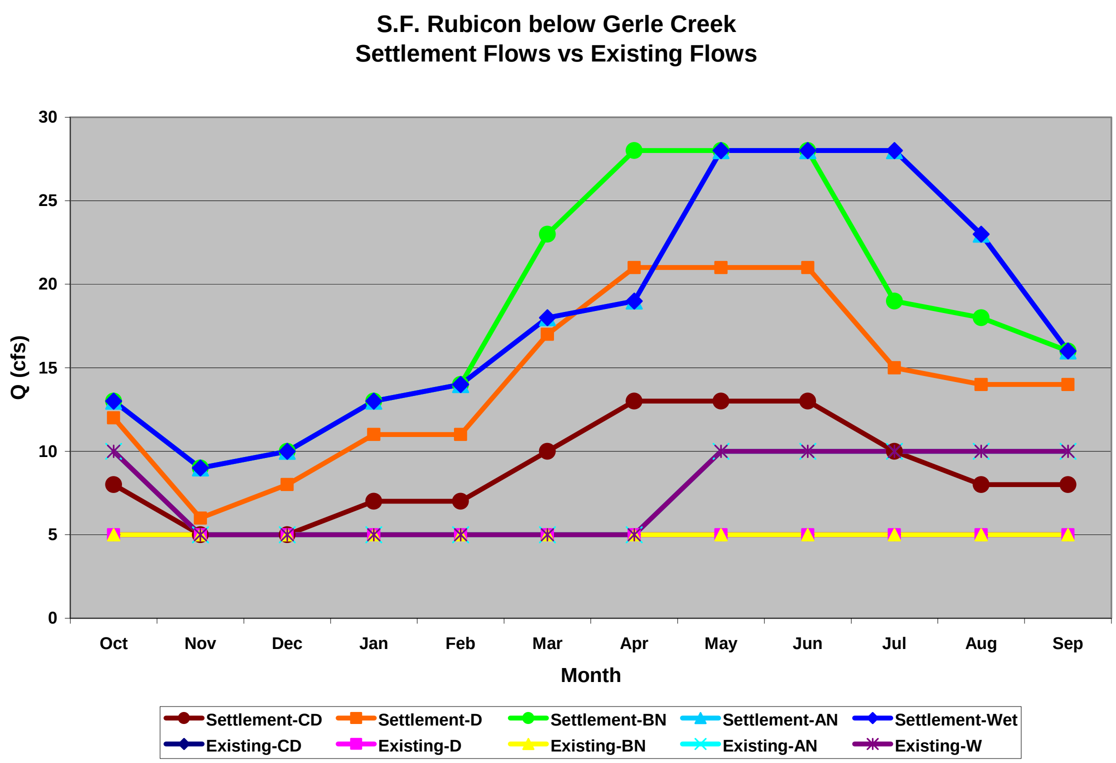
The following charts display examples of the water available for hydroelectric operations in representative Wet and AN water year types, respectively, with implementation of the settlement.



Minimum streamflows proposed for this reach are expected to provide a substantially improved angling opportunity downstream of the confluence with Gerle Creek. Below this confluence, South Fork Rubicon River drops into a canyon with extensive pool and fall habitat, which provides an excellent day-long excursion for the serious stream angler (Devine Tarbell & Associates and Louis Berger Group 2004f). PHABSIM results (Devine Tarbell & Associates and Stillwater Sciences 2004d), plus the presence of some larger fish as anecdotally reported, suggest that a relatively modest water investment will result in substantial angling improvements in this reach.

The following chart displays a comparison of the settlement and existing license flows for each water year type for the South Fork Rubicon River below Robbs Peak Reservoir Dam.



The following table depicts the recommended minimum streamflows.

| South Fork Rubicon River Below Robbs Peak Reservoir Dam | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | **Month** | | **Minimum Streamflow by Water Year (cfs)** | | | | |
| | | | CD | DRY | BN | AN | WET |
| | **OCT** | | 3 | 3 | 3 | 3 | 3 |
| | **NOV** | | 1 | 2 | 3 | 3 | 3 |
| | **DEC** | | 1 | 3 | 4 | 4 | 4 |
| | **JAN** | | 2 | 5 | 7 | 7 | 7 |
| | **FEB** | | 2 | 5 | 8 | 8 | 8 |
| | **MAR** | | 3 | 7 | 11 | 9 | 9 |
| | **APR** | | 4 | 9 | 13 | 10 | 10 |
| | **MAY** | | 4 | 9 | 13 | 13 | 13 |
| | **JUNE** | | 4 | 9 | 13 | 13 | 13 |
| | **JULY** | | 3 | 5 | 6 | 13 | 13 |
| | **AUG** | | 3 | 5 | 6 | 11 | 11 |
| | **SEPT** | | 3 | 5 | 6 | 6 | 6 |

***South Fork Silver Creek Below Ice House Reservoir Dam***

The focus in South Fork Silver Creek below Ice House Reservoir Dam was on managing for native aquatic species, including rainbow trout. Refer to the fish community metrics discussion above, under Resource Objectives, for discussion of fisheries objectives. This reach also has foothill yellow-legged frog (FYLF) habitat (Devine Tarbell & Associates and Stillwater Sciences 2005a), a FS sensitive species, and one of the objectives is not to preclude FYLF breeding should they eventually colonize this stream reach. Elevations below 5,000 feet are suitable habitat for FYLF (Devine Tarbell & Associates and Stillwater Sciences 2005a). The lower half of the South Fork Silver Creek reach is below 5,000 feet in elevation.

The density and biomass numbers for rainbow trout in this reach are well below objectives (Devine Tarbell & Associates and Stillwater Sciences 2005j), although the overall fish population numbers when brown trout are included are near or at the objectives. The high biomass numbers reported for site IHD F1 Upper in 2002 are driven solely by a single brown trout (1633 grams) (Devine Tarbell & Associates and Stillwater Sciences 2005j). The management indicator species for this reach is rainbow trout. The brown trout population numbers are indicative of an altered hydrograph with higher fall flows and cooler temperatures than would be found under unimpaired conditions. Therefore, the objective is to have the fisheries component move toward the native management species for this reach via the mechanism of flow management and manipulation. The proposed flow regime will simulate the snowmelt period in the spring and provide quality habitat coinciding with the life history timing of the native fish and amphibians.

The May minimum streamflow in a BN water year (beginning of rainbow trout spawning) was set at 68 cfs, which is 100 percent WUA for rainbow trout adults and 68 percent for rainbow trout spawning based on WUA for the upper study site, which was used because the amount of spawning gravels on the South Fork Silver Creek reach was limited, given the length of this reach (approximately 5,000 square feet for 12.3 miles) (SMUD 2006). However, a large gravel bar that extends across the entire stream adjacent to Silver Creek Campground provides significant spawning opportunities in the upper portion of the reach (SMUD 2006). It is for this reason that the settlement focused on WUA curves for the upper PHABSIM location. A composite analysis of the two study sites was completed (CDFG 2006a) to cross-check the WUA based on both sites, and the percent WUA for this analysis was 97 percent for rainbow trout adult, 89 percent for rainbow trout juveniles, and 70 percent for rainbow trout spawning. Most spawning in this stream reach is limited to pocket gravels and pool-tail crests where appropriate sized gravels are deposited. By maximizing the adult habitat and additional habitat where spawning will occur, both goals are being met (Moyle and Baltz 1985, Moyle and Vondracek 1985).

In June, 46 cfs was set as the minimum streamflow to mimic stepping down the hydrograph (Devine Tarbell & Associates and Hannaford 2005a) and to begin increasing temperatures to assist in initiating FYLF breeding. Based on temperature modeling completed that showed the temperature at node SFSC1 would be greater than 12ºC (Devine Tarbell & Associates 2005e), a flow of 46 cfs is expected to provide temperatures below 20ºC in at least the lower part of the reach. A minimum streamflow of 46 cfs also addresses rainbow trout spawning, juveniles, and adults by providing 94 percent of the WUA for rainbow trout adults, 100 percent of the WUA for rainbow trout juveniles, and 86 percent of the WUA for rainbow trout spawning (Devine Tarbell & Associates and Stillwater Sciences 2004d). Based on the composite analysis of both study sites, the streamflow provides 99 percent of the WUA for rainbow trout adults, 97 percent of the WUA for rainbow trout juveniles, and 84 percent of the WUA for rainbow trout spawning (CDFG 2006a).

For the month of July, a flow of 30 cfs continues the decline of the hydrograph and the reduction in temperature that are cues for FYLF breeding. Water temperature modeling was considered when designing the minimum streamflows, and efforts were made to improve thermal conditions for support of rainbow trout and other cold freshwater species (Trout Unlimited 1997) in the lower one-third of the stream reach. Based on temperature modeling in the Water Temperature Technical Report (Devine Tarbell & Associates 2005e), predicted mean daily temperatures at or below 20°C are expected with a constant release of 30 cfs. In addition, a flow of 30 cfs provides 85 percent of the WUA for rainbow trout adults, 98 percent of the WUA for rainbow trout juveniles, and 90 percent of the WUA for rainbow trout spawning (Devine Tarbell & Associates and Stillwater Sciences 2004d). Based on the composite analysis of both transect sites, a flow of 30 cfs provides 85 percent of the WUA for rainbow trout adults, 98 percent of the WUA for rainbow trout juveniles, and 90 percent of the WUA for rainbow trout spawning (CDFG 2006a).

For August through October, based on temperature modeling in the Water Temperature Technical Report (Devine Tarbell & Associates 2005e), predicted mean daily temperatures of 20°C during August and September are expected with a constant release of 15 cfs. Water temperature modeling was considered when designing the minimum streamflows, and efforts where made to improve thermal conditions for support of rainbow trout and other cold freshwater species in the lower one-third of the stream reach. In addition, a flow of 15 cfs provides 65 percent of the WUA for rainbow trout adults, 87 percent of the WUA for rainbow trout juveniles, and 87 percent of the WUA for rainbow trout spawning (Devine Tarbell & Associates 2004d). Based on the composite analysis of both transect sites (CDFG 2006a), a flow of 15 cfs provides 65 percent of the WUA for rainbow trout adults, 87 percent of the WUA for rainbow trout juveniles, and 88 percent of the WUA for rainbow trout spawning.

For November through April, the shape of the natural hydrograph was used to set the minimum streamflows. These flows were cross-checked with PHABSIM numbers as follows: for November, a flow of 8 cfs provides 42 percent of the WUA for rainbow trout adults, 42 percent of the WUA for rainbow trout juveniles, and 70 percent of the WUA for rainbow trout spawning (Devine Tarbell & Associates and Stillwater Sciences 2004d). Based on the composite analysis of both study sites (CDFG 2006a), a flow of 8 cfs provides 40 percent of the WUA for rainbow trout adults, 70 percent of the WUA for rainbow trout juveniles, and 70 percent of the WUA for rainbow trout spawning.

For December, a flow of 11 cfs provides 51 percent of the WUA for rainbow trout adults and 80 percent of the WUA for rainbow trout juveniles (Devine Tarbell & Associates and Stillwater Sciences 2004d). Based on the composite analysis of both study sites (CDFG 2006a), a flow of 11 cfs provides 51 percent of the WUA for rainbow trout adults and 80 percent of the WUA for rainbow trout juveniles.

For January and February, a flow of 18 cfs provides 71 percent of the WUA for rainbow trout adults and 91 percent of the WUA for rainbow trout juveniles (Devine Tarbell & Associates and Stillwater Sciences 2004d). Based on the composite analysis of both study sites (CDFG 2006a), a flow of 18 cfs provides 74 percent of the WUA for rainbow trout adults and 92 percent of the WUA for rainbow trout juveniles.

For March, a flow of 24 cfs provides 81 percent of the WUA for rainbow trout adults and 98 percent of the WUA for rainbow trout juveniles (Devine Tarbell & Associates and Stillwater Sciences 2004d). Based on the composite analysis for both study sites (CDFG 2006a), a flow of 24 cfs provides 87 percent of the WUA for rainbow trout adults and 98 percent of the WUA for rainbow trout juveniles.

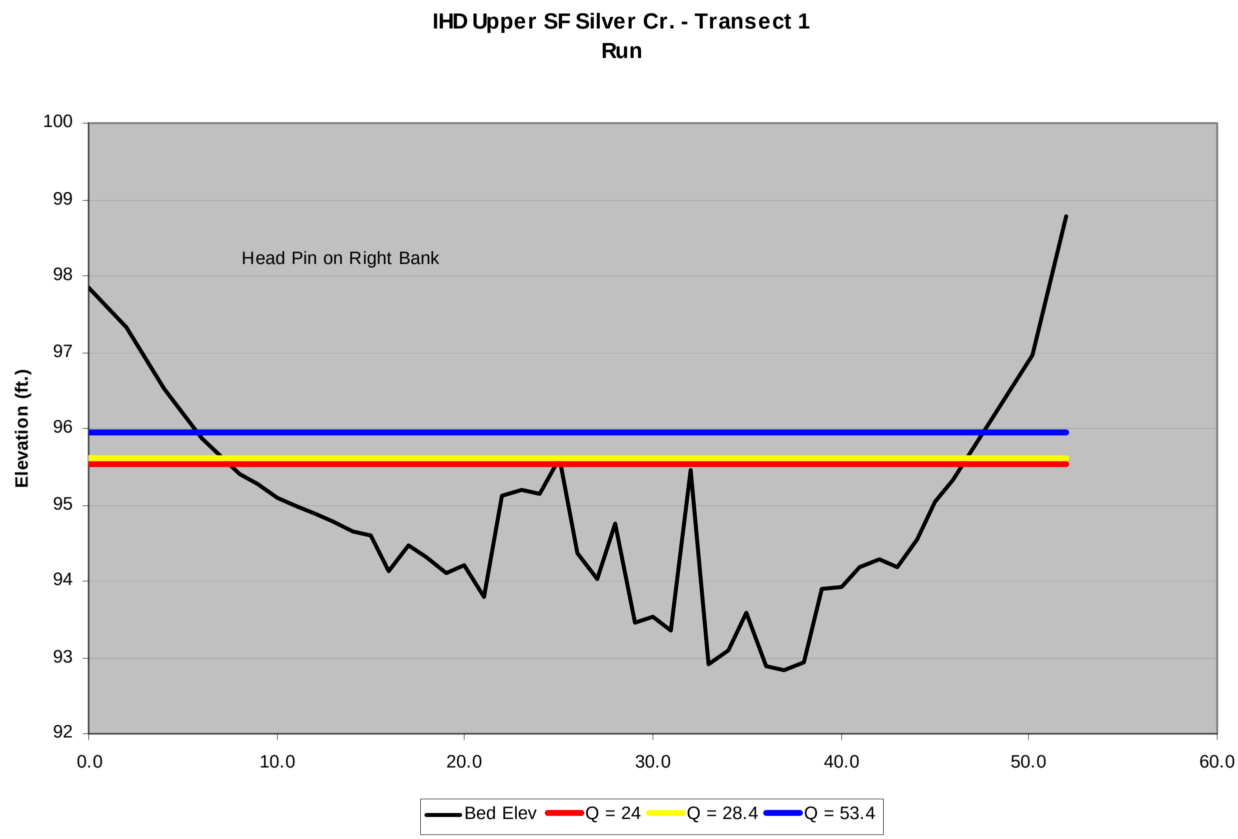
For April, a flow of 41 cfs provides 90 percent of the WUA for rainbow trout adults, 100 percent of the WUA for rainbow trout juveniles, and 80 percent of the WUA for rainbow trout spawning (Devine Tarbell & Associates and Stillwater Sciences 2004d). Based on the compositie analysis for both study sites (CDFG 2006a), a flow of 41 cfs provides 100 percent of the WUA for rainbow trout adults, 100 percent of the WUA for rainbow trout juveniles, and 88 percent of the WUA for rainbow trout spawning.

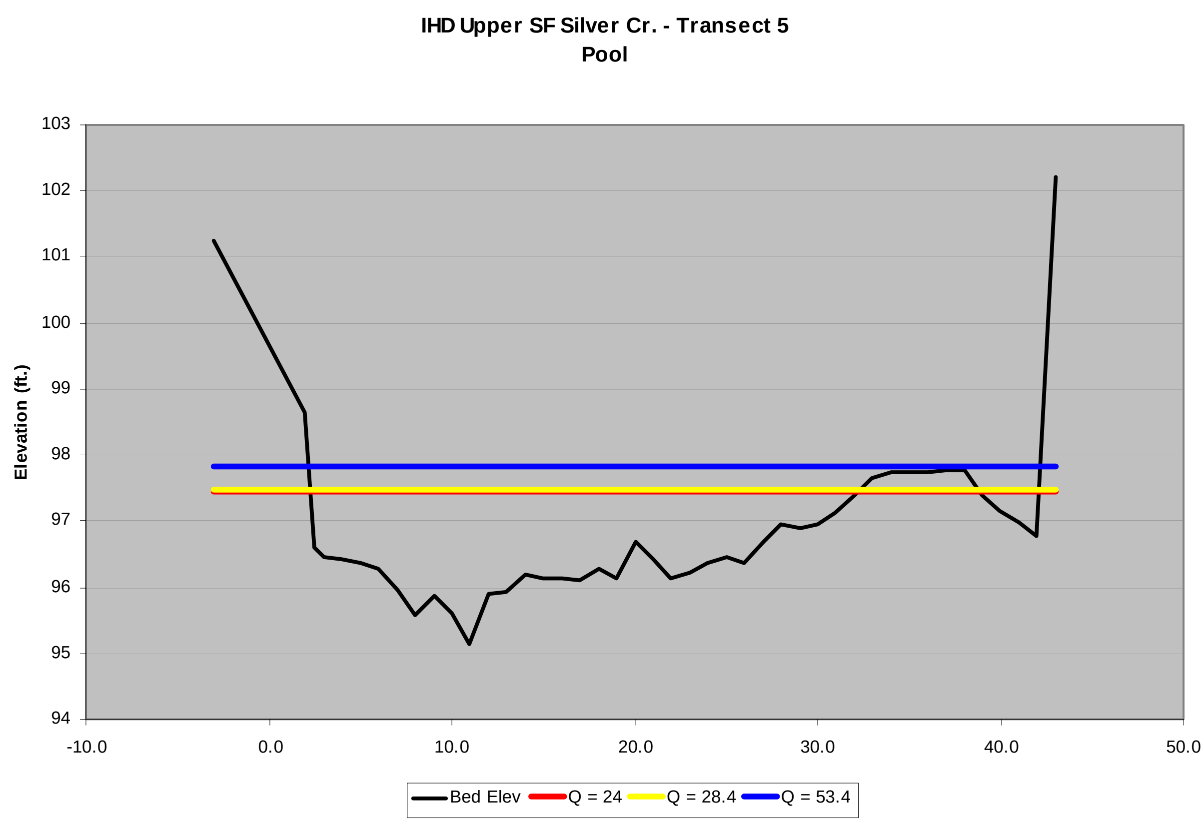
The chart below displays the percent WUA for all water year types for rainbow trout for South Fork Silver Creek below Ice House Reservoir Dam (Devine Tarbell & Associates and Stillwater Sciences 2004d).

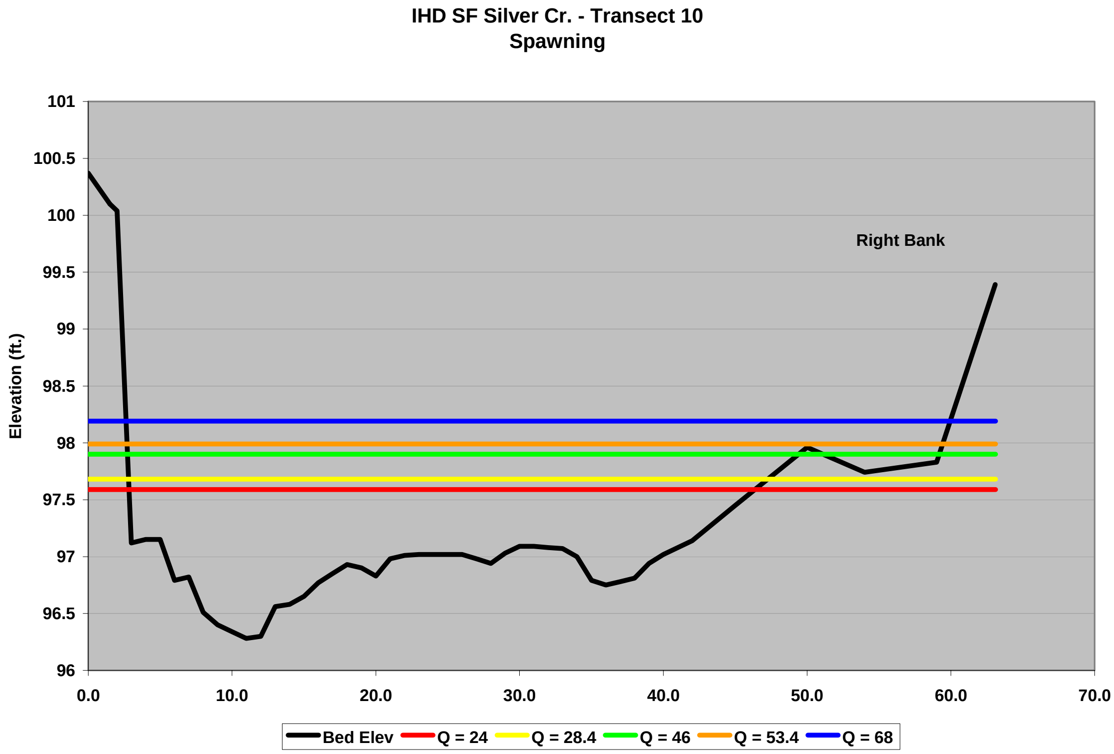
| **Month** | **Water Year Type** | **Flow Range** | **Percent WUA** | **Benefitting Life stage** |
|---|---|---|---|---|
| October | CD | 5 | 44/73 | Adult/juvenile rainbow trout |
| | Dry | 10 | 48/76 | Adult/juvenile rainbow trout |
| | BN | 15 | 65/88 | Adult/juvenile rainbow trout |
| | AN | 15 | 65/88 | Adult/juvenile rainbow trout |
| | Wet | 15 | 65/88 | Adult/juvenile rainbow trout |
| Nov -Dec | CD | 5 | Below 44 | Adult rainbow trout |
| | Dry | 7-8 | Below 44 | Adult rainbow trout |
| | BN | 8-11 | Below 44 to 53 | Adult rainbow trout |
| | AN | 8-11 | Below 44 to 53 | Adult rainbow trout |
| | Wet | 8-11 | Below 44 to 53 | Adult rainbow trout |
| Jan-Feb | CD | 6 | Below 44 to 53 | Adult rainbow trout |
| | Dry | 12 | 57 | Adult rainbow trout |
| | BN | 18 | 74 | Adult rainbow trout |
| | AN | 18 | 74 | Adult rainbow trout |
| | Wet | 18 | 74 | Adult rainbow trout |
| March | CD | 8 | Below 44 | Adult rainbow trout |
| | Dry | 16 | 68 | Adult rainbow trout |
| | BN | 24 | 87 | Adult rainbow trout |
| | AN | 24 | 87 | Adult rainbow trout |
| | Wet | 24 | 87 | Adult rainbow trout |
| April | CD | 15 | 65 | Adult rainbow trout |
| | Dry | 28 | 93 | Adult rainbow trout |
| | BN | 41 | 100 | Adult rainbow trout |
| | AN | 41 | 100 | Adult rainbow trout |
| | Wet | 41 | 100 | Adult rainbow trout |
| May | CD | 30 | 95/97 | Adult/spawning rainbow trout |
| | Dry | 46 | 99/84 | Adult/spawning rainbow trout |
| | BN | 68 | 96/71 | Adult/spawning rainbow trout |
| | AN | 68 | 96/71 | Adult/spawning rainbow trout |
| | Wet | 68 | 96/71 | Adult/spawning/juvenile rainbow trout |
| June | CD | 25 | 89/100/99 | Adult/spawning/juvenile rainbow trout |
| | Dry | 31 | 97/96/100 | Adult/spawning/juvenile rainbow trout |
| | BN | 46 | 99/84/97 | Adult/spawning/juvenile rainbow trout |
| | AN | 46 | 99/84/97 | Adult/spawning/juvenile rainbow trout |

| Month | Water Year Type | Flow Range | Percent WUA | Benefitting Life stage |
|---|---|---|---|---|
| | Wet | 46 | 99/84/97 | Adult/spawning/juvenile rainbow trout |
| July | CD | 21 | 81/99/96 | Adult/spawning/juvenile rainbow trout |
| | Dry | 21 | 81/99/96 | Adult/spawning/juvenile rainbow trout |
| | BN | 30 | 95/97/100 | Adult/spawning/juvenile rainbow trout |
| | AN | 30 | 95/97/100 | Adult/spawning/juvenile rainbow trout |
| | Wet | 30 | 95/97/100 | Adult/spawning/juvenile rainbow trout |
| Aug-Sept | CD | 10-14 | 48/76 to 63/86 | Adult/juvenile rainbow trout |
| | Dry | 10-14 | 48/76 to 63/86 | Adult/juvenile rainbow trout |
| | BN | 15 | 65/88 | Adult/juvenile rainbow trout |
| | AN | 15 | 65/88 | Adult/juvenile rainbow trout |
| | Wet | 15 | 65/88 | Adult/juvenile rainbow trout |

Additionally, the recommended minimum streamflows were referenced against the PHABSIM transects (Devine Tarbell & Associates and Stillwater Sciences 2004d) to ensure that inundation of the primary flood terraces and bank margins would occur to benefit riparian vegetation during the spring by promoting initial scouring, sediment and nutrient deposition, and seed dispersal as shown in the following cross-section plots.  It is expected that riparian vegetation would be enhanced by returning to some semblance of a natural hydrograph (Castelli et al. 2000).


IHD Upper SF Silver Cr. - Transect 1
Run
Head Pin on Right Bank
Elevation (ft.)
100
99
98
97
96
95
94
93
92
0.0
10.0
20.0
30.0
40.0
50.0
60.0
Bed Elev
Q = 24
Q = 28.4
Q = 53.4


IHD Upper SF Silver Cr. - Transect 5
Pool
Elevation (ft.)
103
102
101
100
99
98
97
96
95
94
-10.0
0.0
10.0
20.0
30.0
40.0
50.0
Bed Elev
Q = 24
Q = 28.4
Q = 53.4




Based upon the information shown on the preceding transect, the reduction in flows during the rainbow trout spawning period (April through June) continues to inundate the additional spawning habitat that is available in this reach as a result of the minimum streamflows. Therefore the monthly reduction in flows (May and June) is not expected to cause dessication of redds (IHD SF Silver Cr. – Transect 10 (Spawning) and Photo Transect 10 below).

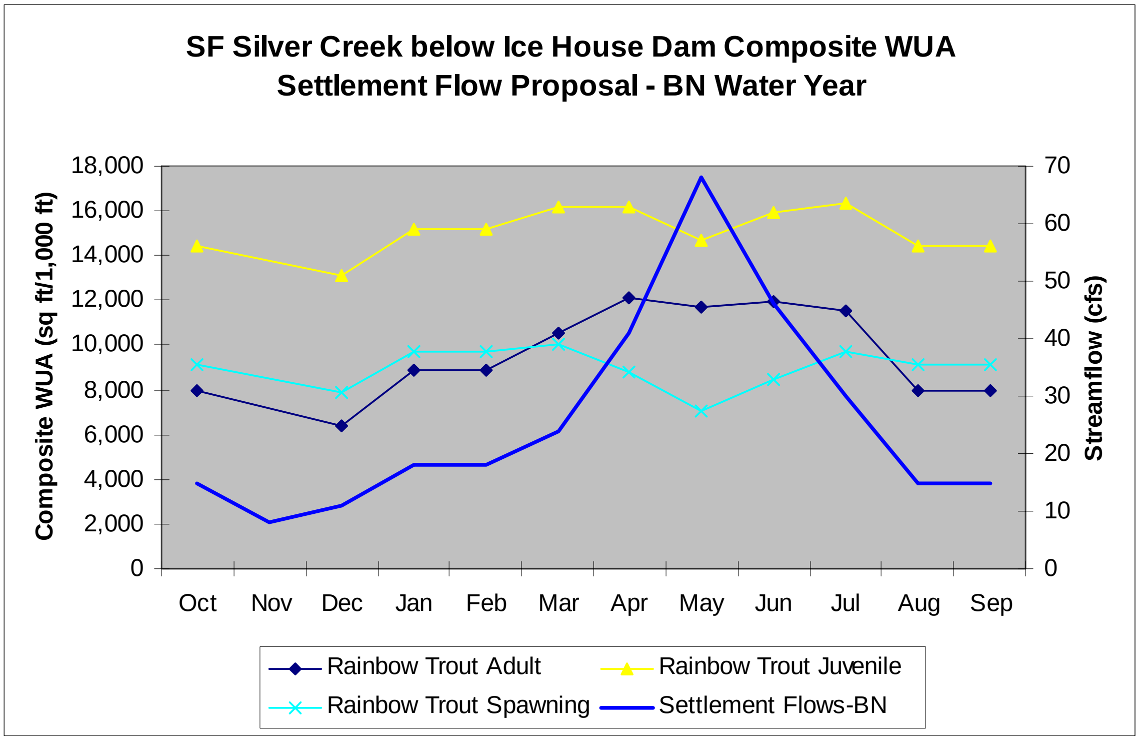
SMUD UARP– Instream Flow Field Survey Upper Silver Creek, Ice House Dam Reach

131_IMG

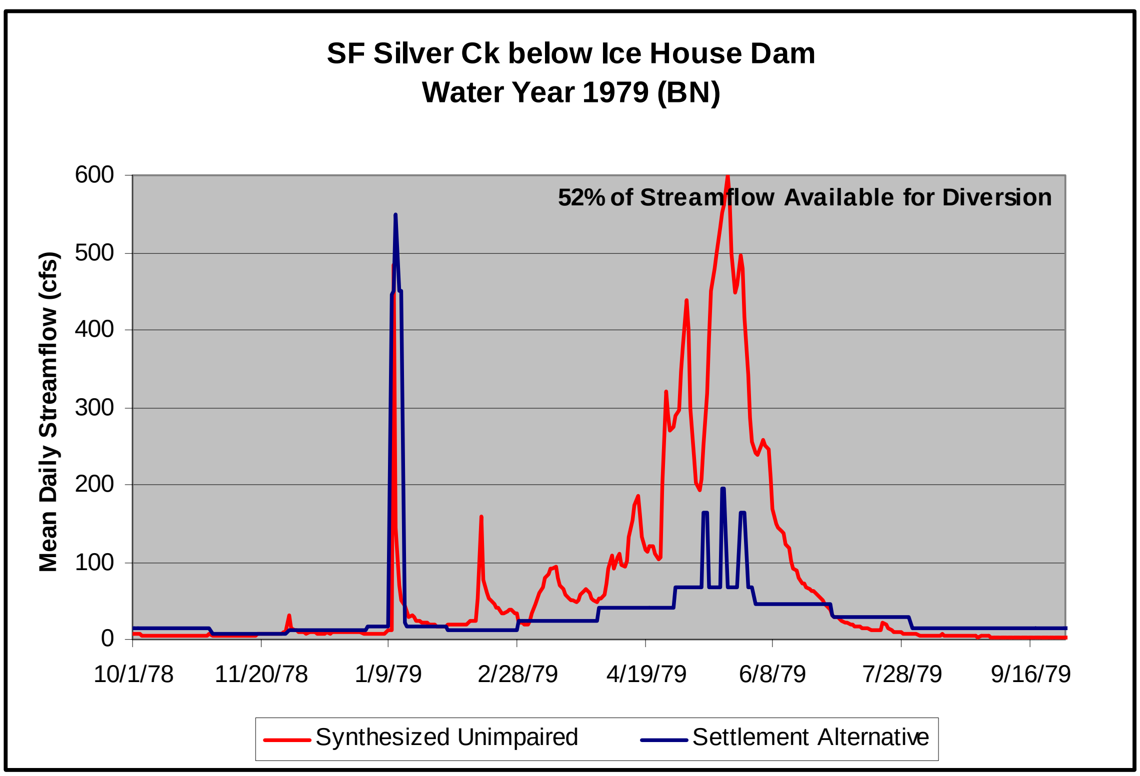
May-July 2003

LOW FLOW Transect 10: looking upstream at RB

The following charts compare the percent WUA from the settlement and existing license flows for rainbow trout and brown trout in a BN water year type, based on the composite analysis (CDFG 2006a).

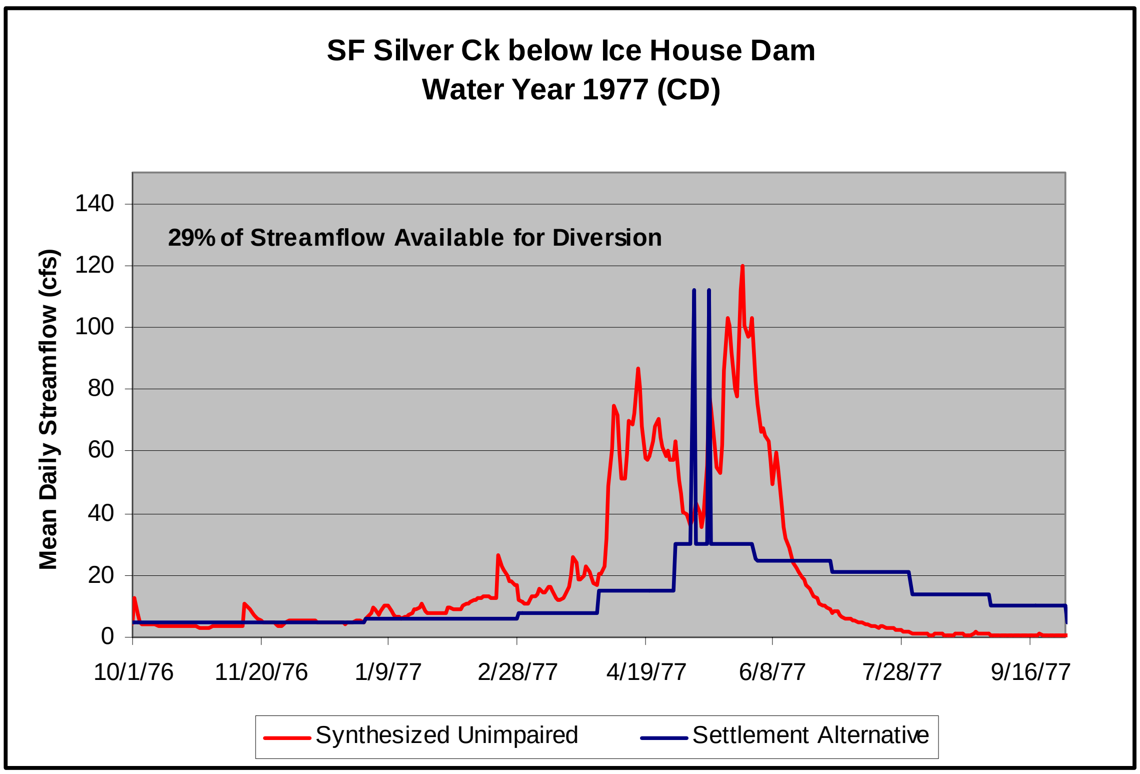



The following chart displays an example of the water available for hydroelectric operations in a representative BN water year type with implementation of the settlement.



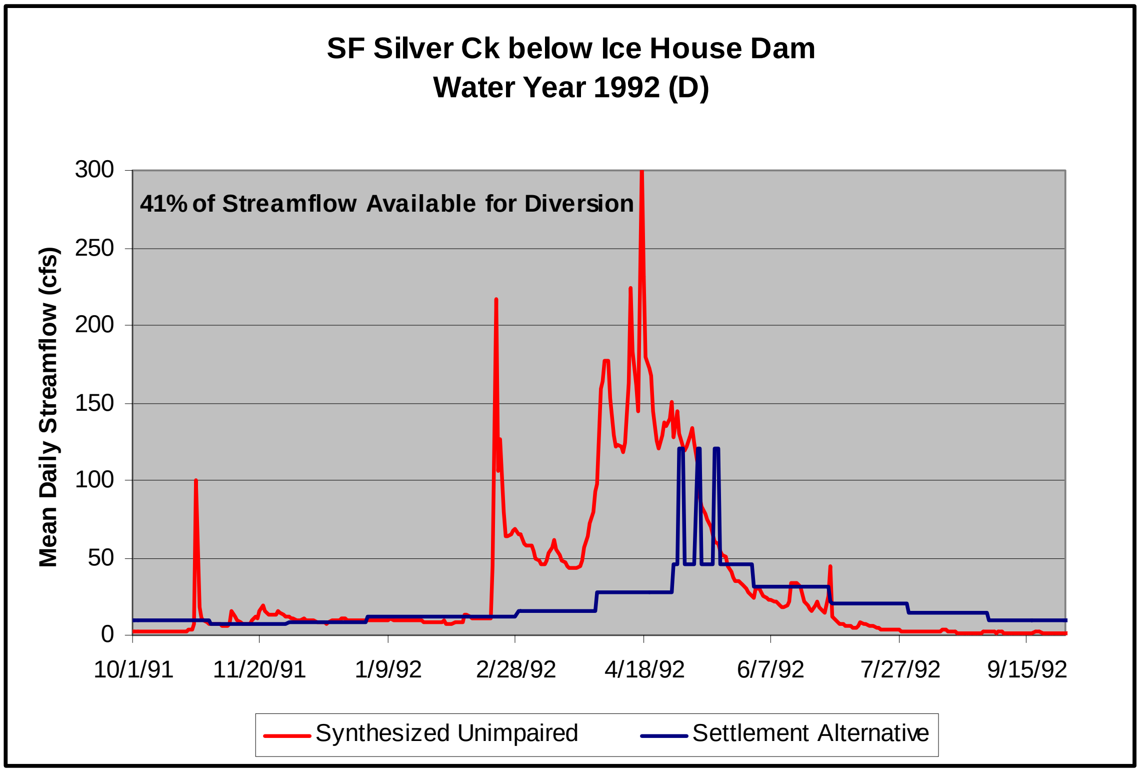
For CD water years, 80 percent WUA for rainbow trout was provided during the spawning period at the upper study site (Devine Tarbell & Associates and Stillwater Sciences 2004d), which is 97 percent WUA based on the composite analysis (CDFG 2006a). The remainder of the streamflows for the CD water year were shaped as closely as possible to an unimpaired hydrograph, taking into consideration temperature modeling in the Water Temperature Technical Report (Devine Tarbell & Associates 2005e) during the months of July through December. Water temperature modeling was considered when designing the minimum streamflows, and efforts where made to improve thermal conditions for support of rainbow trout and other cold freshwater species in the lower one-third of the stream reach during important months.

The following chart displays an example of the water available for hydroelectric operations in representative CD water year type with implementation of the settlement.




Minimum streamflows in Dry water years were developed by interpolating between the CD and BN water year minimum streamflows. Dry water year minimum streamflows were cross-checked with PHABSIM results for rainbow trout to ensure adequate WUA was provided at appropriate times of the year. An examination of the PHABSIM cross sections indicates inundation of the upper bank margin will not occur to the same degree as BN water year flows; however, it is assumed that the similar processes referenced above will still occur to a lesser degree.

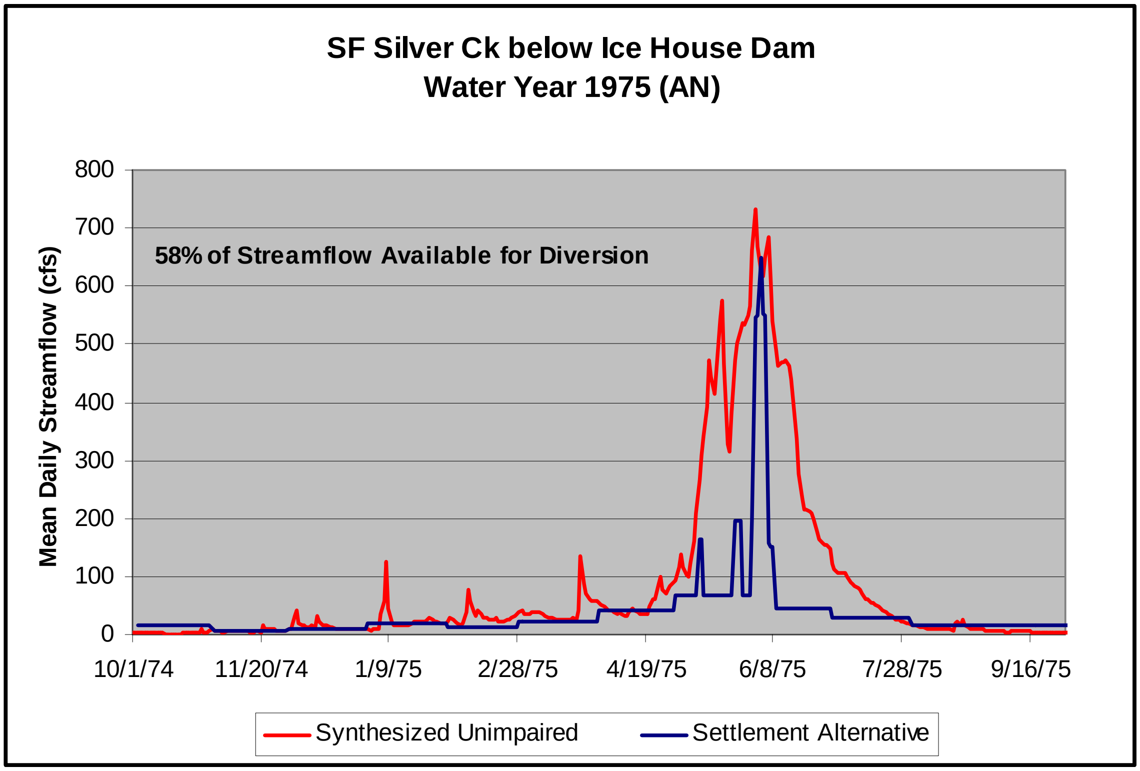
The following chart displays an example of the water available for hydroelectric operations in a representative Dry water year type with implementation of the settlement.

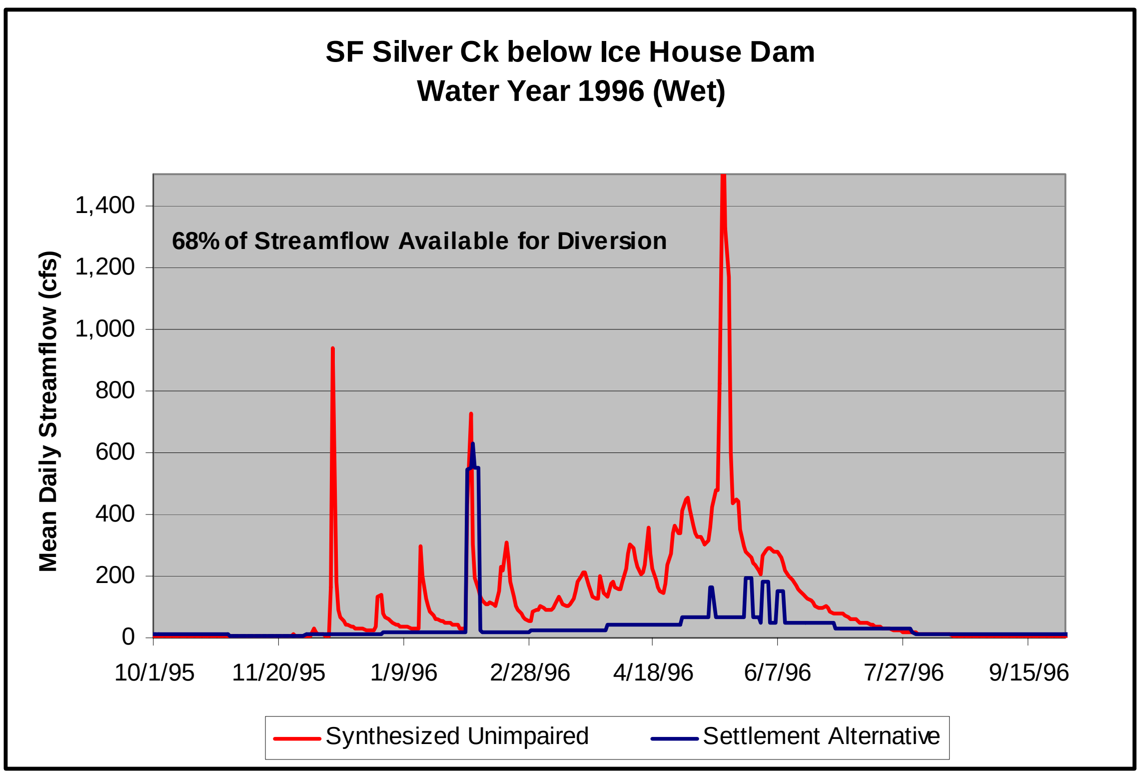



To balance recreational needs (both reservoir levels and recreational streamflows) and hydroelectric generation interests with ecological needs, minimum streamflows were not increased in AN and Wet water years but were kept the same as the minimum streamflows in BN water years. Ice House Reservoir has the smallest contributing watershed area of the UARP storage reservoirs (Devine Tarbell & Associates and Hannaford 2005a), but it is extremely scenic and popular with recreationists, and reservoir levels were an important priority (see Reservoir Levels rationale). This reach is one that was identified as suitable and desirable for whitewater boating (see Recreational Streamflows rationale).

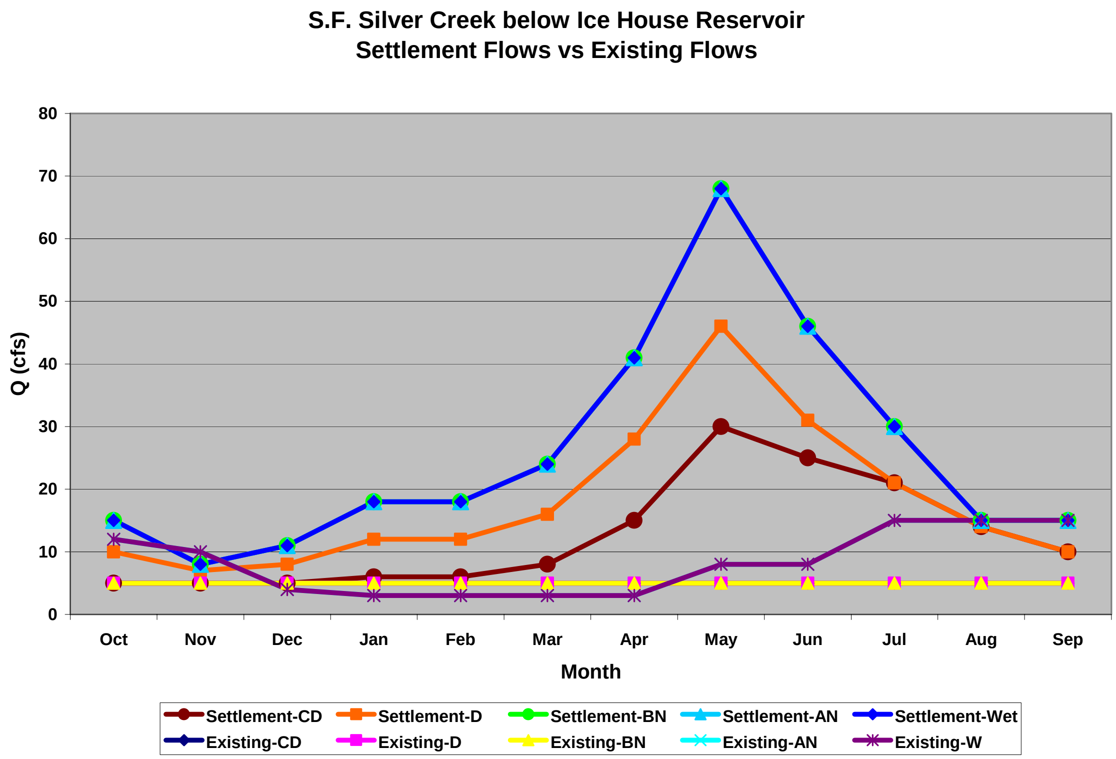
Negative ecological effects and angler effects from recreational streamflows were avoided by providing recreational streamflows within the period when higher flows would have occurred in the unimpaired hydrograph. Recreational streamflows in May occur when the water is very cold for angling and access is often difficult on foot based on a review of a USGS topographic map of South Fork Silver Creek. In June, both recreational and angling streamflows occur, with the recreational streamflows occurring on weekends. In July, there are no recreational streamflows, and flows of 21 cfs in Dry years and 30 cfs in BN through Wet water years provide improved angling opportunities over the existing streamflow regime (Devine Tarbell & Associates and Stillwater Sciences 2004d).

The following charts display examples of the water available for hydroelectric operations in representative AN and Wet water year types, respectively, with implementation of the settlement.



The following chart displays a comparison of the settlement flows and existing license flows for each water year type for the South Fork Silver Creek below Ice House Reservoir Dam.




The following table depicts the recommended minimum streamflows.

| South Fork Silver Creek Below Ice House Reservoir Dam | | | | | |
|---|---|---|---|---|---|
| **Month** | **Minimum Streamflow by Water Year (cfs)** | | | | |
| | CD | DRY | BN | AN | WET |
| **OCT** | 5 | 10 | 15 | 15 | 15 |
| **NOV** | 5 | 7 | 8 | 8 | 8 |
| **DEC** | 5 | 8 | 11 | 11 | 11 |
| **JAN** | 6 | 12 | 18 | 18 | 18 |
| **FEB** | 6 | 12 | 18 | 18 | 18 |
| **MAR** | 8 | 16 | 24 | 24 | 24 |
| **APR** | 15 | 28 | 41 | 41 | 41 |
| **MAY** | 30 | 46 | 68 | 68 | 68 |
| **JUNE** | 25 | 31 | 46 | 46 | 46 |
| **JULY** | 21 | 21 | 30 | 30 | 30 |
| **AUG** | 14 | 14 | 15 | 15 | 15 |
| **SEPT** | 10 | 10 | 15 | 15 | 15 |

***Silver Creek Below Junction Reservoir Dam***

A primary objective in Silver Creek below Junction Reservoir Dam is to provide habitat for healthy foothill yellow-legged frog populations. Other objectives are to provide temperatures that allow for management of native fish and address FYLF breeding, to establish some similarity to the natural hydrograph to restore ecological processes altered by the Project, and to maintain streamflow releases required in South Fork Silver Creek below Ice House Reservoir Dam below Junction Reservoir Dam. Refer to the fish community metrics discussion above, under Resource Objectives, for discussion of fisheries objectives. A targeted objective in Silver Creek below Junction Reservoir Dam is to reduce the presence of an unknown algae species that has proliferated throughout the reach.

The existing biomass for rainbow trout for this reach is 7.5 pounds per surface acre. This is well below a biomass objective of 24 pounds per surface acre. The proposed flow regime is designed to increase instream habitat to improve the biomass and move it closer to the objective.

The May minimum streamflow was established to assist in initiating FYLF breeding should the species colonize this reach by following the shape of a natural hydrograph in the important spring months. The descending limb of the natural hydrograph as well as reduction in temperature are cues for FYLF breeding. There are FYLF populations in the surrounding watershed and this reach has the highest potential for future colonization. The May minimum streamflow in a BN water year (beginning of rainbow trout spawning) was set at 68 cfs, which is 98 percent WUA for rainbow trout adults. A flow of 68 cfs also maintains the streamflow releases from South Fork Silver Creek below Ice House Reservoir Dam. This minimum streamflow was also established to (1) reset the hydrograph and eliminate the stagnant conditions that are resulting in the presence of algae, (2) improve spawning habitat by flushing fine sediments and revitalizing gravel beds with the importation of nutrients (Poff et al. 1997) (3), and maintain or increase the minimum streamflows that enter Junction Reservoir from the South Fork Silver Creek, since the South Fork Silver Creek watershed area is 27.3 square miles, and the Silver Creek watershed area increases to 142.6 square miles.

In June, 50 cfs was set as the minimum streamflow to mimic stepping down the hydrograph (Devine Tarbell & Associates and Hannaford 2005a) and to begin increasing temperatures to assist in initiating FYLF breeding. A minimum streamflow of 50 cfs also addresses rainbow trout spawning, juveniles, and adults by providing 100 percent of the WUA for rainbow trout adults, 84 percent of the WUA for rainbow trout juveniles, and 79 percent of the WUA for rainbow trout spawning (Devine Tarbell & Associates and Stillwater Sciences 2004d). This flow also slightly increases the streamflow releases from South Fork Silver Creek below Ice House Reservoir Dam and is expected to help eliminate the stagnant conditions that are resulting in the presence of algae and improve spawning habitat by flushing fine sediments and revitalizing gravel beds with the importation of nutrients (Poff et al. 1997).

For the month of July, a flow of 30 cfs continues the decline of the hydrograph and the reduction in temperature that are cues for FYLF breeding. Water temperatures were considered when designing the minimum streamflows, and efforts were made to improve thermal conditions for support of rainbow trout and other cold freshwater species (Trout Unlimited 1997). This streamflow maintains the minimum streamflow releases that enter Junction Reservoir from South Fork Silver Creek. A flow of 30 cfs provides 94 percent of the WUA for rainbow trout adults, 91 percent of the WUA for rainbow trout juveniles, and 100 percent of the WUA for rainbow trout spawning (Devine Tarbell & Associates and Stillwater Sciences 2004d).

For August through October, a streamflow of 15 cfs maintains the streamflow that enters Junction Reservoir from South Fork Silver Creek. Water temperature was considered when designing the minimum streamflows, and efforts where made to improve thermal conditions for support of rainbow trout and other cold freshwater species (Trout Unlimited 1997). In addition, a flow of 15 cfs provides 71 percent of the WUA for rainbow trout adults, 99 percent of the WUA for rainbow trout juveniles (Devine Tarbell & Associates 2004d).

For November through February, the streamflows maintain or slightly increase the streamflow that enters Junction Reservoir from South Fork Silver Creek. These flows were cross-checked with PHABSIM numbers as follows: for November through February, a flow of 20 cfs provides 83 percent of the WUA for rainbow trout adults (Devine Tarbell & Associates and Stillwater Sciences 2004d).

For March, a flow of 25 cfs provides 90 percent of the WUA for rainbow trout adults (Devine Tarbell & Associates and Stillwater Sciences 2004d).

For April, a flow of 42 cfs provides 100 percent of the WUA for rainbow trout adults, and 90 of the WUA for rainbow trout spawning (Devine Tarbell & Associates and Stillwater Sciences 2004d).

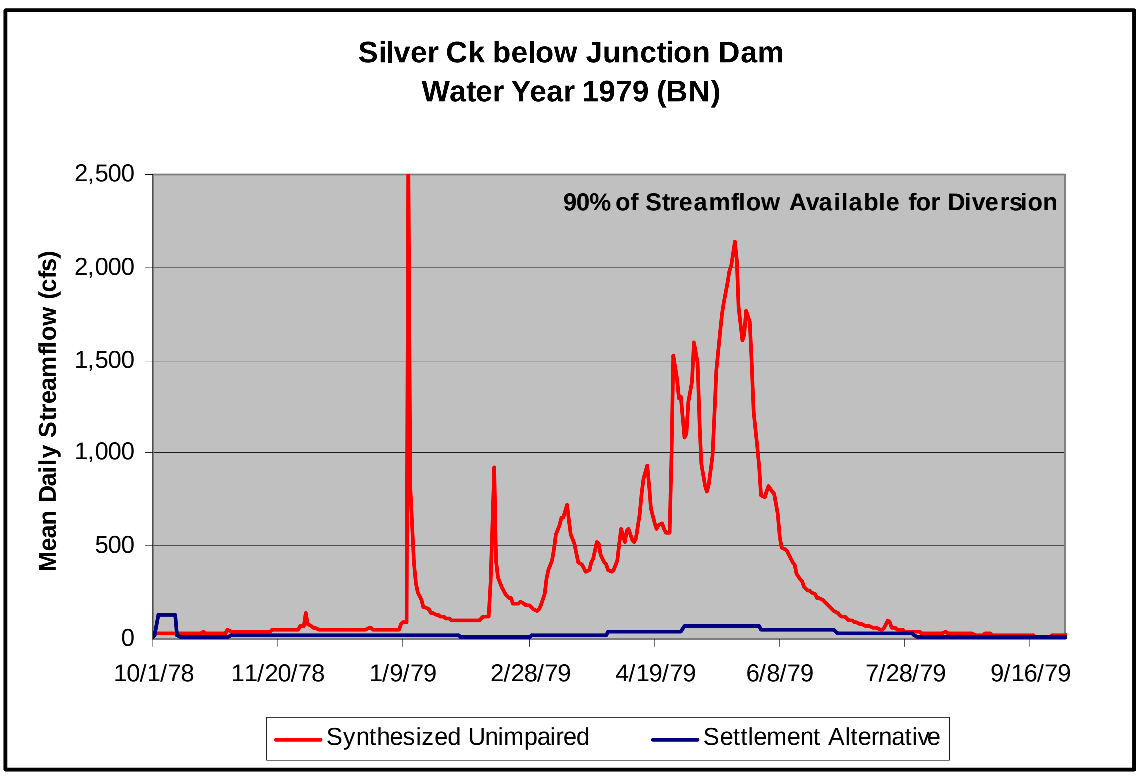
The chart below displays the percent WUA for all water year types for rainbow trout for Silver Creek below Junction Reservoir Dam (Devine Tarbell & Associates and Stillwater Sciences 2004d).

| **Month** | **Water Year Type** | **Flow Range** | **Percent WUA** | **Benefitting Life stage** |
|---|---|---|---|---|
| October | CD | 5 | <36/<86 | Adult/juvenile rainbow trout |
| | Dry | 10 | 54/98 | Adult/juvenile rainbow trout |
| | BN | 15 | 71/99 | Adult/juvenile rainbow trout |
| | AN | 18 | 79/98 | Adult/juvenile rainbow trout |
| | Wet | 20 | 83/96 | Adult/juvenile rainbow trout |
| Nov -Feb | CD | 5 | <36 | Adult rainbow trout |
| | Dry | 7 | 41 | Adult rainbow trout |
| | BN | 20 | 83 | Adult rainbow trout |
| | AN | 24 | 89 | Adult rainbow trout |
| | Wet | 35 | 97 | Adult rainbow trout |
| March | CD | 8 | 46 | Adult rainbow trout |
| | Dry | 16 | 74 | Adult rainbow trout |
| | BN | 25 | 90 | Adult rainbow trout |
| | AN | 29 | 94 | Adult rainbow trout |
| | Wet | 42 | 100 | Adult rainbow trout |
| April | CD | 15 | 71/90 | Adult/spawning rainbow trout |
| | Dry | 28 | 93/100 | Adult/spawning rainbow trout |
| | BN | 42 | 100/90 | Adult/spawning rainbow trout |
| | AN | 49 | 100/80 | Adult/spawning rainbow trout |
| | Wet | 73 | 98/57 | Adult/spawning rainbow trout |
| May | CD | 30 | 95/100 | Adult/spawning rainbow trout |
| | Dry | 46 | 100/85 | Adult/spawning rainbow trout |
| | BN | 68 | 98/61 | Adult/spawning rainbow trout |
| | AN | 80 | 97/54 | Adult/spawning rainbow trout |
| | Wet | 100 | 93/48 | Adult/spawning rainbow trout |
| June | CD | 25 | 90/99/94 | Adult/spawning/juvenile rainbow trout |
| | Dry | 31 | 95/99/91 | Adult/spawning/juvenile rainbow trout |
| | BN | 50 | 100/79/84 | Adult/spawning/juvenile rainbow trout |
| | AN | 59 | 100/68/81 | Adult/spawning/juvenile rainbow trout |
| | Wet | 87 | 95/51/79 | Adult/spawning/juvenile rainbow trout |
| July | CD | 21 | 85/97/96 | Adult/spawning/juvenile rainbow trout |
| | Dry | 21 | 85/97/96 | Adult/spawning/juvenile rainbow trout |
| | BN | 30 | 94/100/91 | Adult/spawning/juvenile rainbow trout |
| | AN | 35 | 97/96/89 | Adult/spawning/juvenile rainbow trout |

| Month | Water Year Type | Flow Range | Percent WUA | Benefitting Life stage |
|---|---|---|---|---|
| | Wet | 52 | 100/76/83 | Adult/spawning/juvenile rainbow trout |
| Aug-Sept | CD | 14 | 68/98-100 | Adult/juvenile rainbow trout |
| | Dry | 14 | 68/98-100 | Adult/juvenile rainbow trout |
| | BN | 15 | 71/99 | Adult/juvenile rainbow trout |
| | AN | 18 | 79/98 | Adult/juvenile rainbow trout |
| | Wet | 26 | 91/94 | Adult/juvenile rainbow trout |

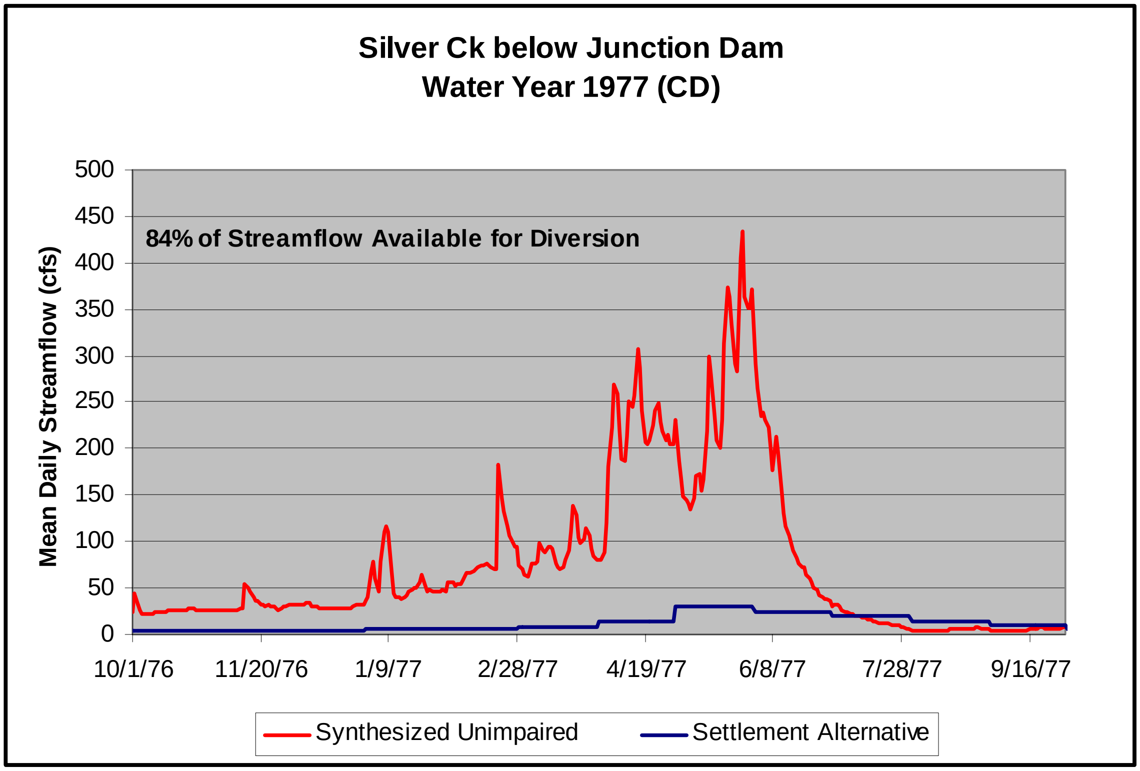
Providing adequate WUA for adult habitat should also provide habitat for spawning (Moyle and Baltz 1985, Moyle and Vondracek 1985) Summer flows are expected to maintain suitable water temperatures for the cold-water fisheries throughout the reach, and also allow warmer water temperatures to develop in the edgewater habitat of the lower half of the reach. In the event this is not the case, the settlement includes a block of water that may be released for water temperature in Wet water year types should the resource agencies determine it is necessary.  The warmer water temperatures (approximately 20 to 22°C) are deemed suitable for FYLFs (Kupferberg 2006).

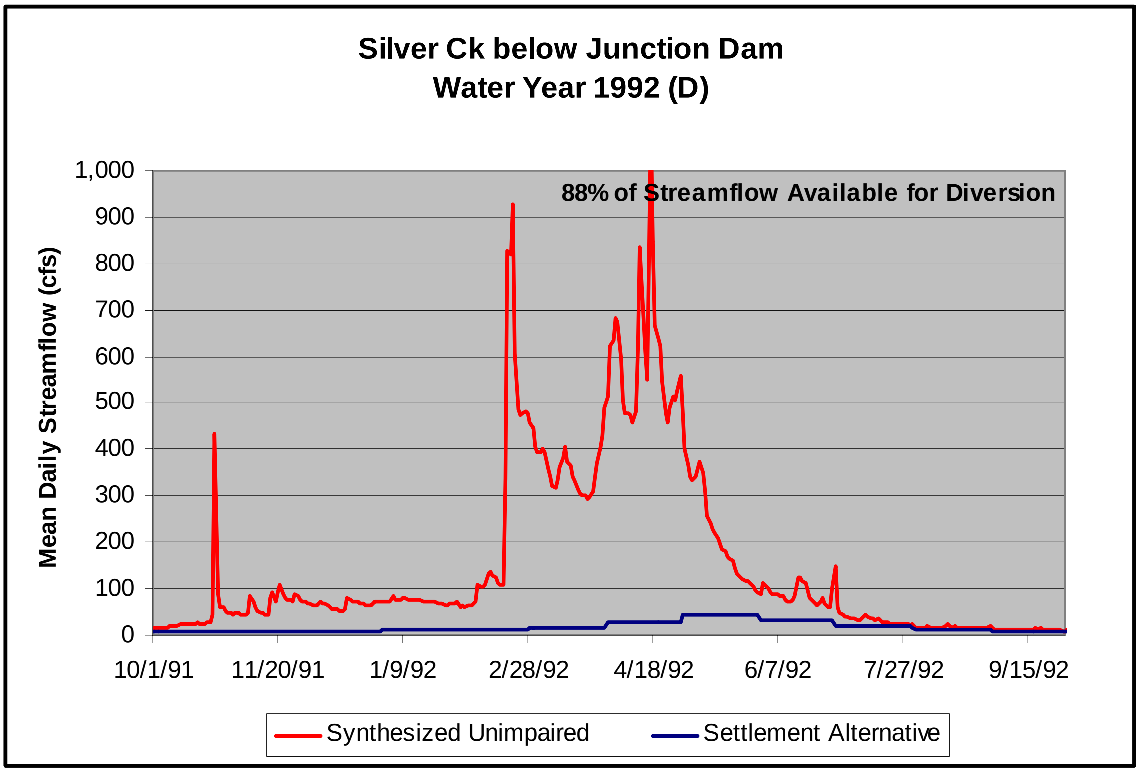
The following chart displays an example of the water available for hydroelectric operations in a representative BN water year type with implementation of the settlement.



For CD and Dry water years, minimum streamflows were passed through from South Fork Silver Creek to maintain connectivity above and below Junction Reservoir Dam. These flows were cross-checked with PHABSIM results (Devine Tarbell & Associates 2004d), which are reflected in the above chart.

The following charts display examples of the water available for hydroelectric operations in representative CD and Dry water year types, respectively, with implementation of the settlement.

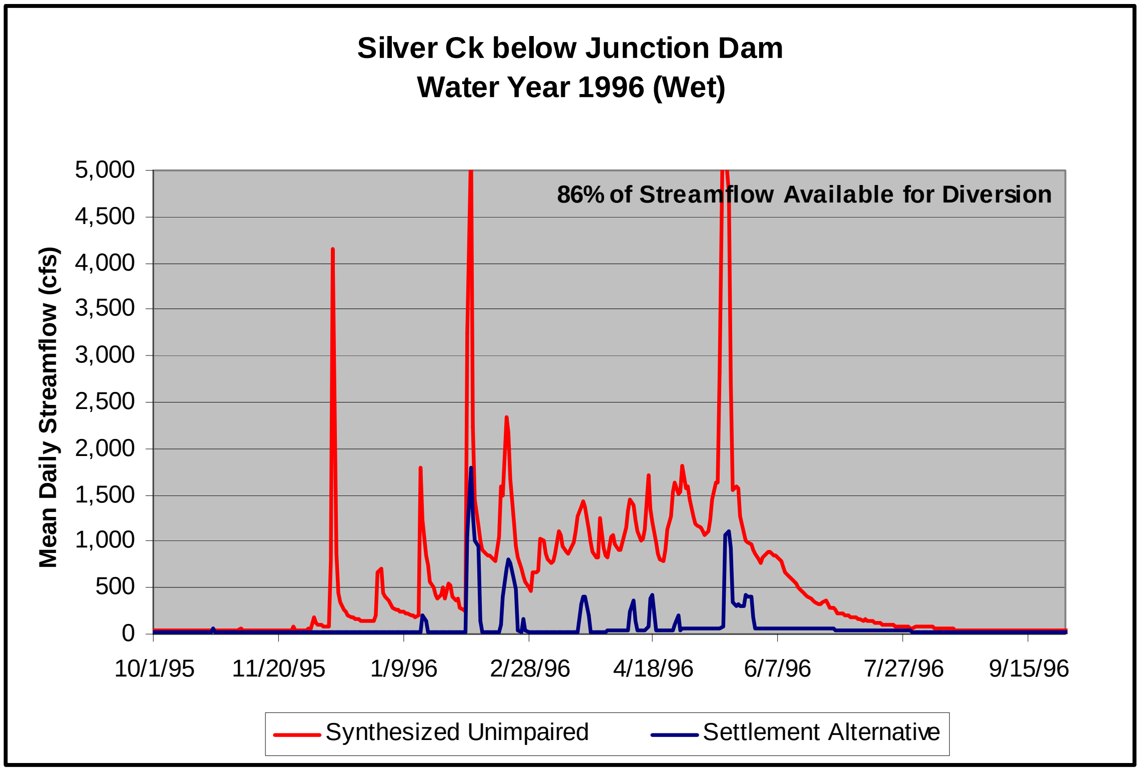


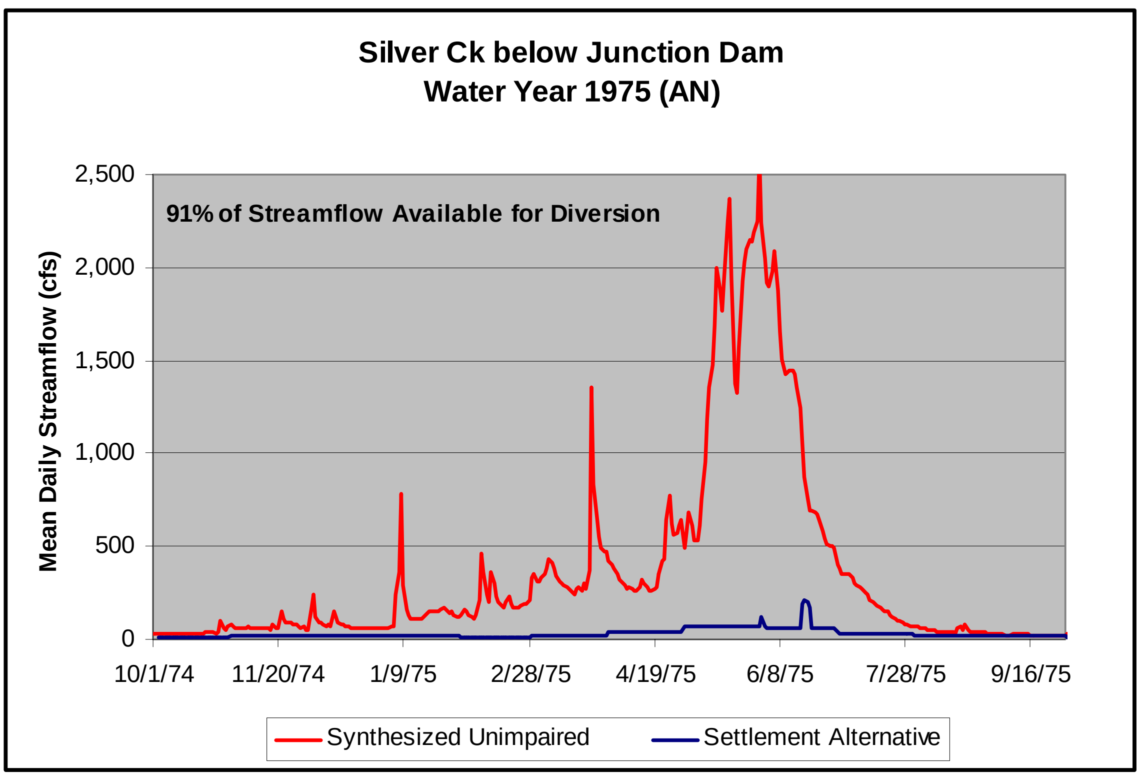



To develop minimum streamflows for Wet water years, the percent difference between the runoff of the driest Wet water year in the period of record (1996) and the average annual runoff was calculated. BN water year minimum streamflows were increased by this percentage to obtain minimum streamflows for the Wet water year. Minimum streamflows in AN water years were developed by interpolating between BN and Wet water year minimum streamflows. Wet and AN water year minimum streamflows were cross-checked with PHABSIM results for rainbow trout to ensure adequate WUA was provided at appropriate times of the year and are displayed in the table above. Higher minimum streamflows were included in AN and Wet water years in this reach (as compared to South Fork Silver Creek) because (1) the watershed area above Junction Reservoir is 143 square miles compared to the watershed area above Ice House Reservoir, which is only 27 square miles, and (2) the higher minimum streamflows are expected suppress unknown algae species through the reach.

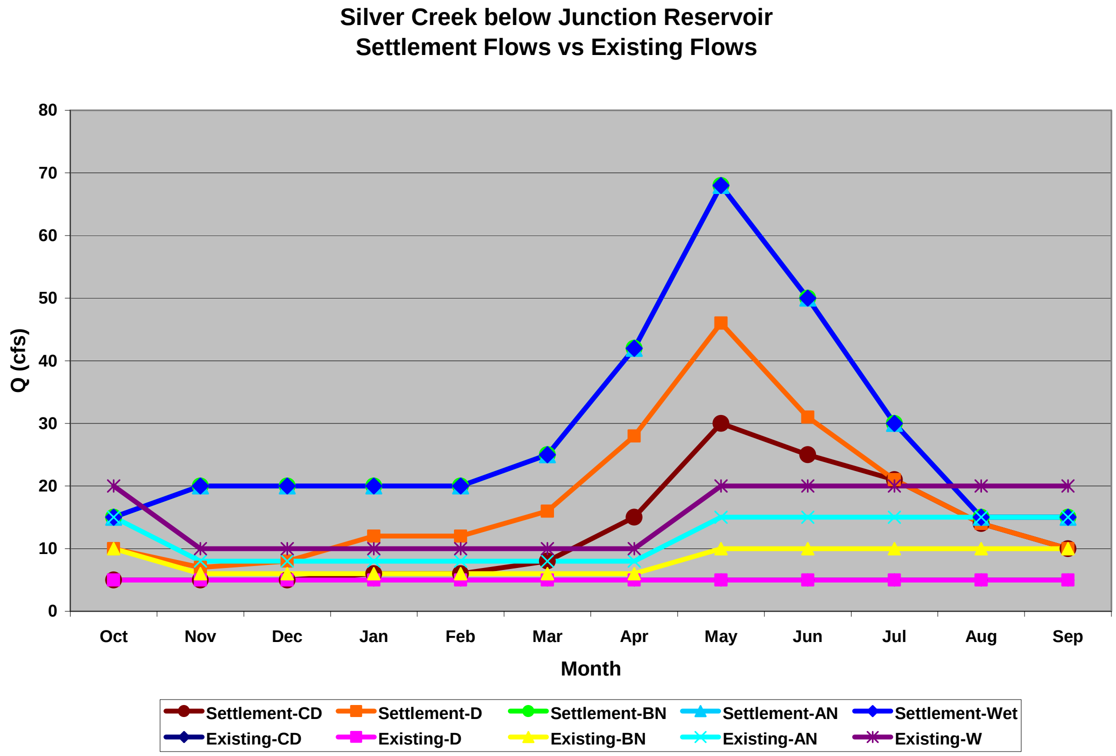
Pulse flows were strongly considered in this reach to address the stagnant algae conditions and move spawning gravels; however, to conserve water for hydroelectric generation and recreational interests, minimum streamflows that follow an unimpaired hydrograph shape and are of a greater magnitude than current minimum streamflows were implemented instead in hopes that they will address these undesirable ecological conditions.

The following charts display examples of the water available for hydroelectric operations in representative Wet and AN water year types, respectively, with implementation of the settlement.



The following chart displays a comparison of the settlement flows and existing license flows for each water year type for the Silver Creek below Junction Reservoir Dam.



The following table depicts the recommended minimum streamflows.

| Silver Creek Below Junction Reservoir Dam | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | Month | | Minimum Streamflow by Water Year (cfs) | | | | |
| | | | CD | DRY | BN | AN | WET |
| | OCT | | 5 | 10 | 15 | 15 | 15 |
| | NOV | | 5 | 7 | 20 | 20 | 20 |
| | DEC | | 5 | 8 | 20 | 20 | 20 |
| | JAN | | 6 | 12 | 20 | 20 | 20 |
| | FEB | | 6 | 12 | 20 | 20 | 20 |
| | MAR | | 8 | 16 | 25 | 25 | 25 |
| | APR | | 15 | 28 | 42 | 42 | 42 |
| | MAY | | 30 | 46 | 68 | 68 | 68 |
| | JUNE | | 25 | 31 | 50 | 59 | 59 |
| | JULY | | 21 | 21 | 30 | 35 | 35* |
| | AUG | | 14 | 14 | 15 | 18 | 18* |
| | SEPT | | 10 | 10 | 15 | 18 | 18* |

*The licensee shall be required to release additional water into Silver Creek below Junction Reservoir Dam annually in the months of July, August, and/or September in Wet water year types for temperature control upon approval of the SWRCB, CDFG, FWS, and FS. A block of water shall not exceed the acre-feet of water described in the table below. Within 1 year of license issuance, the licensee shall, in consultation with SWRCB, CDFG, FWS, and FS, develop a plan for the block of water that addresses, at a minimum: notification protocols for temperature exceedances, emergency temperature operation contingencies, and ecological monitoring needs associated with use of the block of water. The plan shall be approved by SWRCB, CDFG, FWS, and FS.

The licensee shall release the block of water as directed by SWRCB, CDFG, FWS, and FS to maintain mean daily water temperatures of 20ºC or below in this reach. The Block of Water shall become available if water temperature in Silver Creek below Junction Reservoir Dam exceeds a mean daily water temperature of 20ºC, as measured at Silver Creek immediately upstream of Camino Reservoir. The licensee shall install and maintain a temperature gage on Silver Creek immediately upstream of Camino Reservoir to measure water temperature in Silver Creek below Junction Reservoir Dam. The licensee shall, promptly but not later than within 24 hours, notify the SWRCB, CDFG, FWS, and FS if the water temperatures in Silver Creek below Junction Reservoir Dam exceed the water temperature criteria above.

If the water temperature criterion is exceeded, the licensee may be required to monitor for presence of foothill yellow-legged frog life prior to and after the release of the Block of Water.

The Block of Water specified shall be the total amount of additional water available for release in the specified time periods. The Block of Water shall be made available concurrent with implementation of the initial minimum streamflows and through the remainder of the license term.

| | | | |
|---|---|---|---|
| **Adaptive Management Block of Water for Water Temperature Moderation** | | | |
| **Silver Creek Below Junction Reservoir Dam** | | | |
| | **Month** | | |
| | **JULY** | | 1044* |
| | **AUG** | | 491* |
| | **SEPT** | | 475* |

*All values referenced above are in acre-feet.

***Silver Creek Below Camino Reservoir Dam***

A primary objective in Silver Creek below Camino Reservoir Dam is to provide habitat for healthy foothill yellow-legged frog populations. Other objectives are to provide temperatures that allow for management of native fish and address FYLF breeding, to establish some similarity to the natural hydrograph to restore ecological processes altered by the Project, and to maintain streamflows required in Silver Creek below Junction Reservoir Dam. Refer to the fish community metrics discussion above, under Resource Objectives, for discussion of fisheries objectives.

No PHABSIM studies were completed in this reach. Because it is in the same watershed as Silver Creek below Junction Reservoir Dam, the flows from this reach were applied to Silver Creek below Camino Reservoir Dam.

For FYLF reproduction, an attempt was made to simulate the natural summer decline of the hydrograph, typical of an unimpaired system. This summer discharge decline, where water temperatures become progressively warmer and water depths become shallower, helps to speed egg development to hatching, thus decreasing the time eggs are vulnerable to predators. Stranding of FYLF egg masses out of water from May to July was considered when designing the flows and the change of discharge between months (Kupferberg 2004). Depth measurements at FYLF habitat sites presented in Tables 4.3-1a and 4.3-1b of the Amphibian Habitat Test Flow Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004a) indicated that there is an average decrease in stage of 4.5 inches as discharge varies from 100 to 50 cfs at the Camino Adit site in Silver Creek below Camino Reservoir Dam. From 50 to 20 cfs, the change in stage was 5.2 inches. Because eggs are usually laid at average depths of 7.75 inches (the range is 2 to 18 inches) (see Table 3.1.2 Amphibian Habitat Test Flow Report), it is likely that the monthly flow transitions would keep most eggs and larvae within inundated areas. The declining discharge situation in which eggs are in progressively warmer and shallower water is what is most typically observed in unimpaired systems. This can speed up development to hatching and thus decrease the time eggs are vulnerable to predators. This approach was validated in a peer review conducted by Dr. Sarah Kupferberg.

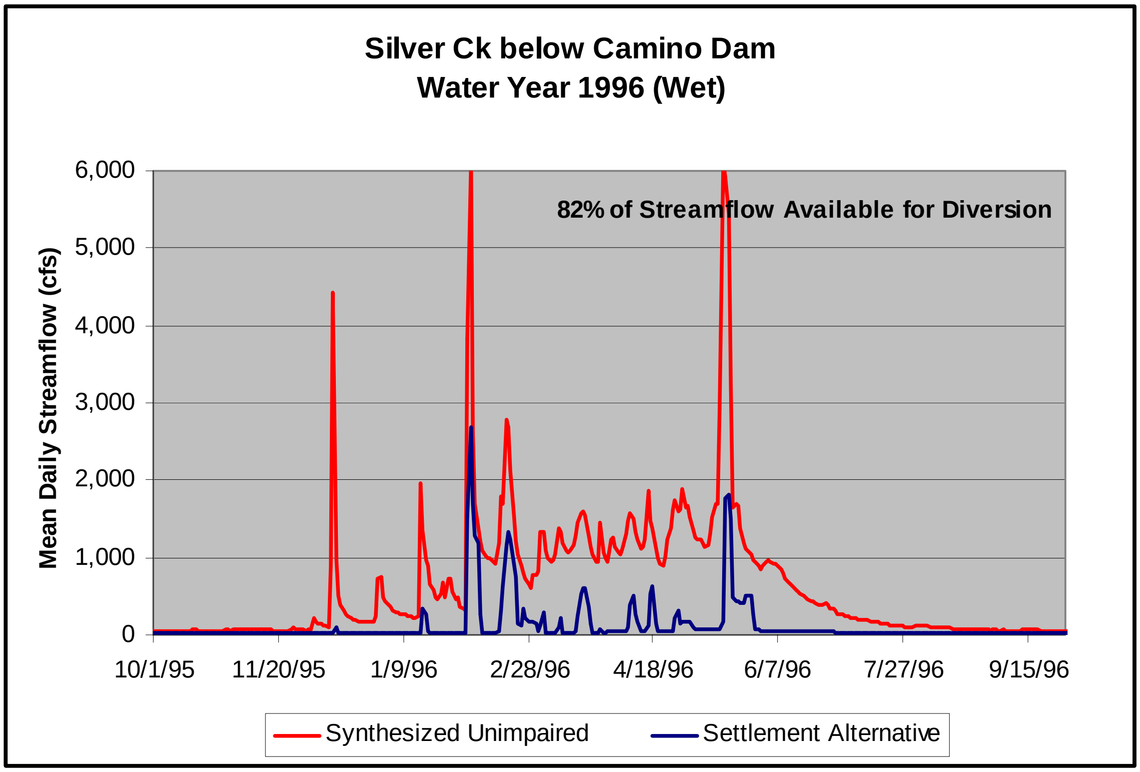
Water temperature modeling was also considered when designing the minimum streamflows to assist in successful FYLF reproduction. Modeling shows water temperatures would reach a mean of 12°C between early to mid-May for 30 to 60 cfs flows upstream of confluence with SFAR (Devine Tarbell & Associates 2005e and R2 Resource Consultants, Inc. 2004a). These water temperatures at or above a mean of 12°C, as well as the decline of the natural hydrograph, are important cues for FYLF reproduction. Flows are below 60 cfs by June in all years to assist in successful reproduction in those water year types. Summer flows are expected to maintain suitable water temperatures for the cold-water fisheries throughout the reach, and also allow warmer water temperatures to develop in the edgewater habitat of the lower half of the reach. In the event this is not the case, the settlement includes a block of water that may be released for water temperature in Wet water year types should the resource agencies determine it is necessary.

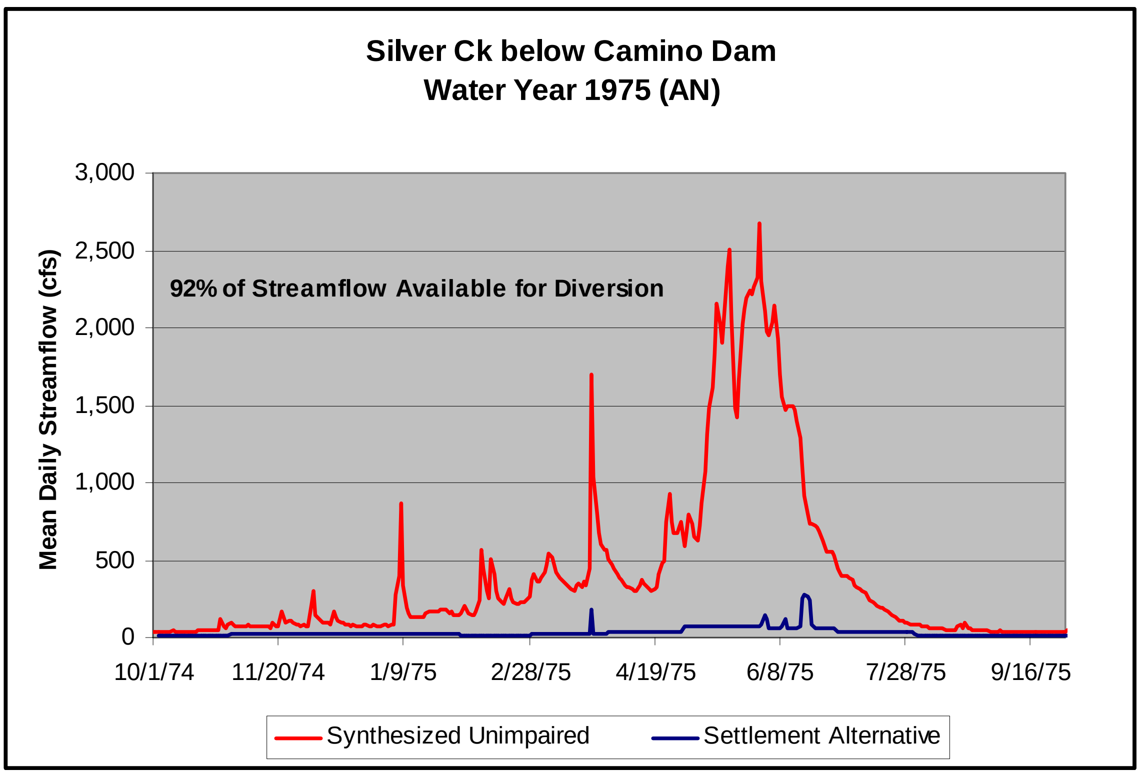
For this reach, an index of catchable trout per mile (>150 mm total length) was used due to the difficulty in accessing sample sites and the highly variable stream habitat. Therefore, the sample protocol used direct observation (snorkeling) as the sampling method. The existing index of catchable trout per mile for rainbow trout in this reach is 79 fish per mile. This is well below the objective of 278 catchable trout per mile (Gerstung 1973). The proposed flow regime is designed to increase instream habitat to improve the biomass and move it closer to the objective.

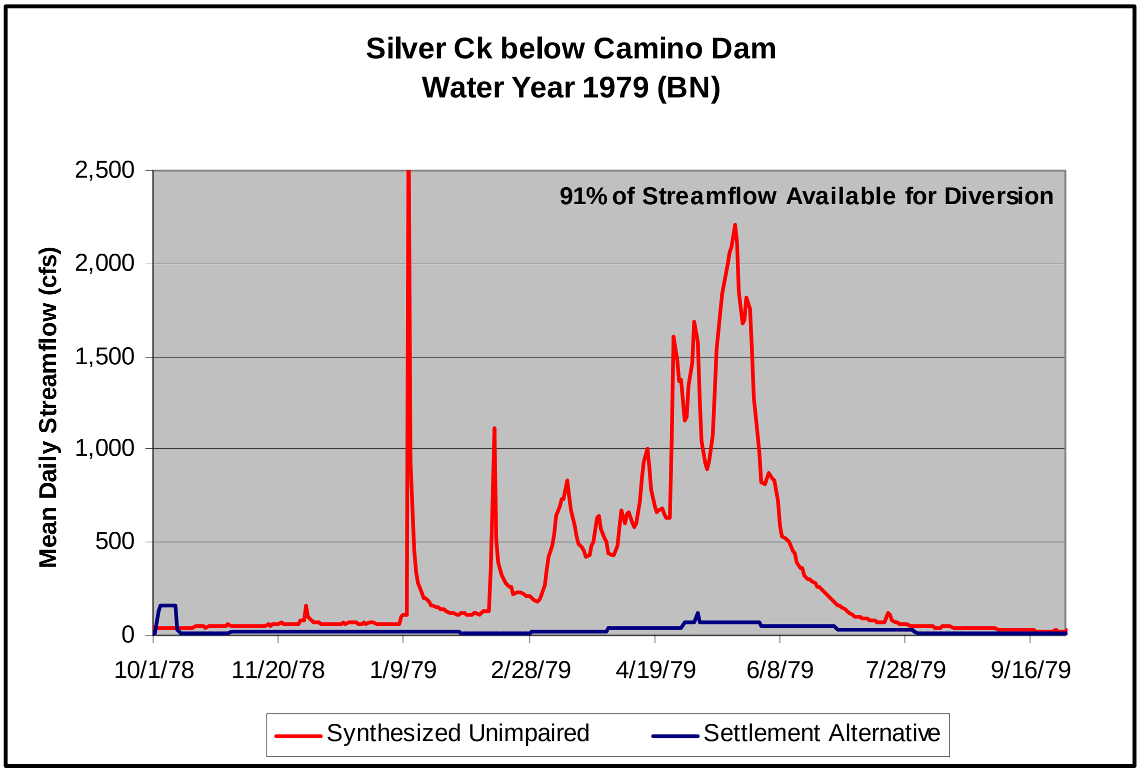
Fish population data generated for this reach was obtained using snorkeling rather than electrofishing. Snorkeling gives only a subjective index and cannot generate a quantitative value. Therefore, using the values generated during the snorkeling surveys, there was an estimate of 137 adult rainbow trout per mile; if brown trout were included, there were 153 adult trout per mile. The reach would still not meet the objective of 278 adult fish per mile (Gerstung 1973). The minimum streamflow regime seeks to increase the density of resident adult rainbow trout through the increase in available habitat for most months of most water year types. The variability of the hydrograph over the entire year attempts to mimic the fluctuations that would have occurred under unimpaired conditions, yet takes into account the need of the licensee to provide hydroelectric generation.

Higher spring flows in BN, AN, and Wet water years would move spawning gravels to maintain trout habitat. Because approximately half of this reach is low gradient, 2 percent or less, spawning gravels should have frequently settled into niche areas.

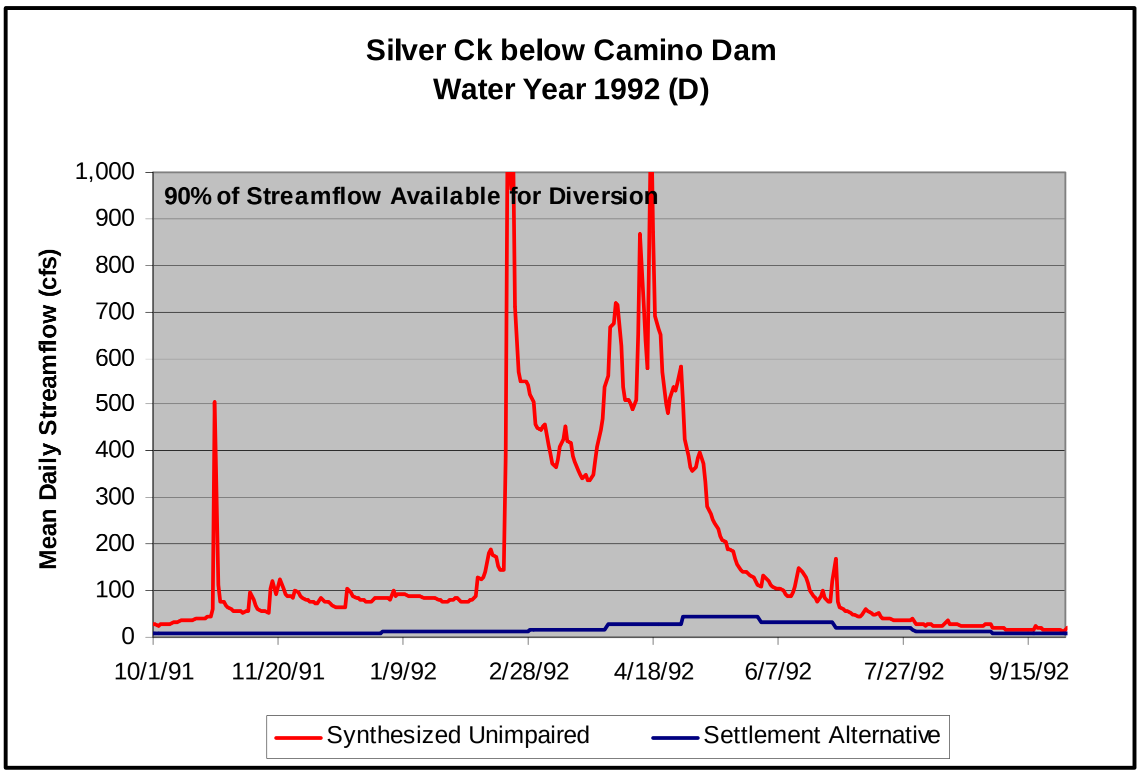
The following charts display examples of the water available for hydroelectric operations in representative Wet, AN, BN, Dry, and CD water year types, respectively, with implementation of the settlement.


Silver Ck below Camino Dam
Water Year 1996 (Wet)
82% of Streamflow Available for Diversion
Mean Daily Streamflow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
0
10/1/95
11/20/95
1/9/96
2/28/96
4/18/96
6/7/96
7/27/96
9/15/96
Synthesized Unimpaired
Settlement Alternative

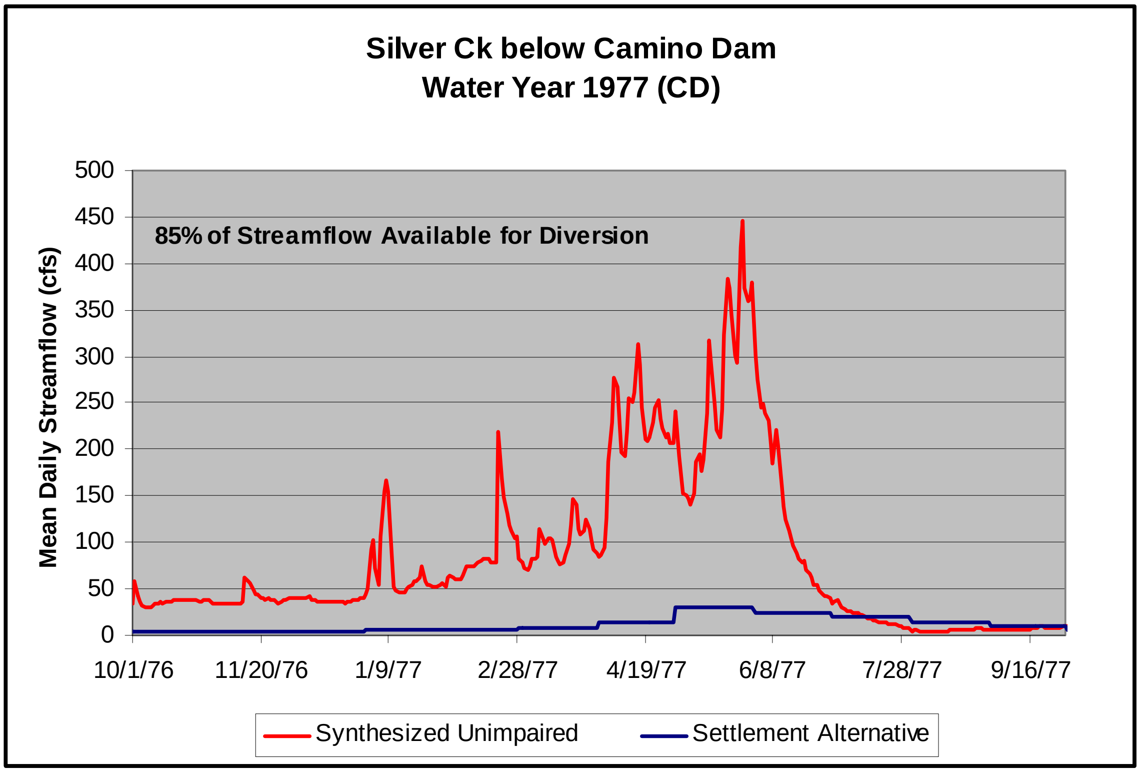

Silver Ck below Camino Dam
Water Year 1975 (AN)
92% of Streamflow Available for Diversion
Mean Daily Streamflow (cfs)
3,000
2,500
2,000
1,500
1,000
500
0
10/1/74
11/20/74
1/9/75
2/28/75
4/19/75
6/8/75
7/28/75
9/16/75
Synthesized Unimpaired
Settlement Alternative



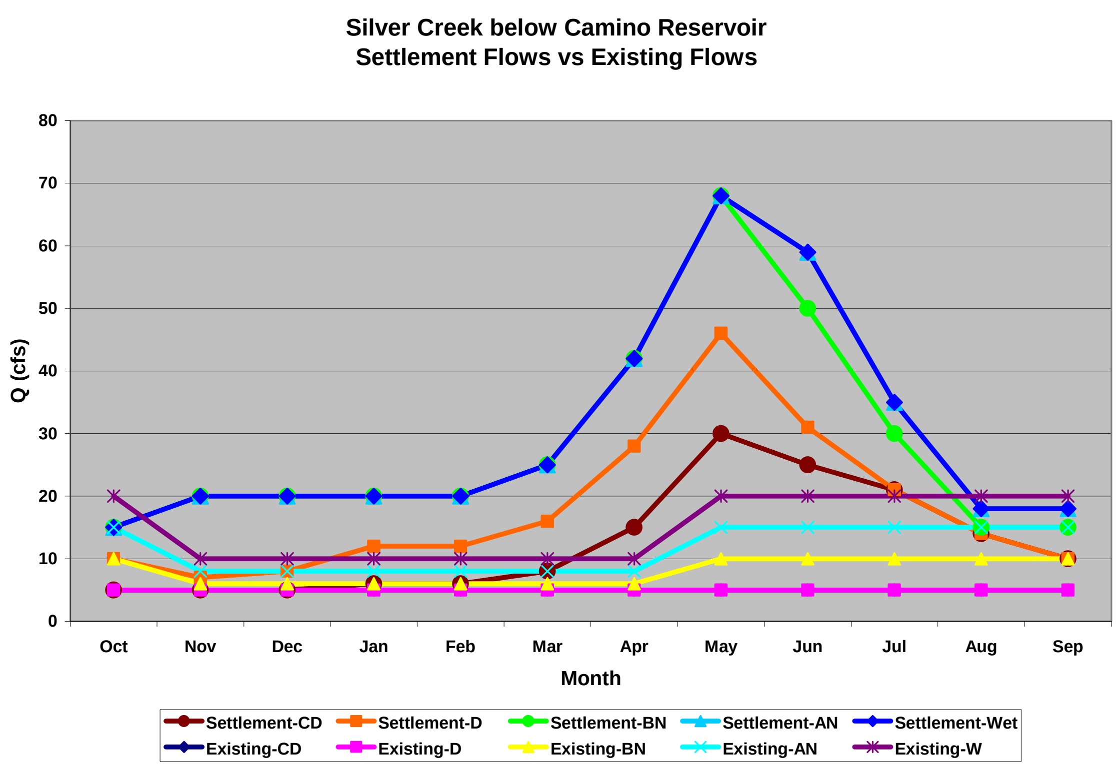
Silver Ck below Camino Dam
Water Year 1979 (BN)
91% of Streamflow Available for Diversion
Mean Daily Streamflow (cfs)
2,500
2,000
1,500
1,000
500
0
10/1/78
11/20/78
1/9/79
2/28/79
4/19/79
6/8/79
7/28/79
9/16/79
Synthesized Unimpaired
Settlement Alternative

Silver Ck below Camino Dam
Water Year 1992 (D)
90% of Streamflow Available for Diversion
Mean Daily Streamflow (cfs)
1,000
900
800
700
600
500
400
300
200
100
0
10/1/91
11/20/91
1/9/92
2/28/92
4/18/92
6/7/92
7/27/92
9/15/92
Synthesized Unimpaired
Settlement Alternative




The following chart displays a comparison of the settlement and existing license flows for each water year type for the Silver Creek below Camino Reservoir Dam.



The following table depicts the recommended minimum streamflows.

| Silver Creek Below Camino Reservoir Dam | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| | Month | | Minimum Streamflow by Water Year (cfs) | | | | |
| | | | CD | DRY | BN | AN | WET |
| | OCT | | 5 | 10 | 15 | 15 | 15 |
| | NOV | | 5 | 7 | 20 | 20 | 20 |
| | DEC | | 5 | 8 | 20 | 20 | 20 |
| | JAN | | 6 | 12 | 20 | 20 | 20 |
| | FEB | | 6 | 12 | 20 | 20 | 20 |
| | MAR | | 8 | 16 | 25 | 25 | 25 |
| | APR | | 15 | 28 | 42 | 42 | 42 |
| | MAY | | 30 | 46 | 68 | 68 | 68 |
| | JUNE | | 25 | 31 | 50 | 59 | 59 |
| | JULY | | 21 | 21 | 30 | 35 | 35* |
| | AUG | | 14 | 14 | 15 | 18 | 18* |
| | SEPT | | 10 | 10 | 15 | 18 | 18* |

*The licensee shall be required to release additional water into Silver Creek below Camino Reservoir Dam annually in the months of July, August, and/or September in Wet water year types for temperature control upon approval of the SWRCB, CDFG, FWS, and FS. A block of water shall not exceed the acre-feet of water described in the table below. Within 1 year of license issuance, the licensee shall, in consultation with SWRCB, CDFG, FWS, and FS, develop a plan for the block of water that addresses, at a minimum: notification protocols for temperature exceedances, emergency temperature operation contingencies, and ecological monitoring needs associated with use of the block of water. The plan shall be approved by SWRCB, CDFG, FWS, and FS.

The licensee shall release the block of water as directed by SWRCB, CDFG, FWS, and FS to maintain mean daily water temperatures of 20ºC or below in this reach. The Block of Water shall become available if water temperature in Silver Creek below Camino Reservoir Dam exceeds a mean daily water temperature of 20ºC, as measured at Silver Creek immediately upstream of SFAR (at or near discontinued USGS gage 11442000, licensee station SC1). The licensee shall install and maintain a temperature gage on Silver Creek upstream of SFAR at or near the site of discontinued USGS gage 11442000 (licensee station SC1). Within 2 years of license issuance, the licensee shall develop and install a telemetry system that provides daily access to hourly temperature monitoring data. The licensee shall, promptly but not later than within 24 hours, notify SWRCB, CDFG, FWS, and FS if the water temperatures in Silver Creek below Camino Reservoir Dam exceed the water temperature criteria above.

If the water temperature criterion is exceeded, the licensee may be required to monitor for presence of foothill yellow-legged frog life prior to and after the release of the Block of Water.

The Block of Water specified shall be the total amount of additional water available for release in the specified time periods. The Block of Water shall be made available concurrent with implementation of the initial minimum streamflows and through the remainder of the license term.

| | | | |
|---|---|---|---|
| **Adaptive Management Block of Water** | | | |
| **for Water Temperature Moderation** | | | |
| **Silver Creek Below Camino** | | | |
| **Reservoir Dam** | | | |
| | **Month** | | |
| | **JULY** | | 1044* |
| | **AUG** | | 491* |
| | **SEPT** | | 475* |

*All values referenced above are in acre-feet.

***Brush Creek Below Brush Creek Reservoir Dam***

The emphasis in this reach was to manage for native aquatic species. Refer to the fish community metrics discussion above, under Resource Objectives, for discussion of fisheries objectives. The resident rainbow trout population had a mean biomass of 14.8 pounds per surface acre. This was based on an average of both the upper and lower electrofishing sample sites. The agencies recommended a mean rainbow trout biomass objective of 35 pounds per surface acre (Gerstung 1973). The mean biomass present in Brush Creek is well below the recommended objective, so the objective of minimum streamflows is to increase biomass by increasing the available stream habitat via streamflow regime manipulation.

The PHABSIM study, though conducted in this reach, was determined not to be appropriate for use. When the flows recommended from the PHABSIM were modeled, the flow results were so high that Brush Creek Reservoir would be drained completely. Therefore another method was used to assist in developing minimum streamflows. The Tessmann adaptation of the Tennant method (Annear et al. 2004) was used to establish upper limits for the streamflow regime in Brush Creek for BN water years as follows:

- If MMF (mean monthly flow) < 40% MAF (monthly acre feet), monthly minimum streamflow = MMF
- If MMF > 40% MAF, monthly minimum streamflow = 40% MAF
- If 40% MMF > 40% MAF, monthly minimum streamflow = 40% MAF

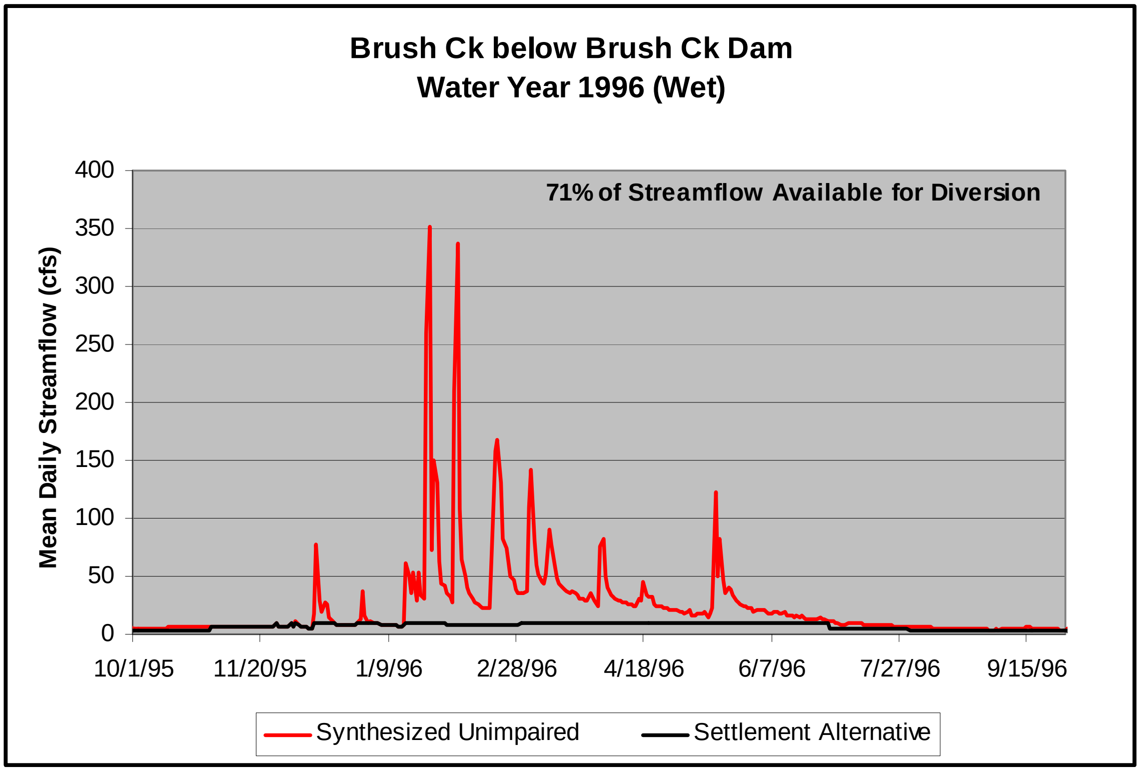
The "or Natural Flow" component of each minimum streamflow provides the natural variation that would have occurred in unimpaired conditions yet allows hydroelectric generation to occur.

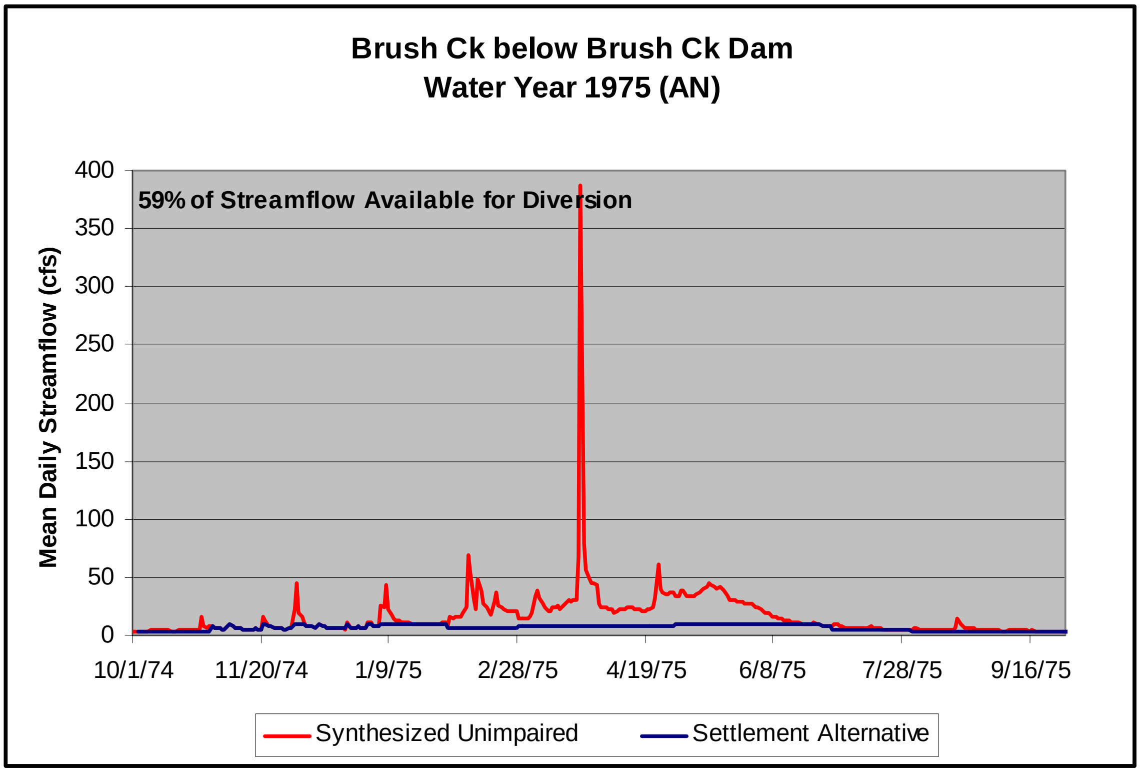
For CD, Dry, AN, and Wet water years, the 40 percent was replaced with the percentages listed below based on the Tennant method classifications:

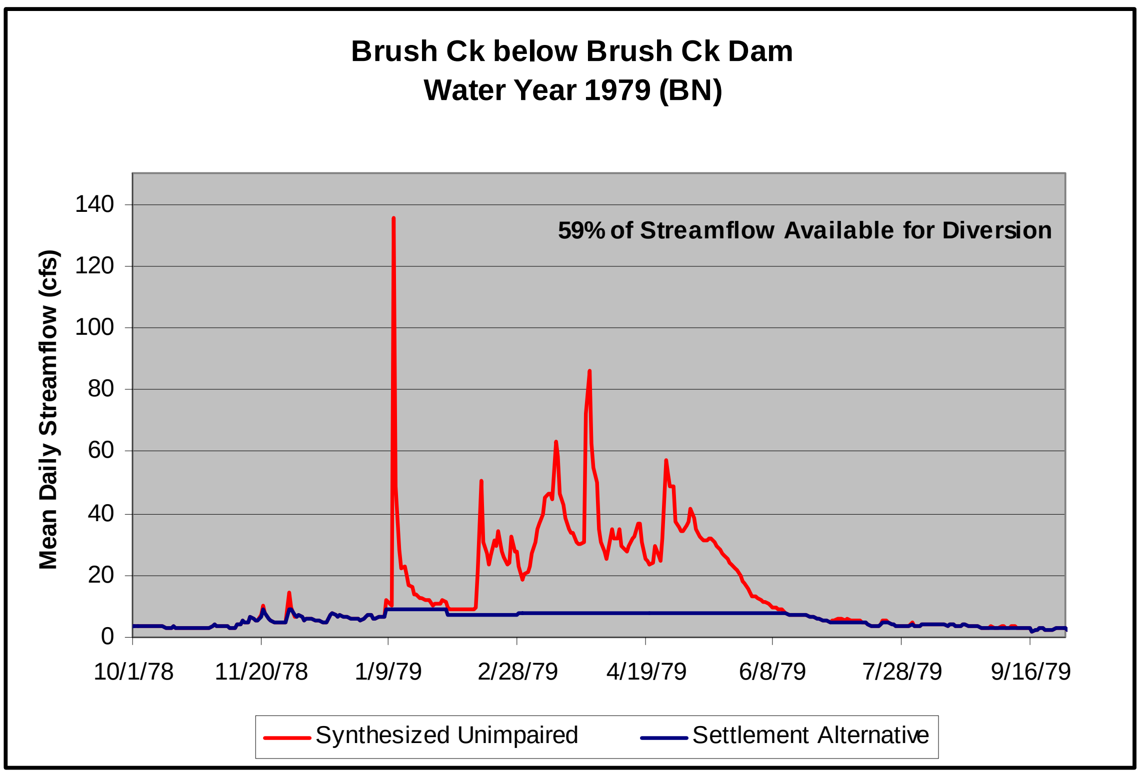
- Wet: X = 50% (Excellent Habitat)
- AN: X = 45%
- BN: X = 40% (Good Habitat)
- Dry: X = 35%
- CD: X = 30% (Fair Habitat)

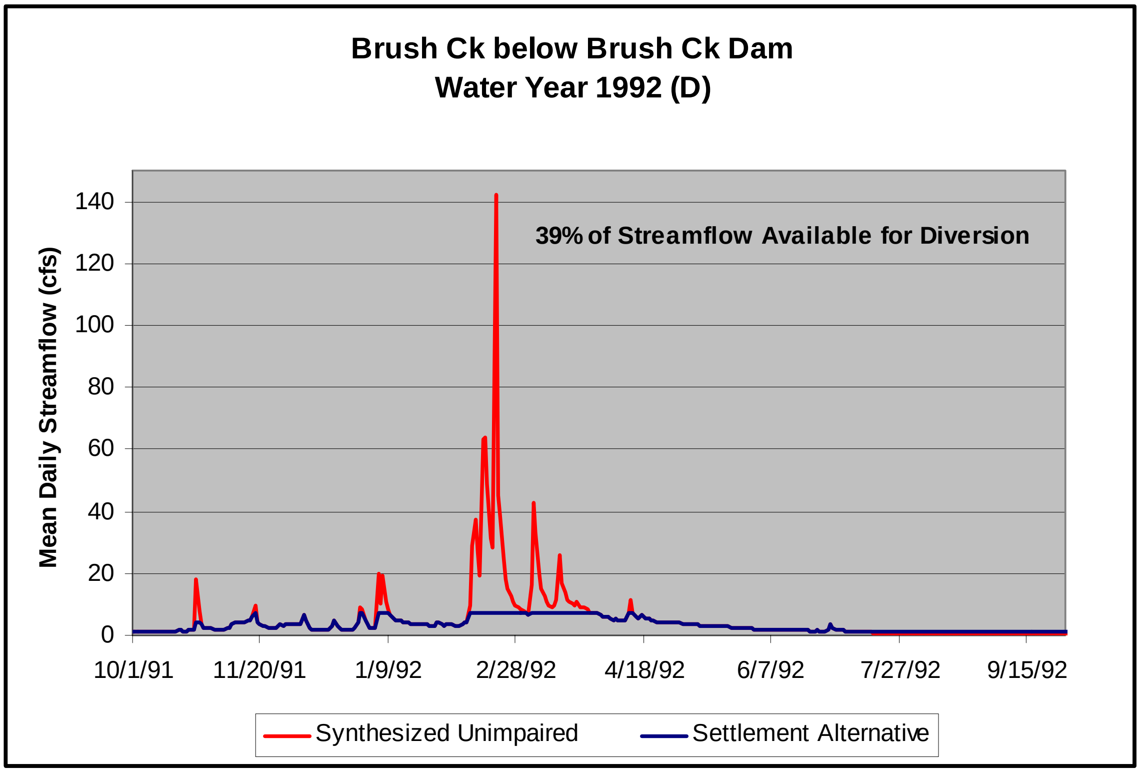
Based on these classifications, minimum streamflows were classified into water year types. To ensure that Brush Creek Reservoir is not drained, each minimum streamflow requirement is accompanied by a "or NF (natural flow)" allowance. The only exception is if the NF is below 1 cfs; in that case, the minimum streamflow in Brush Creek shall be 1 cfs.

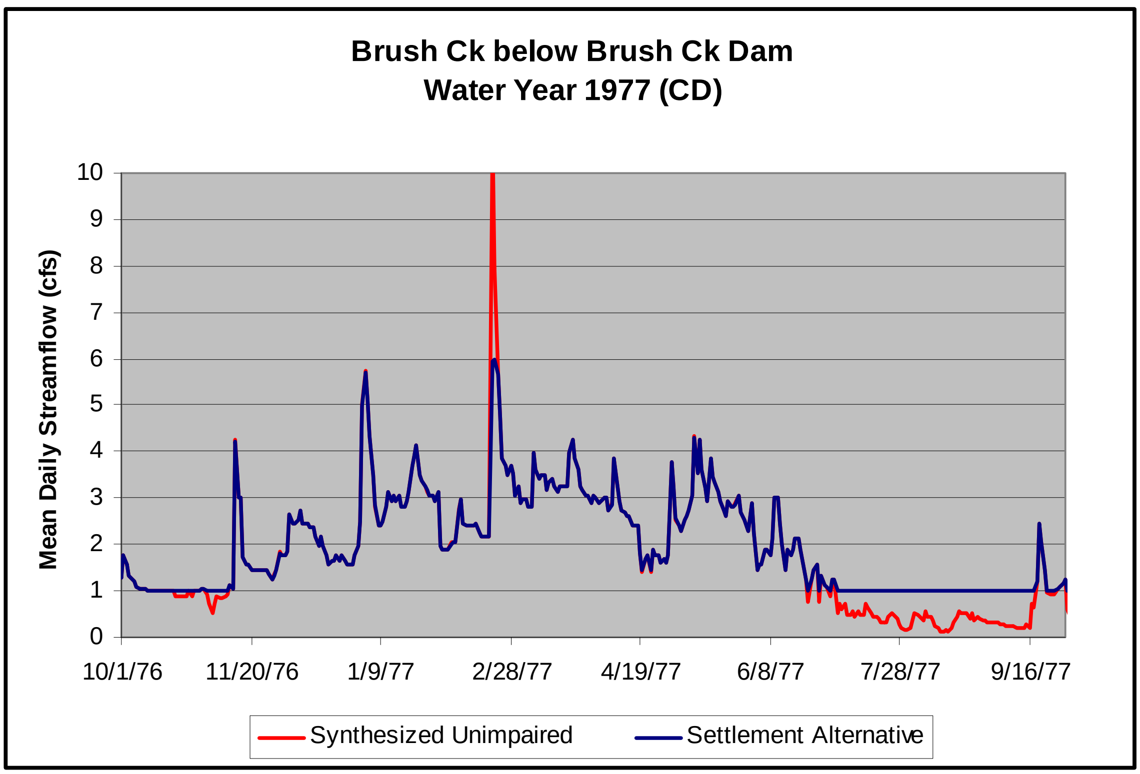
The following charts display examples of the water available for hydroelectric operations in representative Wet, AN, BN, Dry, and CD water year types, respectively, with implementation of the settlement.



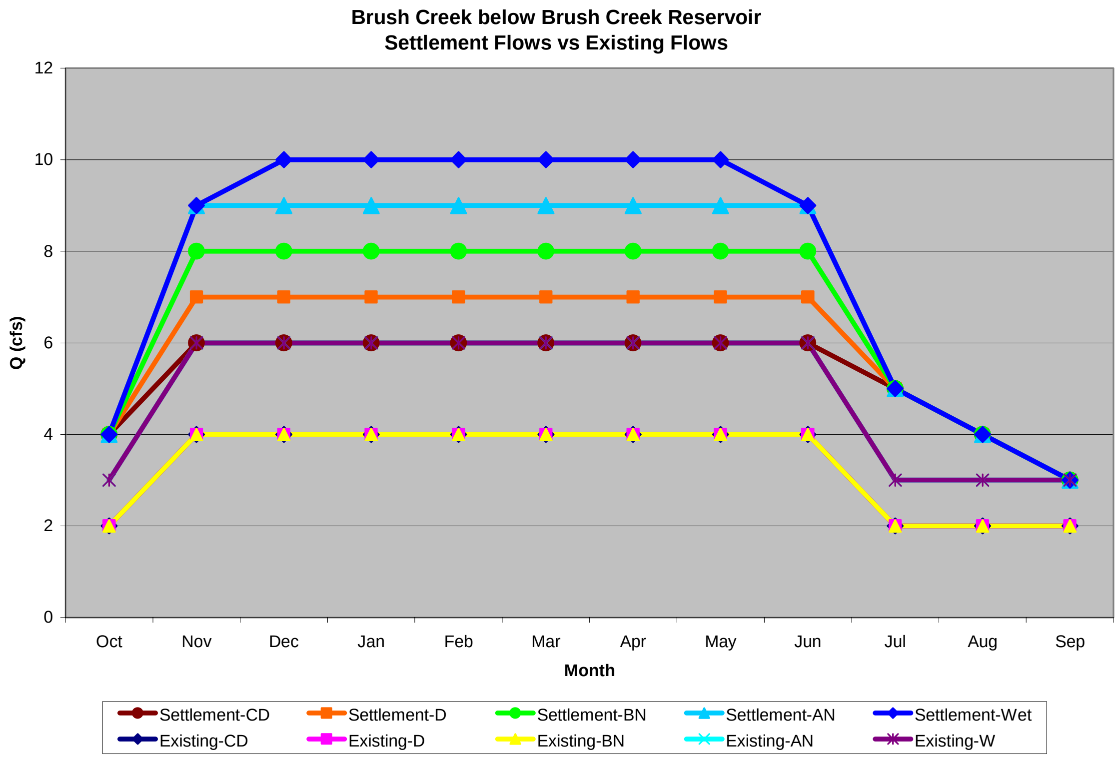

Brush Ck below Brush Ck Dam
Water Year 1975 (AN)
59% of Streamflow Available for Diversion
Mean Daily Streamflow (cfs)
400
350
300
250
200
150
100
50
0
10/1/74
11/20/74
1/9/75
2/28/75
4/19/75
6/8/75
7/28/75
9/16/75
Synthesized Unimpaired
Settlement Alternative


Brush Ck below Brush Ck Dam
Water Year 1979 (BN)
59% of Streamflow Available for Diversion
Mean Daily Streamflow (cfs)
140
120
100
80
60
40
20
0
10/1/78
11/20/78
1/9/79
2/28/79
4/19/79
6/8/79
7/28/79
9/16/79
Synthesized Unimpaired
Settlement Alternative


Brush Ck below Brush Ck Dam
Water Year 1992 (D)
39% of Streamflow Available for Diversion
Mean Daily Streamflow (cfs)
140
120
100
80
60
40
20
0
10/1/91
11/20/91
1/9/92
2/28/92
4/18/92
6/7/92
7/27/92
9/15/92
Synthesized Unimpaired
Settlement Alternative


Brush Ck below Brush Ck Dam
Water Year 1977 (CD)
Mean Daily Streamflow (cfs)
10
9
8
7
6
5
4
3
2
1
0
10/1/76
11/20/76
1/9/77
2/28/77
4/19/77
6/8/77
7/28/77
9/16/77
Synthesized Unimpaired
Settlement Alternative

The following chart displays a comparison of the settlement and existing license flows for each water year type for the Silver Creek below Camino Reservoir Dam.




The following table depicts the recommended minimum streamflows.

| Brush Creek Below Brush Creek Reservoir Dam | | | | | | |
|---|---|---|---|---|---|---|
| Month | | Minimum Streamflow by Water Year (cfs) | | | | |
| | | CD | DRY | BN | AN | WET |
| OCT | | 4 or NF* | 4 or NF* | 4 or NF* | 4 or NF* | 4 or NF* |
| NOV | | 6 or NF* | 7 or NF* | 8 or NF* | 9 or NF* | 9 or NF* |
| DEC | | 6 or NF* | 7 or NF* | 8 or NF* | 9 or NF* | 10 or NF* |
| JAN | | 6 or NF* | 7 or NF* | 8 or NF* | 9 or NF* | 10 or NF* |
| FEB | | 6 or NF* | 7 or NF* | 8 or NF* | 9 or NF* | 10 or NF* |
| MAR | | 6 or NF* | 7 or NF* | 8 or NF* | 9 or NF* | 10 or NF* |
| APR | | 6 or NF* | 7 or NF* | 8 or NF* | 9 or NF* | 10 or NF* |
| MAY | | 6 or NF* | 7 or NF* | 8 or NF* | 9 or NF* | 10 or NF* |
| JUNE | | 6 or NF* | 7 or NF* | 8 or NF* | 9 or NF* | 9 or NF* |
| JULY | | 5 or NF* | 5 or NF* | 5 or NF* | 5 or NF* | 5 or NF* |
| AUG | | 4 or NF* | 4 or NF* | 4 or NF* | 4 or NF* | 4 or NF* |
| SEPT | | 3 or NF* | 3 or NF* | 3 or NF* | 3 or NF* | 3 or NF* |

*If Natural Flow (NF) measured in Brush Creek above Brush Creek Reservoir is below 1 cfs, the minimum flow shall be 1 cfs.

***South Fork American River Below Slab Creek Reservoir Dam***

The primary objectives for the SFAR below Slab Creek Reservoir Dam are to provide habitat for healthy foothill yellow-legged frog, hardhead, and western pond turtle populations; to provide temperatures that allow for management of native fish; to reduce non-native species, such as bullfrogs and bass; to re-establish some similarity to a natural hydrograph; and to maintain streamflows in the SFAR above Slab Creek Reservoir below Slab Creek Reservoir Dam. Refer to the fish community metrics discussion above, under Resource Objectives, for discussion of fisheries objectives.

This reach uses a combined sampling protocol of electrofishing and snorkeling to establish biomass and indices for desired fish populations. The fish management species for this reach are rainbow trout and hardhead. The existing biomass for rainbow trout for this reach is 4.6 pounds per surface acres. This is well below a biomass objective of 13 pounds per surface acre. The proposed flow regime is designed to increase instream habitat to improve the biomass and move it closer to the objective.

Although the licensee's studies did not indicate that FYLF were found at the sites surveyed on this reach, there are FYLF 0.9 miles upstream of Slab Creek Reservoir in the area of the El Dorado Hydroelectric Project (ECORP 2002, ECORP 2004, and Garcia and Associates 2005). It is likely that past untimely spill flows from Slab Creek Dam during FYLF reproduction eliminated or drastically reduced any existing FYLF populations in this reach below Slab Creek Reservoir Dam. It is possible that FYLF do reside in this reach, but in low numbers, as not all areas of this reach were surveyed for FYLF, nor were the tributaries. It is also possible for FYLF to recolonize this reach from its tributaries, such as Rock Creek, Mosquito Creek, Redbird Creek, and Iowa Canyon. ECORP Consulting (2002 and 2004) found additional sites of FYLF in the SFAR in 2004 that were not observed in their 2002 surveys, and vice versa, which demonstrates that a survey can overlook existing FYLF, or adult FYLF may be observed one year at a site but not another and that it is warranted to manage suitable habitat for this species, even if they are not located in a particular survey effort. A reproductive population of FYLF has been observed using a tributary of SFAR, Indian Creek, in the reach downstream of Chili Bar Reservoir Dam. As stated in the Amphibian and Reptile report, "FYLF sightings on one of these tributaries suggests that tributary streams could indeed support breeding populations" (Devine Tarbell & Associates and Stillwater Sciences 2005a). This report also states "use of the mainstem SF American River by FYLF as a dispersal corridor is possible" (Devine Tarbell & Associates and Stillwater Sciences 2005a). These dispersing FYLF could also breed in the reach below Slab Creek Reservoir Dam, if habitat conditions were conducive to reproduction.

To establish the minimum streamflows for SFAR below Slab Creek Reservoir Dam, beginning with the BN water year, the combined flows from the SFAR at Kyburz Diversion Dam and Alder Creek below Alder Creek Diversion Dam of the El Dorado Hydroelectric Project and Silver Creek below Junction Reservoir Dam of the UARP were reviewed. For the month of April, the combined flow is 287 cfs. This is 95 percent of the WUA for rainbow trout spawning (Devine Tarbell & Associates and Stillwater Sciences 2004d). For May, the combined flow is 303 cfs. This is 96 percent of the WUA for rainbow trout spawning (Devine Tarbell & Associates and Stillwater Sciences

2004d). Based on this information, the April and May streamflows were set at 287 cfs and 303 cfs, respectively, to address rainbow trout spawning and to attempt to simulate the ascending limb in the natural spring hydrograph to restore ecological processes altered by the Project, as follows.

Once the April and May minimum streamflows were established for the BN water year, simulating the decline of the natural hydrograph was emphasized in designing the minimum streamflow regime for June, because this decline serves as an important cue for FYLF reproduction, as well as reproduction for other aquatic species (Moyle and Marchetti 1998, Moyle 2002, Moyle and Light 1996). This discharge decline was spaced at 1-week intervals in an attempt to simulate the natural hydrograph as closely as possible. This gradual decline was suggested by Kupferberg (2004), as it would decrease the chance of eggs being stranded and allows tadpoles to follow the receding water line, if eggs and tadpoles are already present. This decline also simulates the unimpaired hydrograph for this important reproductive time of year. The licensee proposed additional weekly time steps for this reach, and the resource agencies reviewed the proposal and determined that the weekly time steps were representative of an unimpaired hydrograph and would provide similar benefits to those described herein to aquatic species in this reach.

To establish this decline in the hydrograph, the unimpaired hydrology (Devine Tarbell & Associates and Hannaford 2005a) was reviewed. During spring, it was noted that the unimpaired hydrograph declined fairly rapidly and then leveled off at the end of spring runoff. Based on this review, each water year in the period of record was reviewed to determine what time of month the decline should begin, by water year type. The following tables display these dates for each of the five water year types.

**Critically Dry Water Years**

| WY | Start of Decline | End of Decline |
|---|---|---|
| 1976 | 19-May | 5-Jul |
| 1977 | 12-Jun | 24-Jun |
| 1987 | 18-May | 26-Jun |
| 1988 | 5-Jun | 31-Jul |
| 1994 | 17-May | 30-Jun |

**Dry Water Years**

| WY | Start of Decline | End of Decline |
|---|---|---|
| 1981 | 6-May | 20-Jun |
| 1990 | 5-Jun | 17-Jul |
| 1991 | 7-Jun | 12-Jul |
| 1992 | 10-Jun | 20-Jul |
| 2001 | 21-May | 10-Jun |

| Below Normal Water Years | | |
|---|---|---|
| | | |
| WY | Start of Decline | End of Decline |
| | | |
| 1979 | 1-Jun | 10-Jul |
| 1989 | 25-Jun | 16-Jul |

| Above Normal Water Years | | |
|---|---|---|
| | | |
| WY | Start of Decline | End of Decline |
| | | |
| 1975 | 20-Jun | 25-Jul |
| 1993 | 23-Jun | 29-Jul |
| 1996 | 24-May | 21-Jul |
| 1999 | 27-Jun | 20-Jul |
| 2000 | 1-Jun | 11-Jul |

| Wet Water Years | | |
|---|---|---|
| | | |
| WY | Start of Decline | End of Decline |
| | | |
| 1978 | 16-Jun | 24-Jul |
| 1980 | 26-May | 26-Jul |
| 1982 | 24-Jun | 24-Jul |
| 1983 | 9-Jul | 27-Aug |
| 1984 | 7-Jun | 11-Jul |
| 1986 | 8-Jun | 14-Jul |
| 1995 | 13-Jul | 19-Aug |
| 1997 | 16-Jun | 11-Jul |
| 1998 | 24-Jun | 9-Aug |

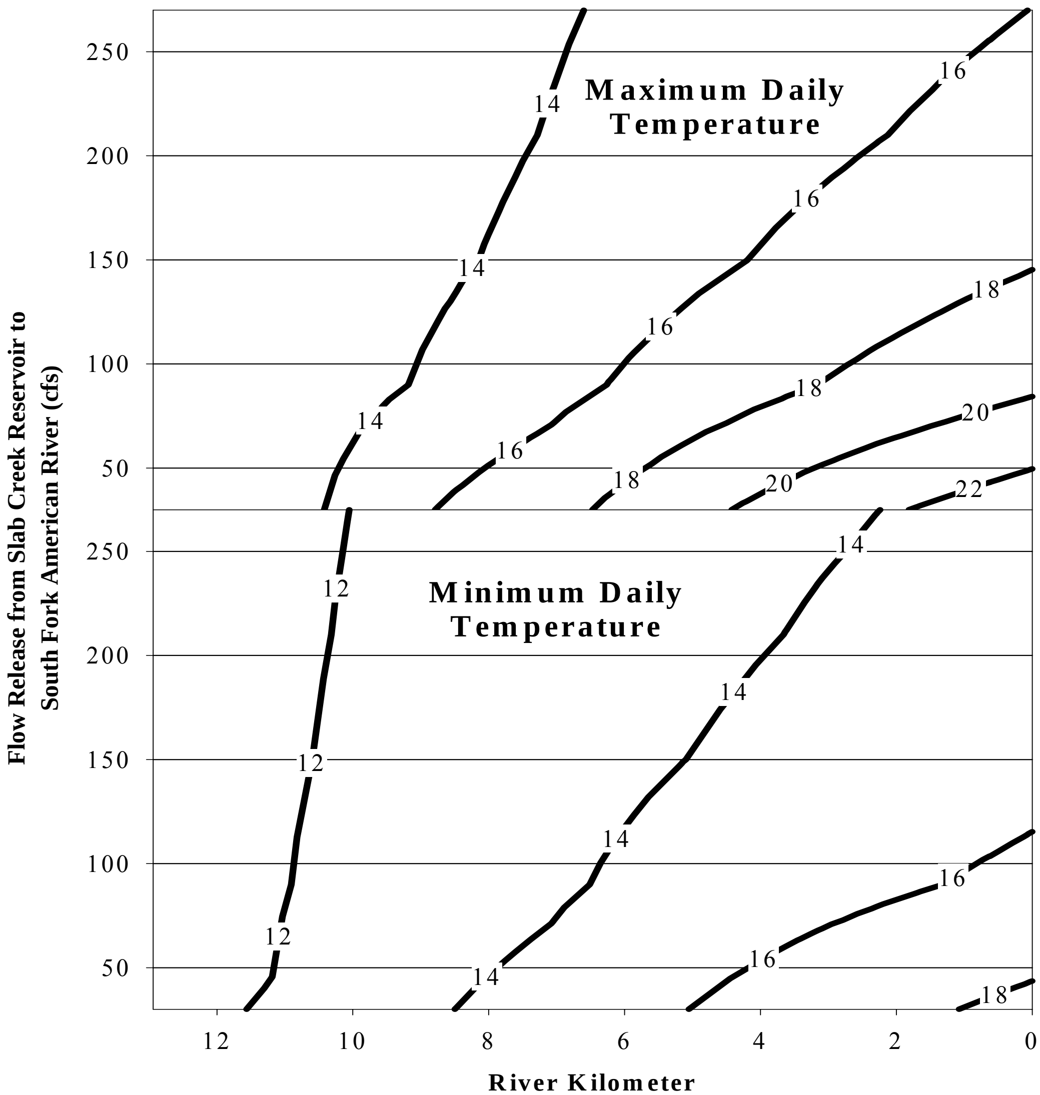
Since the weekly step-down was based on interpolating between the months of May and July, the next step was to establish the minimum streamflow for July. To establish the minimum streamflow for July, water temperature modeling was reviewed. The modeling shows that at 90 cfs, water temperatures would reach a mean of 12°C above White Rock Powerhouse during the middle to end of May and 15-22°C during June (Devine Tarbell & Associates 2005). These water temperatures at or above a mean of 12°C, as well as the decline of the natural hydrograph, are important cues for FYLF reproduction. In addition, the summer months are important for hydroelectric generation, and the lower flows allow more water to be used for hydroelectric generation.

Once the May and July streamflows were established, the June minimum streamflows were developed with the goal of mimicking the descending limb of the natural hydrograph, as described above. The actual streamflows for each weekly step-down were developed by interpolating between the May and July minimum streamflows in approximately equal weekly steps.

The PHABSIM results were reviewed for each of the weekly minimum streamflows in June. A flow of 255 cfs is 92 percent of the WUA for rainbow trout spawning, 45 percent of the WUA for rainbow trout juveniles, and 96 percent of the WUA for rainbow trout adults. A flow of 210 cfs is 93 percent of the WUA for rainbow trout spawning, 50 percent of the WUA for rainbow trout juveniles, and 98 percent of the WUA for rainbow trout adults. A flow of 165 cfs is 91 percent of the WUA for rainbow trout spawning, 56 percent of the WUA for rainbow trout juveniles, and 98 percent of the WUA for rainbow trout adults. A flow of 120 cfs is 84 percent of the WUA for rainbow trout spawning, 70 percent of the WUA for rainbow trout juveniles, and 98 percent of the WUA for rainbow trout adults. Although the WUA for rainbow trout juveniles is low, the WUA gradually increases throughout the month and achieves 80 percent WUA by July (Devine Tarbell & Associates and Stillwater Sciences 2004d).

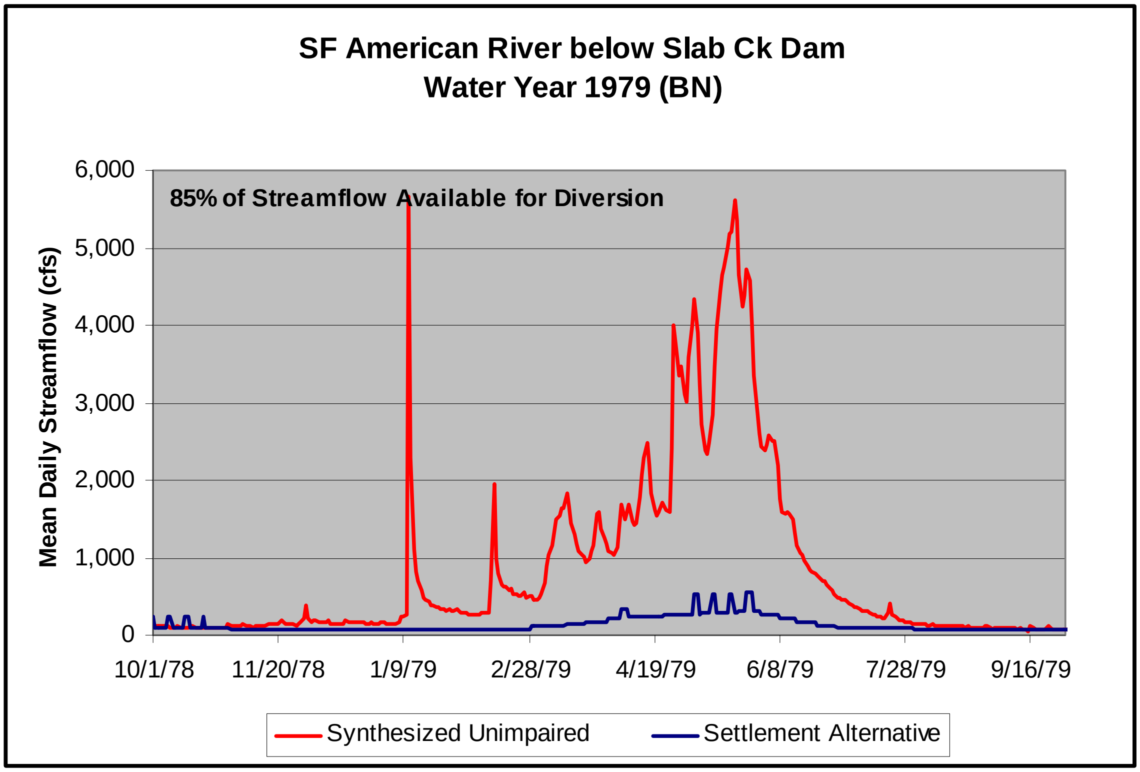
Hardhead spawning occurs with the declining spring hydrograph and associated changes in water temperature and probably spawn in flowing water above gravel beds in riffles, runs, or at the heads of pools (Devine Tarbell & Associates and Stillwater Sciences 2004d). Based on this information, the declining hydrograph and associated changes in water temperature are expected to address hardhead spawning.

Once the streamflows were established for May through July, the August through February streamflows were developed based on WUA and the recognition that winter hydroelectric operations were considered important to the licensee; therefore, a minimum streamflow in a typical transition pattern was not required throughout this time period. Development of minimum streamflows during the transition period also took into consideration the occurrence of accretion flows (including peak flow events). A flow of 70 cfs is 88 percent of the WUA for rainbow trout juveniles and 83 percent of the WUA for rainbow trout adults (Devine Tarbell & Associates and Stillwater Sciences 2004d). A flow of 70 cfs also addresses water temperature necessary for timely larval development of FYLF during August as shown in the following figure (Kupferberg 2006). SNTEMP modeling results performed by R2 Resource Consultants predict that 70 cfs releases in August will result in water temperatures at or below 20ºC for all but the 2.5 kilometers upstream of Chili Bar Reservoir (R2 Resource Consultants 2004b), providing needed habitat for rainbow trout.

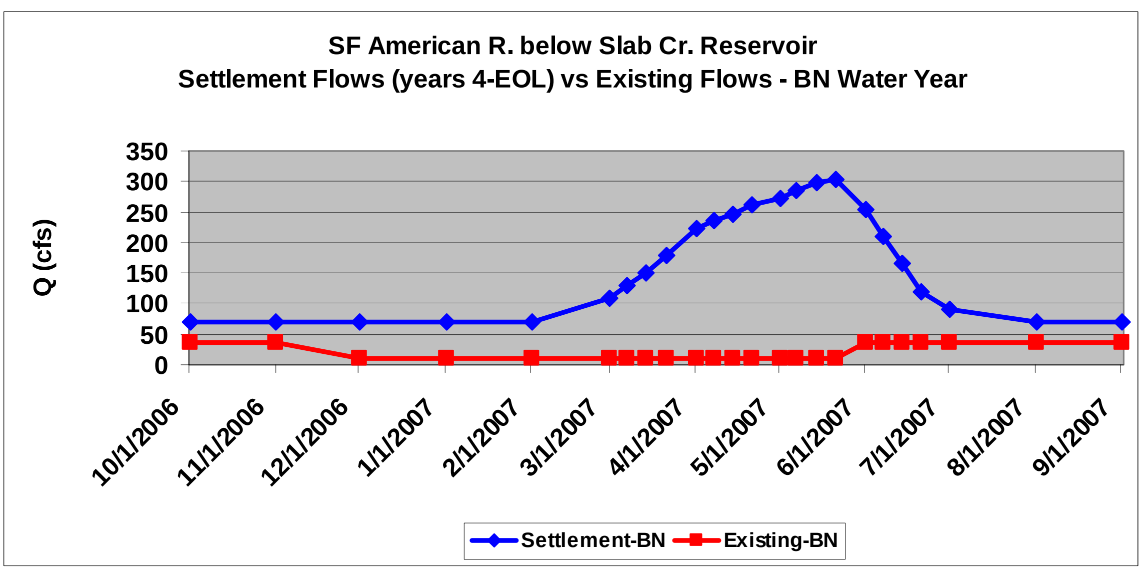



For March, the combined flows from the SFAR at Kyburz Diversion Dam and Alder Creek below Alder Creek Diversion Dam of the El Dorado Hydroelectric Project and Silver Creek below Junction Reservoir Dam of the UARP were reviewed. For the month of March, the combined flow is 180 cfs. This is 100 percent of the WUA for adult rainbow trout, and 54 percent of the WUA for rainbow trout juveniles (Devine Tarbell & Associates and Stillwater Sciences 2004d). This flow also provides an increase to the ascending limb of the hydrograph as it approaches the important spring period.

The following chart displays an example of the water available for hydroelectric operations in a representative BN water year type with implementation of the settlement.




The following chart displays a comparison of the settlement and existing license flows for a BN water year type in the SFAR below Slab Creek Reservoir Dam.




To establish the minimum streamflows for SFAR below Slab Creek Reservoir Dam for CD water years, the combined flows from the SFAR at Kyburz Diversion Dam and Alder Creek below Alder Creek Diversion Dam of the El Dorado Hydroelectric Project and

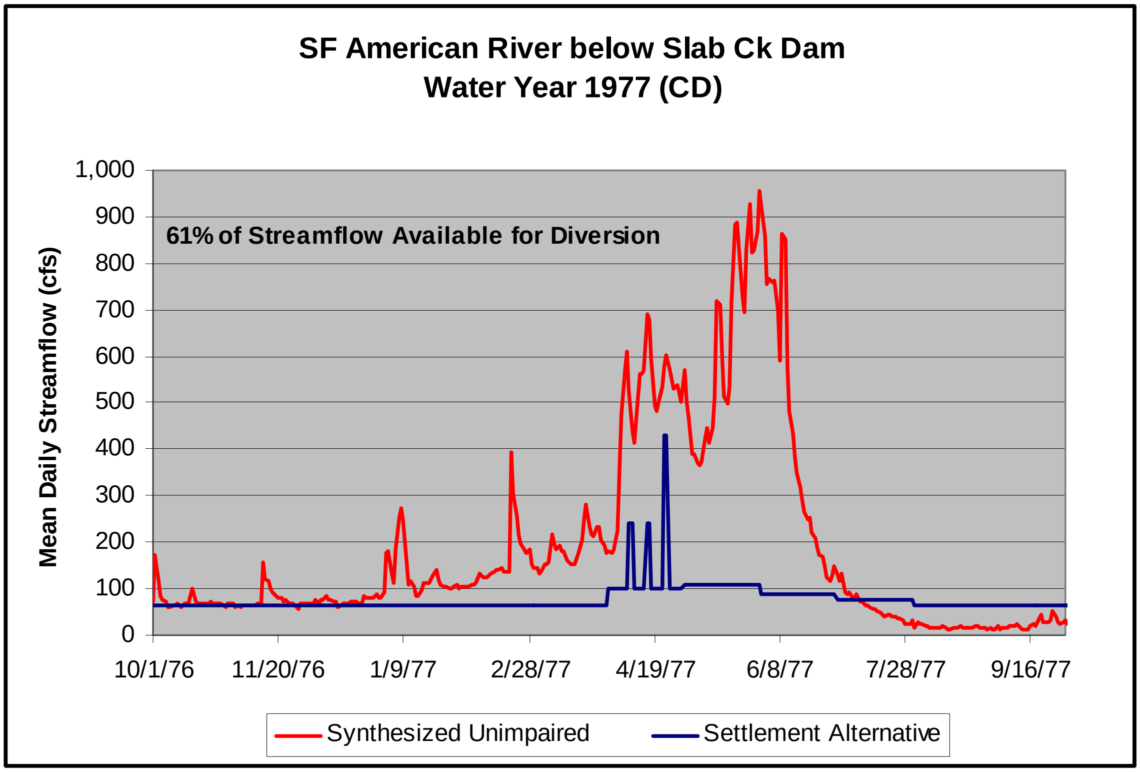
Silver Creek below Junction Reservoir Dam of the UARP were reviewed. For the month of April, the combined flow is 100 cfs. This is 81 percent of the WUA for rainbow trout spawning (Devine Tarbell & Associates and Stillwater Sciences 2004d). For May, the combined flow is 109 cfs. This is 82 percent of the WUA for rainbow trout spawning (Devine Tarbell & Associates and Stillwater Sciences 2004d). Based on this information, the April and May streamflows were set at 100 cfs and 109 cfs, respectively, to address rainbow trout spawning and to attempt to simulate the ascending limb in the natural spring hydrograph to restore ecological processes altered by the Project.

Once the April and May flows for a CD water year were established, FYLF breeding and water temperature concerns were important attributes for the month of June. Based on water temperature modeling, a flow of 90 cfs is predicted to maintain mean daily water temperatures of 20ºC or below for the majority of the reach for the month of June (R2 Resource Consultants 2004b). This temperature maintains cold freshwater habitat in compliance with the Basin Plan (CVRWQCB 1998) and moves closer to achieving temperatures necessary for FYLF breeding than the combined flow of 101 cfs from the SFAR at Kyburz Diversion Dam and Alder Creek below Alder Creek Diversion Dam of the El Dorado Hydroelectric Project and Silver Creek below Junction Reservoir Dam of the UARP. The PHABSIM results were reviewed to determine whether 90 cfs is an appropriate flow for rainbow trout juveniles (Devine Tarbell & Associates and Stillwater Sciences 2004d), and based on this information, the WUA for rainbow trout juveniles would be 75 percent; therefore, the minimum streamflow for June was set at 90 cfs.

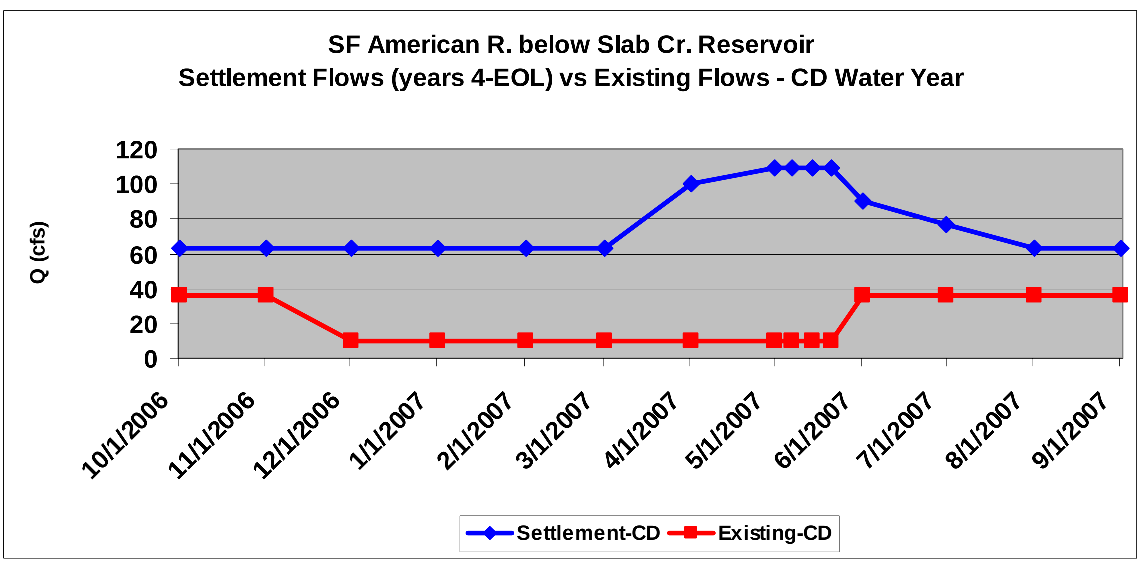
For the month of July, important cues for FYLF breeding include warmer water temperatures and the descending limb of the hydrograph. The combined flow of 77 cfs from the SFAR at Kyburz Diversion Dam and Alder Creek below Alder Creek Diversion Dam of the El Dorado Hydroelectric Project and Silver Creek below Junction Reservoir Dam of the UARP is predicted to result in temperatures of 20ºC in the upper half of the reach that gradually increase to approximately 22ºC in the lower half of the reach (Kupferberg 2006). The warmer temperatures in combination with the descent of the hydrograph are expected to encourage FYLF breeding in this reach. This flow also results in 85 percent percent WUA for rainbow trout juveniles and 87 percent for rainbow trout adults (Devine Tarbell & Associates and Stillwater Sciences 2004d).

Once the streamflows were established for May through July, the August through March streamflows were developed based on the percent WUA and the recognition that winter hydroelectric operations were considered important to the licensee; therefore, a minimum streamflow in a typical transition pattern was not required throughout this time period. Development of minimum streamflows during the transition period also took into consideration the occurrence of accretion flows. A flow of 63 cfs is 90 percent of the WUA for rainbow trout juveniles and 80 percent of the WUA for rainbow trout adults (Devine Tarbell & Associates and Stillwater Sciences 2004d).

The following chart displays an example of the water available for hydroelectric operations in a representative CD water year type with implementation of the settlement.




The following chart displays a comparison of the settlement and existing license flows for a CD water year type in the SFAR below Slab Creek Reservoir Dam.




For Dry water year types, a similar process to BN and CD water year types was followed. The combined flows from the SFAR at Kyburz Diversion Dam and Alder Creek below Alder Creek Diversion Dam of the El Dorado Hydroelectric Project and Silver Creek below Junction Reservoir Dam of the UARP were reviewed and review of PHABSIM and other information was used to establish the March and April flows (Devine Tarbell & Associates and Stillwater Sciences 2004d). For May, simulating the decline of the natural hydrograph similar to June in a BN water year type was emphasized. The step-down occurred earlier in the year than the BN because it was estimated that breeding would occur earlier under warmer, drier conditions. The step-down was developed in the same manner as the BN water year type step-down, above (Kupferberg 2004). The actual streamflows for each weekly step-down were developed by interpolating between the April and June minimum streamflows in approximately equal weekly steps. The PHABSIM results were reviewed for each of the weekly minimum streamflows in May as shown in the following table (Devine Tarbell & Associates and Stillwater Sciences 2004d).

| Month | Water Year Type | Flow Range | Percent WUA | Benefitting Life stage |
|---|---|---|---|---|
| October thru February | CD | 63 | 80 | Adult rainbow trout |
| | Dry | 63 | 80 | Adult rainbow trout |
| | BN | 70 | 83 | Adult rainbow trout |
| | AN | 80 | 89 | Adult rainbow trout |
| | Wet | 90 | 92 | Adult rainbow trout |
| March | CD | 63 | 80 | Adult rainbow trout |
| | Dry | 101 | 95 | Adult rainbow trout |
| | BN | 180 | 100 | Adult rainbow trout |
| | AN | 180 | 100 | Adult rainbow trout |
| | Wet | 180 | 100 | Adult rainbow trout |
| April/May (years 1-3) | CD | 100-109 | 81-82 | Rainbow trout spawning |
| | Dry | 107-183 | 81-82 | Rainbow trout spawning |
| | BN | 222-263 | 93-95 | Rainbow trout spawning |
| | AN | 222-263 | 93-95 | Rainbow trout spawning |
| | Wet | 222-263 | 93-95 | Rainbow trout spawning |
| April/May (years 3 thru license term) | CD | 100-109 | 81-82 | Rainbow trout spawning |
| | Dry | 107-183 | 81-82 | Rainbow trout spawning |
| | BN | 263-303 | 95-96 | Rainbow trout spawning |
| | AN | 263-395 | 95 | Rainbow trout spawning |
| | Wet | 263-415 | 95 | Rainbow trout spawning |
| June (years 1-3) | CD | 90 | 75 | Rainbow trout spawning |
| | Dry | 90 | 75 | Rainbow trout spawning |
| | BN | 123-228 | 84-94 | Rainbow trout spawning |
| | AN | 123-228 | 84-94 | Rainbow trout spawning |
| | Wet | 123-228 | 84-94 | Rainbow trout spawning |
| June (years 3 thru license term) | CD | 90 | 75 | Rainbow trout spawning |
| | Dry | 90 | 75 | Rainbow trout spawning |
| | BN | 120-255 | 84-92 | Rainbow trout spawning |
| | AN | 120-324 | 84-97 | Rainbow trout spawning |
| | Wet | 120-352 | 84-97 | Rainbow trout spawning |
| July | CD | 77 | 85/87 | Rainbow trout juveniles / adults |
| | Dry | 90 | 80/92 | Rainbow trout juveniles / adults |
| | BN | 90 | 80/92 | Rainbow trout juveniles / adults |

| | | | | |
|---|---|---|---|---|
| | AN | 90 | 80/92 | Rainbow trout juveniles / adults |
| | Wet | 90 | 80/92 | Rainbow trout juveniles / adults |
| August/September | CD | 63 | 90/80 | Rainbow trout juveniles / adults |
| | Dry | 70 | 88/83 | Rainbow trout juveniles / adults |
| | BN | 70 | 88/83 | Rainbow trout juveniles / adults |
| | AN | 70 | 88/83 | Rainbow trout juveniles / adults |
| | Wet | 70 | 88/83 | Rainbow trout juveniles / adults |

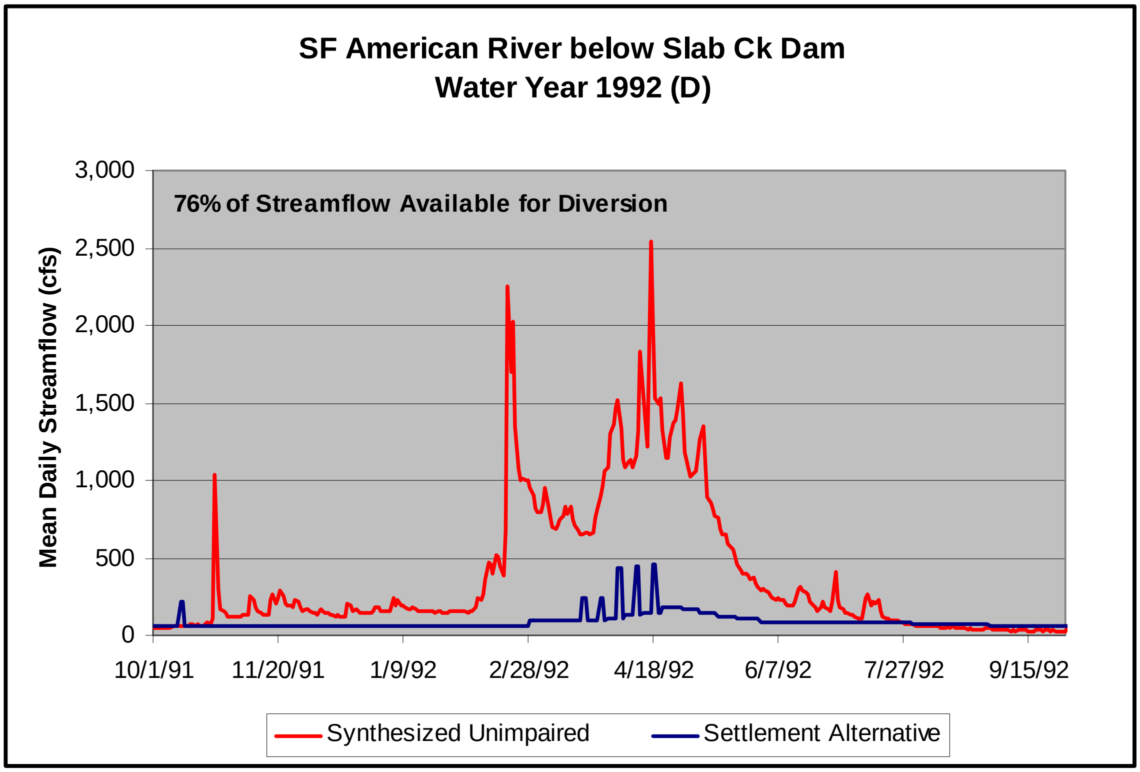
To establish the minimum streamflows for June and July, water temperature modeling was reviewed. The modeling shows that at 90 cfs, water temperatures would reach a mean of 12°C above White Rock Powerhouse during the middle to end of May and 15-22°C during June (Devine Tarbell & Associates 2005). These water temperatures at or above a mean of 12°C, as well as the decline of the natural hydrograph, are important cues for FYLF reproduction. In addition, the summer months are important for hydroelectric generation, and the lower flows allow more water to be used for hydroelectric generation.

Hardhead spawning occurs with the declining spring hydrograph and associated changes in water temperature and probably spawn in flowing water above gravel beds in riffles, runs, or at the heads of pools (Devine Tarbell & Associates and Stillwater Sciences 2004d). Based on this information, the declining hydrograph and associated changes in water temperature are expected to address hardhead spawning.

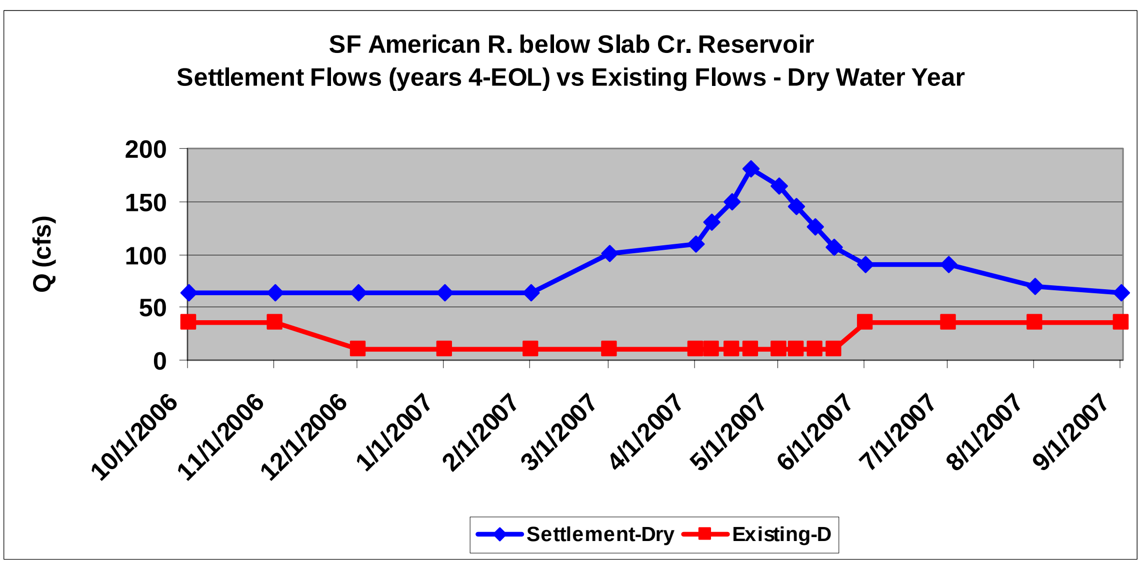
The August streamflow took into consideration declining temperatures that would assist in FYLF reproduction. A flow of 70 cfs also addresses water temperature necessary for timely larval development of FYLF during August as shown in the following figure (Kupferberg 2006). SNTEMP modeling results performed by R2 Resource Consultants predicts that 70 cfs results in water temperatures of 22ºC for the 4.5 kilometers upstream of Chili Bar Reservoir (R2 Resource Consultants 2004b). In addition, a flow of 70 cfs is 88 percent of the WUA for rainbow trout juveniles and 83 percent of the WUA for rainbow trout adults (Devine Tarbell & Associates and Stillwater Sciences 2004d).

Once the streamflows were established for March through August, the September through February streamflows were developed based on percent WUA (see chart above) (Devine Tarbell & Associates and Stillwater Sciences 2004d) and the recognition that winter hydroelectric operations were considered important to the licensee; therefore, a minimum streamflow in a typical transition pattern was not required throughout this time period.

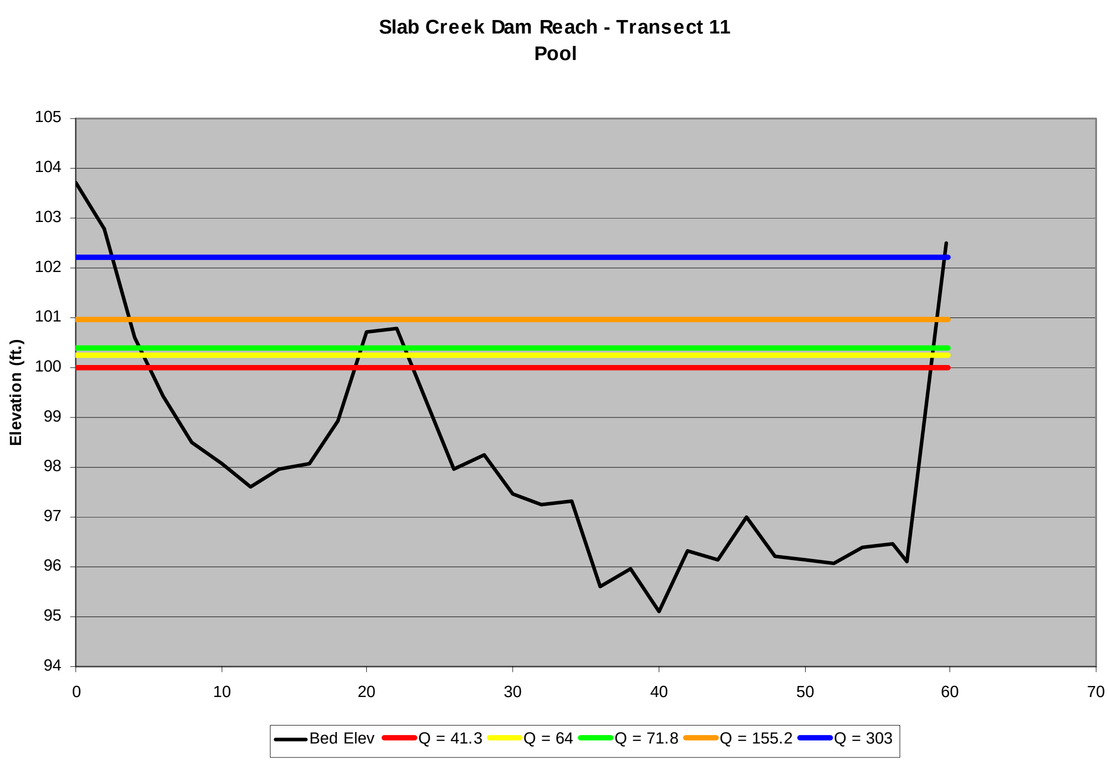
The following chart displays an example of the water available for hydroelectric operations in a representative Dry water year type with implementation of the settlement.

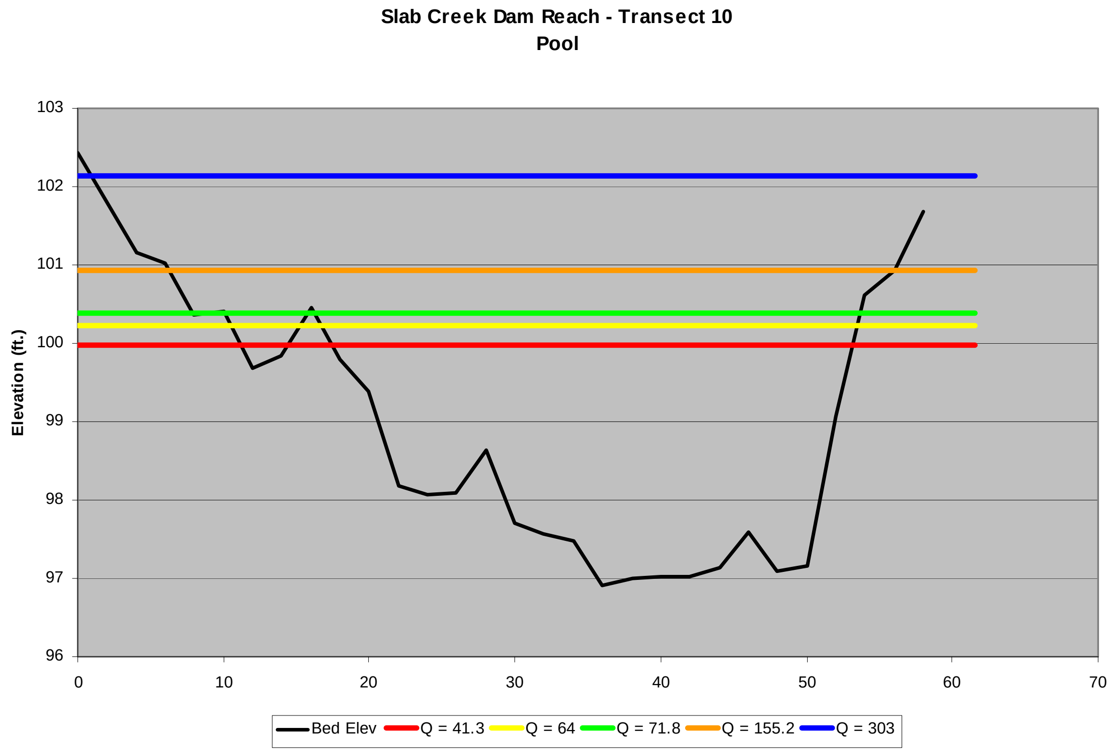



The following chart displays a comparison of the settlement and existing license flows for a Dry water year type in the SFAR below Slab Creek Reservoir Dam.

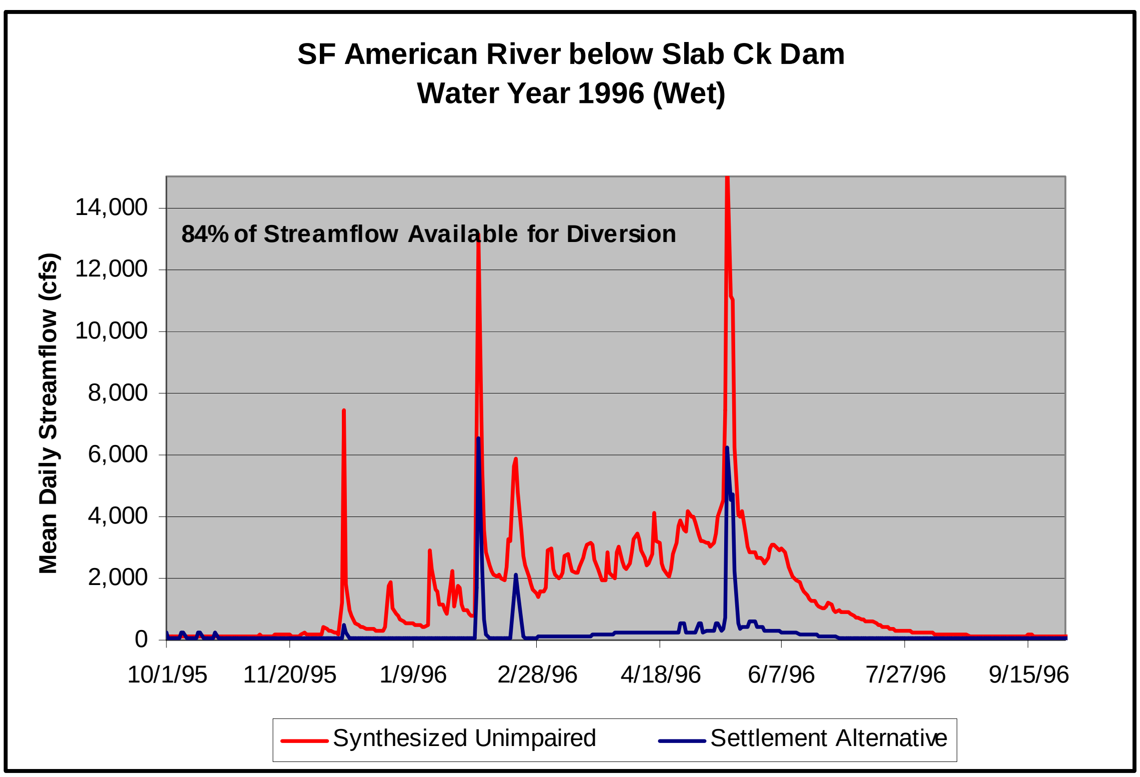


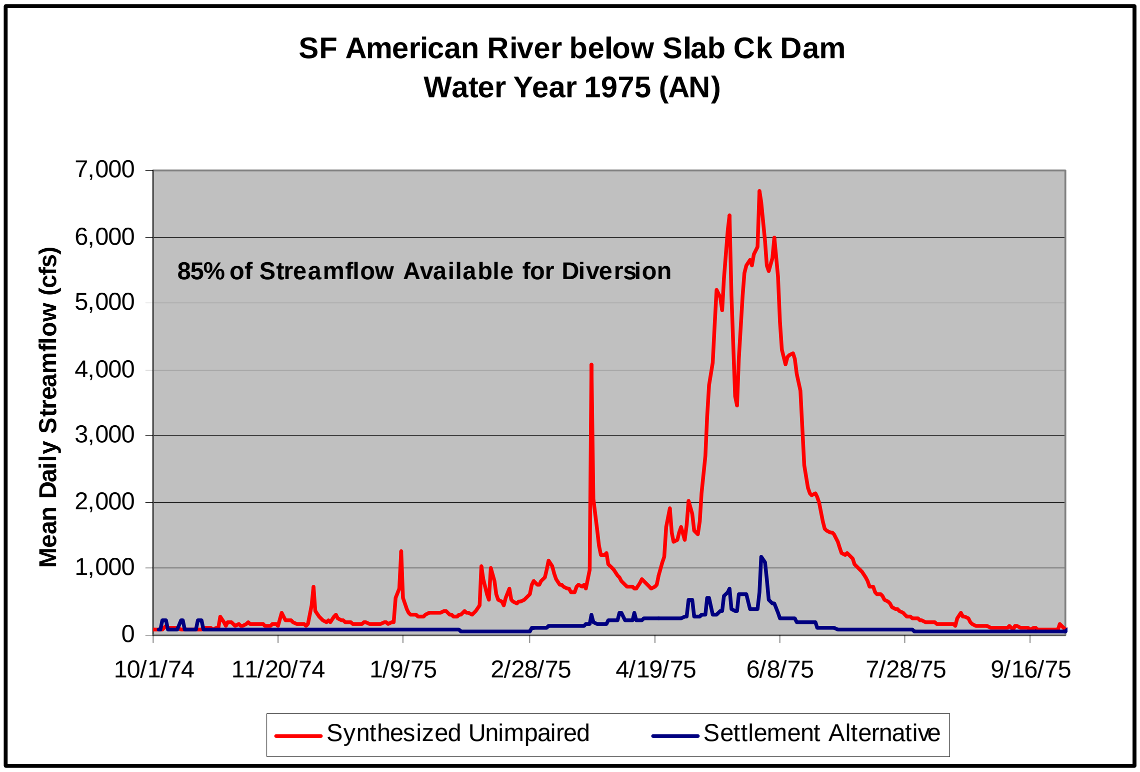
A similar approach was use for the Wet and AN water year types. The same minimum streamflows as are included in a BN water year type for the months of July through April were included in the Wet and AN water year types to provide the licensee with as much water as possible and still meet ecological objectives. However, during the important spring months of May and June (which includes the step-down month), higher flows were included for the Wet and AN water year types. The PHABSIM results are extrapolated only to 388 cfs, which is 100 percent of the WUA for rainbow trout spawning (Devine Tarbell & Associates and Stillwater Sciences 2004d). In reviewing the WUA curves (Devine Tarbell & Associates and Stillwater Sciences 2004d), rainbow trout spawning habitat would continue to increase as flow increases to a point where the flow inundates the entire channel and additional spawning habitat does not become available, as shown in the following chart. It must be recognized that most spawning in this reach occurs in pocket gravels, pool-tail crests, and small lateral bar areas that increase in availability and area with higher flows (Devine Tarbell & Associates and Stillwater Sciences 2005e). In the SFAR, this point is well above 415 cfs; therefore, although the PHABSIM study does not extrapolate the WUA for rainbow trout spawning to 415 cfs, it is estimated that this flow provides more spawning habitat in this reach. The percent WUA for each month of the Wet and AN water year types is displayed in the chart above. These flows will assist in raising the water-table at river bars, especially those at the downstream end of the reach. Declines in water tables, such as a result of diversions, can cause shifts in plant composition from mesic to xeric species and decreases in the overall extent of riparian ecosystems (Castelli et al.2000). Also, there is a possibility that these higher flows will help control the over-wintering non-native bullfrog tadpoles by flushing them out of the inundated side pools.

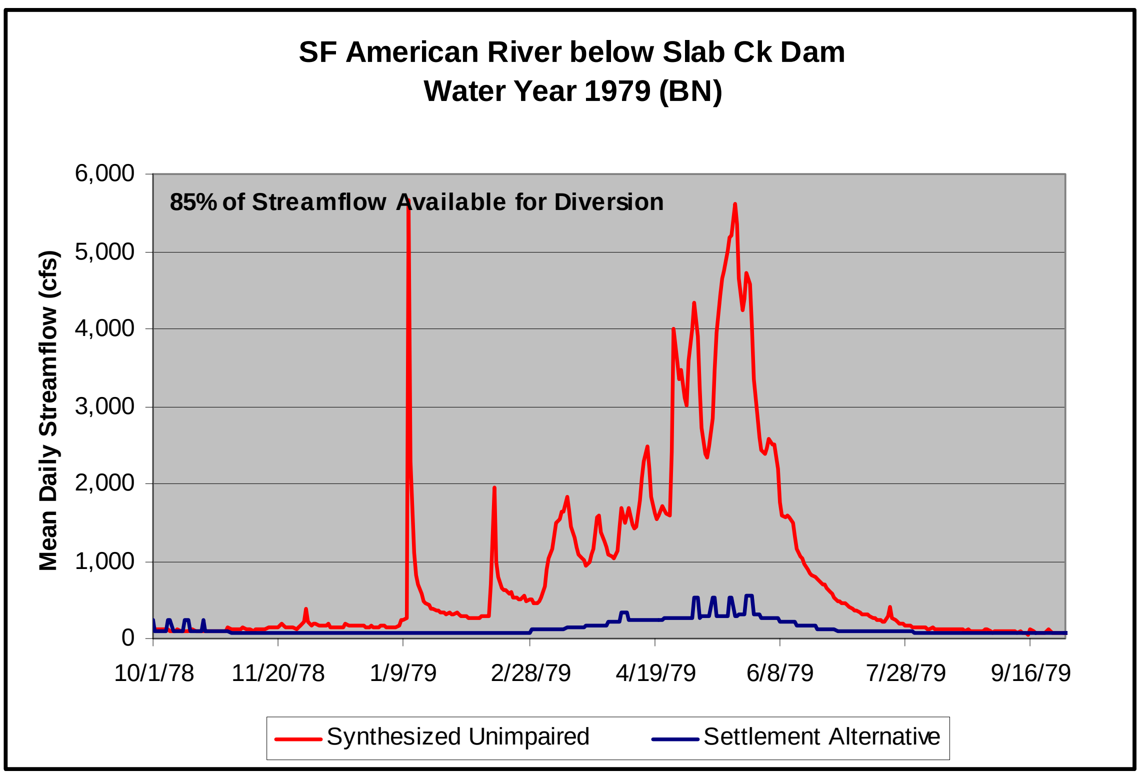


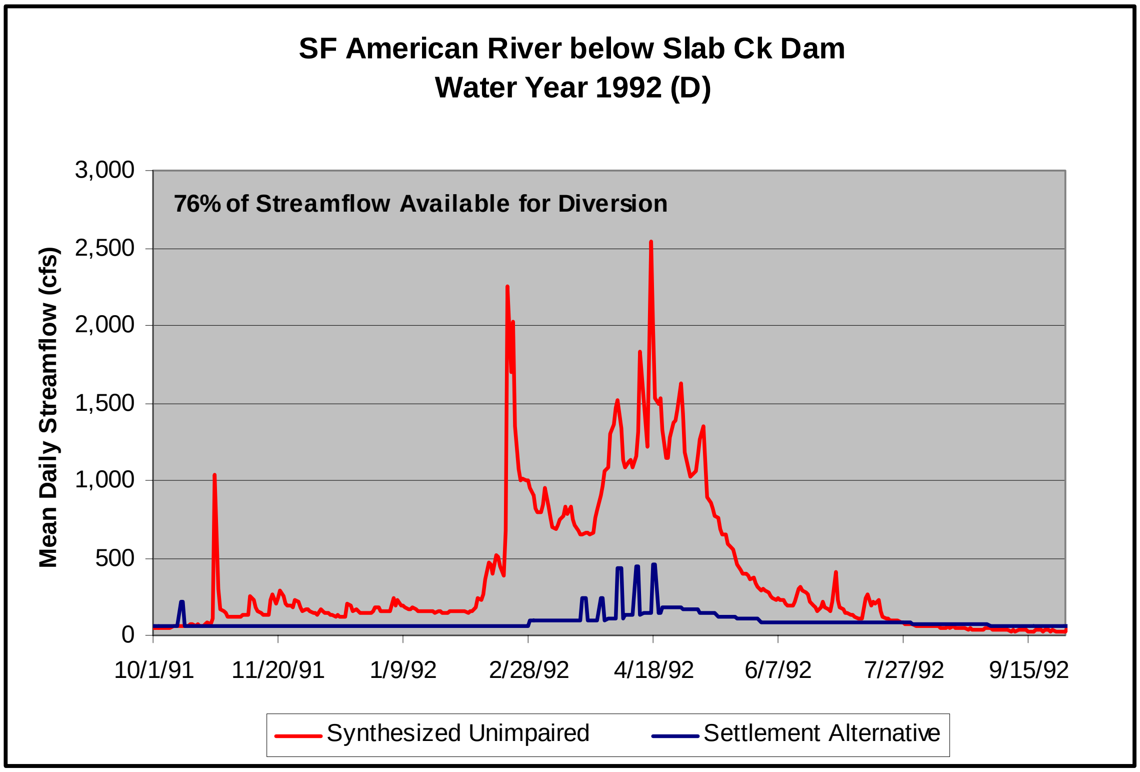


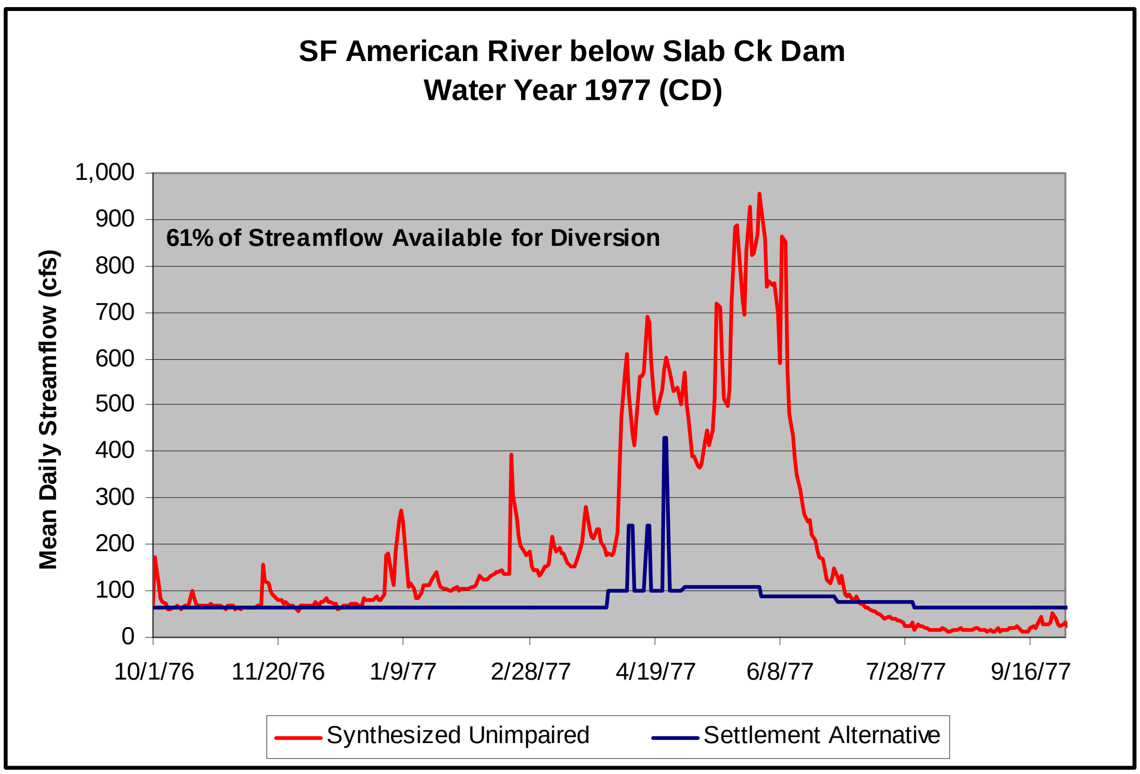

The following charts display the unimpaired and regulated mean daily streamflows in representative Wet, AN, BN, Dry, and CD water year types, respectively, with implementation of the settlement.



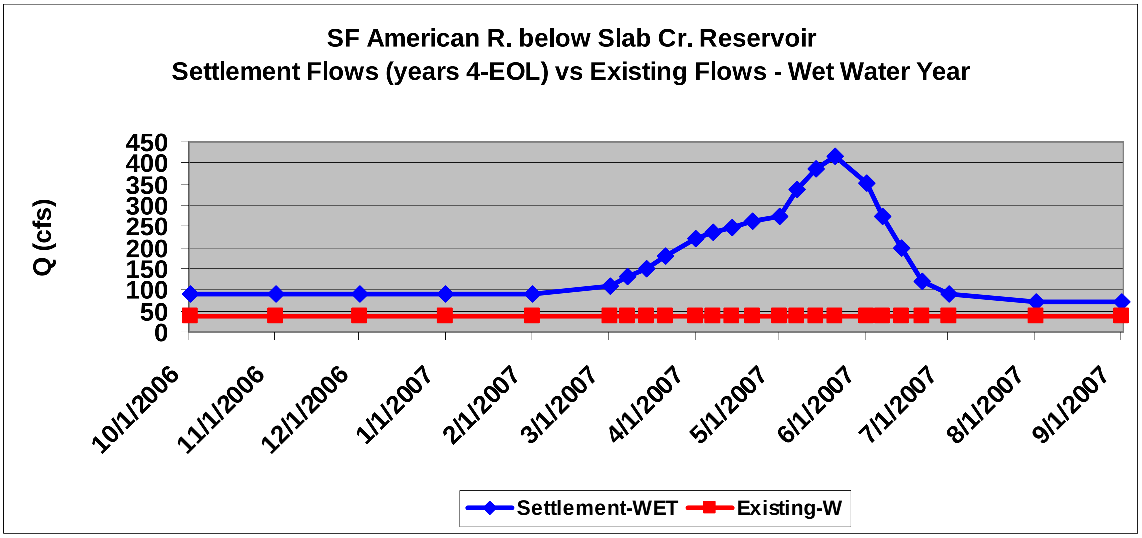

SF American River below Slab Ck Dam
Water Year 1975 (AN)
Mean Daily Streamflow (cfs)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
85% of Streamflow Available for Diversion
10/1/74
11/20/74
1/9/75
2/28/75
4/19/75
6/8/75
7/28/75
9/16/75
Synthesized Unimpaired
Settlement Alternative

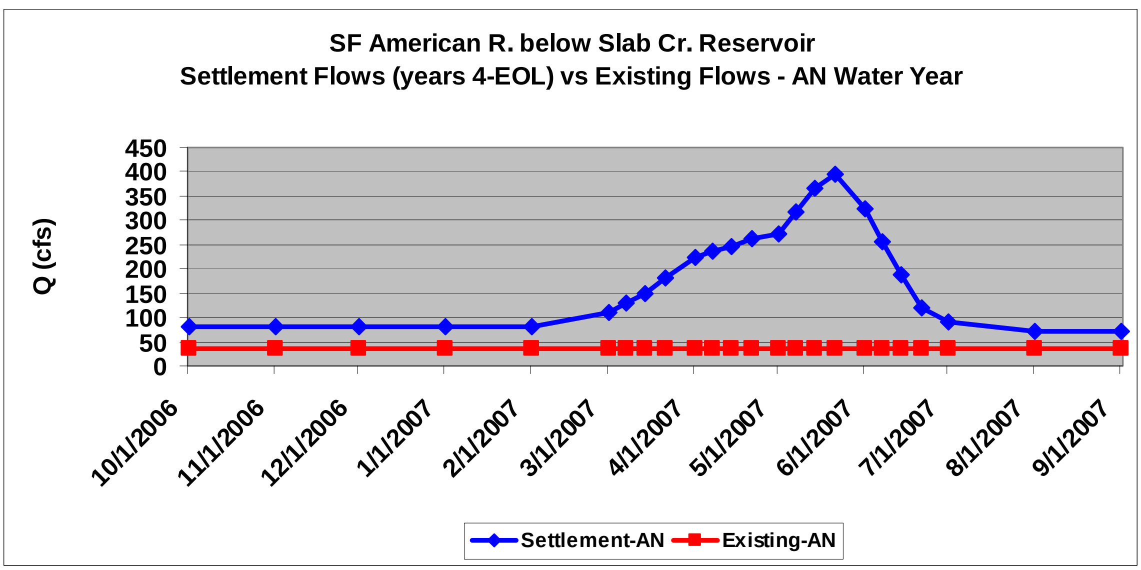

SF American River below Slab Ck Dam
Water Year 1979 (BN)
Mean Daily Streamflow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
0
85% of Streamflow Available for Diversion
10/1/78
11/20/78
1/9/79
2/28/79
4/19/79
6/8/79
7/28/79
9/16/79
Synthesized Unimpaired
Settlement Alternative


SF American River below Slab Ck Dam
Water Year 1992 (D)
76% of Streamflow Available for Diversion
Mean Daily Streamflow (cfs)
3,000
2,500
2,000
1,500
1,000
500
0
10/1/91
11/20/91
1/9/92
2/28/92
4/18/92
6/7/92
7/27/92
9/15/92
Synthesized Unimpaired
Settlement Alternative


SF American River below Slab Ck Dam
Water Year 1977 (CD)
61% of Streamflow Available for Diversion
Mean Daily Streamflow (cfs)
1,000
900
800
700
600
500
400
300
200
100
0
10/1/76
11/20/76
1/9/77
2/28/77
4/19/77
6/8/77
7/28/77
9/16/77
Synthesized Unimpaired
Settlement Alternative

The following charts display a comparison of the settlement and existing license flows for Wet and AN water year types, respectively, in the SFAR below Slab Creek Reservoir Dam.




Increased minimum streamflows are expected to provide an increased percent of WUA over current minimum streamflows and seek to improve water quality. Higher spring flows in BN, AN, and Wet years would redistribute spawning gravels to maintain trout habitat and transport some large woody debris downstream. Because approximately 75 percent of this reach is low gradient, large woody debris and spawning gravels should frequently settle into niche areas.

Increased minimum streamflows in the spring may also be beneficial to the native aquatic species in this reach by dislodging the second year bullfrog tadpoles from their residence pools. Bullfrogs, a non-native predator to FYLF life stages and young western pond turtles, are common in the lower part of this reach, and a higher spring flow may reduce the survival of over-wintering bullfrog tadpoles. FYLF tadpoles would not be affected in this way, as they metamorphose prior to the first winter.

The original Slab Creek minimum streamflows proposed by the resource agencies also attempted to simulate the shape of the unimpaired hydrograph, similar to the analysis for other reaches (see following table).

| **South Fork American River Below Slab Creek Reservoir Dam** | | | | | |
|---|---|---|---|---|---|
| **Month** | **Minimum Streamflow by Water Year (cfs)** | | | | |
| | CD | DRY | BN | AN | WET |
| **OCT** | 63 | 63 | 80 | 93 | 101 |
| **NOV** | 63 | 63 | 108 | 118 | 128 |
| **DEC** | 63 | 63 | 121 | 130 | 141 |
| **JAN** | 63 | 63 | 154 | 160 | 173 |
| **FEB** | 63 | 63 | 165 | 170 | 183 |
| **MAR** | 63 | 101 | 180 | 184 | 198 |
| **APR** | 100 | 183 | 287 | 319 | 343 |
| **MAY** | 109 | 196 | 303 | 395 | 415 |
| **JUNE** | 101 | 176 | 255 | 324 | 352 |
| **JULY** | 77 | 152/128/104/80 | 218/180/143/105 | 270/216/162/108 | 293/234/175/116 |
| **AUG** | 63 | 80 | 105 | 108 | 116 |
| **SEPT** | 63 | 63 | 90 | 93 | 101 |

However, to reduce the loss of hydroelectric generation, the resource agencies substantially reduced minimum streamflows from late summer through late winter. Also, because the higher spring flows could require the licensee to modify facilities, there is a minimum streamflow regime for 2 years that is within the capability of the existing facility, and then the minimum streamflows increase once appropriate facility modifications are made to accommodate the flows.

The following table depicts the recommended minimum streamflows.

| **South Fork American River Below Slab Creek Reservoir Dam** | | | | | |
|---|---|---|---|---|---|
| **Years 4 through License Term** | | | | | |
| **Month** | **Minimum Streamflow by Water Year (cfs)** | | | | |
| | CD | DRY | BN | AN | WET |
| **OCT** | 63 | 63 | 70 | 80 | 90 |
| **NOV** | 63 | 63 | 70 | 80 | 90 |
| **DEC** | 63 | 63 | 70 | 80 | 90 |
| **JAN** | 63 | 63 | 70 | 80 | 90 |
| **FEB** | 63 | 63 | 70 | 80 | 90 |
| **MAR** | 63 | 101 | 110-130-150-180 | 110-130-150-180 | 110-130-150-180 |
| **APR** | 100 | 110-130-150-183 | 222-236-247-263 | 222-236-247-263 | 222-236-247-263 |
| **MAY** | 109 | 164-145-126-107 | 272-286-297-303 | 272-316-367-395* | 272-337-287-415* |
| **JUNE** | 90 | 90 | 255-210-165-120 | 324-256-188-120 | 352-274-197-120 |
| **JULY** | 77 | 90 | 90 | 90 | 90 |
| **AUG** | 63 | 70 | 70 | 70 | 70 |
| **SEPT** | 63 | 63 | 70 | 70 | 70 |

*Or maximum capacity of the new retrofit valve, whichever is less.

In addition to the substantial environmental benefits the streamflows provide, if the licensee undertakes facility modifications, the licensee will have greater control over operations at Slab Creek Reservoir Dam. This is expected to result in improved operation of the Project works for electricity production.

***South Fork American River Below Chili Bar Reservoir Dam***

The SFAR is subject to daily tidal-like flow fluctuations below Chili Bar Reservoir Dam due to Project operations, primarily from the UARP (flows characteristically range from 100 to 1,200 cfs on a daily basis during most months) (Devine Tarbell & Associates and Stillwater Sciences 2005e). These fluctuations were considered when defining a minimum streamflow that is more protective of the resident aquatic community. Minimum streamflows were established at levels adequate to provide access into tributary streams with perennial connectivity to the river and maintenance of spawning, nursery habitat, and refugia for fish and other aquatic species. This approach sought to maximize to the greatest extent possible instream refugia from velocity and depth fluctuations in the SFAR downstream of Chili Bar Reservoir Dam.

The flow fluctuations cause disturbance and subject fish to stresses that may limit feeding behavior, placing greater physiologic demands for foraging during these daily high velocity events and increasing risks of stranding during rapid dewatering (Hunter 1992, 1985). The minimum streamflows were developed to increase wetted perimeter and provide more suitable habitat for benthic macroinvertebrate (BMI) colonization and greater productivitiy in the reach (Cushman 1985; Stanford 1994). The goal was to increase the standing crop of BMI with a reduction in the energetic demands on foraging fish. The BMI inundation study element of the Flow and Fluctuation in the Reach Downstream of Chili Bar Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005e) supports a finding that BMI total taxa richness, total insect taxa, total EPT (Ephemeroptera-Plecoptera-Trichoptera) taxa, and individuals per square foot decrease along a transect from Zone 1 (always inundated) to Zone 3 where substrate is de-watered at discharges ≤ 900 cfs. Stream profile surface water elevation data presented in the technical report (Devine Tarbell & Associates and Stillwater Sciences 2005e) demonstrate substantial gains in wetted perimeter as flow increases from ≤ 185 cfs to ≥ 498 cfs at the Indian Creek (Figure 4.2.1-4), Camp Lotus (Figure 4.2.1-7), and Gorilla Rock (Figure 4.2.1-11) study sites; an overall increase was shown at every measured site.

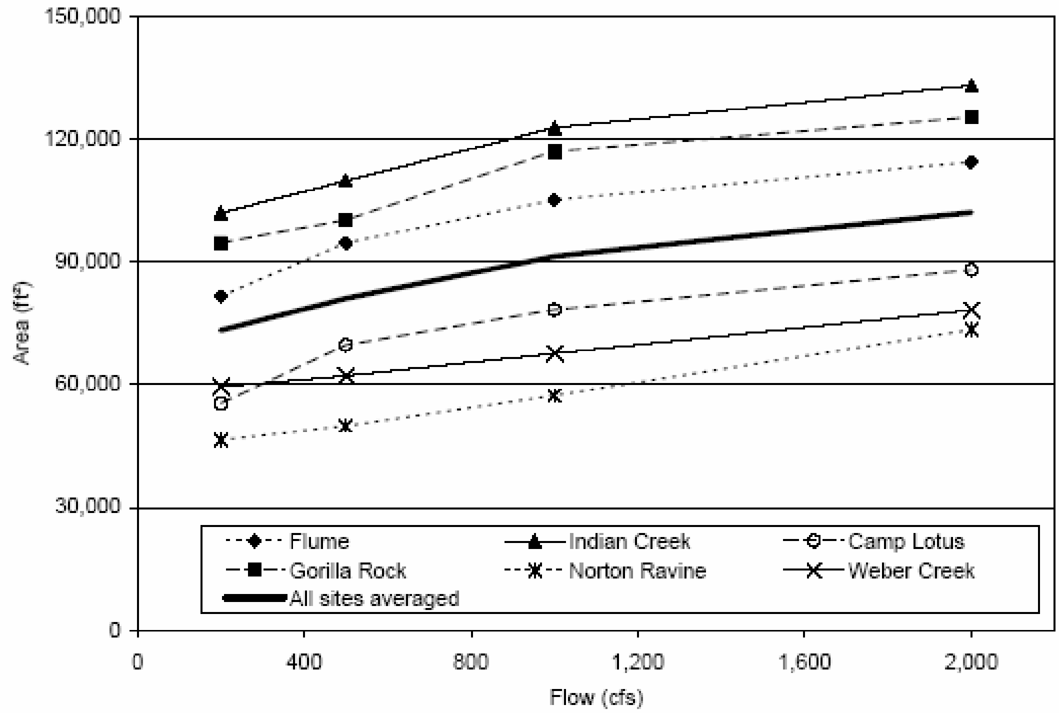



**Figure 5.1-7. Average and total wetted area by site at each test flow.**

Inspection of the upper transect site on Indian Creek shows flows less than 186 cfs will be confined to the channel thalweg, but flows increasing above 200 cfs will inundate the bench, creating increased wetted width and substrate habitat area to support the BMI prey base for the stream fishery.  Base flows from 200 cfs to 500 cfs increase wetted width and provide buffering from the effects of scour or standing that may result with peaking operations at Chili Bar powerhouse or spill due to UARP operations.

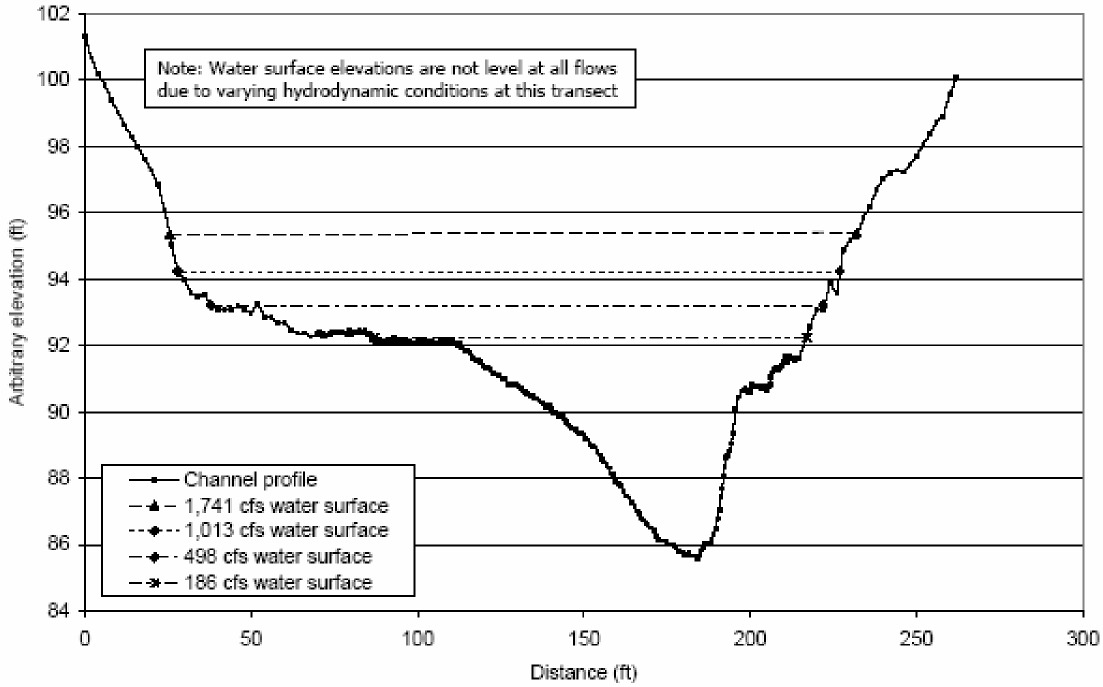



**Figure 4.2.1-4. Indian Creek study site, upper transect profile and water surface elevations.**

To increase habitat for the BMI forage base, minimum streamflows in the SFAR downstream of Chili Bar Reservoir Dam are established at ≥ 185 cfs in all water years except the second of a sequence of multiple Dry or CD water years when water conservation is imperative. The minimum streamflows in AN and Wet water years increase with available runoff and attempt to move toward maximizing BMI habitat while recognizing the limitations on storage in Chili Bar Reservoir. Variations in flow between water year types and months within the year are designed to reduce the tendency for secondary stream incision and the resulting bench geometry of the stream channel.

The Flow and Fluctuation Study (Devine Tarbell & Associates and Stillwater Sciences 2005e) indicated that fish stranding potential at most study sites peaks when flows decrease in the 400–200 cfs and 600–400 cfs ranges, with smaller peaks occurring in the 1,400–1,200 cfs and 800–600 cfs ranges (Figure 4.2.2-1). The Gorilla Rock study site was the primary site for stranding impacts these lower flow ranges and the Camp Lotus site was affected largely by the flow fluctuations from 2,400 to 2,000 cfs and 400 to 200 cfs. While base flows established at or above 600 cfs would minimize the impacts of stranding throughout the reach, minimum flows of 400 cfs could significantly reduce losses.

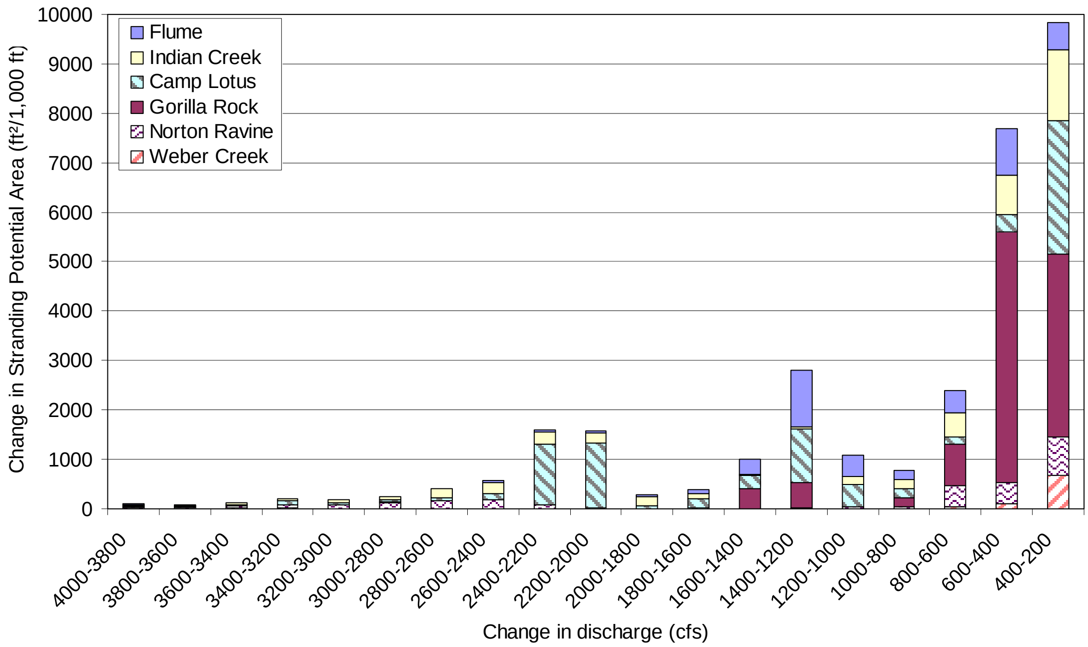
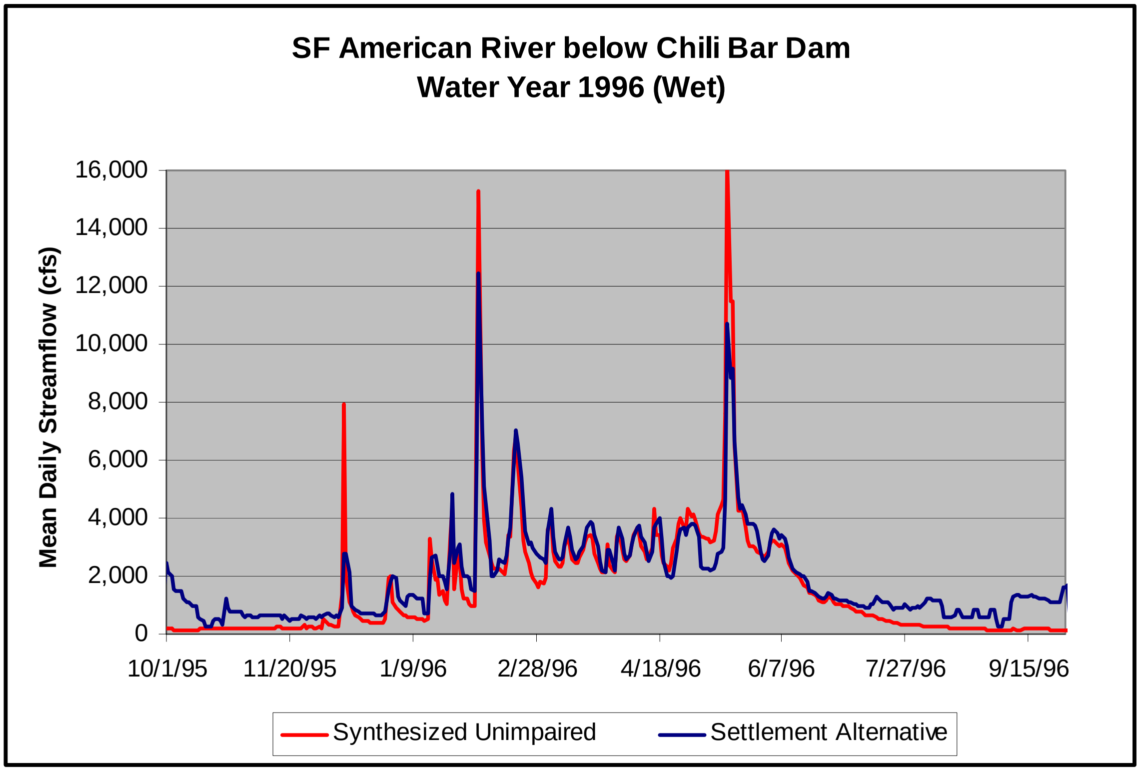


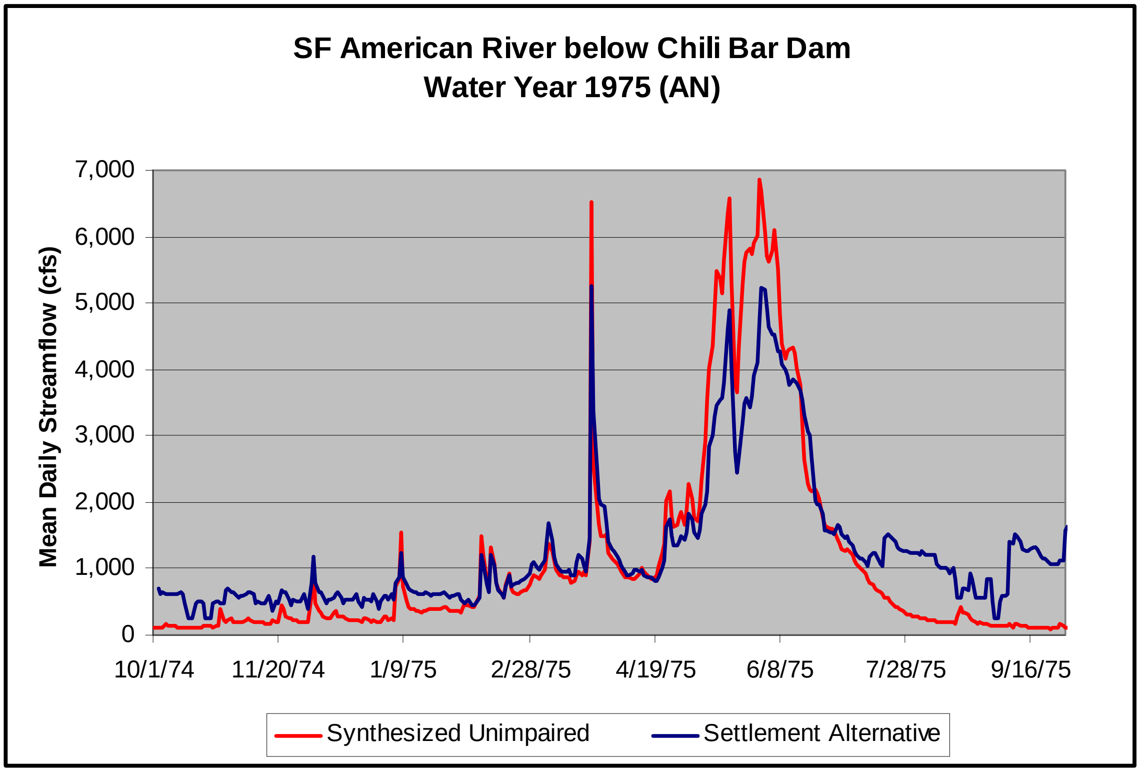

**Figure 4.2.2-1. Change in stranding potential area with 200 cfs incremental decreases in discharge at all sites.**

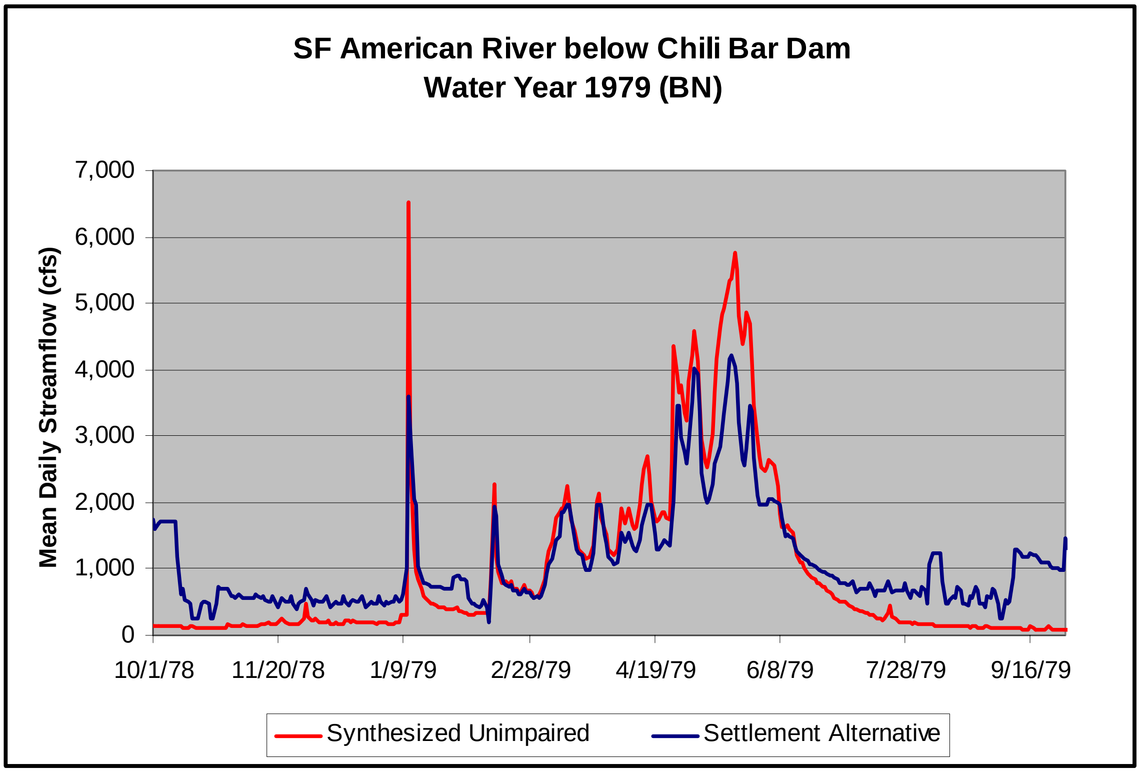
Establishment of base flows considered power generation and recreation needs and accordingly modified the monthly minimum flows downward to conserve water for these uses. Minimum flows for most months of the Wet and Above Normal water year types are high enough to moderate rates of stranding, and monthly base flows for all other water year types should provide an improvement over the existing rate of impacts.

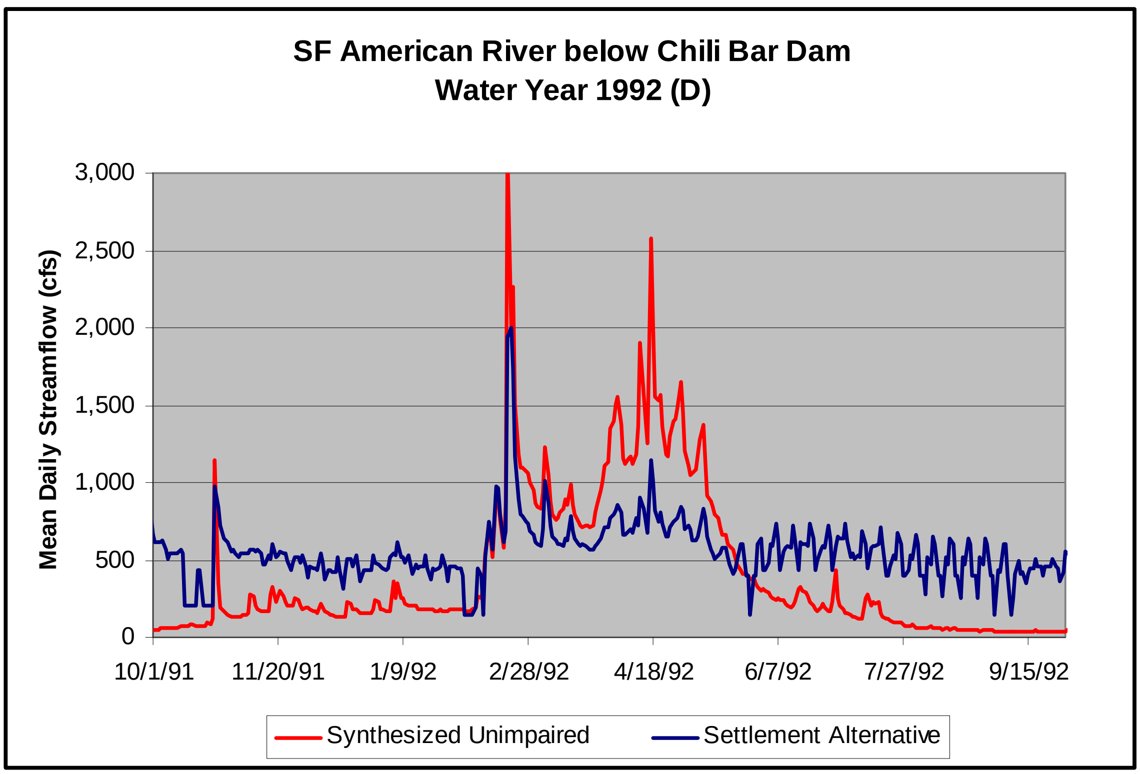
Fish populations in the reach downstream of Chili Bar Reservoir Dam are depauperate when compared to the Kings River and the Merced River (unregulated West Slope Sierra Nevada rivers of similar size and elevation) (CDFG 2005d). In an attempt to increase the resident rainbow trout populations and native non-game species, the resource agencies sought to reduce the difference between the base flow and the daily peak flows. By reducing the differences between daily high and low flows, it is believed that the potential for stranding will be reduced, BMI habitat will be more stable, and the daily variation in velocities and habitat will be reduced. The resource agencies recognize the importance of hydroelectric generation and the recreational values in this reach of the river and have attempted to balance to some degree these competing beneficial uses.

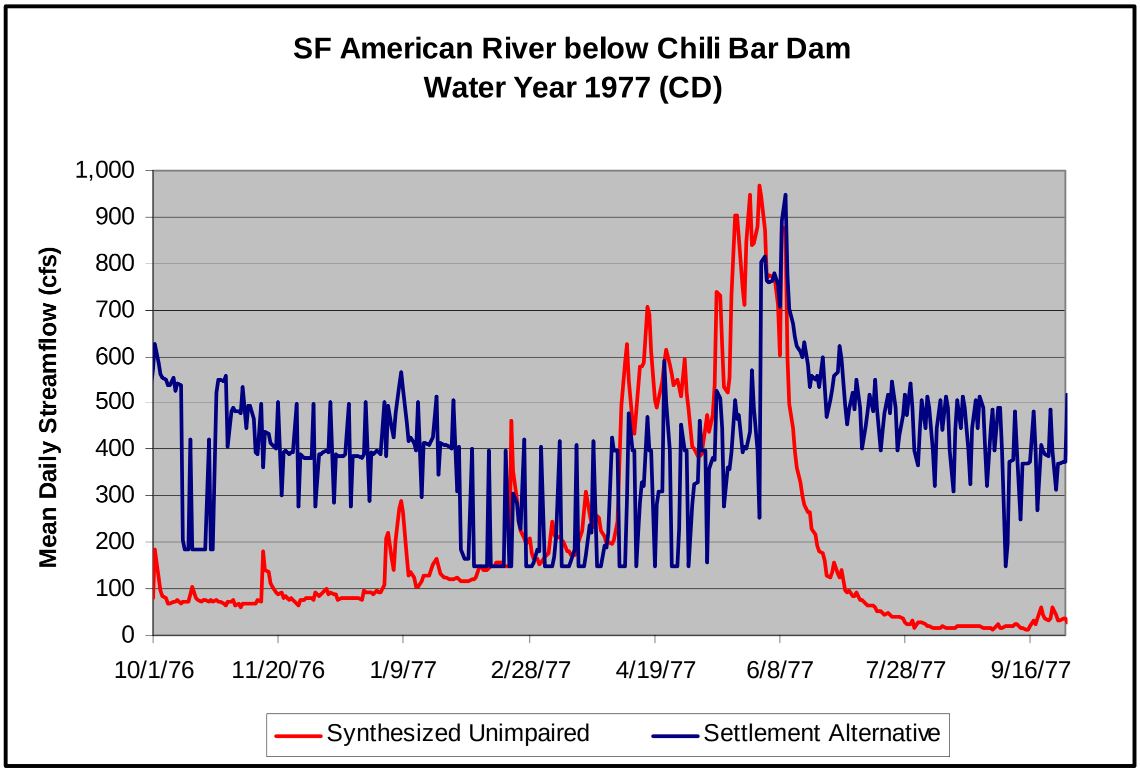
The following charts display examples of the water available for hydroelectric operations in Wet, AN, BN, Dry, and CD water year types, respectively, with implementation of the settlement.




SF American River below Chili Bar Dam
Water Year 1979 (BN)
Mean Daily Streamflow (cfs)
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
10/1/78
11/20/78
1/9/79
2/28/79
4/19/79
6/8/79
7/28/79
9/16/79
Synthesized Unimpaired
Settlement Alternative


SF American River below Chili Bar Dam
Water Year 1992 (D)
Mean Daily Streamflow (cfs)
3,000
2,500
2,000
1,500
1,000
500
0
10/1/91
11/20/91
1/9/92
2/28/92
4/18/92
6/7/92
7/27/92
9/15/92
Synthesized Unimpaired
Settlement Alternative




The following table depicts the recommended streamflows.

| South Fork American River Below Chili Bar Reservoir Dam | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | | |
| Month | | Minimum Streamflow by Water Year (cfs) | | | | |
| | SD | CD | DRY | BN | AN | WET |
| **OCT** | 150 | 185 | 200 | 250 | 250 | 250 |
| **NOV** | 150 | 185 | 200 | 200 | 200 | 250 |
| **DEC** | 150 | 185 | 200 | 200 | 200 | 250 |
| **JAN** | 150 | 185 | 200 | 200 | 200 | 250 |
| **FEB** | 150 | 185 | 200 | 200 | 200 | 250 |
| **MAR** | 150 | 185 | 200 | 200 | 200 | 250 |
| **APR** | 150 | 200 | 250 | 250 | 300 | 350 |
| **MAY** | 150 | 200 | 250 | 250 | 350 | 500 |
| **JUNE** | 200 | 200 | 250 | 250 | 350 | 500 |
| **JULY** | 150 | 185 | 200 | 250 | 300 | 350 |
| **AUG** | 150 | 185 | 200 | 250 | 300 | 300 |
| **SEPT** | 150 | 185 | 200 | 250 | 250 | 250 |

## Pulse Flows

### Objectives Addressed by Pulse Flows

Aquatic Biota
Fisheries
Macroinvertebrates
Large Woody Debris
Water Temperature
Target Lake Levels
Water Quality
Natural Hydrograph
Geomorphology
Riparian Habitat
Threatened, Endangered, and Sensitive Species and Management Indicator Species
Hydropower Operations
Recreational Streamflows
Connectivity
Visual Resource
Wilderness and Wild and Scenic River

### Information Used to Establish Pulse Flows

The following information was used to analyze streamflows: (a) regulated streamflow data from several licensee and United States Geological Survey (USGS) gages in the basin**,** (b) Hydrology Technical Report (Devine Tarbell & Associates and Hannaford 2005a), (c) Amphibians and Aquatic Reptiles Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005a), (d) Amphibian and Habitat Test Flow Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004a), (e) Aquatic Bioassessment Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005b), (f) Channel Morphology Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005c), (g) Chili Bar Reservoir Sediment Deposition Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005d), (h) Fish Passage Barriers Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004b), (i) Flow and Fluctuation in the Reach Downstream of Chili Bar Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005e), (j) Iowa Hill Turbidity Analysis Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004c), (k) PHABSIM Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004d), (l) Reservoir Fisheries Technical Report (Devine Tarbell & Associates and, Stillwater Sciences 2004e), (m) Reservoir Shoreline Habitat Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005g), (n) Stream Habitat Mapping Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005i), (o) Iowa Hill Fish Entrainment Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005f), (p) Shallow Water Entrainment Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005h, (q) Stream Fisheries Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005j), (r) Deepwater Intake Entrainment Technical Report (Devine Tarbell & Associates 2004g), (s) Iowa Hill Wetlands Technical Report (Devine Tarbell & Associates 2004p), (t) Project Sources of Sediment

Technical Report (Devine Tarbell & Associates 2005c), (u) Riparian Vegetation and Wetlands Technical Report (Devine Tarbell & Associates 2004t), (v) Iowa Hill Water Temperature Technical Report (Devine Tarbell & Associates and EES Consulting 2005a), (w) Water Quality Technical Report (Devine Tarbell & Associates 2005d), (x) literature related to amphibian life cycles (Hayes and Jennings 1988, Kupferberg 1996, Lind et al. 1996, FWS 1996 and 2000, Marchetti and Moyle 2001, Trout Unlimited 1997), (y) literature related to fluvial geomorphology (FWS 1999, Harrelson et al. 1994, Klingeman 1985, Leopold et al. 1964 and 1999, Montgomery and Buffington 1993 and 1997, Potyondy and Andrews 1999, Rosgen 1994 and 1996, Williams and Wolman 1984, Beschta and Jackson 1979, Keller and Swanson 1979, Hupp and Osterland 1985, Scott et al. 1996, Stromberg et al. 1997, McBain and Trush 2004) (z) other pertinent literature (for example, Klingeman 1985, Leopold et al. 1964, Gerstung 1973, Gregory et al. 1991, Estes and Orsborn 1986, Stanford et al. 1994, Stanford et al. 1996), (aa) Sierra Nevada Forest Plan Amendment Record of Decision (USDA 2004a), (bb) Basin Plan (CVRWQCB 1998), (cc) HEC-Res-Sim Model Runs (CDFG 2007), (dd) historic peak flow information for Project streamflow gaging stations obtained from the USGS, (ee) Output from Rivermorph® Analysis (USDA 2005a), (ff) McBain and Trush 2004, and (gg) map of Rubicon River Geomorphology Cross-Sections (USDA 2006).

**Rationale for Pulse Flows**

Normal, unimpaired annual hydrographs for streams within the UARP basin show that the system experiences numerous pulse flow events in all years, with varying magnitude, timing, and duration. These events are in response to late fall freshet rainfall events, spring snowmelt in the upper reaches, rain on snow in the middle reaches, and rainfall in the lower reaches. The UARP interrupts the supply of sediment to stream channels below reservoirs and intercepts almost all (except extreme) peak flow events. Through the geomorphology and hydrology studies, reaches with apparent imbalance between sediment supply and peak flows were identified. Pulse flows were prescribed for three reaches where there is evidence of channel shape, form, and capacity being impacted, and which experience high attenuation of peak flows, with infrequent spill flow events with effective discharges.

There is a need to include pulse flow events in the streamflow regime to mimic the magnitude and timing of runoff associated with precipitation and snowmelt runoff events that normally occur within a natural hydrograph. These natural events provide for channel maintenance and sediment transport, build and maintain meadow systems through flooding and deposition of fine materials, and function as triggers for biological processes in the aquatic ecosystem.

The ecological integrity of river ecosystems depends on their natural dynamic character (Poff et al. 1997). The lateral connection between the stream channel and floodplain and riparian zone provides nutrients, organic matter (including large woody debris) and sediments to the channel (Gregory et al. 1991). High flows remove and transport sediments that would otherwise fill the interstitial spaces in productive gravel habitats (Beschta and Jackson 1979). High flows import large woody debris into the channel, and recruit it downstream (Keller and Swanson 1979), where it creates new habitat for aquatic species. Riparian communities, which are typically disturbance-adapted, are maintained by flooding along river corridors, even in river sections that have steep banks and lack floodplains (Hupp and Osterkamp 1985). The scouring of floodplain soils rejuvenates habitat for plant species that germinate (during the growing season) only on barren, wetted surfaces that are free of competition (Scott et al. 1996) or that require access to shallow water tables (Stromberg et al. 1997).

The timing of spring pulse flows is critical ecologically because the life cycles of aquatic and riparian species are timed to exploit high flows or to avoid them, many using the decline in the hydrograph after the pulse flow as the cue to initiate reproduction (Kupferberg 1996). Flow regimes that mimic natural, pre-modified flows are more likely to restore ecosystem complexity and enhance natural salmonid production (Marchetti and Moyle 2001, Trout Unlimited 1997). Altered flow timing may modify entire food webs, not just a single species (Poff et al. 1997). For example, in regulated rivers of northern California, the seasonal shifting of scouring flows from winter to summer indirectly reduces the growth rate of juvenile steelhead trout by increasing the relative abundance of predator-resistant invertebrates, which are less palatable to fish (Wootton et al. 1996 in Poff et al. 1997). In unregulated rivers, high winter flows reduce these predator-resistant insects and favor species that are more palatable to fish (Poff et al. 1997). Riparian plant species are also strongly affected by altered flow timing (Poff et al. 1997). During the late1990s, nine hydropower projects throughout the United States had proposed flows to mimic the timing and/or duration of peak flows (Poff et al. 1997).

The intent of introducing pulse flow events to the channel is to: (a) more closely mimic the timing and duration of peak flows that would occur under an unimpaired hydrograph; (b) initiate transport of bedload material, which would assist in improving habitat conditions for aquatic species; and (c) facilitate flooding of the streamside riparian community at the appropriate time of the year.

Pulse flows are designed to occur with a frequency that mimics the natural hydrograph in timing, and to some extent, in magnitude. Pulse flows are designed to be of a magnitude that would occur within the natural hydrograph with a high frequency, filling the channel to bankfull and slightly above at least every 1 to 5 years. The use of bankfull (assumed to be a 1.5-year peak flow frequency) as an objective in designing pulse flows is targeted at filling the channel and inundating all available aquatic habitat during the growing and spring spawning season. It is assumed that effective discharge with bed mobilization begins at approximately .7 of bankfull discharge (Andrews and Nankervis 1995) and that a range of peak flows that fill and flood the bankfull channel flow will provide for (1) cleaning of detritus, (2) regular mobilization of bedload, (3) distribution of invertebrates and food sources, and (4) wetting of riparian vegetation rooting zones.

Hydrology Evaluation for Pulse Flows

The unimpaired flows described in the Hydrology Technical Report (Devine Tarbell & Associates and Hannaford 2005a) were reviewed in relation to recorded peak flow data (USGS records) and compared to the regulated peak flow data from both sources. Incipient motion analysis for bedload presented in the geomorphology report was also considered. The prescribed peak flows were designed to:

- Fit within the bankfull channel and local flood-prone area, as determined by examining cross-sectional data in the geomorphology report.
- Transport bedload that was characterized in the geomorphology report, timed with the delivery of bedload from tributary channels during spring runoff events or winter storm events.
- Maintain a properly functioning riparian community.
- Transport and distribute large woody debris in the channel.
- Occur within the natural hydrograph in timing and duration.
- Fit within the balance of meeting other needs within the system for recreation, hydroelectric generation, and aquatic ecosystem beneficial uses.

The measures associated with pulse flows allow for the use of the stream to improve channel condition by restoring and maintaining fluvial geomorphological processes and, in particular, to establish a balanced transport of sediment. A pulse flow is not required in CD and Dry water years in any reaches due to an overall reduction of available water and based on the natural distribution of peak flow events in various water year types. It is assumed a peak flow event of a magnitude great enough to effectively transport channel bed materials would not commonly occur in CD years.

**Rubicon River Below Rubicon Reservoir Dam**

The Rubicon River reach below Rubicon Reservoir Dam is 4.1 miles long, extending from the base of Rubicon Reservoir Dam to the confluence of Miller Creek. There is a 1.25-mile, low-gradient meadow in the center of the reach. No major tributaries enter this reach. The Rubicon River drains a glaciated watershed, much of which is designated as wilderness, and flows through many sections of exposed granite and steep, confined bedrock chutes. Approximately 75 percent of the watershed is underlain by Mesozoic granitic and dioritic rocks. The remainder consists of the Miocene Mehrten Formation, glacial moraine deposits, and minor outcrops of the Jurassic metasedimentary rocks of the Sailor Canyon Formation (Devine Tarbell & Associates and Stillwater 2005c).

Channel survey data was collected along the Rubicon River (Devine Tarbell & Associates and Stillwater Sciences 2005c) and on National Forest System lands (Devine Tarbell & Associates and Stillwater 2005c and USDA 2006). There is evidence that the ecosystem is out of balance due to the presence of California roach and speckled dace as well as the low trout biomass in Rubicon Springs area (Devine Tarbell & Associates and Stillwater Sciences 2005j). However, a large amount of spawning gravel was observed in this reach, the second highest of all UARP streams, with 11,059 square feet of spawning gravel total and 1,908 square feet spawning gravel per mile (Devine Tarbell & Associates and Stillwater Sciences 2005j).

Although the Rubicon River below Rubicon Reservoir Dam is characterized by many sections of exposed granite and steep, confined bedrock chutes, there are areas that contain depositional features, including the geomorphic transect sites. These depositional areas are important in bedrock Sierra Nevada river systems and may support unique and/or more diverse aquatic and riparian communities (McBain and Trush 2004). Even bedrock systems require annual hydrographs for the following reasons:

1. To contribute to geomorphic processes that shape and maintain depositional features.

2. To sustain varied life history and habitat requirements for plant and animal species native to bedrock Sierra Nevada river ecosystems.

3. To perpetuate early-successional woody riparian communities.

4. To provide multiple flow thresholds to initiate diverse depositional and erosional processes essential to maintaining the erosional and depositional features of bedrock channels.

Currently, the operational program for diversions and releases from Rubicon Reservoir does not include control of the diversion into the tunnel during spring runoff. During spring runoff, transbasin diversions up to 1,200 cfs out of Rubicon River are possible and have occurred when the diversion gate is open. In mid-summer as inflow is receding,,a gate is dropped into place that allows the reservoir to fill, although 600-plus cfs is potentially diverted into the diversion tunnel before the reservoir fills.

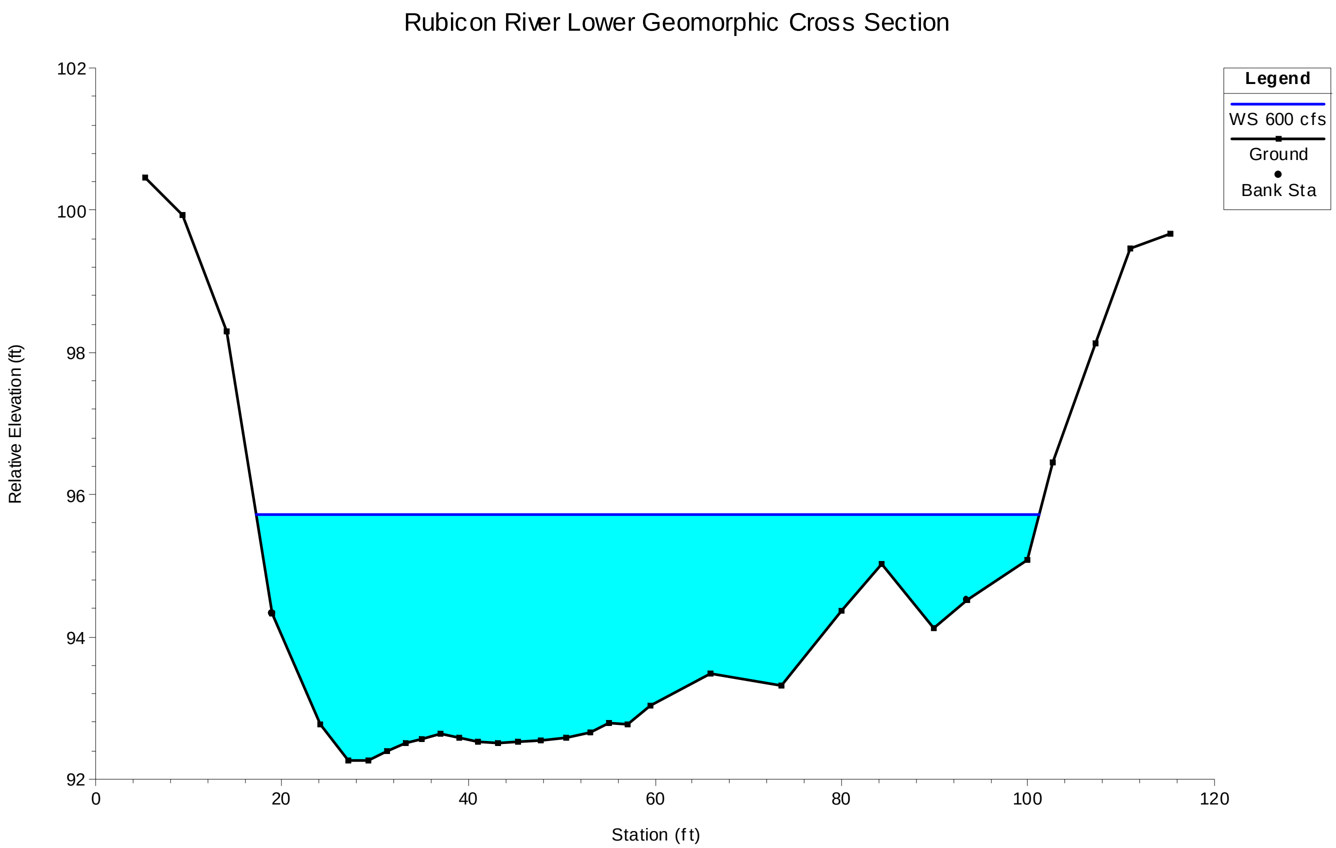
Resultant channel dimensions and bedload transport capacity are affected due to water being diverted into the tunnel and not going downstream into Rubicon River. The channel at the geomorphology study reach has a high width/depth ratio and vigorous vegetative growth across the channel, signifying an imbalance of bedload supply and transport in this reach, based on site-survey data provided in the geomorphology report (Devine Tarbell & Associates and Stillwater Sciences 2005c). According to the geomorphology report, there is a moderate presence of fine material in this reach (Devine Tarbell & Associates and Stillwater Sciences 2005c). Pulse flows sort and clean this sediment from spawning gravels (Trush et al. 2005).

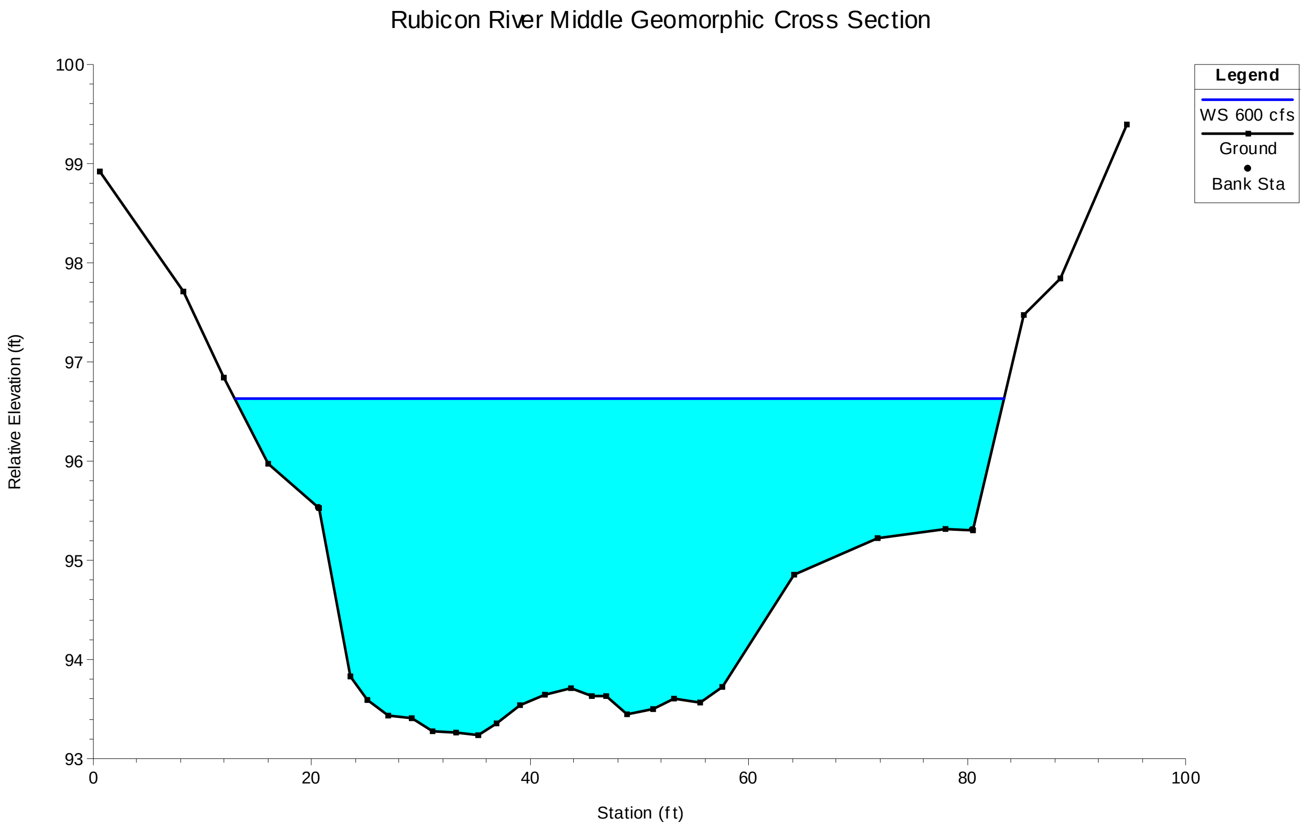
***Magnitude of Pulse Flow Events***

The channel survey data was analyzed using the Rivermorph software program (Rivermorph® 2002-2005). Although surveyors had a difficult time identifying bankfull dimensions in the field, the channel cross-sectional data shows that the bankfull area would support a flow of 646 cfs (Devine Tarbell & Associates and Stillwater Sciences 2005c). Reference reaches that would have aided in this determination were not examined by the licensee.

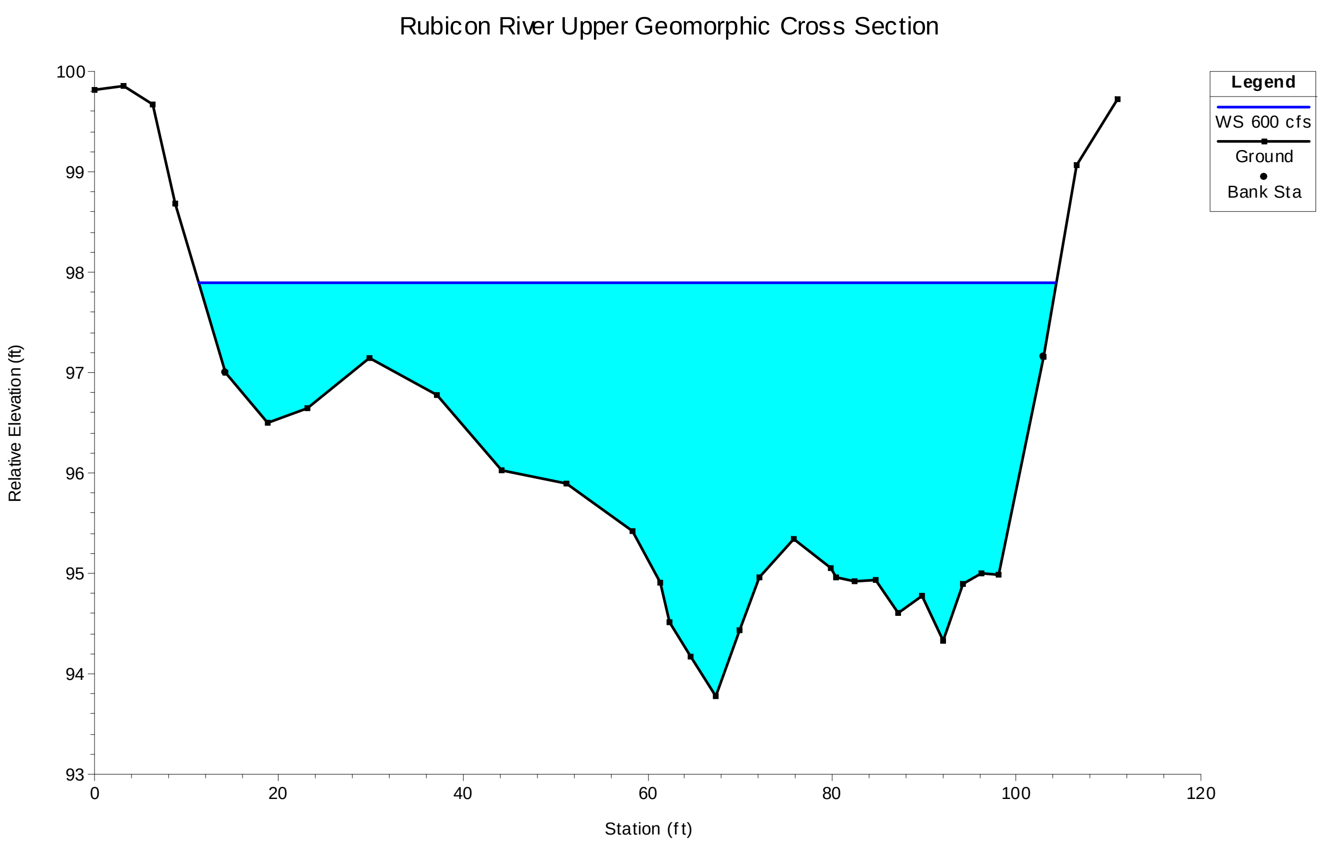
Based on (1) the bankfull flow calculation, (2) flood frequency analysis based on Rubicon Springs gage data, and (3) a review of instantaneous peak flow information for

Rubicon Springs (Devine Tarbell & Associates and Hannaford 2005a), a pulse flow objective of 600 cfs for 3 days in BN, AN, and Wet years was developed in an attempt to fill the Rubicon River channel to bankfull at the geomorphology study reach site (see following cross-sectional information for the three transects at the geomorphology study site) at the time of year when sediment washes off local granitic surfaces and enters the stream below the reservoir.





Rubicon River Middle Geomorphic Cross Section
Legend
WS 600 cfs
Ground
Bank Sta
Relative Elevation (ft)
Station (ft)
100
99
98
97
96
95
94
93
0
20
40
60
80
100

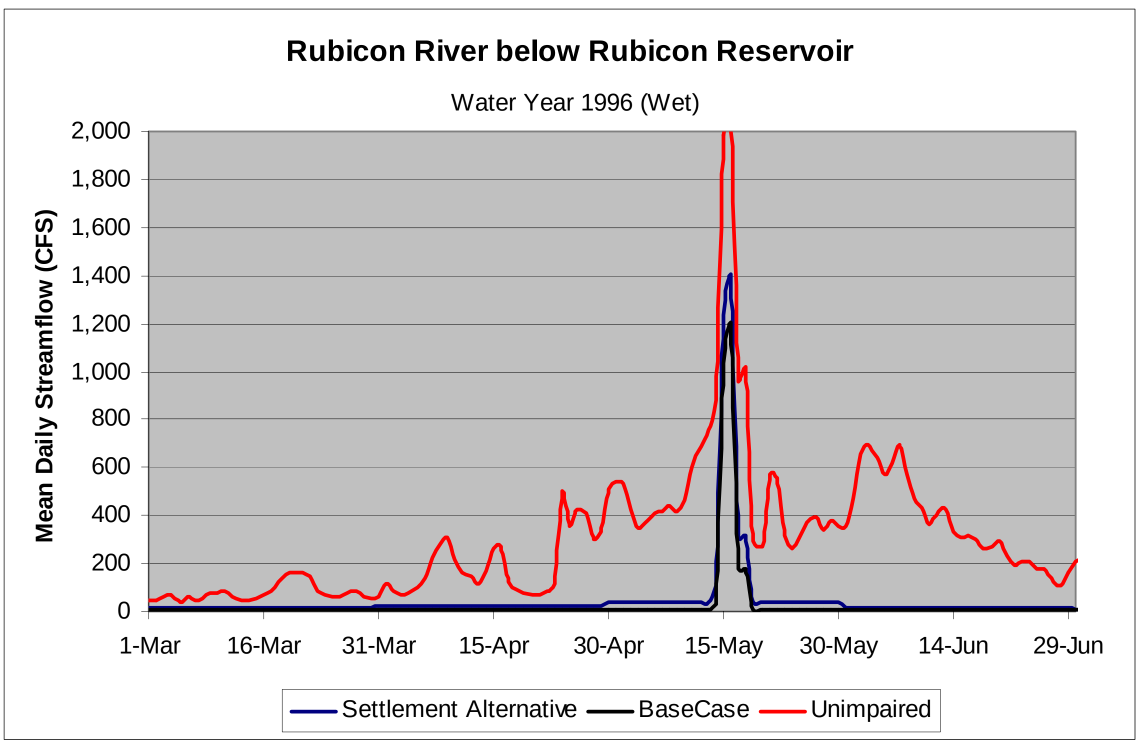
Rubicon River Upper Geomorphic Cross Section
Legend
WS 600 cfs
Ground
Bank Sta
Relative Elevation (ft)
Station (ft)
100
99
98
97
96
95
94
93
0
20
40
60
80
100
120

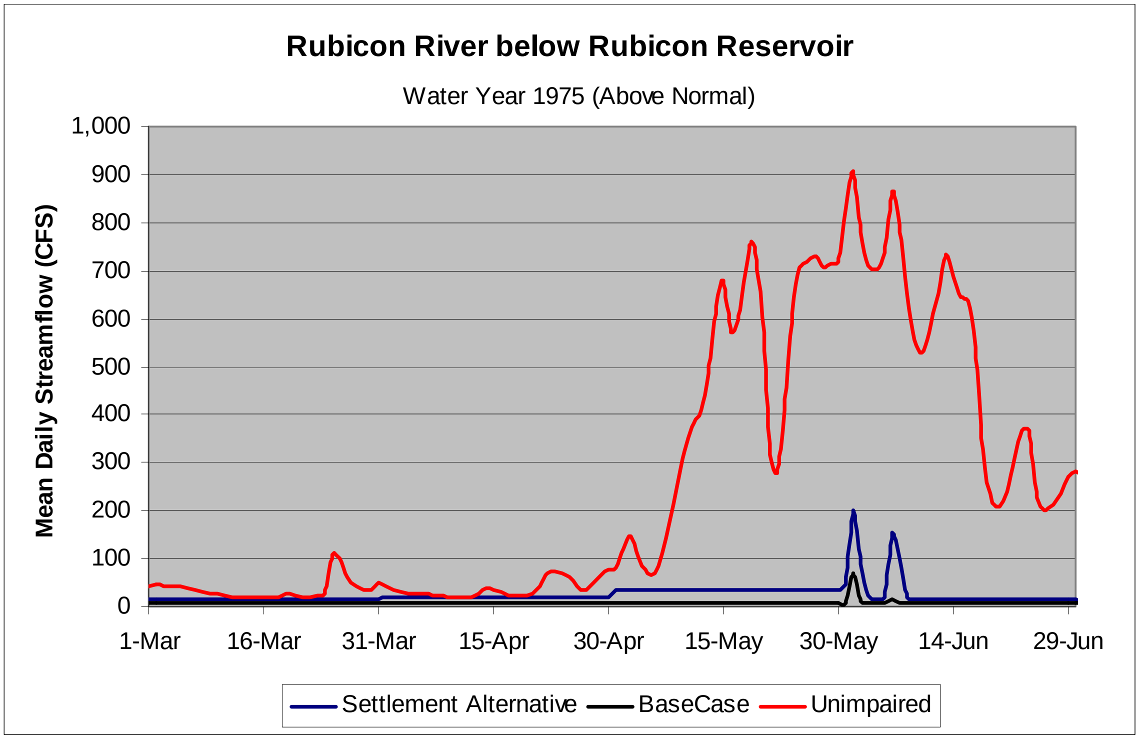
### ***Duration of Pulse Flow Events***

According to Annear et al. (2004), several studies recommend pulse flows with a duration of 48 hours or longer. Specifically, the: (1) the Incipient Motion Methodology, applied in Wyoming by Water and Environment Consultants, recommended a 72-hour flushing flow; (2) the Tennant Method recommends a flushing flow with a 48-hour to 72-hour duration; and (3) Estes and Orsborn (1986) recommend a flushing flow with a 3- to 7-day duration. In addition, 5-7 day pulse flows have been prescribed for other hydroelectric projects in the state (e.g. Mokelumne River Hydroelectric Project, FERC No. 137; Trinity River Division of the Bureau of Reclamation's Central Valley Project; El Dorado Project, FERC No. 184). For the Rubicon River, the period of record shows that a pulse flow of 3 days is within the normal duration of flows according to the unimpaired hydrology (Devine Tarbell & Associates and Hannaford 2005a). In addition, since frequent flashy storms occur in the Rubicon River, the 3-day pulse flow duration was determined to be adequate in this reach.

### ***Timing of Pulse Flow Events***

The estimated 1.5-year natural return period peak flow event in this reach was 1,386 cfs in the unimpaired state. Pulses during snowmelt would have been numerous, with a higher base flow duration supporting theaquatic ecosystem. Post-Project, the 1.5-year return period peak flow event has been 665 cfs at Rubicon Springs, which is below the geomorphology study reach. Flows at this level have periodically occurred for short periods (usually 1 day) in the fall or spring since the Project was constructed.






As identified in the monthly ecosystem attribute matrix, the critical months for channel formation and sediment transport flows occurs in the months between April and July, with May and June having the highest importance for channel formation. The regulated hydrograph indicates that a 1.5-year return period peak flow event of 665 cfs occurs at Rubicon Springs (Devine Tarbell & Associates and Hannaford 2005a). This event does not always occur during the time of year that is important for bedload transport and triggering of ecosystem processes nor is it usually more than 1 day in duration. The 1.5-year pulse flow frequency is important so that at least a peak flow of 600 cfs occurs with some regularity coincident with spring snowmelt runoff to facilitate the regular and timely transport of tributary bedload during the appropriate time of year when material is being introduced from active hillslope processes and from tributary contributions. A 600 cfs pulse flow (nearly a bankfull flow) is expected to move material that is sized 60 to 93 millimeters (size D84) based on the incipient motion study in the geomorphology report (Devine Tarbell & Associates and Stillwater Sciences 2005c). This material is important for sorting spawning gravels and removing sediment from spawning materials.

The pulse flows, when timed with the rise in base flows, act as a trigger for natural ecosystem processes to occur during the early spring season. It is anticipated that incidental benefits maybe to control beaver dam building activities in the lower reach and distribute large woody debris downstream. These flows will not be required to be produced in years when there are equivalent or larger spring spill events over Rubicon Reservoir Dam. Although multiple flow thresholds are not prescribed, various higher flow events are expected to occur; for example, a 10-year event of between 4,000 and 5,000 cfs is anticipated to occur based on the hydrology data (Devine Tarbell & Associates and Hannaford 2005a).

The resource agencies originally proposed peak flow events annually for this reach; however, the water coming from Rubicon River into the UARP is the most valuable water in the Project because it can run through every powerhouse in the Project (except the Jones Fork Powerhouse). To address the licensee's interest in maintaining as much water as possible for diversion, the pulse flows were restricted to BN, AN, and Wet water years and occur for only 3 days at at least 600 cfs during those water years. In addition, during the settlement negotiations, the resource agencies agreed: (1) that the 600 cfs pulse flow is an objective rather than a minimum pulse flow requirement, (2) to further modify the Rubicon pulse flows by agreeing that pulse flows can be produced by re-operating the tunnel gates into the Rubicon-Rockbound Tunnel rather than modifications to the river outlet works, and (3) that if the pulse flow objective cannot be met due to insufficient inflow into Rubicon Reservoir, the licensee may produce an alternate flow that is still in compliance with the pulse flow requirement for this reach. Although these changes will result in a flow of 600 cfs occurring in substantially fewer years than originally proposed, it is believed that the beneficial effects described above would occur more frequently than in the past.

In this reach, once released, pulse flows are immediately available for downstream power production through Placer County Water Agency's Middle Fork American River Hydroelectric Project.

**Gerle Creek Below Loon Lake Reservoir Dam**

Currently, regulated releases in Gerle Creek below Loon Lake Reservoir Dam rarely exceed 20 cfs. This reach is approximately 6,150 feet in elevation, with a drainage area of 8.01 square miles. Under unimpaired conditions, this reach would have peak flows of approximately 356 cfs at 1.5-year intervals. In wetter water years, peak flows would be substantially higher, up to 1,430 cfs for daily average flows as represented in the unimpaired flows in the hydrology report. As seen in the hydrology report, runoff per square mile during peak events in this reach averages 64 cfs per square mile, with a great deal of variation, duration, and number of events during the water year (Devine Tarbell & Associates and Hannaford 2005a).

The channel is in poor condition and needs the reintroduction of pulse flows. One pulse flow event per year in BN, AN, and Wet water years should reset the flow regime to a more natural setting. Many downed logs are in the channel, and a high level of fine bedload exists (Devine Tarbell & Associates and Stillwater Sciences 2005c). Channel banks are unstable, due to the lack of transport of the bedload and the lateral scour pools created as the channel attempts to flow around the logs (Devine Tarbell & Associates and Stillwater Sciences 2005c). The BEHI (bank erosion hazard index) for the upper reach, as performed in the geomorphology study, identified the banks as highly erodible (Devine Tarbell & Associates and Stillwater Sciences 2005c). Resultant contribution of sediment to the system from the unstable stream banks will likely be more than 15 tons of sediment per year (Devine Tarbell & Associates and Stillwater Sciences 2005c and Rivermorph®), in addition to bedload contributed from hillslope processes. There is a high interest in providing high quality rainbow trout and brown trout habitat in this reach, and pulse flows are expected to improve habitat quality.

### *Magnitude of Pulse Flow Events*

The range of pulse flows for the different year types (125-740 cfs) is expected to redefine the Gerle Creek stream channel below Loon Lake Reservoir Dam, sort spawning gravels, and transport bedload and fines. The geomorphology report was not conclusive as to the extent of flows that should be prescribed for this reach. The Level 4 sensitive site investigation (Rosgen 1996), which would include test flows, additional cross-sections, a more intensive review of the need for channel stabilization and whether it can be achieved through pulse flows, mechanical work, or a combination, has not been completed. Thus, the initial pulse flows were developed based on an analysis of the hydrology (Devine Tarbell & Associates and Hannaford 2005a). By water year type, the unimpaired mean daily peak flow snowmelt runoff events in the hydrology report (Devine Tarbell & Associates and Hannaford 2005a) were reviewed. To determine the magnitude of the 5-day pulse flow event, these snowmelt runoff events for each water year type were grouped, and an annual event for each water year type was chosen from the grouping as representative for a pulse flow event for that water year type. Because the mean daily pulse flows are derived by averaging the peak flow data, the magnitude of the mean daily pulse flows tend to be less than the magnitude of the actual instantaneous peak flow events. To provide a representation of the actual magnitude of a peak flow event during the pulse flow, the middle day of the pulse flow event includes a peak, or a higher flow than the other days of the pulse flow. This peak was developed by comparing the pre-Project instantaneous peak data from the South Fork Silver Creek gage (USGS 11441500) with the mean daily peak flow information in the hydrology report (Devine Tarbell & Associates and Hannaford 2005a).

### *Timing of Pulse Flow Events*

The pulse flows are timed to occur during the snowmelt runoff, when Barts and Dellar Creeks, Rocky Basin Creek, and Jerrett Creek are also running higher. When timed with the rise in base flows, the pulse flows act as a trigger for natural ecosystem processes to occur during the early spring season (Poff et al. 1997, Stanford et al. 1996, Gore 1994). There are substantial fines in the Gerle Creek channel, and one of the goals is to move these fines through the channel. The pulse flows are expected to move these fines and material that is sized 95 to 205 millimeters (size D84) based on the incipient motion study in the geomorphology report (Devine Tarbell & Associates and Stillwater Sciences 2005c). It is important to move the fines and other material to remove sediment from spawning materials and to sort spawning gravels.

### *Duration of Pulse Flow Events*

According to the Instream Flow Council (IFC pp. 167-168), several studies recommend pulse flows with a duration of 48 hours or longer. Specifically, the IFC notes that: (1) the Incipient Motion Methodology, applied in Wyoming by Water and Environment Consultants, recommended a 72-hour flushing flow; (2) the Tennant Method recommends a flushing flow with a 48-hour to 72-hour duration; and (3) Estes and Osborne recommend a flushing flow with a 3- to 7-day duration. In addition, 5-7 day pulse flows have been prescribed for other hydroelectric projects in the state (e.g. Mokelumne River Hydroelectric Project, FERC No. 137; Trinity River Division of the Bureau of Reclamation's Central Valley Project; El Dorado Project, FERC No. 184). For Gerle Creek, the period of record shows that a pulse flow of 5 days is within the duration of flows according to the unimpaired hydrology (Devine Tarbell & Associates and Hannaford 2005a).

| Gerle Creek Below Loon Lake Reservoir Dam Pulse Flows | | | | | |
|---|---|---|---|---|---|
| | **CD** | **Dry** | **BN** | **AN** | **Wet** |
| **Day 1** | 50 | 75 | 125 | 200 | 600 |
| **Day 2** | 50 | 75 | 125 | 200 | 600 |
| **Day 3** | 75 | 180 | 180 | 250 | 900 |
| **Day 4** | 50 | 75 | 125 | 200 | 600 |
| **Day 5** | 50 | 75 | 125 | 200 | 600 |

The resource agencies originally proposed pulse flows in this reach in all water year types, and the peak flow in Wet water year types was proposed to be 900 cfs (see following table). To reduce the loss of hydroelectric generation, and to address recreational reservoir levels in Loon Lake Reservoir, CD and Dry water year pulse flows were eliminated from the settlement. In addition, the peak flow in Wet water years was reduced to 740 cfs or the capacity of the licensee's outlet works, whichever is less. This was done to avoid requiring the licensee to make facility modifications at this location. In addition, several items will need to be completed (including test pulse flows) before the final pulse flow regime is established, and the settlement specifies that the final pulse flows will not exceed the pulse flows in the settlement. In this reach, once released, pulse flows are immediately available for downstream power production through the licensee's hydroelectric facilities. The following table depicts the recommended pulse flows for Gerle Creek below Loon Lake Reservoir Dam.

| Gerle Creek Below Loon Lake Reservoir Dam Pulse Flows | | | |
|---|---|---|---|
| | **BN** | **AN** | **Wet** |
| **Day 1** | 125 | 200 | 600 |
| **Day 2** | 125 | 200 | 600 |
| **Day 3** | 180 | 250 | 740* |
| **Day 4** | 125 | 200 | 600 |
| **Day 5** | 125 | 200 | 600 |

*Or maximum capacity of outlet works, whichever is less.

## South Fork Silver Creek Below Ice House Reservoir Dam

Since the Jones Fork Power House was constructed in 1986, peak flow events in South Fork Silver Creek have been infrequent and of a lower magnitude than in the first 25 years of Project operations (peak events in the first 25 years were already of a lower magnitude than unimpaired peak flows). A considerable amount of bedload is in the stream channel, contributed from tributaries and surrounding hillslopes (Devine Tarbell & Associates and Stillwater Sciences 2005c). Geomorphology surveys reveal a channel that has a lack of distinguishable bedforms and a highly embedded substrate. This reach was identified in the geomorphology study and during a site visit as a reach in need of reintroduction of pulse flows due to its relatively low gradient, high amount of unsorted bedload, and few descriptive features (lack of pools, runs, riffles) (Devine Tarbell & Associates and Stillwater Sciences 2005c). Peak flows of at least 400 cfs in the upper reach and 775 cfs in the lower reach are needed to move and sort bedload (Devine Tarbell & Associates and Stillwater Sciences 2005c).

The pulse flows are designed to provide hydrologic events that will distribute sediment into the flood-prone area in the low gradient response reach; to maintain channel shape, form, and dimensions; and to support a healthy, diverse aquatic and riparian ecosystem. The pulse flows would also distribute the large woody debris downstream, which presently occurs in high amounts in some areas of the reach and low amounts in others. Spawning gravels for trout would be cleaned and sorted, and pool depths should increase. Because the prescribed pulse flows will occur only in BN, AN, and Wet years, the frequency of 1.5-year intervals for bedload-moving peak flow events will still be low. However, several smaller duration pulses that will accompany the recreational streamflows should provide additional support in restoring a healthy channel system.

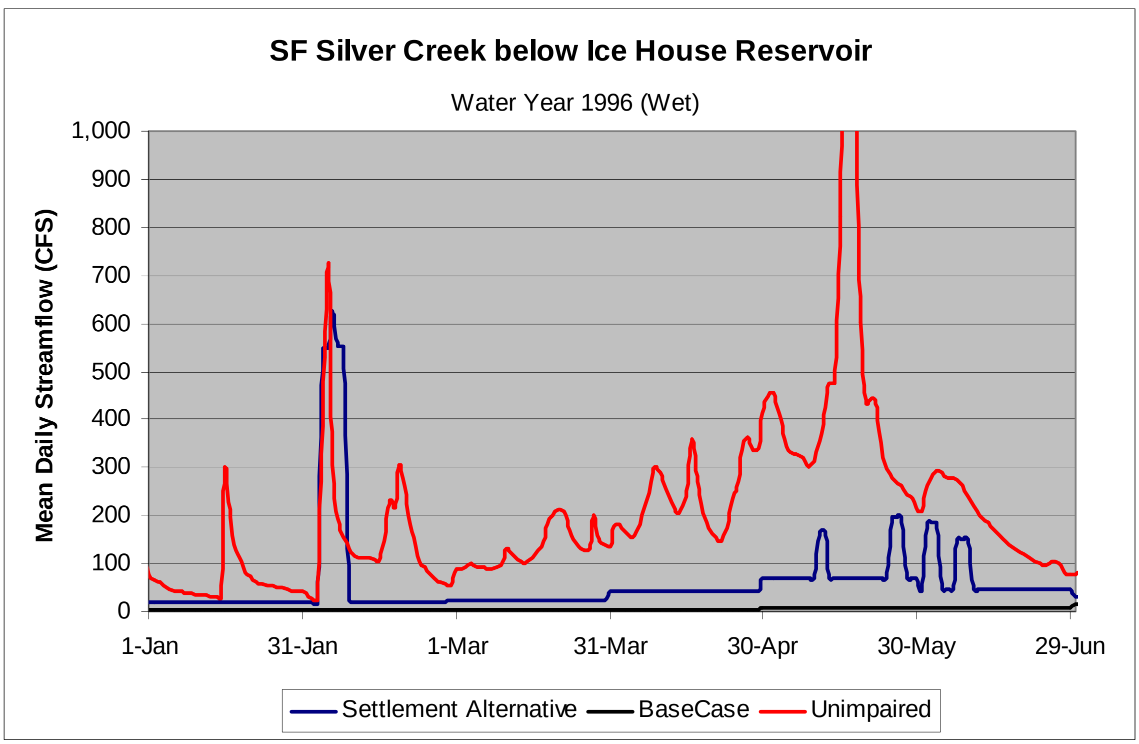
### *Magnitude of Pulse Flow Events*

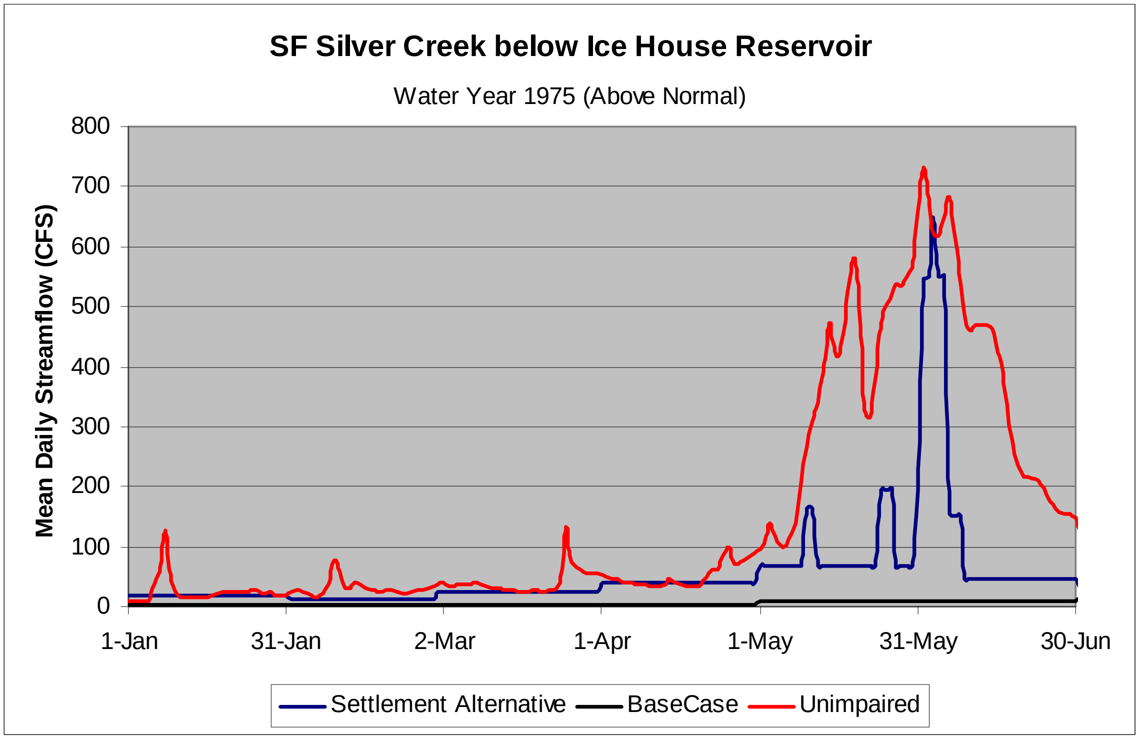
An examination of historic peak flow data, pre- and post-Project, reveals that the peak flows in this reach have been greatly reduced, especially since construction of the Jones Fork Powerhouse in 1986 (Devine Tarbell & Associates and Hannaford 2005a). The upper reach had a pre-Project 1.5-year return frequency peak flow of 674 cfs before construction of the Jones Fork Powerhouse. Post-construction, this has been reduced to 176 cfs. The pulse flows prescribed for BN, AN, and Wet years were developed as follows with the 674 cfs flow in mind.

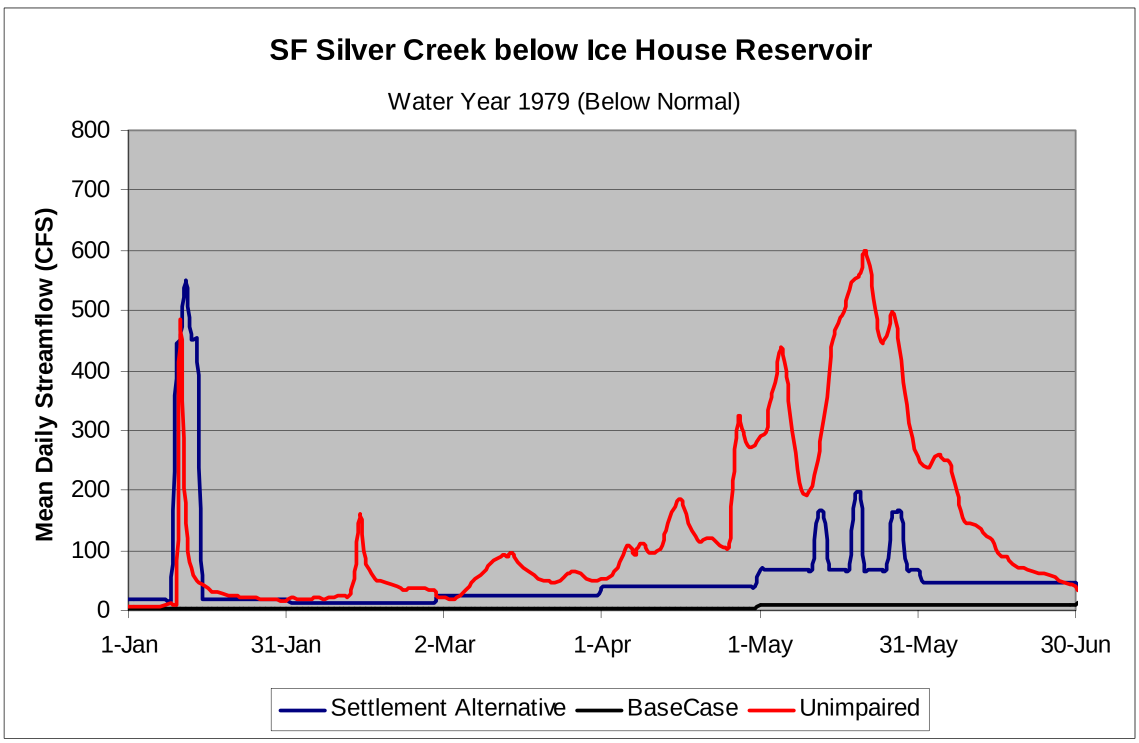
Surveyors had a difficult time identifying bankfull dimensions in the field, as shown in the ranges of bankfull flows in the geomorphology report (Devine Tarbell & Associates and Stillwater Sciences 2005c). Reference reaches that would have aided in this determination were not examined by the licensee. By water year type, the unimpaired mean daily peak flow snowmelt runoff events in the hydrology report (Devine Tarbell & Associates and Hannaford 2005a) were reviewed. To determine the magnitude of the 5-day pulse flow event, these snowmelt runoff events for each water year type were grouped, and an annual event for each water year type was chosen from the grouping as representative for a pulse flow event for that water year type. Because the mean daily peak flows are derived by averaging the peak flow events, the magnitude of the mean daily peak flows tend to be less than the magnitude of the actual peak flow events. To provide a representation of the actual magnitude of a peak flow event during the pulse flow, the middle day of the pulse flow event includes a peak, or a higher flow than the other days of the pulse flow. This peak was developed by comparing the pre-Project instantaneous peak data from the South Fork Silver Creek gage (USGS 11441500)with the mean daily peak flow information in the hydrology report (Devine Tarbell & Associates and Hannaford 2005a).

### *Timing of Pulse Flow Events*

The pulse flow events were designed to occur within winter storm and snowmelt runoff patterns within the annual hydrograph (Devine Tarbell & Associates and Hannaford 2005a). When timed in the annual hydrograph with the rise in base flows, the pulse flows act as a trigger for natural ecosystem processes to occur during the early spring season (McBain and Trush 2004). The pulse flows are expected to move material that is sized 19 to 25 millimeters (size D84) in the upper reach and 130 to 265 millimeters (size D84) in the lower reach (size D84) based on the incipient motion study in the geomorphology report (Devine Tarbell & Associates and Stillwater Sciences 2005c). The movement of this material is important for maintaining bedform features, sorting spawning gravels, and removing sediment from spawning materials. These flows will not be required to be released in years when there are equivalent or larger spring spill events over Ice House Reservoir Dam.






### *Duration of Pulse Flow Events*

According to the Instream Flow Council (IFC, pages 167 and 168), several studies recommend pulse flows with a duration of 48 hours or longer. Specifically, the IFC notes that: 1) the Incipient Motion Methodology, applied in Wyoming by Water and Environment Consultants, recommended a 72-hour flushing flow; 2) the Tennant Method recommends a flushing flow with a 48-hour to 72-hour duration; and 3) Estes and Orsborn recommend a flushing flow with a 3- to 7-day duration. In addition, 5-7 day pulse flows have been prescribed for other hydroelectric projects in the state (e.g. Mokelumne River Hydroelectric Project, FERC No. 137; Trinity River Division of the Bureau of Reclamation's Central Valley Project; El Dorado Project, FERC No. 184). For South Fork Silver Creek, the period of record shows that a pulse flow of 5 days is within the natural duration of flows according to the unimpaired hydrology (Devine Tarbell & Associates and Hannaford 2005a).

The resource agencies originally proposed pulse flows in this reach for Dry through Wet water year types, and the peak flow in Wet water year types was proposed to be 900 cfs (see following table).

| South Fork Silver Below Ice House Reservoir Dam Pulse Flows | | | | |
|---|---|---|---|---|
| | **Dry** | **BN** | **AN** | **Wet** |
| **Day 1** | 150 | 450 | 550 | 600 |
| **Day 2** | 150 | 450 | 550 | 600 |
| **Day 3** | 150 | 550 | 650 | 900 |
| **Day 4** | | 450 | 550 | 600 |
| **Day 5** | | 450 | 550 | 600 |

To reduce the loss of hydroelectric generation, and to address recreational reservoir levels in the three main storage reservoirs, Dry water year pulse flows were eliminated from the settlement, and the peak flow in Wet water years was reduced to 740 cfs or the capacity of the licensee's outlet works, whichever is less. In this reach, once released, pulse flows are immediately available for downstream power production through the licensee's hydroelectric facilities.

| South Fork Silver Below Ice House Reservoir Dam Pulse Flows | | | |
|---|---|---|---|
| | **BN** | **AN** | **Wet** |
| **Day 1** | 450 | 550 | 600 |
| **Day 2** | 450 | 550 | 600 |
| **Day 3** | 550 | 650 | 780* |
| **Day 4** | 450 | 550 | 600 |
| **Day 5** | 450 | 550 | 600 |

<u>Reaches in Which Pulse Flows Were Eliminated</u>

The resource agencies also originally proposed passing runoff through Robbs Peak Reservoir Dam for 5 to 7 days during spring runoff; however, this was eliminated from the pulse flow regime in order to address licensee and recreational interests. The resource agencies also considered including pulse flows in Silver Creek below Junction Reservoir Dam to address undesirable algae conditions and to reset spawning gravels; however, a minimum streamflow regime that simulates the pattern of the unimpaired hydrograph was proposed instead to conserve water for hydroelectric generation and recreational interests.

## Ramping Rates

### Objectives Addressed by Ramping Rates

Fisheries
Aquatic Biota
Macroinvertebrates
Target Lake Levels
Water Quality
Natural Hydrograph
Flow Fluctuations
Geomorphology
Riparian Habitat
Threatened, Endangered, and Sensitive Species and Management Indicator Species
Hydropower Operations
Public Safety

### Information Used to Establish Ramping Rates

The following information was used to establish ramping rates: (a) Amphibian and Habitat Test Flow Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004a), (b) Stream Fisheries Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005j), (c) regulated streamflow data from several licensee and United States Geological Survey (USGS) gages in the basin**,** (d) Hydrology Technical Report (Devine Tarbell & Associates and Hannaford 2005a), (e) Water Quality Technical Report (Devine Tarbell & Associates 2005d) (f) literature related to amphibian life cycles (Hayes and Jenning. 1988, Kupferberg 1996, Lind et al. 1996, FWS 1996 and 2000, Kupferberg 2006, Mount et al. 2006), (g) Sierra Nevada Forest Plan Amendment Record of Decision (USDA 2004a), (h) Flow and Fluctuation in the Reach Downstream of Chili Bar Dam Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005e), (i) Federal Land and Policy Management Act § 102(a)(8) (USDI 2001), (j) BLM's Sierra MFP Amendment p. 17, (k) SFARMP pp. 11-12, and (l) BLM's Draft Sierra RMP § 2-5.

### Rationale for Ramping Rates

The reaches identified to have specified ramping rates were so determined because of sensitive aquatic species, such as amphibians or management indicator species that may be affected by abrupt changes in flow. These reaches are Gerle Creek below Loon Lake Reservoir Dam, South Fork Silver Creek below Ice House Reservoir Dam, Silver Creek below Camino Reservoir Dam, SFAR below Slab Creek Reservoir Dam, and SFAR below Chili Bar Reservoir Dam. After a pulse flow or recreational flow, the flow differences between high and low are substantial so the ramping of the flow would preclude abrupt flow fluctuations that may adversely affect aquatic species or dislodge them from their preferred habitats. The differences in flow discharge between months with minimum streamflow releases are not as substantial but can affect sensitive reproductive stages of some aquatic species, such as FYLFs in reaches where they reside. The ramping rates proposed are typical for other hydropower projects in the Sierras and thus have a history of success.

## Coordination of Operations

### Objectives Addressed by Coordination of Operations

Fisheries
Aquatic Biota
Macroinvertebrates
Water Temperature
Large Woody Debris
Reservoir Levels
Water Quality
Natural Hydrograph
Geomorphology
Riparian Habitat
Threatened, Endangered, and Sensitive Species and Management Indicator Species
Hydropower Operations
Recreational Streamflows
Connectivity
Visual Resource
Wilderness and Wild and Scenic River

### Information Used to Establish Coordinated Operations

The following information was used to establish coordinated operations: (a) Flow and Fluctuation in the Reach Downstream of Chili Bar Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005e), (b) Stream Fisheries Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005j), (c) regulated streamflow data from a number of licensee and United States Geological Survey (USGS) gages in the basin**,** (d) Hydrology Technical Report (Devine Tarbell & Associates and Hannaford 2005a), (e) Chili Bar Reservoir Incremental Storage Modification Technical Report (Devine Tarbell & Associates 2005b), (f) Channel Morphology Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005c), (g) Recreational Flow in the Reach Downstream of Chili Bar Technical Report (Devine Tarbell & Associates and Louis Berger Group 2005e), (h) Basin Plan (CVRWQCB 1998), (i) Federal Land and Policy Management Act § 102(a)(8) (USDI 2001), (j) BLM's Sierra MFP § 4, pp. 60-62, (k) BLM's Sierra MFP Summary p. 10, (l) BLM's Sierra MFP Amendment p. 17, and (m) BLM's Draft Sierra RMP §§ 2-3, 2.15.

### Rationale for Coordinated Operations

The following excerpts from the Recreational Flow in the Reach Downstream of Chili Bar Dam Technical Report clearly demonstrate that formalized operational coordination protocols between the UARP and Chili Bar Hydroelectric Project are essential to ensure that flows in the reach downstream of Chili Bar Reservoir Dam meet recreational, water quality, aquatic, and public safety objectives. Such protocols should be available for public review and should be subject to modification as necessary to ensure that license conditions are met.

“The UARP controls the major storage of water use in the river system upstream of the Chili Bar Hydroelectric Project. This seasonal storage is then regulated through releases for hydroelectric generation through White Rock Powerhouse into Chili Bar Reservoir and subsequently into the Reach Downstream of Chili Bar either through Chili Bar Powerhouse or as spill at Chili Bar Dam. The storage capacity of Chili Bar Reservoir and the quantity and timing of water delivered to Chili Bar Reservoir can be limiting factors in providing suitable flows for whitewater boating. This creates a need for communication and coordination between operations staff of the two projects to avoid spills at Chili Bar Dam, provide enough water in Chili Bar Reservoir to provide sustained suitable flows and to schedule releases at times most beneficial for whitewater boating” (Devine Tarbell & Associates and Louis Berger 2005e, p.1).

“Water discharged from SMUD’s Slab Creek Reservoir and White Rock Powerhouse is used for generation at Chili Bar Powerhouse or it is spilled at Chili Bar Dam. Flows from White Rock Powerhouse can peak up to about 4,000 cfs. Chili Bar Powerhouse has a peak flow capacity of about 1,979 cfs when the reservoir is full, and up to about 2,100 cfs can pass through the Powerhouse during spills when reservoir levels are higher” (Devine Tarbell & Associates and Louis Berger 2005e, p.19).

"Except during winter storms and spring snowmelt flood events that may cause spills upstream, the Chili Bar Hydroelectric Project’s operation is entirely dependent on SMUD’s operation of Slab Creek Reservoir and White Rock Powerhouse. Without formalized operational coordination protocols between the UARP and Chili Bar Hydroelectric Project, the Chili Bar licensee cannot reliably forecast Chili Bar Powerhouse generation or commit to flow schedules in the Reach Downstream of Chili Bar" (Devine Tarbell & Associates and Louis Berger 2005e, p.20).

“The most important recreational activity on the Reach Downstream of Chili Bar is whitewater boating. Many factors contribute to this importance, including the character of the reach and its NRI designation under the WSR Act, the class of difficulty, access and proximity to population centers. But the most important factor is the presence of flows that are provided in the reach during summer months due to releases from the UARP and Chili Bar Hydroelectric Project. The timing, duration, and magnitude of these flows provided by operation of the projects are critical to providing whitewater boating opportunities in the Reach Downstream of Chili Bar. Flows in the reach result from the UARP and Chili Bar Hydroelectric Project and coordination between the two Licensees is essential for successfully providing whitewater boating opportunities” (Devine Tarbell & Associates and Louis Berger 2005e, p.30).

The above excerpts clearly demonstrate that formalized operational coordination protocols between the UARP and Chili Bar Hydroelectric Project are essential to ensure that flows in the reach downstream of Chili Bar Reservoir Dam meet recreational, water quality, aquatic, reducing spill occurrences, and public safety objectives. Such protocols should be available for public review and should be subject to modification as necessary to ensure that license conditions are met.

## Monitoring Plan and Ecological Resources Adaptive Management Program

### Objectives Addressed by Monitoring Plan and Adaptive Management Program

Aquatic Biota
Fisheries
Macroinvertebrates
Reservoir Levels
Natural Hydrograph
Flow Fluctuations
Geomorphology
Riparian Habitat
Threatened, Endangered, and Sensitive Species and Management Indicator Species
Recreation Streamflow
Resource Protection
Hydropower Operations
Connectivity
Water Quality
Water Temperature
Sediment Management
Large Woody Debris
Recreation Management

### Information Used to Establish Monitoring Plan and Adaptive Management Program

The following information was used to establish the recommended adaptive management program and its measures: (a) recent environmental agreements (from other projects) containing adaptive management elements, (b) literature on adaptive management (for example, FWS and National Oceanic and Atmospheric Administration 1999), (c) all information items listed in other sections of this Rationale Report for the conditions related to streamflows, (d), Sierra Nevada Forest Plan Amendment Final Supplemental Environmental Impact Statement Record of Decision (USDA 2004a), (e) Basin Plan (CVRWQCB 1998), (f)Shallow Water Entrainment Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005h), (g) Didymosphenia in Western Streams (US EPA 2005), (h) Dartmouth Toxic Metals Research Program (Center of Environmental Health Sciences 2005), (i) Water Quality Standards; Numeric Criteria for Priority Toxic Pollutants for the State of California (USEPA 2000b), (j) Fish Passage Barriers Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004b), (k) Stream Fisheries Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005j), (l) The South Fork American River: A Management Plan (USDI 2004), (m) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (n) Poff et al. 1997, (o) personal communication from Dr. Sarah Spaulding to Stafford Lehr (CDFG 2005d), (p) Hydrologic and Geomorphic Factors Affecting Conservation of a River-Breeding Frog (Kupferberg 1996), (q) Final Letter Report re *Rana boylii* in UARP (Kupferberg

2006), (r) Federal Land and Management Policy Act § 102(a)(7)(8) (USDI 2001), (s) BLM's Sierra MFP § 4, pp. 60-62, (t) BLM's Sierra MFP Summary p. 10, (u) BLM's Sierra MFP Amendment p. 17, (v) SFARMP pp. 11-14, 16-17, and (w) BLM's Draft Sierra RMP §§ 2.2-2.6, 2.15.

**Rationale for Monitoring Program**

The Monitoring Program is designed to support the adaptive management approach to resource protection. It is limited to items considered to be essential for determining if the resource objectives are being met. The Monitoring Plan covers monitoring to be conducted during the term of the license. The methods and frequency of monitoring are designed to measure the response of resources to adjustments in streamflow and other conditions over the period of the license.

When dams are first built, there are first-order impacts, for example, reductions in peak flow, entrapment of sediment load, reduction in suspended sediment load, induced erosion immediately below the dam, and channel changes. These induce second-order impacts, such as changes in channels and invertebrate populations, taking place over a longer period after construction--perhaps as long as 50 years (Petts 1980). The information collected through this monitoring program will assist in gaining a better understanding of the changes to the ecosystem that are a result of the longer term impacts caused by dams and their effects on important ecological processes.

Moyle et al. (1998) and Platts and Nelson (1988) studied stream trout populations and found that they are variable in their biomass and numbers from year-to-year and within a year. Because of these fluctuations, it is important to have multiple years of monitoring data to improve confidence with the results. Fish biomass and abundance measurements are more well-suited for use as population metrics after extensive data is collected over many years (SMUD 2006).

Monitoring shall be conducted to determine if the applicable ecological resource objectives are achievable and being met. Adaptive management decisions shall be based on monitoring results and other scientific information and a determination that the applicable ecological resource objectives will likely not be met without application of the adaptive management measures.

**Rationale for Adaptive Management Program**

The adaptive management program provides resource managers with the opportunity to set resource management goals and objectives; establish and implement initial resource measures designed to meet those management goals and objectives; monitor the response of target organisms and resources to the measures and determine if the management goals and objectives are being met; implement modifications to the measures within pre-established limits in an attempt to meet management goals and objectives not being met by current measures; and then continue a defined program of monitoring and readjustment of measures within pre-established limits over time to meet the established goals and objectives.

The primary components of the adaptive management program are: a stream ecology monitoring program and specific adaptive management measures that will be implemented if FS, CDFG, BLM, and SWRCB determine through the monitoring program and other scientific information that adjustments are needed. The rationale for the specific adaptive management measures is described below.

**Rationale for Specific Adaptive Management Measures**

A series of recommended adaptive management measures has been developed to address adjustments associated with water temperature, fish screening, sediment management, algae growth, metals bioaccumulation, and bear/human interactions.

<u>Cancellation of Pulse and Recreational Streamflows in South Fork Silver Creek Due to Water Temperature</u>

If FYLFs *(Rana boylii)* are found on South Fork Silver Creek, and water temperatures at monitoring site SFSC 1 rise above 12°C mean daily temperature for a 7-day running average at USGS gage 11441500, the licensee shall defer the pulse and recreational flow events in South Fork Silver Creek unless the FS and CDFG determine that such events are compatible with protection of FYLF and other biological resources. Two reproductive cues for FYLFs are the decline of the natural hydrograph along with warming of water temperatures to at least 12°C. By deferring any pulse or recreational streamflows if the temperature cue is present, and if FYLFs have been sighted in the South Fork Silver Creek reach, then conditions for their reproductive activities would not be adversely affected.

<u>Cancellation of Recreational Streamflows in SFAR Due to Water Temperature</u>

If water temperatures below Slab Creek Reservoir Dam rise above 12°C mean daily temperature for a 7-day running average at monitoring site SFAR 6, the licensee shall defer the recreational flow events in SFAR below Slab Creek Reservoir Dam unless the FS and CDFG determine that such events are compatible with protection of FYLF and other biological resources. Two reproductive cues for FYLFs are the decline of the natural hydrograph along with warming of water temperatures to at least 12°C. By deferring any pulse or recreational streamflows if the temperature cue is present, then conditions for their reproductive activities should not be adversely affected.

<u>Untimely Spill Events Below Slab Creek Reservoir Dam and Camino Reservoir Dam</u>

The licensee shall make a good faith effort to avoid untimely spills from Slab Creek Reservoir Dam and Camino Reservoir Dam once FYLF breeding has been initiated. If spills do not occur during FYLF breeding, egg masses are less likely to be dessicated, which should result in higher likelihood of breeding success. If the licensee is unable to avoid untimely spills and unacceptable adverse effects are occurring from untimely spills, adaptive management measures may be implemented to address these effects. Untimely slows that occur after egg laying has occurred have been shown to have a negative impact on the survival of egg masses and juvenile tadpoles (Kupferberg, 1996). The settlement seeks to minimize the number of events through good faith efforts. Egg masses are often deposited in slack water areas where focal point velocities are 10 cm/sec or less. When higher than expected flow event occur, there is the likelihood that focal point velocities can exceed 20 cm/sec, causing the egg mass to sheer and break apart. Tadpoles swimming performance is limited due to their size, and recent research has noted that after untimely flow events that there is a significant decrease in the number of tadpoles at documented breeding sites (Kupferberg 2006).

<u>October Recreational Steamflows Below Slab Creek Reservoir Dam</u>

Waiting until year 6 to make a determination as to whether October recreational streamflows will occur below Slab Creek Reservoir will allow time to investigate how the cooler temperatures of the new higher minimum flows will affect the timing of reproduction and time to metamorphosis for FYLF. It is likely that there will be a shift in the timing of breeding to later in the spring since the high flow releases are colder. Shifting metamorphosis later into the fall has at least two potential negative side effects which should be studied in years 1-5. First, tadpoles might still be present in October and thus vulnerable to the lethal and sub-lethal effects of increased flow velocity. Preliminary results from laboratory swimming trials conducted by Dr. Amy Lind and Dr. Sarah Kupferberg indicate that larger tadpoles cannot stay in substrate refuges like crevices in the rocks as long as small tadpoles (Kupferberg 2006, Mount et al. 2006). The second potential negative side effect is the impact of fall flows on emergence of aquatic insects. In the Rock Creek and Cresta reaches of the North Fork Feather River, recreational flows in the fall have caused large numbers of macroinvertebrates to enter the drift and be exported downstream. Thus, in addition to less time for metamorphs to grow in the fall, there could be less insect food available. How pronounced the timing shifts in frog breeding and rearing will be is dependent upon the types of water years occurring during the initial study period.

<u>Fish Screen in South Fork Rubicon River</u>

It is unknown whether Robbs Peak powerhouse may be causing entrainment of rainbow trout and whether there are downstream migrating trout from the headwaters of the South Fork Rubicon River that could be entrained at Robbs Peak Afterbay. Downstream movements of rainbow trout could be related to the following: ontogenetic shifts in microhabitat use, possibly to increase rate of food intake or avoid competition by habitat segregation; fish having different microhabitats preferences at different water temperatures; or seasonal movements between summer and winter habitat (Devine Tarbell & Associates and Stillwater Sciences 2004b). Mean biomass of rainbow trout on the South Fork Rubicon River above Robbs Peak Afterbay, as surveyed by Cressey on 10/2/78 (included entire reach), was determined to be 21.43 pounds per acre (Devine Tarbell & Associates and Stillwater Sciences 2005h). On November 1, 1979, the FS surveyed in the area downstream of Poison Hole tributary confluence with the main river and recorded 35.3 pounds per acre (Devine Tarbell & Associates and Stillwater Sciences 2005h). A survey in 2003 by SMUD upstream of Robbs Forebay resulted with rainbow trout biomass of 6.59 pounds per acre (Devine Tarbell & Associates 2005j). There is a concern that the 2003 biomass numbers may be a reflection of downstream migrant loss and entrainment at Robbs Peak Afterbay. There is also a consideration that climate

conditions prior to and including 2003 could have resulted in lower than normal stream flows that may be causing trout population declines.
Monitoring shall determine whether downstream migration by rainbow trout to Robbs Peak Afterbay is occurring which would result with entrainment at Robbs Peak Powerhouse. The monitoring for potential fish entrainment and subsequent mitigation to minimize the entrainment at Robbs Peak Afterbay would protect the native trout in the South Fork Rubicon River, where populations appear to be declining. Populations are expected to be maintained or improved through these measures.

Sediment Management

Medium- and fine-grained materials that are dredged out of reservoirs and deposited away from Project streams are reducing important habitat elements from the reaches downstream. Some of these materials create spawning gravels and form river bars that are important habitat elements for a large number of aquatic species, including FS sensitive FYLF and western pond turtles. Dams capture all but the finest sediments moving down a river, with many severe downstream consequences (Poff et al. 1997). UARP studies found Silver Creek below Camino Reservoir Dam and SFAR below Slab Creek Reservoir Dam and Chili Bar Reservoir Dam to be absent of medium and finer grained sediment deposits.

Incision in the reach below Chili Bar Reservoir Dam may be partially attributed to the lack of contribution of bedload from the upstream reaches of the SFAR, combined with daily peaking flows primarily due to UARP operations. Upstream episodic inputs of sediment from mass wasting have created a high amount of bedload in the system. It has, however, been interrupted by the existence of instream reservoirs. Delivery of sediment to the reaches below the facilities will closer mimic the fluvial processes that the aquatic ecosystem would undergo in unimpaired conditions. The amount of sediment reintroduced to the reaches below the facilities must be balanced with the peak flow regime. Even though many reaches in the system are of sufficient gradient to be considered transport reaches, in an unimpaired system, it would still be likely that sediments would have some residence time in patches behind boulders and adjacent to bar formations. A continuous supply of sediment would likely be metered out over time from the episodic mass wasting sources of material in or adjacent to the stream channels.

Algae Growth in Silver Creek below Junction Reservoir Dam

There is a concern that the blanket of green-colored algae is abnormal in Silver Creek downstream of Junction Reservoir Dam. Additionally, there is concern that algal blooms could occur in other reaches of the Project. It is important to establish baseline information as to species and potential adverse affects that could result from abnormally high densities. In large amounts, algae can adversely affect water quality. When algae decompose, they consume copious amounts of dissolved oxygen, creating an oxygen-deprived environment for aquatic animals. Excessive algal growth can also inhibit the passage of sunlight through water, harming other plants by reducing the amount of light they receive. Invasive diatomaceous algae has been identified in the Middle Fork American River by a California Deptartment of Fish and Game algae specialist; therefore, there are concerns where other associated rivers have algae blooms.

There is also concern that this algae may be *Didymosphenia geminata*, a species of single-celled algae that attaches to stream substrates by a mucilaginous stalk. In some streams, *D. geminata* growth covers more than 90 percent of available substrates, and the dense mats can cover 2 to 3 kilometers of stream length. The dense mats exclude the growth of other diatoms, an important source of food for aquatic invertebrates. As a result, a decline in aquatic invertebrates causes a decline in food available for fish. In South Dakota, brown trout populations have experienced severe declines that have been correlated to dense blooms of *D.geminata* (CDFG 2005c).

<u>Water Quality</u>

The Basin Plan for the Sacramento and San Joaquin River Basins designates *existing* and *potential* beneficial uses of surface waters within the UARP. These designations include 1) beneficial uses of the SFAR: Municipal and Domestic Supply, Agricultural Uses, Power Generation, Contact Recreation (including canoeing and rafting), Non-contact Recreation, Cold Freshwater Habitat, Warm Freshwater Habitat (*potential*, to Placerville), Cold Water Spawning, and Wildlife Habitat; and 2) beneficial uses of the Rubicon drainage (tributary to the MFAR): Municipal and Domestic Supply, Agricultural Uses, Power Generation, Contact Recreation (including canoeing and rafting), Non-contact Recreation, Cold Freshwater Habitat, Warm Freshwater Habitat (*potential*), Cold Water Spawning Habitat, and Wildlife Habitat (CVRWQCB 1998). Protection and enhancement of these beneficial uses, including state and federal water quality objectives and criteria necessary to support them, are primary goals of water quality planning and ongoing watershed management. Active stewardship of surface waters from both the Rubicon drainage and the SFAR watershed, will require that a program of monitoring be implemented to demonstrate that water quality standards are maintained as the UARP is operated through the term of licensing.

The SFAR, below Slab Creek Reservoir and downstream to Folsom Lake, has been proposed for listing on the Clean Water Act Section 303(d) List of Water Quality Limited Segments as impaired for mercury concentrations (State Water Resources Control Board 2006). The current proposal for listing recognizes two clear lines of evidence to justify placing the SFAR below Slab Creek Reservoir on the final 2006 CWA Section 303(d) List. Data specific to Slab Creek Reservoir and the Chili Bar diverted reach have been identified as evidence of the SFAR pollutant condition for mercury (State Water Resources Control Board 2006).

Water quality screening data collected from various project water bodies indicate seasonal exceedances of criteria established for aluminum, copper, iron, lead, silver, and mercury (Devine Tarbell & Associates 2005d). Bacterial concentrations detected at designated swim beaches, specifically on Union Valley Reservoir, exceed the Basin Plan water quality objective for bacteria established for protection of waters designated for contact recreational uses (Devine Tarbell & Associates 2005d). These data emphasize the need for vigilance in the monitoring of water quality changes that may occur with modifications to project operation and alterations to the existing carrying capacity for recreational access. With re-operation of the project an ongoing program of monitoring will provide data necessary for trend analyses to characterize improvements and/or additional degradation of the water quality associated with impoundment and other operations.

Metals Bioaccumulation

Fish collected from Project reservoirs and analyzed for body burden of metals indicate that bioaccumulation is occurring in the aquatic food chain (Devine Tarbell & Associates 2005d). Data demonstrate uptake rates of methylmercury (Table 4.3.2-10) that exceed the US EPA criteria for human health protection, and liver tissue levels (Table 4.3.2-11) suggest wildlife consumption risks for arsenic, cadmium, copper, selenium and zinc in various water bodies, based on USDI Fish and Wildlife Guidelines (USDI 1998).

Continued operation of the Project has potential for concentrating metals and other constituents bound to organic and inorganic sediments that are impounded within the reservoir basins. Limnologic conditions in some reservoirs provide an environment for potential methylation of mercury and for other chemical behavior that may increase the bioavailability of contaminants for uptake by organisms within the aquatic food chain. The licensee's ongoing cloud seeding program continues to introduce elemental silver into the atmosphere where deposition into project waters is likely to occur. Additional environmental loading of silver raises the risk for exposure of both aquatic and terrestrial species to this metal.

Scientists now suspect that lower doses of silver compounds over longer periods of time may have more subtle but equally worrisome effects on fish and other aquatic organisms and possibly affecting the reproductive system in sensitive species (Center of Environmental Health Sciences 2005). Fish tissue samples, as shown on Table 4.3.2-11 in the Water Quality Report, revealed 1.74 ppm silver in fish livers from Loon Lake and 1.86 ppm silver in fish livers from Gerle Creek Reservoir. Besides the fisheries concerns, there is a concern that amphibians, such as mountain yellow-legged frogs, in nearby high mountain lake locations of the Desolation Wilderness could also be negatively affected by metals bioaccumulation.

The bioaccumulation monitoring program will provide data necessary to develop a long-term water quality trend assessment in project waters. Data collected will identify trends of risk to human health and wildlife and will provide opportunity to design possible adaptive management measures to intervene in this water quality degradation.

Water Temperature for Foothill Yellow-Legged Frogs

If site-specific water temperature monitoring for foothill yellow-legged frogs concludes that water temperatures at which breeding for FYLF is initiated in the reach below Slab Creek Reservoir Dam and the reach below Camino Reservoir Dam are different than 12ºC daily temperature for a 7-day running average, then these site-specific water temperatures will be used to make a determinations based on water temperature for FYLF breeding, such as cancellation of recreational streamflows.

Bear/Human Interactions

This measure is necessary to ensure that bears and recreationists are safe in Project-related facilities.

## Gerle Creek Channel Stabilization

### Objectives Addressed by Gerle Creek Channel Stabilization

Aquatic Biota
Fisheries
Macroinvertebrates
Large Woody Debris
Water Temperature
Target Lake Levels
Water Quality
Natural Hydrograph
Geomorphology
Riparian Habitat
Threatened, Endangered, and Sensitive Species and Management Indicator Species
Hydropower Operations
Recreational Streamflows
Connectivity
Visual Resource
Wilderness and Wild and Scenic River

### Information Used to Establish Gerle Creek Channel Stabilization

The following information was used to analyze streamflows: (a) regulated streamflow data from several licensee and United States Geological Survey (USGS) gages in the basin**,** (b) Hydrology Technical Report (Devine Tarbell & Associates and Hannaford 2005a), (c) Channel Morphology Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005c), (d) PHABSIM Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004d), (e) Stream Fisheries Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005j), (f) Project Sources of Sediment Technical Report (Devine Tarbell & Associates 2005c), (g) Riparian Vegetation and Wetlands Technical Report (Devine Tarbell & Associates 2004t), (h) literature related to fluvial geomorphology (Andrew and Nankervis 1995, FWS 1999, Harrelson et al. 1994, Klingeman 1985, Leopold 1994, Leopold et al. 1964 and 1999, Lisle 1997, Milhous 1998, Montgomery and Buffington 1993 and 1997, Poff et al. 1997, Potyondy and Andrews 1999, Rosgen 1994 and 1996, Trush and McBain 1997, Williams and Wolman 1984, Wolman 1954, Wondzell and Swanson 1999) (i) other pertinent literature (for example, Klingeman 1985, Leopold et al. 1964, Gerstung 1973), (j) Sierra Nevada Forest Plan Amendment Record of Decision (USDA 2004a), (k) Basin Plan (CVRWQCB 1998), (l) HEC-Res-Sim Model Runs (CDFG 2007), and (m) historic peak flow information for Project streamflow gaging stations obtained from the USGS.

### Rationale for Gerle Creek Channel Stabilization

See Rationale for Pulse Flows, above. Although it is expected that modified minimum streamflows and pulse flows will result in beneficial effects to the degraded channel conditions in Gerle Creek, based on the problems occurring in the channel, stabilization work in addition to these streamflows is needed to improve conditions in the channel. The sensitive site investigation and channel stabilization plan will be completed before introduction of the new pulse flows. The prescribed pulse flows may be changed, if the results of the plans indicate another flow would be more appropriate. Flows would not be increased, due to facility constraints.

## Fish Passage

### Objectives Addressed by Fish Passage

Fisheries
Reservoir Levels
Natural Hydrograph
Hydropower Operations

### Information Used to Establish Fish Passage Measures

The following information was used to establish fish passage measures: (a) regulated streamflow data from several licensee and United States Geological Survey (USGS) gages in the basin**,** (b) Hydrology Technical Report (Devine Tarbell & Associates and Hannaford 2005a), (c) Reservoir Fisheries Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004e), (d) Shallow Water Entrainment Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005h, (e) Stream Fisheries Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005j), and (f) Fish Passage Barriers Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004b).

### Rationale for Fish Passage

Gerle Creek Reservoir levels below 5,228 feet in elevation have been found to block passage of brown trout upstream to their important spawning grounds in Gerle Creek. Gerle Creek has been identified as an important and unique brown trout fishery by sports anglers that recreate in the Crystal Basin. By ensuring that fall reservoir elevation levels stay above 5,228 feet between August and October, the brown trout using the reservoir will be allowed to access Gerle Creek for their spawning run.

## Large Woody Debris

### Objectives Addressed by Large Woody Debris

Large Woody Debris
Aquatic Biota
Fisheries
Macroinvertebrates
Water Quality
Geomorphology
Riparian Habitat
Fisheries Production
Natural Hydrograph
Hydropower Operations
Flow Fluctuations
Recreational Streamflow
Threatened, Endangered, and Sensitive Species and Management Indicator Species

### Information Used to Address Large Woody Debris

The following information was used to analyze large woody debris: (a) Hydrology Technical Report (Devine Tarbell & Associates and Hannaford 2005a), (b) Channel Morphology Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005c), (c) Stream Fisheries Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005j), (d) Stream Habitat Mapping Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005i), (e) Diversity of juvenile anadromous salmonid assemblages in coastal Oregon basins with different levels of timber harvest (Reeves et al. 1993), (f) Federal Land and Policy Management Act § 102(a)(8), (USDI 2001), (g) SFARMP p. 11, (h) BLM's Sierra MFP § 4, p. 51, and (i) BLM's Draft Sierra RMP §§ 2.3, 2.5.

### Rationale for Large Woody Debris

Large trees and snags that fall into streams play an important role in forming pools, metering sediment, trapping spawning gravels, and creating a more complex stream environment. Heavier pieces require higher flows for mobilization, and longer pieces are more likely to be caught by the stream bank and its vegetation. Reeves et al. (1993) found "that wood is a primary element influencing habitat diversity and complexity in streams. Consequences of decreased amounts of wood include loss of cover (for aquatic species) and structural complexity, decreased availability and abundance of habitat units, and reduced varieties of current velocities and other hydraulic features."

## Streamflow and Reservoir Storage Gaging

### Objectives Addressed by Streamflow and Reservoir Storage Gaging

Natural Hydrograph
Flow Fluctuations
Geomorphology
Streamflow and Reservoir Storage Gaging Plan
Hydropower Operations
Recreation Streamflow
Streamflow Information
Water Quality
Water Temperature
Reservoir Level
Streamflow and Reservoir Level Information

### Information Used to Establish Streamflow and Reservoir Storage Gaging Condition

The following information was used to develop the Streamflow and Reservoir Storage Gaging Plan condition: (a) regulated streamflow data from several licensee and USGS gages in the basin, (b) unimpaired mean daily streamflow data (Devine Tarbell & Associates and Hannaford 2005a), (c) historic peak flow information for Project streamflow gaging stations obtained from the USGS, (d) Water Quality Technical Report (Devine Tarbell & Associates 2005d), (e) Upper American River Project Initial Information Package (SMUD 2001), (f) Federal Land and Policy Management Act § 102(a)(7)(8) (USDI 2001), (g) BLM's Sierra MFP § 4, p. 51, (h) BLM's Sierra MFP Amendment p. 17; SFARMP p. 16, and (i) BLM's Draft Sierra RMP § 2.15.

### Rationale for Streamflow and Reservoir Storage Gaging

The Streamflow and Reservoir Storage Gaging Plan will specify how compliance with PM&E measures relating to streamflows and reservoir storage will be verified. The Streamflow and Reservoir Storage Gaging Plan will also provide useful information for interpretation of results of future monitoring efforts and will be used to determine the need for the implementation of adaptive management measures.

## Preferred Canal Drainage Structure and Release Points

### Objectives Addressed by Preferred Canal Drainage Structure and Release Points

Fisheries Objectives
Macroinvertebrates
Flow Fluctuations
Geomorphology
Riparian Habitat
Threatened, Endangered, and Sensitive Species and Management Indicator Species
Hydropower Operations
Water Quality

### Information Used to Establish Preferred Canal Drainage Structure and Release Points Condition

The following information was used to develop the recommended canal maintenance and operations measures: (a) impaired and unimpaired hydrology (Devine Tarbell & Associates and Hannaford 2005a), (b) Water Quality Technical Report (Devine Tarbell & Associates 2005d), and (c) Sierra Nevada Forest Plan Amendment Record of Decision (USDA 2004a).

### Rationale for Preferred Canal Drainage Structure and Release Points

The Gerle Canal and several penstocks are Project features located on hillslopes that may experience undesirable results in drainages and hillslopes below should there be a failure or release from the canal or penstocks. It is anticipated that developing a plan that designates preferred canal/penstock drainage structures and release points to be used for drainage during maintenance will minimize adverse impacts to water quality and aquatic biota.

## Water Temperature

### Objectives Addressed by Water Temperature

Fisheries
Aquatic Biota
Macroinvertebrates
Water Temperature
Water Quality
Natural Hydrograph
Geomorphology
Riparian Habitat
Threatened, Endangered, and Sensitive and Management Indicator Species
Hydropower Operations

**Information Used to Establish Water Temperature Condition**

The following information was used to establish water temperature measures: (a) regulated streamflow data from several licensee and United States Geological Survey (USGS) gages in the basin, (b) Hydrology Technical Report (Devine Tarbell & Associates and Hannaford 2005a), (c) Amphibians and Aquatic Reptiles Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005a), (d) Amphibian and Habitat Test Flow Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004a), (e) Aquatic Bioassessment Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005b), (f) Water Quality Technical Report (Devine Tarbell & Associates 2005d), (g) Stream Fisheries Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2005j), (h) Water Temperature Technical Report (Devine Tarbell & Associates 2005e), (i) literature related to amphibian life cycles (Hayes and Jennings 1988, Kupferberg 1996, Lind et al. 1996, FWS 1996 and 2000), (j) Sierra Nevada Forest Plan Amendment Record of Decision (USDA 2004a), (k) Basin Plan (CVRWQCB 1998), (l) Predicted Water Temperatures from South Fork Silver Creek below Ice House Reservoir Dam, Silver Creek below Camino Reservoir Dam, and SFAR below Slab Creek Reservoir Dam (R2 Resource Consultants, Inc. 2004a), and (m) Simulated Maximum and Minimum Daily Temperatures in the SFAR Below Slab Creek Reservoir (R2 Resource Consultants, Inc. 2004b).

**Rationale for Water Temperature Condition**

Water temperature concerns include whether streams affected by the Projects continue to meet water quality standards of the Basin Plan and whether FS sensitive species and management indicator species habitat is maintained at temperatures suitable for the life stages of those species. By monitoring water temperatures, one could determine protection levels provided for all designated beneficial uses dependent on thermal conditions.

Flow regimes are designed, in part, to address specific water temperature concerns including the preservation of cool water temperatures to meet the biological needs of cold water fish species, such as trout, in stream reaches designated as cold freshwater habitat. In reaches designated as both cold and warm freshwater habitat, such as the SFAR below Slab Creek Reservoir Dam, the FS sensitive hardhead and FYLF may not thrive in a coldwater habitat environment; thus, water temperatures providing a longitudinal transition from cold to warm will provide protection for both uses. Silver Creek below Camino Reservoir Dam is designated as cold freshwater habitat; however, consideration is given to the existing sensitive species supported in the middle and lower segments of the reach, and the biological needs of these species. FYLFs reside in Silver Creek and prefer transitional water temperatures during the summer reproductive months, and it is expected that the water temperatures provided shall ensure that protection.

SNTEMP modeling predicts that thermal relief for cold freshwater species can be attained in the South Fork Silver Creek below Ice House Dam downstream to the mouth at Junction Reservoir during the peak summer month of July, with a flow of 30 cfs (Devine Tarbell & Associates 2005e, Fig. 4.4-7). Additional modeling (R2 Resource Consultants, Inc. 2004a) simulates conditions in Silver Creek below Camino

ReservoirDam where releases of approximately 45 cfs may moderate mean daily temperatures for cold water species through much of the reach during summer months, but allow the lower segment of the stream to warm up to temperatures more suitable for FYLF growth. The SFAR below Slab Creek Reservoir Dam supports both trout species and a community of warm water aquatic species including hardhead. Longitudinal stream profile SNTEMP modeling (R2 Resource Consultants, Inc. 2004b) predicts that 90 cfs (July) and 70 cfs (August) flow releases from Slab Creek Reservoir (with existing structures in place) will preserve water temperatures at or below 20$^{o}$ C for cold water species in the upper 50 percent of the reach while providing a warming gradient through the downstream reach to support the warm water species. Flows have been developed for each stream reach by water-year type and month, to protect cold freshwater habitat (designated on all UARP stream reaches) while addressing the needs of warm water species in the lower elevation project reaches and attempting to conserve water for both hydroelectric generation and on-water recreational uses. An ongoing water temperature monitoring program will document the thermal response to flow releases and validate the accuracy of modeling predictions.

**Wildlife and Sensitive Plant Protection Measures**

### Objectives Addressed by Wildlife and Sensitive Plant Protection Measures

Threatened, Endangered, and Sensitive Species and Management Indicator Species

### Information Used to Establish Wildlife and Sensitive Plant Protection Measures

The following information was used to establish wildlife and sensitive plant protection measures: (a) Bald Eagle and Osprey Technical Report (Devine Tarbell & Associates 2004a), (b) Bats Technical Report (Devine Tarbell & Associates 2004b), (c) Bird-Powerline Associations Technical Report (Devine Tarbell & Associates 2004c), (d) Black Bear Technical Report (Devine Tarbell & Associates 2004d), (e) California Spotted Owl Technical Report (Devine Tarbell & Associates 2004e), (f) Mesocarnivores Technical Report (Devine Tarbell & Associates 2004q), (g) Mule Deer Technical Report (Devine Tarbell & Associates 2004r), (h) Northern Goshawk Technical Report (Devine Tarbell & Associates 2004s), (i) Riparian Vegetation and Wetlands Technical Report (Devine Tarbell & Associates 2004t), (j) Special Status Plants and Invasive/Noxious Weeds Technical Report (Devine Tarbell & Associates 2004v), (k) Valley Elderberry Longhorn Beetle Technical Report (Devine Tarbell & Associates 2004w), (l) Vegetation Mapping Technical Report (Devine Tarbell & Associates 2004x), (m) Waterfowl Nesting Habitat Technical Report (Devine Tarbell & Associates 2004y), (n) Willow Flycatcher Nesting Habitat Technical Report (Devine Tarbell & Associates 2004z), (o) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (p) Sierra Nevada Forest Plan Amendment Record of Decision (USDA 2004a), (q) The South Fork American River: A Management Plan (USDI 2004), (r) The Cronan Draft Ranch Management Plan (USDI 2006a), (s) The Draft Sierra Resource Management Plan 2.4-2.5(USDI 2006b), (t) Bald Eagle Management Plan (Draft) (USDA 1998c), (u) Federal Land and Policy Management Act § 102(a)(8) (USDI 2001), and (v) BLM's Sierra MFP § 4, p. 51.

## Rationale for Wildlife and Sensitive Plant Protection Measures

Direction in the Forest Plan and BLM Plan states that populations of threatened and endangered wildlife and plant species shall be maintained or enhanced, and viable populations of sensitive species shall be maintained. A diverse habitat for all species, including harvestable game fish and wildlife shall be provided. Medium to high quality habitat for management indicator species shall be maintained.

Several terrestrial threatened, endangered, and sensitive species, including bald eagles, California spotted owls, northern goshawks, and sensitive plant species, are known to occur within the Project area. Additional species may be detected in the Project area and new species may be designated as threatened, endangered, or sensitive, over the term of the license. These species could be disturbed or displaced by project operations or by future development of Project facilities. PM&E measures have been developed to allow for protection of known occurrences and to provide for future surveys and analyses that may be necessary to avoid impacts to threatened, endangered, and sensitive species.

The Gerle Canal is a Project feature that may affect terrestrial wildlife species through direct mortality and influences upon movement and dispersal patterns. PM&E measures have been developed to reduce impacts of the canal upon deer and other wildlife by ensuring that canal fencing and wildlife crossing structures, should they be required, meet current design requirements and are functional during the deer migration period each year.

The Bird-Power Line Associations Technical Report (Devine Tarbell & Associates 2004c), identifies several power transmission line features that do not meet the design and siting standards for avoidance or minimization of bird electrocutions and collisions (APLIC and USDI 2005). Such standards were developed by the Avian Power Line Interaction Committee (APLIC) to reduce avian fatalities associated with power lines and thus improve the ability of utilities to meet the requirements of the Migratory Bird Treaty Act. A PM&E measure requiring the retrofitting of power lines in accordance with APLIC standards has been developed to address the protection of avian species required under the Migratory Bird Treaty Act and the Golden and Bald Eagle Protection Act.

Monitoring biological resources is an important component of the license, as it is through this means that it can be determined if resource objectives are being met and, if not, what possible changes in license conditions are needed.

Direction in the South Fork American River, A Management Plan (USDI 2004), which is included in its entirety as part of the Draft Sierra Resource Management Plan (USDI 2006b) states: all plants or animals identified as Threatened or Endangered by the Federal Government or as Rare or Endangered by the State of California will be given special preference for protection and management. Species which are candidates for listing by either the Federal or State governments will also be given special attention. The lands of the Pine Hill Planning Unit total 1,284 acres of land, all of it public domain. Geologically and botanically, this area is unique. Soils derived from the weathering of gabbro bedrock are different from the surrounding area and support plant communities that could not exist without them. The Pine Hill Preserve contains one of the largest concentrations of rare plant species in the state, and a large number of serpentine and/or gabbro endemic species. The Pine Hill gabbro formation is also important with respect to overall plant species diversity. In the Salmon Falls area, gabbro soils contain populations of four federally-listed plant species, three of which are known to occur on public land. Three species that occur on the Pine Hill gabbro formation have never been found growing elsewhere in the wild. The UARP licensee's transmission lines currently pass through sections of the Pine Hill Preserve.

The only known federally-listed species that may be observed on BLM lands is the bald eagle, listed as threatened by FWS. Federal species of concern include the western pond turtle, northern goshawk, California spotted owl, western mastiff bat, Townsend's big ear bat, and FYLF. The State of California has identified the willow flycatcher and peregrine falcon as endangered, and also considers the FYLF a species of special concern.

## Invasive Weeds

### Objectives Addressed by Invasive Weed Measures

Invasive weed objective.

### Information Used to Establish Invasive Weed Measures

The following information was used to develop the recommended noxious weed section: (a) Special Status Plants and Invasive/Noxious Weeds Technical Report (Devine Tarbell & Associates 2004v), (b) Forest Service Regional Noxious Weed Strategy (USDA 1995b), (c) Sierra Nevada Forest Plan Amendment Record of Decision (USDA 2004a), (e) Forest Service noxious weed manual (USDA 1995a), (d) Iowa Hill Development Invasive/Noxious Weeds Technical Report (Devine Tarbell & Associates 2004l), (e) Partners Against Weeds, An Action Plan for the Bureau of Land Management (USDI 1996), (f) The South Fork American River: A River Management Plan (USDI 2004), (g) The Cronan Ranch Draft Management Plan (USDI 2006a), (h) The Draft Sierra Resource Management Plan (USDI 2006b), (i) Federal Land and Management Policy Act § 102(a)(8) (USDI 2001), (j) BLM's Sierra MFP § 4, p. 51, (k) SFARMP p. 12, and (l) BLM's Draft Sierra RMP § 2.4.

### Rationale for Invasive Weed Measures

Noxious weeds occur in the Project area. Once noxious weeds colonize an area, they can be difficult and expensive to eradicate. The Sierra Nevada Forest Plan Amendment Record of Decision (USDA 2004a) requires the FS to control the spread of noxious weeds by incorporating weed prevention and control measures into ongoing management or maintenance activities that involve ground disturbance or the possibility or spreading weeds. The amendment also requires the FS to complete noxious weed inventories based on Regional protocols, evaluate treatment options relative to the risk of weed spread, and monitor noxious weed populations. The amendment also requires the FS to include weed prevention measures when amending or issuing or re-issuing permits. The noxious weed management plan condition will assist in meeting these requirements on National Forest System lands affected by the Project.

The South Fork American River: A River Management Plan (USDI 2004) states that it is the policy of BLM to eradicate populations of noxious weeds. Each planning unit along the South Fork American River shall have a Noxious Weed Control Plan to expedite this policy. The principle weeds along the South Fork American include medusa head, scotch broom, and star thistle.

## Annual Review of Ecological Conditions

### Objectives Addressed by Annual Review of Ecological Conditions

Fisheries
Aquatic Biota
Macroinvertebrates
Large Woody Debris
Natural Hydrograph
Flow Fluctuations
Fluvial Geomorphology
Riparian Habitat
Connectivity
Water Quality
Water Temperature
Streamflow and Reservoir Storage Gaging Plan
Threatened, Endangered, and Sensitive Species and Management Indicator Species

### Information Used to Establish Annual Review of Ecological Conditions

See information in all preceding sections.

### Rationale for Annual Review of Ecological Conditions

It is the desire of the FS, BLM, CDFG, and SWRCB, along with other interested parties, to continue a level of coordination and adjustment for the Project. By having specific coordination meetings, results of surveys and other information will be reviewed. Data from ongoing monitoring will assist in making any needed changes in management of the area and in future planning. Also, because the licensees must provide an operations and maintenance plan for the year 2 weeks before this meeting, any necessary surveys or analyses for sensitive wildlife and plant and/or management indicator species can be completed.

## RECREATION AND VISUAL QUALITY

### Applicable Sections

Articles 1-4 and 2-3, Coordination of Operations
Article 1-15, Recreation Implementation Plan
Article 1-16, Recreation Survey
Articles 1-17 and 2-12, Forest Service Liaison and BLM Liaison
Article 1-18, Review of Recreation Developments
Articles 1-19 and 2-13, Specific Recreation Measures and BLM Recreation Improvements
Article 1-20, Heavy Maintenance
Article 1-21, Recreation Operation, Maintenance, and Administration
Article 1-22, Carrying Capacity on Lands Affected by the Project
Article 1-23, Reservoir Levels
Articles 1-24 and 2-15, Recreational Streamflows
Articles 1-25 and 2-14, Public Information Services
Article 1-26, Fish Stocking
Articles 1-27 and 2-16, Visual Resource Protection

### Existing Conditions

- Operations between the UARP and Chili Bar Hydroelectric Projects are not formally coordinated, resulting in operation of the Projects that does not always address recreation.
- Some Project-related facilities do not meet current FS, or CDPR design or accessibility standards, current and projected user needs, and public health and safety requirements.
- Some Project-related facilities may affect or induce effects to other resources.
- FS, BLM, and CDPR must administer multiple use permits related to the Projects. The permits associated with various uses or facilities provide services or opportunities for Project-related visitors.
- The licensees do not provide adequate assistance to address the level of Project-related recreation. The licensee for the UARP currently provides funding for Project-related recreation activities; however, the funding is not adequate to cover increasing costs. No assistance has been provided in the past for Project-related recreation activities that occur downstream of Chili Bar Reservoir Dam. The 19.1-mile segment of the SFAR below Chili Bar Reservoir Dam is the most popular whitewater run in the state, and one of the top seven largest used rivers in the United States. Management costs associated with this activity have continuously increased since the 1970s. CDPR and El Dorado County have invested hundreds of thousands of dollars annually to manage recreational activities on public lands. These costs would not have been necessary had the Projects not been built on the SFAR.
- Approximately 85 percent of the recreational boating use on the SFAR occurs outside of the normal unimpaired hydrograph. Spring and early summer boating is extremely popular and many experienced boaters flock to other Sierra rivers during this time of year. Once these river systems dry up, boaters return to the SFAR, one of the few remaining river segments available for boating during the hot, dry summer months.

With a few thousand boaters utilizing the public lands during the spring months from March through middle of June of the natural hydrograph, managing agencies would not have had to build the infrastructure for Put-In and Take-Out sites, parking areas, remote composting toilet facilities, trails and roads leading to these facilities, and fund and manage a large whitewater management program to meet the public demand. The infrastructure necessary to accommodate up to 150,000 boaters with 135,000 boaters boating outside the natural hydrograph requires a substantial investment in facilities, land, maintenance, management, and planning.

- Because of inadequate funding, FS, BLM, and CDPR have not been able to manage all Project-related recreation in a manner that meets FS, BLM, and CDPR standards.
- Use of Project reservoirs and associated developed recreation sites results in increased impacts in other parts of the Forest for which the FS is responsible. There is Project-related dispersed recreation use for which the FS is now responsible.
- There is Project-related recreation use within Desolation Wilderness for which the FS is now responsible.
- Reservoir levels have not always been maintained in a consistent manner, or in cases, have not provided for Project-related visitor needs and desires.
- Inadequate public recreation-related information exists about Project-related recreation.
- The carrying capacity of Project-affected lands has not been determined due to lack of study information.
- Project facilities may not meet FS or BLM visual quality standards.
- Parts of the UARP are within the Desolation Wilderness. Non-conforming activities occur within wilderness to maintain and operate the Project.
- A Project construction road that has not been completely obliterated exists within the Desolation Wilderness.
- UARP operations affect one river segment recommended for inclusion in the Wild and Scenic Rivers System and one river segment that has been found to be eligible for inclusion in the National Wild and Scenic Rivers System: The 29-mile segment of the Rubicon River below Hell Hole Reservoir is recommended for Wild and Scenic River designation. The 31-mile segment of the SFAR River below the confluence with Silver Creek is eligible for inclusion in this system. The SFAR below Chili Bar Reservoir Dam is currently being evaluated by BLM as a potential candidate river segment under the Wild and Scenic Rivers System. BLM is currently conducting an eligibility and suitability analysis for this segment in preparing its Draft Sierra Resource Management Plan and Environmental Impact Statement. Two Outstandingly Remarkable values have been identified for this segment of river, Cultural and Recreational Significant Cultural values found in this reach relate to the changing of the West with the migration of prospectors coming to California in their search for gold. Sutter's Mill, located in the Marshall Gold State Historic Park where gold was first discovered, is located in this reach at Coloma. The significant Recreational value in this segment is one of the nation's most popular whitewater boating runs, the Chili Bar segment. BLM has determined this segment meets the eligibility criteria for wild and scenic river status and now is examining suitability in the Draft Sierra Resource Management Plan. It is the policy of the BLM to protect and enhance these Outstandingly Remarkable values while suitability is being determined.

- There are no recreational streamflows in the UARP area; such flows would have occurred in several reaches prior to construction of the Project.
- There is no minimum recreational flow schedule for the SFAR below Chili Bar Reservoir Dam.

**Desired Conditions**

- Formally coordinate operations between the UARP and Chili Bar Hydroelectric Project to provide more consistent recreation opportunities.
- Ensure Project-related facilities meet FS, BLM, and CDPR design and accessibility standards, current and projected user needs, and public health and safety requirements.
- Ensure Project-related recreation is not adversely affecting other resources.
- Provide funding for administration of use permits that exist due to the Projects.
- Determine the appropriate level of licensees' responsibility for Project-related recreation, including dispersed and wilderness recreation, and ensure the licensees provide that level of assistance.
- Provide reservoir levels that address recreation needs.
- Provide streamflow and other Project information to the public or assist the FS, BLM, and CDPR in providing such information.
- Determine carrying capacity for the UARP.
- Ensure Project-related recreation use is consistent with wilderness direction.
- Protect the outstandingly remarkable values on the one recommended and one eligible wild and scenic river segments and the SFAR below Chili Bar Reservoir Dam segment if BLM determines this segment meets eligibility and suitability requirements in its Draft Sierra Resource Management Plan.
- Consider converting the construction road within Desolation Wilderness to a trail.
- Ensure Project facilities meet visual quality standards.
- Monitor to ensure objectives are met.
- Provide recreational streamflows within the natural hydrograph in selected UARP reaches that were identified in the whitewater flow studies.
- Provide a formal schedule of recreational streamflows below Chili Bar Reservoir Dam.

**Coordination of Operations**

See Coordination of Operations section, above.

**Recreation Implementation Plan**

**Objectives Addressed by Recreation Implementation Plan**

Recreation Management Objective
Resource Protection Objective
Recreation Design Objective

### Information Used to Establish Recreation Implementation Plan

The following information was used to establish the need for a recreation implementation plan: (a) Upper American River Project Initial Information Package (SMUD 2001), (b) Potential Measures to Address Non-Water Related Impacts to El Dorado County (2004b), (c) Recreation Supply Technical Report (Devine Tarbell & Associates and Louis Berger 2004c), (d) Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d), (e) Recreation Demand Technical Report (Devine Tarbell & Associates and Louis Berger 2004d), (f) Visitor Use and Impact Technical Report (Devine Tarbell & Associates and Louis Berger 2005f), (g) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (h) The South Fork American River: A Management Plan (USDI 2004), (j) El Dorado County River Management Plan (El Dorado County 2001), (k) The Cronan Ranch Draft Management Plan (USDI 2006a), (l) Draft Sierra Resource Management Plan (USDI 2006b), (m) Final Sierra Planning Area Management Framework Plan Amendment and Environmental Assessment (USDI 1988), (n) Sierra Planning Area Management Framework Summary (USDI 1983a), and (o) Folsom Resource Area Sierra Planning Area Management Framework Plan (1983b).

### Rationale for Recreation Implementation Plan

The recreation plan was initially identified during the ALP as a mechanism for developing a long-term plan to address recreation within and adjacent to the Project boundary to integrate information from a variety of sources to develop a recreation plan for SMUD's application for new license. While the plan was never completed nor included in the application for new license, it remains an important element in managing recreation over the new license term. This recreation plan (including the implementation plan) will form the basis for the cooperative effort in managing the recreation within the Project area, while meeting the standards set forth in the Eldorado National Forest Land and Resource Management Plan (USDA 1989) as well as other applicable standards established by the various agencies with management authority. The implementation plan allows all parties to coordinate in planning for and scheduling of upcoming work needs and provides the means for each party to plan accordingly for their workload and commitments.

## <u>Recreation Survey</u>

### Objectives Addressed by Recreation Survey

Recreation Management Objective
Resource Protection Objective
Reservoir Levels Objective

### Information Used to Establish Recreation Survey

The following information was used to establish the need for recreation surveys: (a) Upper American River Project Initial Information Package (SMUD 2001), (b) Recreation Supply Technical Report (Devine Tarbell & Associates and Louis Berger 2004c), (c) Recreation Demand Technical Report (Devine Tarbell & Associates and Louis Berger

2004d), (d) Visitor Use and Impact Technical Report (Devine Tarbell & Associates and Louis Berger 2005f), (e) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (f) BLM's The South Fork American River: A Management Plan (USDI 2004), (g) National Survey on Recreation and the Environment (NSRE): 2000-2002 (USDA 2005c), (h) The Cronan Ranch Draft Management Plan (USDI 2006a), and (i) Draft Sierra Resource Management Plan (USDI 2006b).

**Rationale for Recreation Survey**

As part of managing the recreation resources within or affected by the Project, understanding the dynamic changes in recreation over the life of the license is critical. It is widely recognized that substantial changes in recreation use, activities, motivations, and other related items can happen in a short span of time. These trends are important to recognize and track so that adjustments in management strategies can be made in order to prevent the degradation of either resource conditions or recreation experiences. As an example, the Outdoor Recreation Resources Review Commission, which was largely responsible for developing use, activity, and motivation data starting in 1960, recommended completing recreation surveys on a 5-year interval (USDA 2005c). The change over time of visitor attitudes, preferences, use patterns, experience, and capacity may require modifications to the management of recreation within the Project area. This form of information gathering is aimed at fully using recreation sites while mitigating Project-related impacts within and adjacent to Project-affected areas. The timing of the this measure (6 years) was developed to ensure changes in recreation could be identified with sufficient time for management programs to react and to correspond with reporting requirements for recreation that FERC requires. This measure will provide the licensee and FS, and CDPR the ability to react to changes and provide the quality recreation opportunities in the Project area required to meet the Forest Plan, and other applicable management standards.

**<u>FS, BLM, and CDPR Liaisons</u>**

**Objectives Addressed by FS, BLM, and CDPR Liaisons**

Recreation Management Objective
Resource Protection Objective

**Information Used to Establish FS, BLM, and CDPR Liaisons**

The following information was used to establish the need for a FS liaison: (a) Upper American River Project Initial Information Package (SMUD 2001), (b) Recreation Supply Technical Report (Devine Tarbell & Associates and Louis Berger 2004c), (c) Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d), (d) Recreation Demand Technical Report (Devine Tarbell & Associates and Louis Berger 2004d), (e) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (f) The South Fork American River: A Management Plan (USDI 2004), (g) Flatwater Boating Flow Study for Chili Bar Reservoir Technical Report (Devine Tarbell & Associates and Louis Berger 2005b), (h) Recreational Flow in the Reach Downstream of Chili Bar Technical Report (Devine Tarbell & Associates and Louis

Berger 2005e), (i) Socioeconomic Conditions in the Reach Downstream of Chili Bar Technical Report (Devine Tarbell & Associates 2004u), and (j) Chili Bar Reservoir Shoreline Recreation Study (PG&E 2005), (k) Draft Sierra Resource Management Plan (USDI 2006a), (l) The Cronan Ranch Management Plan (USDI 2006b), (m) Final Sierra Planning Area Management Framework Plan Amendment and Environmental Assessment (USDI 1988), (n) Sierra Planning Area Management Framework Summary (USDI 1983a), (o) Folsom Resource Area Sierra Planning Area Management Framework Plan (1983b), (p) Federal Land Policy and Management Act § 102(a)(7)(8) (USDI 2001), (q) BLM's Sierra MFP § 4, pp. 51, 60-62, (r) BLM's Sierra MFP Summary p. 10, (s) BLM's Sierra MFP Amendment p. 17, (t) SFARMP pp. 9-18, and (u) Draft Sierra Resource Management Plan (USDI 2006b) § 2.15.

**Rationale for FS, BLM, and CDPR Liaisons**

To ensure projects on, adjacent to, or affecting National Forest System lands comply with the Forest Plan, Region 5 design standards, and projects on, adjacent to, or affecting BLM lands comply with the Draft Sierra Resource Management Plan, The Cronan Ranch Management Plan BLM Plan, and the Americans With Disabilities Act, it is critical that the licensee identify a single liaison to meet these objectives. Cooperation during all phases of the Projects will ensure early and upfront clarity to achieve this goal of compliance with applicable standards. This measure is not intended to require specific staffing on the part of the licensees, but rather is intended to provide efficient and effective planning and communication among the FS, BLM, CDPR, and licensees.

**<u>Review of Recreation Developments</u>**

**Objectives Addressed by Review of Recreation Developments**

Visual Resources Objective
Recreation Management Objective
Recreation Design Objective
Lake Fishing Objective
Recreational Access Objective
Resource Protection Objective

**Information Used to Establish Review of Recreation Developments**

The following information was used to establish the need for recreation developments: (a) Upper American River Project Initial Information Package (SMUD 2001), (b) Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d), (c) Visitor Use and Impact Technical Report (Devine Tarbell & Associates and Louis Berger 2005f), (d) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (e) access transition plans (USDA 1998a), (f) Recreation Opportunity Spectrum Book (USDA 1986), (g) Interim Policy – Accessible Outdoor Recreation (USDA 2000), (h) R5 Universal Access Strategy (USDA 1998b), (i) Special Use Permit for Campground and Related Granger-Thye Concessions (USDA 2004b), (j) accessibility guidelines email (USDA 2000d), and (k) The South Fork American River: A Management Plan (USDI 2004), (l) Draft Sierra Resource Management Plan (USDI

2006a), (m) The Cronan Ranch Management Plan (USDI 2006b), (n) Final Sierra Planning Area Management Framework Plan Amendment and Environmental Assessment (USDI 1988), (o) Sierra Planning Area Management Framework Summary (USDI 1983a), and (p) Folsom Resource Area Sierra Planning Area Management Framework Plan (1983b)..

**Rationale for Review of Recreation Developments**

It is the desire of the FS, CDFG, NPS, CDPR, and SWRCB, along with other interested parties, to continue a level of coordination and adjustment for the Project. Annual meetings Meetings every 6 years to review results of surveys and other data will assist in determining necessary maintenance, rehabilitation, construction, and reconstruction work needed, based on facility condition and other factors at the time. Data from ongoing monitoring will assist in making any needed changes in the schedule of work, and for future planning.

This measure also identifies recreation facilities associated with the Project that shall remain inside the Project boundary.

**Specific Recreation Measures**

**Objectives Addressed by Specific Recreation Measures**

Recreation Management Objectives
Recreation Design Objective
Resource Protection Objective

**Information Used to Establish Specific Recreation Measures**

The following information was used to develop the proposed recommendations for specific recreation measures: (a) Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d); (b) Recreation Demand Technical Report (Devine Tarbell & Associates and Louis Berger 2004d); (c) Recreation Supply Technical Report (Devine Tarbell & Associates and Louis Berger 2004c); (d) The South Fork American River: A River Management Plan (BLM 2004); (e) El Dorado County River Management Plan (El Dorado County 2001), (f) Auburn Reservoir Project/Folsom Lake State Recreation Area General Plan (CDPR 1978); (g) Marshall Gold Discovery State Historic Park General Plan (CDPR 1979b); (h) Folsom Lake State Recreation Area General Plan/Resource Management Plan Update Resource Inventory (CDPR 2004b); (i) Public Opinions and Attitudes on Outdoor Recreation in California (CDPR 2003b); (j) Whitewater Boating Use Data for Salmon Falls (CDPR 2004); (k) California Outdoor Recreation Plan (CDPR 2002); (l) The State Park System Plan 2002 (CDPR 2002a and 2002b); (m) The California Department of Parks and Recreation Department Operations Manual and Handbooks including Chapters 0800 (Maintenance of Facilities) (CDPR 1979a), 1000 (Housekeeping) (CDPR 1972), 1400 (Field Operations) (CDPR 1987), 1700 (Concessions) (CDPR 1990); (n) Computerized Asset Management Program developed by CDPR (CDPR 2005b); (o) Visitor Use and Impact Technical Report (Devine Tarbell & Associates and Louis Berger 2005f); (p) Eldorado National Forest

Land and Resource Management Plan (USDA 1989); (q) Recreation Opportunity Spectrum Book (USDA 1986); (u) Interim Policy – Accessible Outdoor Recreation (USDA 2000); (v) access transition plans (USDA 1998a); (r) R5 Universal Access Strategy (USDA 1998b); (s) Special Use Permit for Campground and Related Granger-Thye Concessions (USDA 2004b); (t) accessibility guidelines email (USDA 2000d); (u) Sixteen Summers of the Ditch, Memories of the South Fork and Gerle Creek Ditches and Old Loon Lake Dam, El Dorado County, California (Brown 2003); (v) professional experience of agency managers and other responsible individuals familiar with recreation management within the Project area; (w) Recreation Plan for Crystal Basin, Project 2101 (USDA 1974a); (x) Socioeconomic Conditions in the Reach Downstream of Chili Bar Technical Report (Devine Tarbell & Associates 2004u); (y) Recreation Analysis and Master Plan, Union Valley and Ice House Reservoirs (SMUD 1958); (z) Amendment to the Agreement between Sacramento Municipal Utility District and the United States Forest Service for the Construction, Administration, Operations, and Maintenance of Recreation Facilities in the Upper American River Project on the Eldorado National Forest (SMUD 1964); (aa) A Report of Findings for the On-site Survey of Recreation Users and Telephone Survey of Area Residents for Folsom Lake State Recreation Area (Fletcher 2003); (bb) Folsom State Recreation Area Resource Inventory Document – Draft (CDPR and USBR 2003), (cc) Letter from Craig Harasek, District Ranger, to Gary Brumley, SMUD (USDA 1992); (dd) Agreement Between the Sacramento Municipal Utility District and United States Forest Service for the Construction, Administration, Operation, and Maintenance of Recreation Facilities in the Upper American River Project on the Eldorado National Forest (USDA 1964); (ee) Recreation Plan for Crystal Basin FPC Project 2101 (USDA 1974a); (ff) Collection Agreement Between Sacramento Municipal Utility District and Eldorado National Forest (USDA 1988); and (gg) California State Parks Accessibility Guidelines (CDPR 2005c); (hh) Central and Northern California Recreation Market Analysis (USDA 2002b); (ii) Cooperative Agreement for the Construction, Operation, and Maintenance of the Loon Lake Road - Union Valley Reservoir Among Sacramento Municipal Utility District, Michigan-California Lumber Company, United States Forest Service, and County of El Dorado.Eldorado National Forest (USDA1961); (jj) Cooperative Agreement Road Pavement and Maintenance Among Sacramento Municipal Utility District, Michigan-California Lumber Company, United States Forest Service, and County of El Dorado. Eldorado National Forest (USDA 1967a); (kk) Cooperative Agreement for Road Construction between Sacramento Municipal Utility District and United States Forest Service, Eldorado National Forest (USDA 1967b); (ll) Letter to Mr. Ed Carnahan, Sacramento Municipal Utility District, from Robert W. Jessen, District Ranger (USDA 1973b); (mm) Draft Sierra Resource Management Plan (USDI 2006a); (nn) The Cronan Ranch Management Plan (USDI 2006b); (oo) Final Sierra Planning Area Management Framework Plan Amendment and Environmental Assessment (USDI 1988); (pp) Sierra Planning Area Management Framework Summary (USDI 1983a); and (qq) Folsom Resource Area Sierra Planning Area Management Framework Plan (1983b).

**Rationale for Specific Recreation Measures**

Bureau of Land Management

In order to meet the recreation demand for access within Chili Bar Reservoir, BLM believes that there is a need for a trail that leads from Rock Creek Road to Chili Bar Reservoir that meets the demand for day use recreation opportunities, including picnicking. Based on the recreation study within Chili Bar Reservoir, there were numerious trails feeding to and from the reservoir indicating that there is a demand for this type of recreation opportunity. The construction of this trail was included as an element of PG&E's license application for the Chil Bar Project.

California Department of Parks and Recreation

The Gold Fields District of the California Department of Parks and Recreation (CDPR) manages Folsom Lake State Recreation Area (SRA) and Marshall Gold Discovery State Historic Park (SHP). The SFAR River passes through both parks. CDPR manages river access facilities on the SFAR at both sites. The river access site at the North Beach Use Area within Marshall Gold Discovery SHP is a popular access point for novice whitewater boaters and instructional use of the Class 2 Coloma to Lotus stretch of the SFAR. Annual use by whitewater boaters at the Salmon Falls and Skunk Hollow river access sites has averaged about 70,000 people over the past 10 years. This includes 45,000 park visitors using outfitter services and 25,000 general public boaters.

This rationale document provides information on the river recreation use, CDPR managed river recreation facilities at Marshall Gold Discovery SHP and Folsom Lake SRA on the South Fork of the American River and the cost of managing, operating, maintaining and administering this use and facilities. As part of the settlement negotiation process, CDPR has reached agreement with SMUD and PG&E on a one-time payment of $50,000 as a partial and "fair share" contribution for improvements to river recreation access facilities at Marshall Gold Discovery SHP. In reaching this agreement, SMUD and PG&E dispute whether they have any responsibility to provide funding for any construction, maintenance, operation or administration of public recreation areas management by CDPR on the South Fork of the American River. Nonetheless, CDPR considers this agreement to provide a one-time payment $50,000 for river recreation facility improvements at Marshall Gold Discovery SHP as a partial and reasonable "fair share" contribution by the utilities to the overall cost of providing river access facilities. In the utilization of these funds for these facilities improvements, CDPR will make efforts to be as efficient as possible, will prioritize the work to be accomplished to stay within available funding, and will look to other funding sources to accomplish the work needed to meet the recreation visitor needs and to address impacts from recreation visitors as necessary.

***Marshall Gold Discovery SHP River Access***

The Marshall Gold Discovery SHP General Plan (pp. 41 and 56) recognizes the need to separate recreation activities (such as rafting) not related to the preservation and interpretation of the historic resources from the gold discovery site and other historic resources within the park. Since development of the plan, CDPR has limited and separated whitewater boating use to designated areas away from the gold discovery site. This use now occurs at the North Beach Day Use Area. The plan also recommends expanding parking in the North Beach area to accommodate 100 vehicles to serve the various recreation uses that occur at the site. The El Dorado County River Management Plan (p. 6-30) also identifies the need for development of river access facilities near Marshall Gold Discovery SHP.

Construction of a parking lot and other improvements at the river access site will help achieve the direction in these plans.

***Property Acquisition and New Facility Development***

The Salmon Falls and Skunk Hollow River Access sites within Folsom Lake SRA are the only take-outs for the very popular Class 3 "Gorge" run on the SFAR. Anglers, swimmers, gold panners, and other river users also access the river at these locations.

Existing facilities at the Salmon Falls river access site include paved parking for 32 vehicles and 12 buses, two concrete vault toilet restrooms, and information signs. The facilities at Skunk Hollow access site include paved parking for 35 vehicles, two concrete vault toilet restrooms, a pedestrian ramp, information signboards, and three picnic tables.

The Auburn Reservoir Project/Folsom Lake SRA General Plan (pp. 148 and 168) recognizes the heavy use by whitewater boaters at Salmon Falls, the need for parking (60 vehicles plus loading zone, to be expanded to 120 vehicles), and the congestion that occurs on roadways in this area during periods of peak use. Facilities have been constructed with State funds to minimally meet the needs identified in the 1978 plan. There is continued congestion during peak use periods when the use exceeds the capacity of the facilities. Limited existing land area is a constraint for the expansion of facilities at these sites. Providing over-flow parking and expanding parking are options identified to address this problem.

An onsite survey of park visitors conducted as part of the ongoing Folsom Lake SRA General Plan update process found that whitewater boating ranked in the middle of the range of 37 recreation activities regarding participation, with 16.7 percent of survey respondents indicating they participated in this activity within the SRA (to give the range of participation rates, 49.9 percent of respondents participated in swimming, and 2.2 percent participated in skateboarding). However, whitewater boating was the second highest activity rated as the most important to recreation users. Among recreation activities within the SRA, whitewater boating has a moderately-sized user base that is extremely dedicated to its specific activity. Whitewater boating also ranked second among the activities respondents would have done more if better opportunities, facilities, or programs had been available. The El Dorado County River Management Plan (p. 6-30) also identifies the need to expand parking at Salmon Falls.

Forest Service

The UARP licensee has been, and continues to be, the significant force in recreation development within the Crystal Basin. The licensee's role in facility and infrastructure development has been pervasive over the last 50 years. Additionally, water and power development companies, dating back to the early 1900s and later purchased by the licensee, were responsible for much of the early access into the area (Brown 2003).

In many areas of the Crystal Basin, driving access for standard 2-wheel drive vehicles can directly be attributed, at least in part, to the UARP licensee through construction of Project roads, many of them paved. Examples include (1) paving the Ice House Road from Marin Rock to Robbs Saddle and (2) paving the Ice House Road from Robbs Forebay to Loon Lake and Gerle Creek (USDA 1973b). This new high standard driving access into the reservoir sites also attracted new recreation visitors to the area, in turn causing resource impacts requiring mitigation. Examples include paving of the Ice House road from Marin Rock to Robbs Saddle and Robbs Forebay to Loon Lake and Gerle Creek (USDA 1961, USDA 1967a, USDA 1967b, USDA 1973b).

Recreation facilities were planned by the licensee during the same period that initial Project development occurred. Early in 1963, the licensee acquired funds to build recreation facilities at Loon Lake Reservoir, Gerle Creek Reservoir, Union Valley Reservoir, and Ice House Reservoir. These funds, received through Davis-Grunsky Act Recreation Grants, required a feasibility report that indicated a projected growth in recreation visitor use from roughly 85,000 visitor days to 2,295,000 visitor days over the period spanning 1952 to 2000. In fact, in the Recreation Analysis and Master Plan for Union Valley and Ice House Reservoirs (commissioned by the licensee as part of its Davis-Grunsky Recreation Grant request, SMUD 1958) the licensee's planning consultant, F. L. Hector, states, "It may be reasonably predicted from this precedent (referring to the proximity of the project to population centers) that the attendance at Union Valley and Ice House reservoirs may reach 250,000 visitor days within the first two years of operation and may be expected to exceed 1,000,000 visitor days annually in the foreseeable future" (SMUD 1958).

In the original agreement between the licensee and the FS for the Construction, Administration, Operation and Maintenance of Recreation Facilities in the Upper American River Project on the Eldorado National Forest (Agreement) (SMUD 1964), it is stated that, "Whereas, the construction by the District (SMUD) of Loon Lake, Gerle Creek, Union Valley and Ice House Reservoirs within the boundaries of the Eldorado National Forest has created mountain lakes having great public potential and … Whereas, the full potential of these lakes can only be utilized only if certain onshore recreation facilities, including roads, water systems, sanitary facilities, campgrounds, picnic areas and boat ramps are constructed; and Whereas, the Forest Service does not have the funds available to construct all of the necessary facilities required to meet the anticipated public demand at these reservoirs … ". As such, the licensee agreed to provide to the FS funds to construct recreation facilities at each of the reservoirs. These facilities were the foundation of the Crystal Basin Recreation Area.

These facilities were later expanded as part of the Exhibit R of the FERC license for the UARP, as stipulated in the 1985 Agreement. The Exhibit R recreation facilities included more than a dozen new campgrounds, trails, and other recreation facilities aimed at meeting recreation demand during the 1980s. Construction of these facilities continued through 2002.

The capacity of total overnight occupancy within the Crystal Basin is more than 4,600 persons at one time (PAOT). Approximately 95 percent of these facilities were constructed directly by (the licensee either directly built or the licensee provided funds for construction of the facilities) (Devine Tarbell & Associates and Louis Berger 2004c). During the summer months, these facilities can provide overnight camping to more than 650,000 visitors. In addition to the significant overnight recreation development, the licensee was also responsible for the development of several day-use recreation sites (including picnic areas, trails, boat launches) at nearly all Project reservoirs.

As was anticipated in the licensee's Davis-Grunsky grant request and Agreement, the combination of new reservoirs and substantially improved infrastructure provided by the licensee (campgrounds, day use areas, information stations, roads, power) caused recreation use within the UARP Project area to skyrocket. The Crystal Basin reservoirs are described as a magnet, attracting visitors from Northern California's large metropolitan areas. Actual use estimated by SMUD within the Project area is more than 330,000 visitor days (Devine Tarbell & Associates and Louis Berger 2004d). The FS, in reporting visitation, used recreation visitor days (RVD) as the unit of measure, which is 12 hours of recreation use in any combination of persons and hours (i.e. one person for 12 hours, 3 people for 4 hours, etc.). The most recent FS complete recreation visitor counts (USDA 1998b) for the Pacific Ranger District indicate some 850,000+ RVDs annually. This should be compared to recreation use reported in Recreation Plan for Crystal Basin (USDA 1973a), where in 1972 there were approximately 196,000 RVDs at developed sites within the Project area. These UARP recreation facilities are completely full on nearly all weekend days (Friday, Saturday, and Sunday) between Memorial Day and Labor Day, with visitors spilling into the adjacent dispersed recreation areas. In addition, during mid-week days (Monday, Tuesday, Wednesday, and Thursday), these facilities are moderately occupied. Use trends show the average stay is more than 4 nights/trip and has steadily increased over the last decade (Devine Tarbell & Associates and Louis Berger 2005f). In addition, survey efforts during the 2002 field season show that 17.8 percent of respondents were on their first visit to the area, indicating the growing use of the area (Devine Tarbell & Associates and Louis Berger 2005f).

User surveys conducted by the licensee indicate how important the reservoirs are to the visitors themselves. Two of the top three activities for visitors to the Crystal Basin are swimming and reservoir fishing. In fact, 76.6 percent of visitors surveyed at Union Valley indicated swimming was an activity they participated or planned to participate in during their stay. Additionally, 61.4 percent of these same individuals indicated that they had participated in or planned to participate in reservoir fishing. In factAlso noteworthy is that, 65 percent of respondents said they had brought a watercraft with them (Devine Tarbell & Associates and Louis Berger 2005f). These survey results should be compared to the results from the Central and Northern California Recreation Market Analysis (USDA 2002b), which indicate that users with similar demographics tend to participate in very different activities when visiting other areas around central and northern California than visitors to the UARP area. As an example, while 76.6 percent of visitors surveyed at Union Valley indicated swimming was an activity they participated or planned to participate in during their stay; only 2.9 to 11.8 percent of the respondents (depending on the survey group) surveyed in the Central and Northern California Recreation Market Analysis indicated that they participated in the activity of swimming in the last year. The role of water-based recreation opportunities is clearly higher for users of the UARP than those visiting other areas throughout northern and central California.

Through the development of the UARP reservoirs--the accompanying infrastructure development, including paved two-lane road access, power, and the recreation facility development--the licensee has been and is the greatest influence within the Crystal Basin and at the other Project reservoirs. With little exception, recreation within the Project area is directly tied and dependent upon the UARP, a fact that was recognized early in the development of the project in the Recreation Plan for Crystal Basin, FPC Project 2101 (USDA 1973a). This plan states, "One of the major by-products of this hydroelectric project is the recreation opportunity which has been created and made available to thousands of people through SMUD's development of the water resources of the Upper American River. The Crystal Basin, through this development, has been converted from basically a timber-oriented area served by low standard dirt roads to a true multiple use situation in which water-oriented recreation, served by high standard paved roads, plays a major role" (USDA 1973a).

For visitors to experience quality recreation opportunities and be able to fully use recreation sites within the Project area, it is necessary to ensure that the appropriate infrastructure is in place and in good condition, and that the appropriate level of accessibility is provided through design standards. Accessibility issues have been identified at nearly all of the developed recreation sites within the UARP. Meeting the design standards in the Americans with Disability Act, the R5 Universal Access Strategy, and the Eldorado National Forest Access Transition Plans will ensure all visitors to the Project area have a quality experience. FERC regulations at 18 CFR 2.8 require the licensee to "develop suitable public recreational facilities upon project lands and waters and to make provisions for adequate public access to such project facilities and waters and to include therein consideration of the needs of physically handicapped individuals in the design and construction of such project facilities and access." FS policy (USDA 1998a and USDA 2000) is to provide 100 percent barrier-free access where possible, consistent with the intent of the Region 5 (R5) "Universal Access Strategy."

Currently, many facilities are at the end of their usable life. Long-term maintenance costs of the reconstructed infrastructure will be commensurately lower after capital investment in facility upgrades is completed. Many of the following facilities are within the immediate Project boundary, or are within the area affected by the Project.

The licensee has, through collection agreements, funded parts of the recreation operations within the Crystal Basin. Numerous other funding sources, including Appropriated, Fee Demonstration (now called Recreation Enhancement Funds) funds, Granger-Thye Act fee offset[1], and others have been used to supplement licensee funds, at times exceeding more than twice the funding the licensee currently provides to the FS. Even with these funds, deferred maintenance within the Crystal Basin has steadily increased.

Several amenity upgrades and improvements are in the specific recreation measures. These have largely been developed through the analysis of the licensee's visitor survey results and their development in the Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d). The needs assessment highlighted needs identified by visitors for new facilities and upgrades to existing amenities at licensee-constructed facilities. These improvements include water systems, showers, and parking (Devine Tarbell & Associates and Louis Berger 2005f). These needs, where appropriate given design standards, ROS classification, and reasonableness, have been included in the specific recreation conditions.

Although large-scale development has not been proposed in this settlement, based on the visitor surveys and on-the-ground experience, there is a need for specific types of facilities in certain areas. These facilities, where determined to be appropriate and required to maintain recreation opportunities, have been conceptually designed with both field work and management analysis. In most cases, these potential new facilities were recognized and described in the Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d). In all cases, their design specifically meets new and growing recreation demand that is a result of the popularity of the UARP Reservoirs.

Additional specific rationales accompany each of the following reservoirs or areas:

***Buck Island Reservoir***

The licensee built the dam for Buck Island Reservoir in 1963, along with the Buck Island-Loon Lake Tunnel. Completion of this project raised the lake level, and created access roads and trails leading from the Loon Lake area.

*Existing Facilities*

- Raising Buck Island Reservoir level by the licensee led to the direct inundation of the Rubicon OHV route, resulting in the need to reroute a portion of the route near the north shoreline away from sensitive areas and to rehabilitate the existing route (Devine Tarbell & Associates and Louis Berger 2005d).
- The foot trails originally constructed by the licensee near the west shoreline were not constructed to current standards, resulting in the need to improve or relocate them.

*New Facilities*

As a result of the attraction that the elevated Buck Island Reservoir has created, users frequently stop and camp overnight in the area. However, no developed facilities exist to

[1] Under the authority of the Granger-Thye Act, campground concessionaires operating government facilities (campgrounds) renovate, recondition, improve and maintain the facilities in lieu of fees due to the government. This heavy maintenance work is referred to as "fee offset".

accommodate this use. Development of a dispersed motorized camping area to include a vault toilet maintained by helicopter, designated campsites, vehicle restrictions, and restoration of impacted areas will address resource concerns and impacts resulting from the licensee's project.

### ***High Country Area Trails***

To access the high country reservoirs, including Buck Island and Rubicon, the licensee developed several access roads and trails, which are currently used by the public as well. A portion of the Rubicon Hiking Trail was originally a licensee construction road for the high country reservoirs.

*Existing Facilities*

- The licensee has requested that the Rubicon Hiking Trail be upgraded to accommodate all-terrain vehicles (ATVs) for administrative purposes.
- The trail connecting Pleasant Campground to the Rubicon hiking trail was not originally constructed to meet present standards. As a result of the popularity of the Rubicon hiking trail, use at Pleasant Campground and these access trails has increased.

### ***Ellis Creek Staging Area at Loon Lake Dam***

UponVehicle access across the two dams at Loon Lake was made possible upon completion of the main Loon Lake Reservoir Dam improvements during initial project development in 1963. Additionally, a large open area was created between the dam and the spillway at that time. This area is now used by the public as the Ellis Creek off-highway vehicle (OHV) staging area/trailhead. OHV use has also shifted from the original and historic route (along the Wentworth Springs Road) to this new access.

*Existing Facilities*

In 2002, Friends of the Rubicon volunteers moved an information kiosk into the area to provide information about the trail. No other designed or developed facilities exist. Currently, both El Dorado County and the FS provide operations and maintenance in the area. As a result of the licensee's improved access and the growing resource concerns in this area, there is a need to provide developed parking, sanitation, and improved information. Vehicle control measures and site restoration are needed to address resource concerns. The existing access road to this location needs to be paved as a result of its low standard of development and high use.

### ***Loon Lake Reservoir***

Loon Lake Reservoir is one of the main storage reservoirs that provides both overnight and day use recreation opportunities. Road improvements made by the licensee just before development of the UARP facilitated the earliest improved access into the area (Brown 2003). Facilities the licensee developed in the Loon Lake area as part of the original license period include campgrounds, picnic areas, trailheads, boat launches, and a ski chalet.

The Recreation Needs Report (Devine Tarbell & Associates and Louis Berger 2005d) identifies several capital improvement needs and other management needs to address the recreation use, resource impacts, and anticipated future demand. In particular, this report describes the impacts to the lakeshore zone and islands from unmanaged recreation, and the need for additional day use opportunities. Completing a development plan will allow for the determination of the appropriate measures needed to meet the recreation needs and protection of resources from damage by public use.

*Existing Facilities*

- Loon Lake Campground (including Equestrian Loop) is in varying states of condition. The first 34 units were constructed in 1967, with an additional 28 (35 – 53, and equestrian units E-1 – E-9) units constructed in 1992. The original sites are in poor to fair condition. Some infrastructure is worn and in need of replacement. Access roads and spurs are narrow with potholes/protruding objects, and broken pavement. Needs were identified through visitor surveys for improvements to the water system and the addition of flush toilets and showers at Loon Lake Campground. Loon Lake Group Campground facility components are in fairly good condition, and not in immediate need of replacement. Loon Lake Group Equestrian Campground was constructed in 1988, with facility components in fair condition. The Loon Lake Boat Launch (and Day Use Area) was originally opened in 1966. The parking area was repaved, and new vault restrooms, faucet units, and an accessible loading ramp were installed in 2000. Components are in good condition and not in need of immediate replacement. This facility is mainly (except for the boarding dock recently installed by the Department of Boating and Waterways) operated and maintained by concessionaire under permit with the FS. Bear problems were identified through visitor surveys at Loon Lake, indicating a need for bear-proof food lockers at all remaining overnight sites (at the boat launch). Accessibility needs were identified at all Loon Lake facilities. These facilities were built (or paid for) by the licensee under either the original license or as part of the Exhibit R Amendment to the License.
- Northshore Recreational Vehicle Campground was constructed in 1990, and existing facilities are in good condition, but are inadequate to serve existing levels of use (Devine Tarbell & Associates and Louis Berger 2004b). Users have created dispersed camping areas to the east and west of the developed facility. These dispersed areas are leading to increased vegetation loss, compaction, and improper disposal of garbage and human waste (Visitor use and impacts, Technical Report, as well as experience of local managers). Campground expansion is needed to address increased overnight recreation demand as well as impacts to resources occurring from existing dispersed camping (Devine Tarbell & Associates and Louis Berger 2005d). Visitor surveys identified needs for bear-proof food lockers. The facility is currently operated and maintained by the FS. This facility was built by the licensee as part of the Exhibit R Amendment to the License.
- Red Fir Group Campground was opened in 1990. Facility components are in fairly good condition and not in immediate need of replacement. Accessibility needs have

been identified at this site. This facility is operated and maintained by the FS. This facility was built by the licensee as part of the Exhibit R Amendment to the License.

- Loon Lake Chalet was opened in 1989 and remodeled in 1994; facility components are in good condition and not in immediate need of replacement. Winter safety and ADA issues have been identified with the current entry area of the facility. Visitor surveys (summer and winter) identified needs for flush toilets, showers, and telephone service at the Chalet. This facility is operated and maintained by the FS. This facility was built (or paid for) by the licensee as part of the Exhibit R Amendment to the License.
- Loon Lake Trailhead was opened in 1992. Facility components are in moderate to good condition and not in immediate need of replacement. Minor accessibility needs have been identified. This facility is operated as part of the Loon Lake Campground Complex. This facility was built (or paid for) by the licensee as part of the Exhibit R Amendment to the License.
- Pleasant Boat-in Campground facilities were constructed in 1968. There are substantially worn or missing components, with degraded access trails and pit restrooms that are non-compliant with current health and safety standards. Site Access Plans indicate that the level of accessibility for the existing facilities within the Project area is inadequate. In addition, shoreline boat mooring and low-water access are problems. This facility is operated and maintained by the FS.
- Loon Lake (Schlein) Sanitation Station was originally constructed in 1992. The facility is in good condition, with minor upgrades needed. This facility was built (or paid for) by the licensee as part of the Exhibit R Amendment to the License.

The licensee is responsible for 100 percent of the costs of upgrading the existing facilities for the following reasons:

- Loon Lake Reservoir is one of three main storage reservoirs for the Project.
- Site Access Plans indicate the level of accessibility for existing facilities within the Project area is inadequate.
- The existing paved access into the area, originally developed by the licensee, has facilitated major expansion in recreation use. The auxiliary and main dams, constructed by the licensee to increase reservoir capacity, also facilitated created recreation access to the north side of the reservoir. The licensee’s construction road on the main dam has substantially modified (made easier) access to the Rubicon OHV trail through the Ellis Creek OHV Route.
- The licensee’s winter plowing of Ice House Road and its development of the Loon Lake Chalet have facilitated year-round recreation in the Loon Lake area.
- Recreation demand exceeds the supply of developed recreation opportunities in the area, as evidenced by the high number of users and the proliferation of dispersed overnight campsites along the shoreline of the reservoir.
- Use in all recreation facilities is reaching or exceeding capacity on weekends and is near full during mid-week periods.
- Visitor surveys indicate recreation in the area is tied to either the reservoir or facilities provided by the licensee.
    - More than 63 percent of respondents indicated their primary activity was water-based.

- More than 50 percent of respondents indicated they would participate in reservoir fishing during their stay, with more than 33 percent saying it was their most important activity.
    - More than 55 percent indicated they would swim.
    - Nearly 70 percent of those surveyed said they would stay overnight in the area.
    - More than 86 percent of Loon Lake respondents indicated developed campgrounds were either moderately or extremely important in their decision to visit the area.
    - Ninety-one percent of Loon Lake respondents indicated the reservoir was either moderately or extremely important in their decision to visit the area. Of these, more than 77 percent indicated it was extremely important.
    - More than 55 percent of respondents brought a watercraft.
    - Crowding is becoming an issue in the area, with almost 30 percent of those surveyed in the area reporting they felt moderately or extremely crowded.
    - Sixty percent of the respondents indicated boat launch ramps were moderately or extremely important in their decision to visit. 86 percent of the respondents indicated developed campgrounds (SMUD constructed) were either moderately or extremely important in their decision to visit.
- All recreation facilities are within the FERC Project boundary.

*New Facilities*

The licensee is responsible for the costs of constructing and maintaining the following specific new developments for the following reasons. With the popularity of Loon Lake Reservoir, demand in the area is growing steadily. Nearly 70 percent of the respondents to the licensee's 2002 Visitor Survey (Devine Tarbell & Associates and Louis Berger 2005f) indicated they would stay overnight in the area. Of these same visitors, more than 86 percent indicated "developed campgrounds" were either moderately or extremely important in their decision to visit the area. Finally, crowding is becoming an issue in the area, with almost 30 percent of those surveyed reporting that they felt either moderately or extremely crowded. As demand grows, the need for overnight developed facilities will increase substantially (Devine Tarbell & Associates and Louis Berger 2005f). A new campground developed on the south shore of Loon Lake Reservoir, would accommodate the growing demand. This site was previously identified as proposed Red Fir Campground in the Recreation Plan for Crystal Basin, Project 2101 (USDA 1973a).

### *Gerle Reservoir*

Gerle Reservoir is a small storage reservoir that serves both overnight and day use. The Gerle Reservoir regulates hydropower water releases from Loon Lake Reservoir and is generally maintained at full pool during summer months. The improvements made by the licensee as part of the reservoir development encouraged recreation growth in the area and created a new recreation demand. The facilities that the licensee developed over the original license period include campgrounds, picnic area, trails, handicapped fishing pier, and an informal boat launch. Except for Airport Flat Campground (also constructed by the licensee), all facilities listed are within the FERC Project boundary.

The Recreation Needs Assessment Report (Devine Tarbell & Associates and Louis Berger 2005d) identifies several capital improvement needs and other management needs to address the recreation use, resource impacts, and anticipated future demand. In particular, this report describes the impacts to the lakeshore zone, along Gerle Creek, and in the Airport Flat area from unmanaged recreation. Completing a development plan will allow for determination of appropriate measures needed to meet recreational needs and protect resources from damage by public use.

*Existing Facilities*

- Gerle Creek Campground was constructed in 1967. Its infrastructure is worn and in need of replacement. Access roads and spurs are narrow with cracked pavement, potholes/protruding objects, and eroding shoulders. Accessibility needs have been identified at this site. Bear-proof food lockers have recently been installed. A new well was drilled during the summer of 2005; however, it yielded only 3.5 gpm. This facility is currently operated and maintained by concessionaire under permit with the FS. This facility was built (or paid for) by the licensee under the original license.
- Gerle Creek Day Use Area was opened in 1990, with parking expanded in 2002. Facility components are in good condition and do not need immediate replacement. The site has an accessible fishing pier. Some accessibility needs have been identified at this site. This facility is currently operated and maintained by concessionaire under permit with the FS. It was built (or paid for) by the licensee as part of the Exhibit R Amendment to the License.
- Angel Creek Day Use Area was opened in 1992. Its facility components are in good condition and do not need immediate replacement. The primary access road into the site is steep and has serious issues with tread stability. This facility is operated by the FS staff. It was built (or paid for) by the licensee as part of the Exhibit R Amendment to the License.
- Angel Creek Trail was developed as part of the last phase of the Exhibit R recreation facilities. The trail and associated parking are in good condition. Day use opportunities will be enhanced by completing the trail to tie with the Summer Harvest Trail. This facility is serviced by the FS. This facility was built (or paid for) by the licensee as part of the Exhibit R Amendment to the License.

- Summer Harvest Trail was developed in 1990 along with the Gerle Creek Day Use Area. The trail surface needs improvement for accessibility. The paved portion of this trail was constructed and paid for by the licensee as part of the Exhibit R Amendment to the License.
- Airport Flat Campground was built by the licensee in 1996 as part of the Exhibit R Amendment to the License. It is one of the few licensee-developed facilities away from a main reservoir. This site was developed by the licensee in lieu of expanding Gerle Creek Campground as a result of concerns that an expanded Gerle Creek Campground would lead to crowding conditions and degradation of the recreation experience. As such, the Airport Flat Campground was developed to handle recreation demand in the area. The facility is in good condition; however, dispersed camping occurs in adjacent areas and is causing resource damage. It is operated and maintained by the FS.

The licensee is responsible for 100 percent of the costs of upgrading the existing facilities for the following reasons:

- Gerle Reservoir is one of the storage reservoirs for the Project.
- Site Access Plans indicate the level of accessibility for existing facilities within the Project area is inadequate.
- The existing paved access into the area, originally developed by the licensee, has facilitated major expansion in recreation use.
- Recreation demand exceeds supply of developed recreation opportunities in the area, as evidenced by the proliferation of dispersed overnight campsites along Gerle Creek in the vicinity of the reservoir.
- Visitor surveys indicate recreation in the area is clearly tied to either the reservoir or facilities provided by the licensee.
    - More than 40 percent of respondents indicated their primary activity was water based.
    - More than 20 percent of respondents indicated hiking/walking was their primary activity, very common along either the paved Summer Harvest Trail or the Gerle Trail (both developed by the licensee).
    - Nearly 75 percent said they would swim.
    - Ninety-five percent of those surveyed indicated they would stay overnight in the area.
    - Nearly 90 percent of the Gerle Creek respondents indicated the reservoir was either moderately or extremely important in their decision to visit the area. Of these, nearly 65 percent indicated it was extremely important.
    - The average stay is more than 3 days/trip.
    - Nearly 30 percent of respondents said they felt either moderately or extremely crowded.
    - Some 86 percent of the respondents indicated developed campgrounds (SMUD constructed) were either moderately or extremely important in their decision to visit.
- All recreation facilities are within the FERC Project Boundary except for Airport Flat Campground, which was built by the licensee as part of the Exhibit R.

***Union Valley Reservoir***

Union Valley is the largest of the three main reservoirs, and has the most substantial recreation developments. The facility has 11 campgrounds with more than 400 developed campsites and has overnight capacity of nearly 3,000 persons per night. The greatest range of recreation opportunities can be found in the Union Valley Reservoir. Because of the many developments and high use of this area, many human use and recreational activities occur each day of the summer months, which leads to management difficulties. In addition to campgrounds, there are three boat ramps, a paved bike trail, and picnic areas. The majority of recreational developments at Union Valley Reservoir are part of the original license and the Exhibit R Amendment to the License. The improvements made by the licensee as part of the reservoir development, spurred the growth of recreation in the area and also affect adjacent dispersed recreation areas.

The Recreation Needs Assessment Report (Devine Tarbell & Associates and Louis Berger 2005d) identifies several capital improvement needs and other management needs to address the recreation use, existing facility conditions, resource impacts, and anticipated future demand. Completing a development plan will allow for the determination of appropriate measures needed to meet recreational needs and to protect resources from damage by public use.

The Recreation Needs Assessment Report **(**Devine Tarbell & Associates and Louis Berger 2005d) also describes public issues relating to boating safety, lake surface access, minimizing conflicts between types of boats and different recreational uses, impacts from interactions between wildlife and humans, and minimizing displacement of users or user groups. Many of these issues will be addressed by completing a boating management plan, which will allow for identification of hazards and safety needs and implementation of measures to address conflicts and enhance boater safety.

*Existing Facilities*

- Azalea Cove Campground is a 10-unit bike in/boat in campground on the east shoreline of Union Valley Reservoir opened in 1999. The facilities meet accessibility standards, and components are in good condition and do not need immediate replacement. Bear-proof accessible refuse cans were installed in spring 2003. Food lockers will be installed in 2006. Visitor surveys indicate a potable water source and distribution system needs to be developed at this site. When reservoir levels decrease, boat access is not available, and use shifts to bike-in and hike-in camping. This creates a need for additional parking near the existing service road access to the bike trail. This facility is operated by the FS. It was built (or paid for) by the licensee as part of the Exhibit R Amendment to the License.
- Big Silver Campground was opened in 1990. This facility meets accessibility standards. Facility components are in good condition and not in need of immediate replacement. FS observations and FS communication with visitors indicate a need for potable water, shade structure, and visitor foot traffic/OHV controls in the campground. This facility is operated by the FS. It was built (or paid for) by the licensee as part of the Exhibit R Amendment to the License.

- Camino Cove Campground is a 32-unit campground opened in 1999. Facility components meet accessibility standards and are in good condition and do not need immediate replacement. Campground roads require upgrades to meet current design standards. Visitor surveys identified a need for picnic tables and a potable water system. This facility is operated by the FS. It was built (or paid for) by the licensee as part of the Exhibit R Amendment to the License.
- Fashoda Campground was originally constructed as a day use area in 1966 and converted to a tent campground in 1991. Facility components are in good condition, and not in need of replacement. Fashoda Day Use Area also opened in 1991, when Fashoda Campground was developed; day-use area restrooms were replaced in 2002. Other facility components are in good condition and not in need of immediate replacement. These facilities are operated and maintained by concessionaire under permit with the FS. They were built (and paid for) by the licensee as part of the Exhibit R Amendment to the License.
- Jones Fork Campground was opened in 1991. Facility components are in good condition and are not in need of replacement. Multiple user-created trails are causing erosion between the campground and high water mark. Visitor surveys indicate a need for potable water. Some accessibility needs have been identified. This facility is operated by the FS. It was built (or paid for) by the licensee as part of the Exhibit R Amendment to the License.
- Lone Rock Campground was opened in 2000. The facilities at this 5-unit bike-in or boat-in campground meet accessibility standards; facility components are in good condition and are not in need of immediate replacement. Visitor surveys identify a need for potable water. This facility is operated by the FS. It was built (or paid for) by the licensee as part of the Exhibit R Amendment to the License.
- Sunset Campground and Boat Launch was originally developed as a 51-unit camp in 1966, with an additional 80 units added in 1969. Infrastructure is worn and needs replacement. Access roads and spurs are narrow, with potholes/protruding objects, and tight turning radii not suitable for today's recreational vehicles (RVs). Multiple user-created trails have been created, and erosion is occurring between the campground and the high water mark. Numerous accessibility needs are identified in the Site Access Plans. Visitor surveys indicate a need for flush toilets, showers, and an RV filling station. This facility is operated and maintained by concessionaire under permit with the FS. The majority of these facilities were built by the licensee under both the original license and as part of the Exhibit R Amendment to the License.
- Wench Creek Campground was constructed in 1969. Some access roads are rough and narrow, but other facility components are in good condition and are not in need of immediate replacement. Wench Creek Group Campground was opened in 1969. The access road is in good condition, but path surfaces are rough with protrusions. Restrooms are worn and need replacement. Accessibility needs have been identified. Visitor surveys indicate a need for showers. The current water system does not meet existing or future demand and requires upgrading.

- Westpoint Campground was opened in 2000, with the Westpoint Boat Launch developed in 1987. Before campground construction, dispersed camping occurred along the reservoir's edge. The facility meets accessibility standards, and components are in good condition and are not in need of immediate replacement. Recreation demand is high, particularly on weekend days. Overnight camping occurs adjacent to the both the campground and the boat ramp area, and resource impacts are evident. The Westpoint Boat Launch area is often inundated with overnight campers when the campground is full, thus the need for expansion of the existing campground. Accessibility needs are identified at Westpoint Campground and boat launch. Visitor surveys (Devine Tarbell & Associates and Louis Berger 2005f) identify needs for picnic tables, improvements to restrooms, boat launch, trails, potable water, and expanded group camping opportunities.
- Wolf Creek Campground was opened in 1996. The facilities at this 42-unit campground meet accessibility standards and are in good condition and not in need of immediate replacement. Visitor surveys indicate a need for shower facilities. Wolf Creek Group Campground was part of the final phase of the Exhibit R recreation development and is one of the newest of the developed recreation facilities.
- Yellowjacket Campground was constructed in 1969 and facilities are in fair to good condition. Accessibility needs have been identified. Visitor surveys identify a need for showers and associated water system upgrades. Yellowjacket Boat Launch was constructed in 1970 and is deteriorating. Wave action in the lake regularly deposits debris on the lower part of the ramp rendering it useless. In addition, the ramp extends to an elevation of 4,850 feet (only 20 feet below the crest of Union Valley Dam) and becomes unavailable for launching on most occasions. With the high demand for water sports at Union Valley Reservoir, many of which include watercraft, there is a need to upgrade this boat launch.
- Union Valley Bike Trail was constructed as part of two different phases of the Exhibit R recreation developments. The northern segments were constructed in 1999 and 2003, and the facilities are in good condition, but there are no designated accessible parking spaces at Jones Fork Trailhead (at Jones Fork Campground). With the large number of visitors to the area, the need for additional non-water-based day use recreation opportunities is high. Currently, resource impacts are apparent in areas adjacent to the reservoir as a result of the lack of day use opportunities. Completion of the Union Valley Bike Trail around Union Valley Reservoir is needed to maintain quality recreation opportunities in the area. This, in turn, will alleviate resource impacts in areas adjacent to the reservoir.
- North Union Valley Road is been extremely popular for dispersed recreation use and access to the lake shore, resulting in severely eroded user created vehicle and foot trails. Paving North Union Valley Road will ensure adequate shoreline access. At paved turnouts or parking pockets, properly designed access trails will mitigate potential resource impacts.

The licensee is responsible for 100 percent of the costs of upgrading the existing facilities for the following reasons:

- Union Valley Reservoir is one of three main storage reservoirs for the Project.
- Site Access Plans indicate the level of accessibility for existing facilities in the Project area is inadequate.
- Upgraded access into the area, developed by the licensee, has facilitated major expansion in recreational use.
- Recreation demand is high in the area, particularly on weekend days. Visitors regularly spill into adjacent dispersed camping areas when facilities are full.
- Union Valley is used year around because the licensee provides snow removal on Bryant Springs Road to the West Point Boat Ramp.
- Visitor surveys indicate recreation in the area is undoubtedly connected to either the reservoir or facilities provided by the licensee.
    - More than 70 percent of respondents indicate their primary activity is water based, with reservoir fishing the single most important activity (28.1 percent) followed closely by power boating (21.6 percent).
    - Sixty-five percent of those surveyed at Union Valley indicate they brought a watercraft.
    - Nearly 80 percent of those surveyed say they would stay overnight in the area.
    - Nearly 90 percent of the Union Valley respondents indicate the reservoir was either moderately or extremely important in their decision to visit the area. Of these, more than 75 percent say it was extremely important.
    - Sixty-five percent of respondents indicate boat launch ramps were either moderately or extremely (47 percent extremely) important in their decision to visit; 78 percent of respondents say developed campgrounds (SMUD constructed) were moderately or extremely important in their decision to visit.
- All recreation facilities are within the FERC Project Boundary, except for Big Silver Group Campground, which is proposed to be included in the Project Boundary.

***Ice House Reservoir***

Ice House Reservoir is one of three main reservoirs and is popular year-round for recreation. The reservoir has more than 100 campsites spread among three campgrounds. The reservoir itself is extremely popular for fishing, with some power boating. Heavy visitation at this reservoir is generally longer than at the other three reservoirs, with stays often extending from early spring to late fall. The licensee provided/developed access to this reservoir, giving visitors easy shoreline access to about two-thirds of the reservoir.

The Recreation Needs Assessment Report (Devine Tarbell & Associates and Louis Berger 2005d) identifies several capital improvements and other management needs to address recreation use in the Ice House reservoir area, existing facility conditions, resource impacts, and anticipated future demand. The Recreation Needs Assessment Report also describes improvements and management efforts needed to provide for whitewater recreation on the Ice House Reach of the South Fork Silver Creek. Completing a development plan will allow for the determination of appropriate measures to meet recreational needs and to protect resources from damage by public use, including whitewater recreation along the Ice House Reach.

*Existing Facilities*

- Ice House Campground was constructed in 1961 and expanded in 1980. In 1988, six of the nine restrooms were replaced. Original sites are in poor to fair condition, and sites added in 1980 are in good condition. Some infrastructure is worn and in need of replacement. Access roads and spurs are narrow with potholes/protruding objects. User surveys indicate a need for showers and associated water system upgrades. The Ice House Day Use Area was constructed in 1969. This site has substantial accessibility deficiencies. Facility components are in poor to fair condition. Infrastructure is worn and needs replacement. Ice House Sanitation Station was opened in 1969. The access road is rough and uneven. It has serious ingress and egress problems that require a substantial road reconfiguration. Signs and service apparatus are worn and need replacement. Numerous accessibility needs are identified at both sites.
- Ice House Boat Launch was constructed in 1963 and rehabilitated in 1983, 1999 (lane widening and courtesy dock), and 2003 (accessible loading ramp). As a result of the licensee's heavy equipment use in maintaining project facilities and winter access, the parking lot subgrade and pavement are damaged. Accessibility needs are identified.
- Northwind Campground was constructed in 1990. The campground has accessibility deficiencies. The access road and other facility components are in good condition and do not need immediate replacement. Accessibility needs are identified. User surveys indicate a need for a potable water system.
- Strawberry Point Campground was constructed in 1990. The campground has accessibility deficiencies. The access road and other facility components are in good condition and do not need immediate replacement. Accessibility needs are identified. User surveys indicate a need for a potable water system. With the topography of the campground and the high demand for day-use opportunities at the site, a trail is needed around the point to provide safe access to the shoreline.
- Ice House Mountain Bike Trail needs to be expanded as a result of the growing need for additional non-water-based day-use recreation opportunities. This trail would also be connected to the completed Union Valley Bike Trail, thus expanding recreation opportunities between the two reservoirs.
- Ice House North Shore Access Road is unpaved with no traffic control and follows closely to the reservoir edge. The construction road, initially used by the licensee, has become popular for recreation along the north side of the reservoir. The result is numerous turnouts and user-created tracks off the road to the water's edge. The resulting loss of shoreline vegetation contributes to sloughing banks and erosion of soil into the reservoir. Paving this road would ensure adequate public access with designed trails. At paved turnouts or parking pockets, properly designed access trails would mitigate potential resource impacts.

The licensee is responsible for 100 percent of the costs of upgrading the existing facilities for the following reasons:

- Ice House Reservoir is one of three main storage reservoirs for the Project.
- Site Access Plans indicate the level of accessibility for existing facilities within the Project area is inadequate.
- Upgraded access into the area, developed by the licensee, has facilitated major expansion in recreational use.
- Recreational demand is high in the area, particularly on weekend days. Visitors regularly spill into adjacent dispersed camping areas when facilities are full.
- Ice House Reservoir is popular from early spring to late fall because the licensee provides snow removal from Ice House Road.
- Visitor surveys indicate recreation in the area is certainly connected to either the reservoir or facilities provided by SMUD.
    - More than 71 percent of respondents indicate their primary activity is water based, with reservoir fishing the single most important activity (31.1 percent) followed by swimming (15.6 percent).
    - More than 55 percent of those surveyed at Ice House indicate they brought a watercraft.
    - More than 70 percent of those surveyed say they would stay overnight in the area.
    - Nearly 95 percent of the Ice House respondents indicated the reservoir was either moderately or extremely important in their decision to visit the area. Of these, more than 76 percent indicated it was extremely important.
    - Sixty-nine percent of respondents say boat launch ramps were either moderately or extremely (48 percent extremely) important in their decision to visit; 80 percent of respondents say developed campgrounds (licensee constructed) were either moderately or extremely important in their decision to visit.
- All recreation facilities are within or are proposed to be included in the FERC Project Boundary.

*New Facilities*

The following new facilities are needed in the Ice House area. The licensee is responsible for the costs of constructing and maintaining the following specific new developments for the following reasons:

- Highland Point Day Use Area is one of the most popular user-created shoreline access points along the north shore of Ice House Reservoir. As many as 9 to 12 vehicles have been observed parked at this point in an uncontrolled fashion, and the resulting loss of vegetation is contributing to erosion into the reservoir, degradation of visual quality, and lack of appropriate sanitation. The area is gently sloping to quite steep. Vehicles need to be controlled and accessible facilities provided. As a result of the heavy impacts at this site, restoration work was completed in 2005. This site was originally identified in the Recreation Plan for Crystal Basin, Project 2101 (USDA 1973a) as recommended for day-use recreation development. Current use pressure amplifies the need for providing developed parking and other recreational facilities at this site.
- Access to the proposed Upper Silver Creek Ice House Day Use Area was informally created by the licensee during construction of the Ice House Reservoir. Visitors currently park in increasing numbers along the road, especially in the large undeveloped clearing at the end of the road, to access the reservoir and Silver Creek. There is a lack of any developed day-use facilities in this area, a lack of sanitation, and resource impacts resulting from recreation use are readily apparent. The slippery, undeveloped, user-created trail leading up Silver Creek is hazardous. As this site is the terminus of the North Shore Ice House Access Road, and there are obvious attractions including the reservoir and the confluence of Silver Creek, development of day-use facilities is needed to mitigate ongoing and future impacts.

***Other Crystal Basin Existing Facilities***

The licensee has been directly responsible for operation, maintenance, and administration of several additional facilities. Some serve as support to the recreational program, and some were directly developed as part of the Exhibit R recreation. These facilities include:

- Crystal Basin Work Center and Information Station is a critical component the recreation operation and maintenance program. Through the Exhibit R Recreation developments, the licensee contributed to the development of both Barracks and the Information Station and continues to be an ongoing partner at the site. Facility upgrades including fuel and water systems will lead to greater operational flexibility and reduced operation and maintenance costs (USDA 1973a).
- Big Hill Vista was built by SMUD during Phase IV of the Exhibit R Recreation developments. Accessibility upgrades are needed to meet current standards.
- Cleveland Corral Information Station was constructed in 1969. It currently serves as a first major public contact facility for visitors to the Crystal Basin. This facility serves nearly 70,000 visitors annually. It needs minor amenity upgrades to better serve the public (USDA 1973a).

- Silver Creek Campground was originally developed before the UARP project. When SMUD provides whitewater flows, this facility will serve that new recreation demand. As such, the facility will need to be reconstructed to meet current design standards and maximize whitewater recreation opportunities.

***Junction Reservoir***

Junction Reservoir is immediately below Union Valley Reservoir on Big Silver Creek. It receives water from both the Union Valley Reservoir Dam and Silver Creek below Ice House Reservoir Dam. The reservoir itself is only 64 acres and lies in a long, narrow, steep-sided canyon. The reservoir has a licensee-constructed access road that serves as an informal boat ramp and camping area. The area is used throughout the summer by anglers and other recreational visitors. The access road is steep with loose material on its surface, which creates a serious safety hazard for unsuspecting visitors. The road needs to be developed to meet safety and design standards, and a small but appropriately designed access and parking area to facilitate car-top boat use and fishing access needs to be maintained (Devine Tarbell & Associates and Louis Berger 2005d).

***Brush Creek Reservoir***

Brush Creek Reservoir is a relatively small, remote reservoir that offers nearly year-around access for fishing (shoreline or boating) and recreational paddling. This reservoir is about 20 acres in size. Although it has the capacity to fluctuate up to 20 feet in a day (SMUD 2001), the reservoir is generally full most of the year (Devine Tarbell & Associates and Louis Berger 2004c). The licensee has provided a paved, single-lane boat ramp along the southern shoreline. There are no developed campgrounds or day-use sites other than the boat ramp. Evidence of dispersed camping can be found at the boat ramp and near the shoreline (SMUD 2001). Access to this reservoir consists of a single-lane paved road that is plowed and maintained by the licensee. The public also uses this road to access both the reservoir and areas along the road (Devine Tarbell & Associates and Louis Berger 2005f).

The paved boat ramp is in disrepair and needs stabilization. Safe public access for angling and other shoreline recreation is needed, along with public health and safety information and information regarding the recreational opportunities (Devine Tarbell & Associates and Louis Berger 2005d). Completing a development plan will allow for the determination of appropriate measures to meet recreational needs and to protect resources from damage by public use.

***Slab Creek Reservoir***

Slab Creek Reservoir provides a lower elevation, flat-water recreation opportunity that is accessible nearly year around. This reservoir is a re-regulating afterbay/forebay, in which the surface elevation fluctuates as much as 30 feet in a week (SMUD 2001). Daily fluctuations generally are less than 6 feet per day. Recreational use of this reservoir is primarily for fishing, swimming, and paddling (canoeing or kayaking), although visitors also picnic and hike. (Devine Tarbell & Associates and Louis Berger 2005f). Some visitors also use the access to fish the river and streams, to participate in whitewater recreation, or to use OHVs.

The licensee developed two access points to the reservoir: one, a narrow, unpaved surface with nearby dispersed camping at the upstream end near Forebay Road and the second, a hardened boat ramp on the south side of the reservoir upstream from the dam (SMUD 2001). Both access points now provide recreational access to the reservoir, and each serves a different purpose. The access from Forebay Road uses a wider road and provides more room for parking, day use, and camping. However, at this upstream access point, there is a discernable downstream current, even at high reservoir levels, which makes boating put-ins and take-outs difficult at times (1,850-foot elevation) (Devine Tarbell & Associates and Louis Berger 2004c). In addition, current use of this area has led to excessive trash, resource damage, and illegal activities (Devine Tarbell & Associates and Louis Berger 2005f). The boat ramp near the dam allows for easier launching over the range of typical reservoir levels (the lower usable limit of the ramp is at 1,820-foot reservoir elevation) ( Devine Tarbell & Associates and Louis Berger 2004c). The road to this boat ramp is very narrow, with limited parking near the ramp. In 2005, one fatality occurred when a vehicle went off the access road into the reservoir. A similar accident occurred in 2006, with four people injured and no fatalities. Other impacts at this site include trash and illegal activities. There are no signs or other information along the primary roads informing the public of either of these reservoir access points

Detailed use information has not been collected at this reservoir. However, windshield surveys and informal observations indicate use is low at the boat ramp near the dam and moderate at the ramp at the upper end of the reservoir. Use is projected to increase in the future, based on increasing population trends and increased participation in outdoor recreational activities (Devine Tarbell & Associates and Louis Berger 2004c).

Safe public access for boating, angling, and other shoreline recreation is needed, along with public health and safety information and information regarding the recreational opportunities. Completing a development plan that addresses the upstream access point, the boat ramp near the dam, and other public access needs will allow for the determination of appropriate measures to meet recreational needs and to protect resources from damage by public use (Devine Tarbell & Associates and Louis Berger 2005d). The development of the plans will reduce the illegal activities, inappropriate social behavior, and resource damage.

### *South Fork American River - Slab Creek Dam to Chili Bar Reservoir Reach Put-In*

The access road to Slab Creek Reservoir Dam also serves as the access for whitewater recreation along the reach of the SFAR below the dam, as well as access for fishing and other riverside recreation. There are no facilities at this location, and parking is limited to five to ten vehicles. Development of a recreation management plan for whitewater recreational use (described more fully below in the section titled Recreational Streamflow Operation, Maintenance, and Administration and Recreational Streamflows) will address the management and resource protection issues relating to whitewater recreation, as well as needs for public access and service at this location.

## Heavy Maintenance

### Objectives Addressed by Heavy Maintenance

Wilderness Values Objective
Recreation Management Objective
Resource Protection Objective
Water Quality Objective
Recreation Design Objective

### Information Used to Establish Heavy Maintenance

The following information was used to establish heavy maintenance requirements for management of recreation at the Project Facilities: (a) Eldorado National Forest Land and Resource Management Plan (USDA 1989); (b) Meaningful Measures Developed Sites National Quality Standards (USDA 2002a); (c) Recreation Opportunity Spectrum Book (USDA 1986); (d) Initial Information Package (SMUD 2001); (e) Visitor Use and Impact Technical Report (Devine Tarbell & Associates and Louis Berger 2005f); (f) FS, BLM, and CDPR cost estimates of work required for patrol and management of recreation at the Project facilities and areas; (g) agency familiarity with uses within and adjacent to the Project boundary; (h) The South Fork American River: A River Management Plan (BLM 2004); (i) El Dorado County River Management Plan (EDC 2001); (j) Auburn Reservoir Project/Folsom Lake State Recreation Area General Plan (CDPR 1978); (k) Marshall Gold Discovery State Historic Park General Plan (CDPR 1979b); (l) Folsom Lake State Recreation Area General Plan/Resource Management Plan Update Resource Inventory (CDPR 2004b); (m) Public Opinions and Attitudes on Outdoor Recreation in California (CDPR 2003); (n) Whitewater Boating Use Data for Salmon Falls (CDPR 2004); (o) California Outdoor Recreation Plan (CDPR 2002); (l) The State Park System Plan 2002 (CDPR 2005a); (p) The California Department of Parks and Recreation Department Operations Manual and Handbooks including Chapters 0800 (Maintenance of Facilities) (CDPR 1979a), 1000 (Housekeeping) (CDPR 1972), 1400 (Field Operations) (CDPR 1987), 1700 (Concessions) (CDPR 1990); (q) Computerized Asset Management Program developed by CDPR (CDPR 2005b); (r) A Report of Findings for the On-site Survey of Recreation Users and Telephone Survey of Area Residents for Folsom Lake State Recreation Area (Fletcher 2003), (s) Folsom State Recreation Area Resource Inventory Document – Draft (CDPR and USBR 2003), (t) Final Sierra Planning Area Management Framework Plan Amendment and Environmental Assessment (USDI 1988), (u) Sierra

Planning Area Management Framework Summary (USDI 1983a), (v) Folsom Resource Area Sierra Planning Area Management Framework Plan (1983b), (w) Federal Land Policy and Management Act § 102(a)(8) (USDA 2001), (x) BLM's Sierra MFP § 4, pp. 51, 60-62, (y) BLM's Sierra MFP Summary p. 10; BLM's Sierra MFP Amendment p. 17, (z) SFARMP pp. 9-18, and (aa) BLM's Draft Sierra RMP § 2.15).

**Rationale for Heavy Maintenance**

Heavy maintenance and rehabilitation are necessary to keep existing FS, and CDPR facilities in serviceable condition to meet health and safety requirements and other public needs. Heavy maintenance and rehabilitation include components of recreation facilities such as water systems, traffic control barriers, roads, spurs, and associated drainage structures, grills and fire rings, picnic tables, toilets, and signboards. As described in the Specific Recreation Measures section above, the necessary maintenance, rehabilitation, and reconstruction will be determined through a periodic review of the facilities the resource agencies and licensees. These reviews will determine the necessary work, based on facility condition and other factors at the time. Data from ongoing monitoring will assist in making needed changes in the work schedule and in future planning.

<u>Forest Service</u>

Heavy maintenance at Slab Creek Reservoir and Brush Creek Reservoir is limited to repairs for the boat ramps, access roads, and any barriers or closure structures, until recreation plans are completed and implemented. As described in the Specific Recreation Measures section above, these boat ramps serve visitors at the Project reservoirs.

The licensee is responsible for the heavy maintenance associated with the facilities within the license boundary or for those facilities that serve the recreation visitors associated with the Project. The relationship of individual facilities and the use of those facilities are presented in the previous section.

There are enormous costs associated with operating the UARP recreation facilities. These costs range from typical operation and maintenance items (toilet pumping, garbage collection, maintenance staff salary, signing, law enforcement, and other items) to capital improvement of recreation sites. The Eldorado National Forest and its partners are currently bearing the greatest costs associated with this operation. While the licensee does contribute funds to assist in the operation, maintenance, and administration of the UARP recreation facilities, they currently share in approximately 36 percent of the total costs. As an example, for the 2005 fiscal year, the total contributed by FS and its partners for operation, maintenance ,and heavy maintenance of the Project developed recreation sites was more than $628,400. The types of expenses and types of funds contributed for operation, maintenance, and heavy maintenance included:

1. NFS Appropriated Recreation and Facility Maintenance Funds - $94,000.

2. Concession Operation and Heavy Maintenance Costs (including heavy maintenance completed in lieu of fees due to the government) – $ 486,700.

3. NFS Appropriated Watershed Restoration Funds to address impacts from recreation visitors - $ 17,000.

4. Operation and maintenance of Loon Lake Chalet - $3,200.

5. Expenses funded with fees collected at Crystal Basin campgrounds under the authority of the Recreation Enhancement Act (REA) - $15,000.

6. Miscellaneous Funds/Grants (Interns, etc.) - $12,500.

7. An unspecified amount of funding for overhead and indirect expenses, such as for supervision, utilities, supplies, personnel, and other items.

The Eldorado National Forest has also been actively making capital improvements to UARP recreation sites. These improvements are designed to mitigate recreation related impacts within the Project where licensee funds are currently unavailable or to improve site conditions in order to maintain a quality recreation experience. These improvements have been and will continue to be, funded through FS appropriated funds, grants, and Capital Improvement Program funds, dependent on funding availability. In the last several years, these capital improvement funds have totaled more than 1.5 million dollars, and include projects such as the installation of bear-proof food lockers (approximately 275,000 dollars of FS Capital Improvement Program funds) at Loon Lake Campground, Gerle Creek Campground, Airport Flat Campground, and other UARP campgrounds; well drilling and water system improvements (approximately 75,000 dollars of FS funds) at Ice House Campground, Wench Creek Campground, and Loon Lake Campground; boat ramp improvements (approximately 1,119,000 dollars in California Department of Boating and Waterways grant for ramp reconstruction, boarding docks, and handicap loading ramps) at Sunset Boat Ramp, Loon Lake Boat Ramp, and Ice House Boat Ramp; and the construction of a mountain bike trail along the north shore of Ice House Reservoirs. An additional project to be funded through FS funds and scheduled for completion in the near future is the Loon Lake Chalet septic improvement project (35,000 dollars).

There are additional costs associated with managing the recreation use outside of the developed recreation facilities and/or outside of the FERC Project boundary as well. Currently, the licensee is not assisting with funding the recreation that occurs on NFS lands adjacent to the Project but outside the FERC Project boundary. Much of this use is directly attributed to the Project, as either the visitors are staying in a Project-developed campground, or utilizing Project-provided infrastructure such as high standard roads. For these areas for the 2005 fiscal year, the funds contributed by the FS and its partners associated with operation and maintenance were approximately 248,900 dollars and included:

1. NFS Appropriated Recreation Funds - $158,600.

2. NFS Appropriated Trails Funds - $16,000.

3. NFS Appropriates Watershed Restoration Funds - $6,500.

4. Rental Huts (Robbs and Van Vleck Huts) - $4,200.

5. Expenses funded through fees collected under the Recreation Enhancement Act (REA for Wrights Lake CG & Desolation) - $15,000.

6. California State OHV "Greensticker" Grant Funds - $9,000.

7. Volunteers contributed time and labor (including public education, patrol, site maintenance, emergency response).

    a. El Dorado Nordic Ski Patrol (staffing the licensee-built Loon Lake Chalet, public education, and patrolling ski trails around Loon Lake and other areas) FY2005 – 1,800 Hours ($ 21,600 contributed value).

    b. Desolation Wilderness Volunteers (providing public education and patrolling trails leading to and through the Wilderness, including the Rubicon Hiking Trail and others.) FY2005 – 1,000 Hours ($ 12,000 contributed value).

    c. OHV Clubs/Organizations (visitor information at the Loon Lake Dam for OHVs accessing the Rubicon) 2005 – 500 Hours ($ 6,000 contributed value).

During the reviews conducted every 6 years where the upcoming heavy maintenance needs are determined (as described in Section 18), work accomplished through FS contributions, along with heavy maintenance work expected to be accomplished by FS or the concessionaire in the upcoming 6-year period will be discussed.

<u>California Department of Parks and Recreation</u>

CDPR recreation funding has been consolidated into a separate settlement agreement. CDPR believe that the funding levels in the various settlement agreements and/or conditions and recommendations are adequate to meet the resource objectives described above and in each of the respective sections of this Rationale Report. In the utilization of these funds for these various operation, maintenance, administration and patrol needs, including heavy maintenance, CDPR will make efforts to be as efficient as possible, will prioritize the work to be accomplished to stay within available funding, and will look to other funding sources to accomplish the work needed to meet the recreation visitor needs and to address impacts from recreation visitors as necessary.

## Recreation Operation, Maintenance, and Administration

### Objectives Addressed by Recreation Operation, Maintenance, and Administration Measures

Recreation Management
Hydropower Operations

### Information Used to Establish Recreation Operation, Maintenance, and Administration Measures

The following information was used to establish recreation operation, maintenance, and administration measures for management of recreation at the Project facilities: (a) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (b) Meaningful Measures Developed Sites National Quality Standards (USDA 2002a), (c) Recreation Opportunity Spectrum Book (USDA 1986), (d) Initial Information Package (SMUD 2001), (e) Visitor Use and Impact Technical Report (Devine Tarbell & Associates and Louis Berger 2005f), (f) FS cost estimates of work required for patrol and management of recreation at the Project facilities and areas, (g) agency familiarity with uses within and adjacent to the Project boundary, (h) Interim Policy – Accessible Outdoor Recreation (USDA 2000), (i) access transition plans (USDA 1999a), (j) R5 Universal Access Strategy (USDA 1998a), (k) Special Use Permit for Campground and Relater Granger-Thye Concessions (USDA 2004b), (l) accessibility guidelines email (USDA 2000d), (m) Recreation Demand Technical Report (Devine Tarbell & Associates and Louis Berger 2004d), and (n) Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d), (o) Letter from Craig Harasek, District Ranger, to Gary Brumley, SMUD (USDA 1992), (p) Agreement Between the Sacramento Municipal Utility District and United States Forest Service for the Construction, Administration, Operation, and Maintenance of Recreation Facilities in the Upper American River Project on the Eldorado National Forest (USDA 1964), (q) Recreation Plan for Crystal Basin FPC Project 2101 (USDA 1974a), (r) Collection Agreement Between Sacramento Municipal Utility District and Eldorado National Forest (USDA 1988), (s) Final Sierra Planning Area Management Framework Plan Amendment and Environmental Assessment (USDI 1988), (t) Sierra Planning Area Management Framework Summary (USDI 1983a), (u) Folsom Resource Area Sierra Planning Area Management Framework Plan (1983b) (v) Federal Land Policy and Management Act § 102(a)(8) (USDA 2001), (w) BLM's Sierra MFP § 4, pp. 51, 60-62, (x) BLM's Sierra MFP Summary p. 10; BLM's Sierra MFP Amendment p. 17, (y) SFARMP pp. 9-18, and (z) BLM's Draft Sierra RMP § 2.15).

### Rationale for Recreation Operation, Maintenance, and Administration Measures

See the Rationale for Specific Recreation Conditions, above.

The settlement agreement and preliminary conditions and recommendations consolidated funding for FS operation, maintenance, patrol, administration, and public information. The Rationale Report displays the specific rationale separately for each of these areas (includingo Special Uses Administration; Recreational Streamflow Operation, Maintenance, and Administration; High Country Area Patrol; Dispersed Area Patrol; Public Information Services; and Law Enforcement). The funding levels displayed in these sections total more than the amount in the settlement agreement and preliminary conditions and recommendations; however, it is believed that it is beneficial to display the rationale for each specific amount.

CDPR recreation funding has been consolidated into a separate settlement agreement. The funding in the CDPR sections below totals more than the amount in the settlement agreement; however, it is believed that it is beneficial to display the rationale for each specific amount.

FS and CDPR believe that the funding levels in the various settlement agreements and/or conditions and recommendations are adequate to meet the resource objectives described above and in each of the respective sections of this Rationale Report. In the utilization of these funds for these various operation, maintenance, administration and patrol needs, FS and CDPR will make efforts to be as efficient as possible, will prioritize the work to be accomplished to stay within available funding, and will look to other funding sources to accomplish the work needed to meet the recreation visitor needs and to address impacts from recreation visitors as necessary.

Within the UARP, the licensee's role in facility and infrastructure development has substantially modified visitation within the area. As described in the Rationale for Specific Recreation Measures, above, the licensee is responsible for most recreation development and human access into the UARP.

As previously described in the Rationale for Specific Recreation Measures, the developed recreation facilities are either operated by a concessionaire under permit or directly by the FS. Generally, the largest and most highly developed facilities are operated by the concessionaire, and smaller, lower developed facilities are operated by the FS. There are numerous reasons for this management strategy, some of which include: (a) there are operational flexibilities attained by both the concessionaire and the FS by operating the facilities under the current strategy; (b) the diversity in managing authority allows for better reactions to changing budgets, personnel, and regulations; (c) the smallest facilities often cost more to operate than the revenues that can be developed at the site, making them unattractive to concessionaires (conversely, the largest facilities are operated by concessionaires because they have highest revenue earning opportunities); (d) the Service Contract Act (2004) precludes concessionaires from operating sites where fees are not charged (and there are a number of facilities in the Crystal Basin that are deemed to be important as either free or low-fee sites); and (e) having uniformed FS presence would be required for law enforcement efforts and public contact regardless of the number of concession-operated facilities.

Actual operation and maintenance of the various licensee-developed sites is generally conducted by seasonal staff. In addition, individual facilities and adjacent use areas are "lumped" into discrete geographic areas that serve as individual "patrol" units. This provides the most efficient means of managing the recreation at and between facilities along the reservoirs. These units are administratively managed separately in terms of hiring personnel and assigning responsibility of work in individual facilities. As such, the following section has been organized to follow this management strategy, and each individual "unit" is separately described. The total annual cost associated with the operation and maintenance of the UARP-related developed recreation is $741,805.84 as described in the summary table below.

| O + M Cost Spreadsheet (UARP Relicensing) | | |
|---|---|---|
| **Area: O + M Totals** | | |
| **Areas** | | **Total** |
| **Ice House Patrol Area** | | $100,650.20 |
| **Union Valley Patrol Area** | | $181,918.87 |
| **Loon Lake Patrol Area** | | $125,047.58 |
| **Concession Administration** | | $120,918.28 |
| **Slab and Brush Patrol Area** | | $50,638.07 |
| **Winter Chalet Staffing and Patrol** | | $72,632.84 |
| **Estimated Additional Missing Costs** | | |
| Annual Move expenditure of personnel related to UARP | est | $25,000.00 |
| OWCP | est | $20,000.00 |
| Unemployment | est | $30,000.00 |
| Working Capital Fund - Buildings | est | $15,000.00 |
| | | $90,000.00 |
| Total: | | $741,805.84 |

The licensee is responsible for the routine operation and maintenance of the recreation facilities within the license boundary or for those facilities that serve the recreation visitors associated with the project. The relationship of individual facilities and the use of those facilities are presented in the Specific Recreation Measures section, above, and in the discussion below. The discussion above in the Heavy Maintenance section describes FS contributions and contributions from partners toward funding operation and maintenance as well as heavy maintenance expenses and some capital improvements.

Crystal Basin (Ice House, Union Valley, and Loon Lake Patrol Areas)

The Crystal Basin recreation facilities are managed by the FS. The FS manages these facilities to meet existing standards (see the Rationale for Specific Recreation Measures). The Crystal Basin recreation facilities are further separated into three distinct patrol units: Ice House, Loon Lake, and Union Valley.

The licensee conducted surveys that illustrate the importance of the UARP reservoirs to summer visitors. As previously noted, two of the top three activities for visitors to the Crystal Basin are swimming and reservoir fishing (Devine Tarbell and Associates and Louis Berger 2005f). As shown throughout the analysis of visitor responses; the history of facility development; and the role that the licensee has played in the construction, operation, and maintenance of these recreation facilities, the UARP reservoirs have substantially modified visitation to the Crystal Basin.

The growing number of “deferred maintenance” items at each facility require continued funding. Numerous facilities were originally constructed by the licensee with no funds provided for their operation and maintenance. Operation, maintenance, and administration costs are directly a result of the licensee’s recreation development. For facilities not operated under a concession permit, onsite operations and maintenance by seasonal and permanent FS staff are required to meet health and safety standards, maintenance standards, and to ensure recreation visitors have a quality experience without impacting resources. Costs are noted below for each unit.

***Ice House Patrol Unit***

**Cost**: The costs are to manage for the recreational use at and generally within ¼ mile of the Ice House Reservoir. For this area, funds would be used to conduct patrols, pick up litter, provide public information, enforce rules and regulations, rehabilitate impacted areas, address sanitation, maintain day-use sites (such as concentrated-use areas), respond to fires and other emergencies, assist in search and rescue, and conduct facility maintenance at both Strawberry and Northwind Campgrounds as well as Big Hill Overlook to meet existing maintenance standards. Regular costs associated with maintenance of these facilities are identified in the “fixed cost” portion of the spreadsheet below. In addition to facility maintenance, there will be shoreline cleanup and resource protection measures within and immediately adjacent to the reservoirs. The following estimate shows the cost to manage for these visitors and the impacts from their visits.

| O + M Cost Spreadsheet (UARP Relicensing) | | | |
|---|---|---|---|
| Area: Ice House (Strawberry, Northwind, Big Hill Overlook, and Zones 1 & 2) | | | |
| **Personnel:** | **Days** | **CTG*/Day** | **Total** |
| Recreation Patrol (GS-5) | 120 | $120.00 | $14,400.00 |
| Recreation Aid (GS-3) | 60 | $100.00 | $6,000.00 |
| Maintenance Mechanic (WG-8) | 20 | $210.00 | $4,200.00 |
| Maintenance Technician (GS-5) | 30 | $120.00 | $3,600.00 |
| Recreation Manager (GS-9) | 40 | $215.00 | $8,600.00 |
| Recreation Officer (GS-11) | 15 | $305.00 | $4,575.00 |
| Resource Officer (GS-11) | 10 | $310.00 | $3,100.00 |
| Resource Business Manager (GS-6) | 30 | $175.00 | $5,250.00 |
| SO Staff Support | 10 | $360.00 | $3,600.00 |
| **Vehicles:** | **Months** | **Cost/Mo** | **Total** |
| Recreation Patrol (206/mo)+(1000 miles x .37mo) | 12 | $576.00 | $6,912.00 |
| Recreation Aid (206/mo)+(500 miles x .37mo) | 3 | $391.00 | $1,173.00 |
| Maintenance Mechanic (260/mo)+(1500 miles x .57mo) | 1 | $1,115.00 | $1,115.00 |
| Maintenance Technician (260/mo)+(1500 miles x .57mo) | 2 | $1,115.00 | $2,230.00 |
| Recreation Manager (206/mo)+(1000 miles x .37 mo) | 2 | $576.00 | $1,152.00 |
| Recreation Officer (313/mo) + (1000 miles x .43 mo) | 1 | $743.00 | $743.00 |
| **Note:** Fleet Vehicles require 12 months FOR (some vehicles are split between several projects/areas). | | | |
| **Project Supplies & Materials:** | | | **Total** |
| Misc. Uniforms, CG Supplies, Paint, etc.. | | | $5,000.00 |
| Recurring maintenance and rehabilitation | | | $2,000.00 |
| **Fixed Costs:** | **Months** | **Cost/Mo.** | **Total** |
| Garbage (4 yrds/week) | 6 | $560.00 | $3,360.00 |
| ** $35.00/mo/yd (w/rental fee) | | | |
| Septic (4 vaults) | 6 | $520.00 | $3,120.00 |
| ** $.52/gal x 1000 gal average/mo. | | | |
| Cleaning Contract (Key Life Janitorial) | 5 | $890.00 | $4,450.00 |
| Sub-Total: | | | $84,580.00 |
| Overhead (19%): | | | $16,070.20 |
| Total: | | | $100,650.20 |

### *Union Valley Patrol Unit*

**Cost**: The costs are to manage for the recreational use at and generally within ¼ mile of the Union Valley Reservoir. For this area, funds would be used to conduct patrols, pick up litter, provide public information, enforce rules and regulations, rehabilitate impacted areas, address sanitation, maintain day-use sites (such as concentrated-use areas), respond to fires and other emergencies, assist in search and rescue, and conduct facility maintenance at Jones Fork, Azalea Cove Lone Rock, Camino Cove, and West Point

Campgrounds, as well as the Union Valley Bike Trail and West Point Boat Ramp to meet existing maintenance standards. Regular costs associated with maintenance of these facilities are identified in the "fixed cost" portion of the spreadsheet below. In addition to facility maintenance, there will be shoreline cleanup and resource protection measures within and immediately adjacent to the reservoirs. The following estimate shows the cost to manage for these visitors and the impacts from their visits.

| O + M Cost Spreadsheet (UARP Relicensing) | | | |
|---|---|---|---|
| **Area: Union Valley (Jones Fork, Azalea Cove, Lone Rock, Camino Cove, West Point & WP Boat Ramp, UV Bike Trail, and Zones 1 & 2)** | | | |
| **Personnel:** | **Days** | **CTG*/Day** | **Total** |
| Permanent Lead Recreation Patrol (GS-7) | 120 | $185.00 | $22,200.00 |
| Recreation Patrol (GS-5) | 100 | $120.00 | $12,000.00 |
| Recreation Aid (GS-3) | 60 | $100.00 | $6,000.00 |
| Maintenance Mechanic (WG-8) | 20 | $210.00 | $4,200.00 |
| Maintenance Technician (GS-5) | 30 | $120.00 | $3,600.00 |
| Recreation Manager (GS-9) | 40 | $215.00 | $8,600.00 |
| Recreation Officer (GS-11) | 20 | $305.00 | $6,100.00 |
| Resource Officer (GS-11) | 10 | $310.00 | $3,100.00 |
| Resource Business Manager (GS-6) | 40 | $175.00 | $7,000.00 |
| SO Staff Support | 15 | $360.00 | $5,400.00 |
| **Vehicles:** | **Months** | **Cost/Mo** | **Total** |
| Recreation Patrol (206/mo)+(1000 miles x .37mo) | 12 | $576.00 | $6,912.00 |
| Recreation Patrol (206/mo)+(1000 miles x .37mo) | 12 | $576.00 | $6,912.00 |
| Recreation Aid (206/mo)+(500 miles x .37mo) | 3 | $391.00 | $1,173.00 |
| Maintenance Mechanic (260/mo)+(1500 miles x .57mo) | 1 | $1,115.00 | $1,115.00 |
| Maintenance Technician (260/mo)+(1500 miles x .57mo) | 2 | $1,115.00 | $2,230.00 |
| Recreation Manager (206/mo)+(1000 miles x .37 mo) | 3 | $576.00 | $1,728.00 |
| Recreation Officer (313/mo) + (1000 miles x .43 mo) | 1 | $743.00 | $743.00 |
| Boston Whaler Patrol Boat | 12 | $200.00 | $2,400.00 |
| **Note:** Fleet Vehicles require 12 months FOR (some vehicles are split between several projects/areas). | | | |
| **Project Supplies & Materials:** | | | **Total** |
| Misc. Uniforms, CG Supplies, Paint, etc.. | | | $7,500.00 |
| Recurring maintenance and rehabilitation | | | $2,500.00 |
| **Fixed Costs:** | **Months** | **Cost/Mo.** | **Total** |
| Garbage (14 yrds/week) | 6 | $1,960.00 | $11,760.00 |
| ** $35.00/mo/yd (w/rental fee) | | | |
| Septic (12 vaults) | 6 | $1,300.00 | $7,800.00 |
| ** $.52/gal x 2500 gal average/mo. | | | |
| Cleaning Contract (Key Life Janitorial) | 5 | $4,380.00 | $21,900.00 |
| Sub-Total: | | | $152,873.00 |
| Overhead (19%): | | | $29,045.87 |
| Total: | | | $181,918.87 |

### *Loon Lake Patrol Unit*

**Cost**: The costs are to manage for the recreational use at and generally within ¼ mile of the Loon Lake Reservoir. For this area, funds would be used to conduct patrols, pick up litter, provide public information, enforce rules and regulations, rehabilitate impacted areas, address sanitation, maintain day-use sites (such as concentrated-use areas), respond to fires and other emergencies, assist in search and rescue, and conduct facility maintenance at Airport Flat, Northshore, and Red Fir Campgrounds, as well as Angel Creek Day Use Area, the Loon Lake Chalet summer operations, and the Summer Harvest and Gerle Creek Trails to meet existing maintenance standards. Regular costs associated with maintenance of these facilities are identified in the "fixed cost" portion of the spreadsheet below. In addition to facility maintenance, there will be shoreline cleanup and resource protection measures within and immediately adjacent to the reservoirs. The following estimate shows the cost to manage for these visitors and the impacts from their visits.

## O + M Cost Spreadsheet (UARP Relicensing)

**Area: Loon Lake (Airport Flat, Angel Creek, Harvest Trail, Northshore, and Red Fir & Zone 1 & 2 Patrol with Loon Chalet summer operations, and Pleasant CG)**

| Personnel: | Days | CTG*/Day | Total |
|---|---|---|---|
| Recreation Patrol (GS-5) | 120 | $120.00 | $14,400.00 |
| Recreation Aid (GS-3) | 60 | $100.00 | $6,000.00 |
| Maintenance Mechanic (WG-8) | 20 | $210.00 | $4,200.00 |
| Maintenance Technician (GS-5) | 40 | $120.00 | $4,800.00 |
| Recreation Manager (GS-9) | 40 | $215.00 | $8,600.00 |
| Recreation Officer (GS-11) | 15 | $305.00 | $4,575.00 |
| Resource Officer (GS-11) | 10 | $310.00 | $3,100.00 |
| Resource Business Manager (GS-6) | 30 | $175.00 | $5,250.00 |
| SO Staff Support | 10 | $360.00 | $3,600.00 |

| Vehicles: | Months | Cost/Mo | Total |
|---|---|---|---|
| Recreation Patrol (206/mo)+(1000 miles x .37mo) | 12 | $576.00 | $6,912.00 |
| Recreation Aid (206/mo)+(500 miles x .37mo) | 3 | $391.00 | $1,173.00 |
| Maintenance Mechanic (260/mo)+(1500 miles x .57mo) | 1 | $1,115.00 | $1,115.00 |
| Maintenance Technician (260/mo)+(1500 miles x .57mo) | 2 | $1,115.00 | $2,230.00 |
| Recreation Manager (206/mo)+(1000 miles x .37 mo) | 3 | $576.00 | $1,728.00 |
| Recreation Officer (313/mo) + (1000 miles x .43 mo) | 1 | $743.00 | $743.00 |

**Note:** Fleet Vehicles require 12 months FOR (some vehicles are split between several projects/areas).

| Project Supplies & Materials: | Total |
|---|---|
| Misc. Uniforms, CG Supplies, Paint, etc.. | $5,000.00 |
| Recurring maintenance and rehabilitation | $2,000.00 |

| Fixed Costs: | Months | Cost/Mo. | Total |
|---|---|---|---|
| Garbage (18 yrds/week) | 5 | $2,520.00 | $12,600.00 |
| ** $35.00/mo/yd (w/rental fee) | | | |
| Septic (9 vaults) | 5 | $1,040.00 | $5,200.00 |
| ** $.52/gal x 2000 gal average/mo. | | | |
| Cleaning Contract (Key Life Janitorial) | 4 | $2,964.00 | $11,856.00 |

| | |
|---|---|
| Sub-Total: | $105,082.00 |
| Overhead (19%): | $19,965.58 |
| Total: | $125,047.58 |

### *Loon Lake Chalet Winter Staffing and Patrol*

As a result of the licensee's winter plowing operations to the Loon Lake Powerhouse, a new winter recreation use has been created. Winter sports have grown in popularity over the last decade. Ultimately, as a result of maintaining access to the Loon Lake Powerhouse, recreational visitors began regularly using the Loon Lake area for winter-related activities. This led to development of the Loon Lake Chalet at the request of the licensee as a way of mitigating stranded winter visitors in the Loon Lake area. Current winter use reaches nearly 17,000 visitors (Devine Tarbell & Associates and Louis Berger 2005f). The Loon Lake Chalet is operated and staffed by a FS Snow Ranger during winter months to manage this new use in the Loon Lake area. Visitors typically engage in numerous activities, with cross-country skiing and snow play ranking approximately equal to photography and reservoir fishing.

**Costs**: The costs are to manage for the recreation use at the Loon Lake Chalet and along the plowed road to the Loon Lake Area during the winter season. For this area, these funds would be used to conduct patrols, pick up litter, provide public information, enforce rules and regulations, rehabilitate impacted areas, address sanitation, maintain day-use sites (such as concentrated-use areas), respond to fires and other emergencies, assist in search and rescue, and conduct facility maintenance at Loon Lake Chalet to meet existing maintenance standards. Regular costs associated with the maintenance of these facilities are identified in the "fixed cost" portion of the spreadsheet below. The following estimate shows the cost to manage for these visitors and the impacts from their visits.

| O + M Cost Spreadsheet (UARP Relicensing) | | | |
|---|---|---|---|
| **Area: Winter Patrol & Loon Chalet Staffing** | | | |
| **Personnel:** | **Days** | **CTG*/Day** | **Total** |
| Winter Recreation Patrol (GS-5) | 120 | $120.00 | $14,400.00 |
| Maintenance Mechanic (WG-8) | 20 | $210.00 | $4,200.00 |
| Maintenance Technician (GS-5) | 20 | $120.00 | $2,400.00 |
| Recreation Manager (GS-9) | 60 | $215.00 | $12,900.00 |
| Recreation Officer (GS-11) | 15 | $305.00 | $4,575.00 |
| Resource Officer (GS-11) | 10 | $310.00 | $3,100.00 |
| Resource Business Manager (GS-6) | 10 | $175.00 | $1,750.00 |
| SO Staff Support | 5 | $350.00 | $1,750.00 |
| **Vehicles:** | **Months** | **Cost/Mo** | **Total** |
| Recreation Patrol (206/mo)+(1000 miles x .37mo) | 6 | $576.00 | $3,456.00 |
| Maintenance Mechanic (260/mo)+(1500 miles x .57mo) | 1 | $1,115.00 | $1,115.00 |
| Maintenance Technician (260/mo)+(1500 miles x .57mo) | 1 | $1,115.00 | $1,115.00 |
| Recreation Manager (206/mo)+(1000 miles x .37 mo) | 3 | $576.00 | $1,728.00 |
| Recreation Officer (313/mo) + (1000 miles x .43 mo) | 1 | $743.00 | $743.00 |
| **Note:** Fleet Vehicles require 12 months FOR (some vehicles are split between several projects/areas). | | | |
| **Project Supplies & Materials:** | | | **Total** |
| Misc. Uniforms, Supplies, Paint, Signs, etc.. | | | $5,000.00 |
| Snow Blower repair and maintenance | | | $500.00 |
| **Fixed Costs:** | **Months** | **Cost/Mo.** | **Total** |
| Garbage (2 yrds/week) | 6 | $280.00 | $1,680.00 |
| ** $35.00/mo/yd (w/rental fee) | | | |
| Septic (2 vaults) | 6 | $104.00 | $624.00 |
| ** $.52/gal x 200 gal average/mo. | | | |
| Sub-Total: | | | $61,036.00 |
| Overhead (19%): | | | $11,596.84 |
| Total: | | | $72,632.84 |

Slab Creek Reservoir and Brush Creek Reservoir Management and Patrol

See the Rationale for Specific Recreation Conditions, above. As documented in the Visitor Use and Impact Technical Report (Devine Tarbell & Associates and Louis Berger 2005f) and other reports, Project-related recreation visitors camp or participate in activities directly around these Project reservoirs and participate in other activities in the vicinity of the reservoirs, or in areas where flows are modified by Project operations. Some of these activities include shoreline fishing, boating, swimming, hiking, picnicking, and dispersed camping. The Visitor Use and Impact Technical Report (Devine Tarbell & Associates and Louis Berger 2005f) identifies specific areas in the vicinity of Slab Creek Reservoir and Brush Creek Reservoir where dispersed recreation occurs.

**Cost:** The costs are to manage for the recreation use at Brush Creek and Slab Creek reservoirs, along the reservoir shorelines and in the vicinity of these reservoirs. The FS conducts patrols, picks up litter, provides public information, enforces rules and regulations, rehabilitates impacted areas, addresses sanitation, maintains day-use sites (such as concentrated use areas), responds to fires and other emergencies, and assists in search and rescue. Public information is provided by field patrols and at the Ranger Station. Increased patrols and cleanup are needed, as evidenced by the continued resource impacts that are still occurring near these reservoirs, including vegetation damage from dispersed camping and day use, continued litter and improperly disposed human waste, and abandoned campfires. Shoreline policing and litter cleanup are needed at both reservoirs. This task is most efficiently completed by boat. The following estimate shows the cost to manage for these visitors and the impacts from their visits.

| **O + M Cost Spreadsheet (UARP Relicensing)** | | | |
|---|---|---|---|
| **Area: Slab Creek and Brush Creek Reservoirs** | | | |
| **Personnel:** | **Days** | **CTG*/Day** | **Total** |
| Recreation Patrol (GS-5) | 60 | $120.00 | $7,200.00 |
| Recreation Aid (GS-3) | 60 | $100.00 | $6,000.00 |
| Recreation Manager (GS-9) | 30 | $215.00 | $6,450.00 |
| Reource Officer (GS-11) | 5 | $310.00 | $1,550.00 |
| Resource Business Manager (GS-6) | 5 | $175.00 | $875.00 |
| Public Information Assistant | 10 | $175.00 | $1,750.00 |
| SO Staff Support | 5 | $360.00 | $1,800.00 |
| **Subtotal** | | | **$25,625.00** |
| **Vehicles:** | **Months** | **Cost/Mo** | **Total** |
| Recreation Patrol (206/mo)+(600 miles x .37mo) | 6 | $428.00 | $2,568.00 |
| Recreation Manager (206/mo)+(200 miles x .37 mo) | 6 | $280.00 | $1,680.00 |
| **Note:** Fleet Vehicles require 12 months FOR (some vehicles are split between several projects/areas). | | | |
| **Subtotal** | | | **$4,248.00** |
| **Project Supplies & Materials:** | | | **Total** |
| Misc. Uniforms, garbage bags, signs, etc. | | | $2,000.00 |
| Patrol boat, PFD, purchase, maintenance | | | $3,500.00 |
| Annual Restoration/Rehabilitation Needs | | | $5,000.00 |
| Portable Toilet facilities at whitewater put-in | | | $500.00 |
| **Subtotal** | | | **$11,000.00** |
| **Fixed Costs:** | **Months** | **Cost/Mo.** | **Total** |
| Garbage (2 yrds/week) | 6 | $280.00 | $1,680.00 |
| ** $35.00/mo/yd (w/rental fee) | | | |
| Sub-Total: | | | $42,553.00 |
| Overhead (19%): | | | $8,085.07 |
| **Total:** | | | **$50,638.07** |

Special Use Administration Funding

See the Rationale for Specific Recreation Conditions, above.

The campgrounds described above in the "Rationale for Specific Recreation Conditions" that are operated within the Crystal Basin provide for recreational visitor needs and utilization at these Project reservoirs. As noted in the previous rationale, approximately 95 percent of the total overnight occupancy of more than 4,600 persons at one time (PAOT) was at sites constructed (either the licensee directly built or provided funds for the facilities) by the licensee (Devine Tarbell & Associates and Louis Berger 2004c). Because theseThe FS determined that the most efficient means to provide daily operations and maintenance of these overnight camping facilities provide overnight camping to for more than 650,000 visitors, was through a large concessionaire operation manages their daily operation and maintenanceunder special use permit.

At this time, many campgrounds are operated by the concessionaire. This minimizes the cost of routine maintenance to the licensee in these campgrounds, as the concessionaire is responsible for completing most routine maintenance. Operating these facilities by concessionaire under the terms of a special-use permit results in the need to administer and monitor the terms of the permit to ensure permit compliance and quality public service. In addition, with the scale of this concession operation and the high percent of Granger-Thye (fee offset) work being completed, routine inspection of projects is critical. As this work typically ranges from $80,000 to $100,000 annually, maintaining quality professional staff is critical.

The total annual cost for performing monitoring and permit compliance assurance for the campground concessionaire special-use permits is estimated to be $120,918.28 (2005 cost basis) as shown in the table below.

| O + M Cost Spreadsheet (UARP Relicensing) | | | |
|---|---|---|---|
| **Area: Concession and Recreation Special Uses Administration** | | | |
| **Personnel:** | **Days** | **CTG*/Day** | **Total** |
| Resource Officer (GS-11) | 20 | $310.00 | $6,200.00 |
| Recreation Officer (GS-11) | 30 | $305.00 | $9,150.00 |
| Special Use Permit Administrator (GS-9) | 180 | $215.00 | $38,700.00 |
| Concession Inspector (GS-7) | 120 | $185.00 | $22,200.00 |
| Maintenance Mechanic (WG-8) | 15 | $210.00 | $3,150.00 |
| Resource Business Manager (GS-6) | 10 | $175.00 | $1,750.00 |
| SO Staff Support | 5 | $350.00 | $1,750.00 |
| **Vehicles:** | **Months** | **Cost/Mo** | **Total** |
| Special Use Permit Administrator (206/mo)+(1000 miles x .37 mo) | 12 | $576.00 | $6,912.00 |
| Concession Inspector (206/mo)+(1000 miles x .37 mo) | 6 | $576.00 | $3,456.00 |
| Recreation Officer & Resource Officer (313/mo) + (1000 miles x .43 mo) | 3 | $743.00 | $2,229.00 |
| Maintenance Mechanic (260/mo)+(1500 miles x .57mo) | 1 | $1,115.00 | $1,115.00 |
| **Note:** Fleet Vehicles require 12 months FOR (some vehicles are split between several projects/areas). | | | |
| **Project Supplies & Materials:** | | | **Total** |
| Misc. Uniforms, Training, Travel | | | $5,000.00 |
| **Fixed Costs:** | **Months** | **Cost/Mo.** | **Total** |
| Sub-Total: | | | $101,612.00 |
| Overhead (19%): | | | $19,306.28 |
| Total: | | | $120,918.28 |

## Recreational Streamflow Operation, Maintenance, and Administration

### Objectives Addressed by Recreational Streamflow Operation, Maintenance, and Administration

Recreation Management Objective
Resource Protection Objective
Water Quality Objective

### Information Used to Establish Recreational Streamflow Operation, Maintenance, and Administration

The following information was used to develop the proposed recommendations for recreation streamflow operation, maintenance, and administration: (a) Upper American River Project Initial Information Package (SMUD 2001); (b) Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d); (c) Recreation Demand Technical Report (Devine Tarbell & Associates and Louis Berger 2004d); (d) Recreation Supply Technical Report (Devine Tarbell & Associates and Louis Berger 2004c); (e) The South Fork American River: A River Management Plan (BLM 2004); (f) El Dorado County River Management Plan (EDC 2001); (f) Auburn Reservoir Project/Folsom Lake State Recreation Area General Plan (CDPR 1978); (g) Marshall Gold Discovery State Historic Park General Plan (CDPR 1979b); (h) Folsom Lake State Recreation Area General Plan/Resource Management Plan Update Resource Inventory (CDPR 2004b); (i) Public Opinions and Attitudes on Outdoor Recreation in California (CDPR 2003); (j) Whitewater Boating Use Data for Salmon Falls (CDPR 2004); (k) California Outdoor Recreation Plan (CDPR 2002); (l) The State Park System Plan 2002 (CDPR 2005a); (m) The California Department of Parks and Recreation Department Operations Manual and Handbooks including Chapters 0800 (Maintenance of Facilities) (CDPR 1979a), 1000 (Housekeeping) (CDPR 1972), 1400 (Field Operations) (CDPR 1987), 1700 (Concessions) (CDPR 1990); (n) Computerized Asset Management Program developed by CDPR (CDPR 2005b); (o) Eldorado National Forest Land and Resource Management Plan (USDA 1989); (p) Meaningful Measures Developed Sites national Quality Standards (USDA 2002a); (q) Recreation Opportunity Spectrum Book (USDA 1986); (r) Ice House Reach Whitewater Boating Technical Report (Devine Tarbell & Associates and Louis Berger 2004a); (s) Slab Creek Reach Whitewater Technical Report (Devine Tarbell & Associates and Louis Berger 2004e); (t) FS, BLM, and CDPR cost estimates of work required for patrol and management of whitewater recreation within the Ice House Dam and Slab Creek reaches; (u) agency familiarity with uses within and adjacent to the Project boundary; (v) A Report of Findings for the On-site Survey of Recreation Users and Telephone Survey of Area Residents for Folsom Lake State Recreation Area (Fletcher 2003); (w) Folsom State Recreation Area Resource Inventory Document – Draft (CDPR and USBR 2003); (x) Final Sierra Planning Area Management Framework Plan Amendment and Environmental Assessment (USDI 1988), (y) Sierra Planning Area Management Framework Summary (USDI 1983a); and (z) Folsom Resource Area Sierra Planning Area Management Framework Plan (1983b).

**Rationale for Recreational Streamflow Operation, Maintenance, and Administration**

Refer to Rationale for Recreation, Operation, Maintenance, and Administration Measures, above.

<u>Ice House Dam Reach</u>

The 11.2-mile stretch of the South Fork of Silver Creek below Ice House Dam was found to be a relatively high-quality whitewater recreational opportunity, based on its moderate difficulty in a mid-elevation Sierra Nevada setting (other alternatives at this elevation are generally of higher level of difficulty). This reach also provides highly desirable angling opportunities. Many of the access points to this reach are on private land, although some are on National Forest System lands. The Recreation Needs Assessment Report states that because of limited public access on this reach and the high recreational potential, there is a need to purchase desirable parcels or the possibility for land exchanges to provide public recreation access to the reach. The goal would be to provide better access to this reach for all types of recreational users. A redesign and reconstruction of the Silver Creek Campground will be considered to facilitate recreational opportunities. Capital improvements such as restrooms and parking areas will be needed at appropriate access points to serve the public. The Recreation Needs Assessment Report documents that a River Management Plan needs to be developed to address access, safety concerns, whitewater boater density, conflicts with other recreational uses, user education, and monitoring. The plan would address future monitoring needs, adaptive management options, resource protection needs, access needs, and management of commercial operations.

As recreation (whitewater) streamflows are provided, there is a need to provide for river patrols and maintenance of existing facilities until the River Management Plan is completed and implemented. To manage for whitewater and streamside use, the FS will conduct river patrols (or work with other patrols), pick up litter, provide public information, enforce rules and regulations, rehabilitate impacted areas, address sanitation, maintain day-use sites (such as concentrated-use areas), maintain information signs, respond to emergencies, and assist in search and rescue. The following estimate shows the cost to manage for these visitors and the impacts from their visits.

| O + M Cost Spreadsheet (UARP Relicensing) | | | |
|---|---|---|---|
| **Area: Ice House/Silver Creek Stream Patrol and White Water Management (2 Month Season)** | | | |
| **Personnel:** | **Days** | **CTG*/Day** | **Total** |
| Lead White Water Recreation Patrol (GS-7) | 40 | $185.00 | $7,400.00 |
| White Water Patrol (GS-5) | 40 | $120.00 | $4,800.00 |
| Recreation Manager (GS-9) | 5 | $215.00 | $1,075.00 |
| Recreation Officer (GS-11) | 3 | $305.00 | $915.00 |
| Resource Business Manager (GS-6) | 3 | $175.00 | $525.00 |
| **Vehicles:** | **Months** | **Cost/Mo** | **Total** |
| White Water Patrol (250/mo)+(500 miles x .37mo) | 2 | $435.00 | $870.00 |
| **Note:** Fleet Vehicles require 12 months FOR (some vehicles are split between several projects/areas). | | | |
| **Project Supplies & Materials:** | | | **Total** |
| Misc. Uniforms, supplies, training, specialized equipment, etc. | | | $2,000.00 |
| Sub-Total: | | | $17,585.00 |
| Overhead (19%): | | | $3,341.15 |
| OWCP, Unemployment, etc. | | | $3,000.00 |
| Total: | | | $23,926.15 |

Slab Creek Reach

The reach of the SFAR below Slab Creek Reservoir Dam was found to be a high-quality whitewater recreational opportunity, based on the Slab Creek Whitewater Boating Flow Study. This study revealed that this reach has the potential to provide Class IV to V whitewater boating opportunities, but that the flows are not available due to regulation by Slab Creek dam and reservoir. This reach also provides highly desirable angling opportunities. Access at the put-in is on National Forest System land; however, many other access or take-out points are on private land. The Recreation Needs Technical Report cites a need for capital improvements such as restrooms and parking areas for access. The report also calls for development of a River Management Plan to address access, safety concerns, whitewater boater density, conflicts with other recreational uses (including, but not limited to, angling and flat-water recreation on Slab Creek Reservoir), user education, and monitoring. The plan would address future monitoring needs, adaptive management options, and resource protection needs.

As recreation (whitewater) streamflows are provided, there is a need to provide for river patrols and maintenance of existing facilities until the River Management Plan is completed and implemented. To manage for the whitewater and streamside use, the FS will conduct river and other patrols, pick up litter, provide public information, enforce rules and regulations, rehabilitate impacted areas, address sanitation, maintain day-use sites (such as concentrated-use areas), maintain information signs, respond to emergencies, and assist in search and rescue. The following estimate shows the cost to manage for these visitors and the impacts from their visits.

| O + M Cost Spreadsheet (UARP Relicensing) | | | |
|---|---|---|---|
| **Area: South Fork American River below Slab Creek Reservoir Patrol and White Water Management** | | | |
| **Personnel:** | **Days** | **CTG*/Day** | **Total** |
| Lead White Water Recreation Patrol (GS-7) | 40 | $185.00 | $7,400.00 |
| White Water Patrol (GS-5) | 40 | $120.00 | $4,800.00 |
| Recreation Manager (GS-9) | 5 | $215.00 | $1,075.00 |
| Recreation Officer (GS-11) | 3 | $305.00 | $915.00 |
| Resource Business Manager (GS-6) | 3 | $175.00 | $525.00 |
| **Vehicles:** | **Months** | **Cost/Mo** | **Total** |
| White Water Patrol (250/mo)+(500 miles x .37mo) | 2 | $435.00 | $870.00 |
| **Note:** Fleet Vehicles require 12 months FOR (some vehicles are split between several projects/areas). | | | |
| **Project Supplies & Materials:** | | | **Total** |
| Misc. Uniforms, supplies, training, specialized equipment, etc. | | | $2,000.00 |
| Sub-Total: | | | $17,585.00 |
| Overhead (19%): | | | $3,341.15 |
| OWCP, Unemployment, etc. | | | $3,000.00 |
| Total: | | | $23,926.15 |

Chili Bar Reach

As part of the settlement negotiation process for the Chili Bar and UARP Re-licensing, CDPR has reached agreement with SMUD and PG&E on an annual payment of $75,000 (to be adjusted annually by the GDP-IPD) for the operation, management, maintenance and administration of river recreation facilities at Marshall Gold Discovery SHP and Folsom Lake SRA. In reaching this agreement, SMUD and PG&E dispute whether they have any responsibility to provide funding for any construction, maintenance operation or administration of public recreation areas management by CDPR on the South Fork of the American River. Nonetheless, CDPR considers this agreement to provide $75,000 as a partial and reasonable "fair share" contribution by the utilities to the overall cost of operating, maintaining and administering to the CDPR river recreation access facilities at Marshall Gold Discovery SHP and Folsom Lake SRA on the South Fork of the American River.

Annual operation and maintenance include daily cleaning and resupplying restrooms; litter pickup; including checking the restroom septic vault pumping and garbage collection; daily opening and closing of access gates; law enforcement patrol; and seasonal on-site staffing and visitor use management. This work also includes river patrol, outfitter permit management, and other river-related administration. This ongoing annual program of maintenance, operation, and administration is required to meet CDPR standards for facilities and visitor use and to safely manage these areas for the whitewater recreation and other river use that occurs at these sites largely as a result of the altered flow regimes produced by the UARP and Chili Bar Hydroelectric Project. The total cost of this annual recreation operation, maintenance, and administration for CDPR facilities and programs directly tied to whitewater use on the SFAR is $218,240. The tables below provide a more detailed breakdown of costs.

***California Department of Parks and Recreation Salmon Falls River Access and Skunk Hollow River Access***

The annual operation and maintenance costs for the Salmon Falls and Skunk Hollow River Access sites is estimated to be $153,734, as displayed in the detailed table below.

| **Annual O + M Cost Spreadsheet**<br>**Area: Salmon Falls/Skunk Hollow** | | | |
|---|---|---|---|
| **Personnel:** | **Days** | **CTG*/Day** | **Total** |
| State Park Ranger (open/close gates & patrol) | 90 | $230.00 | $20,700.00 |
| State Park Ranger (supervise park aids) | 40 | $230.00 | $9,200.00 |
| Senior Park Aid (manage traffic and visitor use at peak season) | 80 | $110.00 | $8,800.00 |
| Senior Park Aid (same as above) | 80 | $110.00 | $8,800.00 |
| Senior Park Aid (same as above) | 80 | $110.00 | $8,800.00 |
| Park Maintenance Assistant (restroom cleaning, litter pick-up, etc) | 130 | $185.00 | $24,050.00 |
| Seasonal Park Aid (maintenance) | 260 | $110.00 | $28,600.00 |
| | | | |
| **Vehicles:** | **Months** | **Cost/Mo** | **Total** |
| Ranger/LE Patrol (2000 miles/mo. and $.37/mi.) | 12 | $740.00 | $8,880.00 |
| Visitor Services Park Aids (600 miles/mo and $.37/mi.) | 4 | $222.00 | $888.00 |
| Maintenance (600 miles/mo and $.37/mi.) | 12 | $222.00 | $2,664.00 |
| | | | |
| **Project Supplies & Materials:** | | | **Total** |
| Misc. Uniforms, Supplies, Paint, etc.. | | | $2,000.00 |
| | | | |
| **Fixed Costs:** | **Months** | **Cost/Mo.** | **Total** |
| Garbage Collection Contract | annual | annual | $4,700.00 |
| Septic Pumping | annual | annual | $5,600.00 |
| | | | |
| Sub-Total: | | | $133,682.00 |
| Overhead (15%): | | | $20,052.30 |
| Total: | | | $153,734.30 |

***California Department of Parks and Recreation Marshall Gold Discovery SHP River Access***

The annual operation and maintenance cost for the Marshall Gold Discovery River Access site is estimated to be $22,758 and is detailed in the table below.

| Annual O + M Cost Spreadsheet | | | |
|---|---|---|---|
| **Area: Marshall Gold Discovery SHP River Access** | | | |
| **Personnel:** | **Days** | **CTG*/Day** | **Total** |
| State Park Ranger (open/close gates & patrol) | 23 | $230.00 | $5,290.00 |
| Park Maintenance Assistant (restroom cleaning, litter pick-up, etc) | 65 | $185.00 | $12,025.00 |
| **Vehicles:** | **Months** | **Cost/Mo** | **Total** |
| Ranger/LE Patrol (100 miles/mo. and $.37/mi.) | 12 | $37.00 | $444.00 |
| Maintenance (100 miles/mo and $.37/mi.) | 12 | $37.00 | $444.00 |
| **Project Supplies & Materials:** | | | **Total** |
| Misc. Uniforms, Supplies, Paint, etc.. | | | $1,000.00 |
| **Fixed Costs:** | **Months** | **Cost/Mo.** | **Total** |
| Garbage Collection Contract | annual | annual | $500.00 |
| Sub-Total: | | | $19,703.00 |
| Overhead (15%): | | | $2,955.45 |
| Total: | | | $22,658.45 |

***California Department of Parks and Recreation River Patrol, Management and Program Administration***

River patrol, management, and program costs are directly related to whitewater use on the SFAR that is not tied to specific facilities. These costs include river patrol, outfitter permit management and administration, and concession contract administration. The estimated annual cost for river patrol, river management, and river program administration for whitewater use on the SFAR is $41,849, as shown in the table below.

| **Annual O + M Cost Spreadsheet** | | | |
|---|---|---|---|
| **Area: River Patrol and Management, Program Administration** | | | |
| **Personnel:** | **Days** | **CTG*/Day** | **Total** |
| State Park Superintendent I (develop/manage river concession contracts, river program oversight) | 15 | $304.00 | $4,560.00 |
| State Park Ranger (manage river program, river patrol, outfitter management) | 47 | $230.00 | $10,810.00 |
| Office Technician (process and track outfitter permits and fees) | 130 | $172.00 | $22,360.00 |
| **Vehicles:** | **Months** | **Cost/Mo** | **Total** |
| State Park Ranger (500 miles/mo. and $.37/mi.) | 12 | $185.00 | $2,220.00 |
| **Project Supplies & Materials:** | | | **Total** |
| Misc. Materials, Equipment, Supplies, etc.. | | | $1,000.00 |
| **Fixed Costs:** | **Months** | **Cost/Mo.** | **Total** |
| | | | |
| Sub-Total: | | | $36,390.00 |
| Overhead (15%): | | | $5,458.50 |
| Total: | | | $41,848.50 |

## High Country Area Patrol

### Objectives Addressed by High Country Area Patrol

Recreation Management Objective
Resource Protection Objective
Water Quality Objective
Wilderness and Wild and Scenic River Objective

### Information Used to Establish High Country Area Patrol

The following information was used to establish High Country Area patrol measures for management of recreation (in the vicinity of Buck Island Reservoir and Rubicon Reservoir): (a) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (b) Desolation Wilderness Management Guidelines (USDA 1998), (c) Recreation Opportunity Spectrum Book (USDA 1986), (d) Initial Information Package (SMUD 2001), (e) Visitor Use and Impact Technical Report (Devine Tarbell & Associates and Louis Berger 2005f), (f) Recreation Supply Technical Report (Devine Tarbell & Associates and Louis Berger 2004c), (g) Recreation Demand Technical Report (Devine Tarbell & Associates and Louis Berger 2004d), (h) Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d) (i) USDA (2005) cost estimates of work required for patrol and management of recreation in the High Country area of the Project, and (j) agency familiarity with uses within and adjacent to the Project boundary.

### Rationale for High Country Patrol

Refer to Rationale for Recreation, Operation, Maintenance, and Administration Measures, above.

Two Project reservoirs are located within an area referred to as High Country in the Recreation Supply Technical Report (Devine Tarbell & Associates and Louis Berger 2004c), which includes recreation within or adjacent to Desolation Wilderness. In addition, as described above, access to portions of the Project area is enhanced by the Project construction road between Loon Lake Reservoir and Buck Island Reservoir. Recreation use consists of dispersed recreation activities, including hiking, camping, equestrian use, mountain biking in a portion of the area, fishing, swimming, and other day-use activities. The Recreation Needs Report (Devine Tarbell & Associates and Louis Berger 2005d) describes the relationship of the Project and recreation uses, associated needs to meet existing and projected recreation use, and the needs to address resource impacts from the recreation use. Needs include patrols, picking up litter, providing public information, enforcing rules and regulations, rehabilitating impacted areas, addressing sanitation, maintaining day-use sites (such as concentrated-use areas), maintaining trails, information signs, and regulatory signs, responding to fires and other emergencies, assisting in search and rescue, and area condition monitoring. Resource impacts are still occurring locally within the High Country area, including vegetation damage from dispersed camping and day use, trail damage from use, continued litter, improperly disposed human waste, and abandoned campfires. Areas will be maintained or rehabilitated through the funds provided by the licensee, in conjunction with funds provided by the FS.

| O + M Cost Spreadsheet (UARP Relicensing) | | | |
|---|---|---|---|
| **Area: High Country Wilderness Patrol** | | | |
| **Personnel:** | **Days** | **CTG*/Day** | **Total** |
| Wilderness Ranger Patrol (GS-5) | 100 | $120.00 | $12,000.00 |
| Recreation Manager (GS-9) | 10 | $215.00 | $2,150.00 |
| Recreation Officer (GS-11) | 5 | $305.00 | $1,525.00 |
| Resource Officer (GS-11) | 5 | $310.00 | $1,550.00 |
| Maintenance Mechanic (WG-8) | 5 | $210.00 | $1,050.00 |
| Resource Business Manager (GS-6) | 5 | $175.00 | $875.00 |
| SO Staff Support | 5 | $350.00 | $1,750.00 |
| **Vehicles:** | **Months** | **Cost/Mo** | **Total** |
| Recreation Patrol (206/mo)+(1000 miles x .37mo) | 6 | $576.00 | $3,456.00 |
| Recreation Officer (313/mo) + (1000 miles x .43 mo) | 1 | $743.00 | $743.00 |
| **Note:** Fleet Vehicles require 12 months FOR (some vehicles are split between several projects/areas). | | | |
| **Project Supplies & Materials:** | | | **Total** |
| Misc. Uniforms, Supplies, Signs, rehabilitation and restoration materials etc.. | | | $3,500.00 |
| **Fixed Costs:** | **Months** | **Cost/Mo.** | **Total** |
| Sub-Total: | | | $40,599.00 |
| Overhead (19%): | | | $7,713.81 |
| OWCP, Unemployment, etc. | | | $4,500.00 |
| Total: | | | $52,812.81 |

## Dispersed Area Patrol

### Objectives Addressed by Dispersed Area Patrol

Recreation Management Objective
Resource Protection Objective
Water Quality Objective

### Information Used to Establish Dispersed Area Patrol

The following information was used to establish patrol measures for management of recreation in the Dispersed Areas within the vicinity of the Project facilities: (a) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (b) Desolation Wilderness Management Guidelines (USDA 1998), (c) Recreation Opportunity Spectrum Book (USDA 1986), (d) Initial Information Package (SMUD 2001), (e) Visitor Use and Impact Technical Report (SMUD, 2005), (f) Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d); (g) Recreation Demand Technical Report

(Devine Tarbell & Associates and Louis Berger 2004d); (h) Recreation Supply Technical Report (Devine Tarbell & Associates and Louis Berger 2004c; (i) Summary of Selected Variables for the Recreation IFG Zone 3 Survey conducted during the Summer of 2004, December 13, 2004 and associated data set (SMUD 2004c); (j) USDA (2005) cost estimates of work required for patrol and management of recreation in the Dispersed area of the Project; and (k) professional experience of FS managers and other responsible individuals familiar with recreation management within the Project area.

**Rationale for Dispersed Area Patrol**

Refer to Rationale for Recreation, Operation, Maintenance, and Administration Measures, above.

<u>Need for Patrol and Determination of Licensee's Proportionate Share</u>

Because of the high levels of public use within the licensee-constructed recreation facilities and the limited size of these facilities, visitors within the FERC Project Boundary regularly spill into dispersed areas immediately adjacent to and generally within 5 miles of the reservoirs[2]. Anecdotal observations of visitors to these dispersed areas illustrate how many had been turned away from developed recreation facilities (no campsite availability), yet had clearly brought equipment (personal water craft and boats) to use on the reservoirs. As a result, the licensee agreed to study the relationship between these visitors and facilities, amenities, services, and access that the licensee has developed or been responsible for. The objective of the survey was as follows: "To quantitatively establish the level of dispersed recreation in Zone 3 (referring to the area generally outside of ¼ mile from the reservoir's edge) that is related to the UARP in order to assist in determining the licensee's proportionate share for addressing dispersed recreation in Zone 3" (SMUD 2004c).

The following statistical analysis shows the relationship between hydropower licensee-provided facilities, amenities, services, and access and the visitors to the area. The analysis relies on a determination of "reservoir dependency." The analysis recognizes that the licensee provides, in addition to actual physical improvements, an improved recreation setting (a reservoir) that attracts visitors to participate in activities not otherwise available without the development of a reservoir. In addition, this analysis focused on determining what percentage of visitors to the adjacent dispersed areas actually stayed within licensee-provided recreation facilities. This analysis consequently shows how "Project" visitors use and impact National Forest System lands outside the FERC Project Boundary. The licensee was responsible for a random sample survey conducted in the summer of 2004 of a representative population of visitors to the dispersed areas within the Crystal Basin. The survey instrument was developed

[2] These dispersed areas have come to be referred to as "Zone 3"; in which Zone 1 is the area within the license boundary, Zone 2 is the area immediately around the project reservoirs, but outside the license boundary, Zone 3 is the area of dispersed recreation outside the license boundary and away from the reservoir, but in which the recreational visitors are at least in part dependent on the reservoirs or Project facilities, and Zone 4 is the area outside the license boundary where recreation is not dependent on the reservoirs or Project facilities.

cooperatively between the licensee and the FS. The following analysis is based on the results of the survey responses collected in 2004.

- Of the total number of respondents surveyed, 31.2 percent are considered "highly reservoir dependent." In addition, 11 percent of those surveyed are considered "moderately reservoir dependent." To determine this, the following information was used:
  - Approximately 55 percent of the visitors to the dispersed areas are considered "water dependent." The term water dependent describes visitors who indicated the importance of water to their visit was between 3.01 and 5.00 on a five-point scale.
  - An additional dimension then was used to explore the importance of the reservoirs ("water-based" visitors need to also show their dependence on the reservoir resources that the licensee provides to indicate they are "reservoir-dependent" visitors). Of the 55 percent (163 respondents) of the visitors considered to be "water dependent," approximately 57 percent (31.2 percent of the total population) were determined to be highly reservoir dependent, and 20 percent (11 percent of the total population) were considered moderately reservoir dependent.
- Eighty-two percent of the total population surveyed stayed overnight in the area (19 percent had stayed in a developed campground).
- Approximately 90 percent of the 45,000 to 70,000 users of the Rubicon 4WD (four-wheel-drive) Trail access the trail across the Loon Lake Main Dam via the Ellis Tie 4WD Trail. As described in the Specific Recreation Measures section, access across this dam serves as a major improvement for recreational access to this popular 4WD trail.
- Approximately 25 percent of all respondents in the dispersed areas indicated that a UARP-related recreation facility or a UARP reservoir was their primary destination. This illustrated how visitors to Project features use National Forest System Lands adjacent to and outside Project boundaries.
- Of the visitors not considered either highly or moderately reservoir dependent (n=172), a facilities dependency analysis was used to describe their relationship to the dispersed areas and the facilities and services the licensee is responsible for providing. This analysis showed that approximately 35 percent (approximately 20 percent of the total population) indicated they ranked at least three facilities or services provided by the licensee as moderately or very important to their visit to the area. There is no overlap between these "facility and services"-dependent individuals and the moderately to highly reservoir-dependent individuals, as both populations were analyzed separately.

Based on the analysis described above, it has been determined that 37 to 62 percent of the recreational use within the dispersed area depends on the reservoirs or access, facilities, and services provided by the Project. The lower range of dependency reflects only individuals deemed "reservoir dependent" (all those reported as highly reservoir dependent and one-half of those reported as moderately reservoir dependent). The upper range of dependency includes those moderately to highly reservoir dependent and those who indicated they ranked at least three facilities or services provided by the licensee as moderately or very important to their visit to the area (20 percent of the total population).

From this, the licensee is considered to be responsible for 50 percent of the cost of managing for this dispersed-area recreation and associated needs.

Costs for Patrol

Work to be completed within these areas includes conducting patrols, picking up litter, providing public information, enforcing rules and regulations, rehabilitating impacted areas, addressing sanitation, maintaining day-use sites (such as concentrated-use areas), maintaining trails, information signs, and regulatory signs, responding to fires and other emergencies, assisting in search and rescue, and area condition monitoring. Resource impacts still occur locally within the dispersed areas outside the immediate project boundary where visitors have been determined to be related to the UARP, including vegetation damage from dispersed camping, improper vehicle use, day use, trail damage from use, continued litter, improperly disposed human waste, and abandoned campfires. Areas will be maintained or rehabilitated with funds provided by the licensee, in conjunction with funds provided by the FS.

## O + M Cost Spreadsheet (UARP Relicensing)

**Area: Dispersed Area Patrol (Zone 3)**

| **Personnel:** | **Days** | **CTG*/Day** | **Total** |
|---|---|---|---|
| Recreation Patrol (GS-5) | 120 | $120.00 | $14,400.00 |
| Recreation Patrol (GS-5) | 120 | $120.00 | $14,400.00 |
| Recreation Patrol (GS-5) | 100 | $120.00 | $12,000.00 |
| Rubicon Technician (GS-5) | 100 | $120.00 | $12,000.00 |
| Maintenance Mechanic (WG-8) | 5 | $210.00 | $1,050.00 |
| Maintenance Technician (GS-5) | 10 | $120.00 | $1,200.00 |
| Recreation Manager (GS-9) | 40 | $215.00 | $8,600.00 |
| Recreation Officer (GS-11) | 30 | $305.00 | $9,150.00 |
| Resource Officer (GS-11) | 25 | $310.00 | $7,750.00 |
| Resource Business Manager (GS-6) | 15 | $175.00 | $2,625.00 |
| SO Staff Support | 15 | $350.00 | $5,250.00 |

| **Vehicles:** | **Months** | **Cost/Mo** | **Total** |
|---|---|---|---|
| Recreation Patrol (206/mo)+(1000 miles x .37mo) | 12 | $576.00 | $6,912.00 |
| Recreation Patrol (206/mo)+(1000 miles x .37mo) | 12 | $576.00 | $6,912.00 |
| Recreation Patrol (206/mo)+(1000 miles x .37mo) | 12 | $576.00 | $6,912.00 |
| Recreation Patrol (206/mo)+(1000 miles x .37mo) | 12 | $576.00 | $6,912.00 |
| Maintenance Technician (260/mo)+(1500 miles x .57mo) | 1 | $1,115.00 | $1,115.00 |
| Recreation Officer (313/mo) + (1000 miles x .43 mo) | 1 | $743.00 | $743.00 |

**Note:** Fleet Vehicles require 12 months FOR (some vehicles are split between several projects/areas).

| **Project Supplies & Materials:** | **Total** |
|---|---|
| Misc. Uniforms, Supplies, Supplies, Paint, etc.. | $7,500.00 |

| **Fixed Costs:** | **Each** | **Cost/yr.** | **Total** |
|---|---|---|---|
| Average Watershed Restoration Project Costs | 1 | $15,000.00 | $15,000.00 |

| | |
|---|---|
| Sub-Total: | $140,431.00 |
| Overhead (19%): | $26,681.89 |
| OWCP, Unemployment, etc. | $9,000.00 |
| Total: | $176,112.89 |
| **Licensee's Proportionate Share (50%)** | **$88,056.45** |

## Carrying Capacity on Lands Affected by the Project

### Objectives Addressed by Carrying Capacity

Wilderness Values
Recreation Management
Resource Protection
Recreation Design

### Information Used to Address Carrying Capacity

The following information was used to establish operation and maintenance requirements for recreation facilities: (a) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (b) Meaningful Measures Developed Sites national National Quality Standards (USDA 2002a), (c) Upper American River Project Initial Information Package (SMUD 2001), (d) Recreation Supply Technical Report (Devine Tarbell & Associates and Louis Berger 2004c), (e) Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d), (f) Recreation Demand Technical Report (Devine Tarbell & Associates and Louis Berger 2004d, (g) Visitor Use and Impact Technical Report (Devine Tarbell & Associates and Louis Berger 2005f), (h) Recreation Opportunity Spectrum Book (USDA 1986), (i) professional experience of Forest Service managers and other responsible individuals familiar with recreation management within the Project area, (j) The South Fork American River: A Management Plan (USDI 2004), (k) Final Sierra Planning Area Management Framework Plan Amendment and Environmental Assessment (USDI 1988), (l) Sierra Planning Area Management Framework Summary (USDI 1983a), and (m) Folsom Resource Area Sierra Planning Area Management Framework Plan (1983b).

### Rationale for Carrying Capacity

The FS is responsible for determining carrying capacity on their respective lands, with respect to ecological, social, physical, and managerial elements. During the ALP, the licensee agreed to collect data to address the issue of carrying capacity. Unfortunately, the data were gathered without consultation with other parties and were too limited in scope and quality to make any determination of carrying capacity. It is generally believed that capacity is not being exceeded in most places (though in some sites it may be close), and this determination is critical toward the development of a sound plan dealing with recreation over the life of the license.

## Reservoir Levels

### Objectives Addressed by Reservoir Levels

Recreation Management
Fish Production
Macroinvertebrates
Temperature
Dissolved Oxygen
Water Quality
Natural Hydrograph
Flow Fluctuations
Geomorphology
Riparian Habitat
Threatened, Endangered, and Sensitive Species and Management Indicator Species
Hydropower Operations

### Information Used to Establish Reservoir Levels

The following information was used to establish minimum monthly average reservoir elevations: (a) regulated streamflow data from several licensee and USGS gages in the basin**,** (b) Hydrology Technical Report (Devine Tarbell & Associates and Hannaford 2005a), (c) HEC-Res-Sim Modeling (CDFG 2007), (d) Water Quality Technical Report (Devine Tarbell & Associates 2005d), (e) Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d), (f) Recreation Demand Technical Report (Devine Tarbell & Associates and Louis Berger 2004d), (g) Recreation Supply Technical Report (Devine Tarbell & Associates and Louis Berger 2004c), (h) Recreation Carrying Capacity Technical Report, (Devine Tarbell & Associates and Louis Berger 2005c), (i) Visitor Use and Impact Technical Report (Devine Tarbell & Associates and Louis Berger 2005f), (j) Technical Report on Visitor Surveys, 2002 – 2003 (SMUD 2004d), (k) Visual Assessment of UARP Project Operations Technical Report (Devine Tarbell & Associates and Goodavish 2004b), (l) Socioeconomic Assessment of Iowa Hill Construction and Operations Technical Report (Devine Tarbell & Associates and CH2M Hill 2005d), (m) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (n) Desolation Wilderness Management Guidelines (USDA 1998), and (o) Upper American River Project Initial Information Package (SMUD 2001), and (p) Flatwater Boating Flow Study for Chili Bar Reservoir Technical Report (Devine Tarbell & Associates and Louis Berger 2004e).

### Rationale for Reservoir Levels

Estimated public recreational use of the four major storage Project reservoirs (Loon Lake, Gerle Reservoir, Union Valley Reservoir, and Ice House reservoir) from 1999 through 2002 is displayed in the Recreation Carrying Capacity Technical Report. This report shows these reservoirs receive substantial amounts of recreational use. Recreational use of the other Project reservoirs (except Camino) also occurs, as described in the Recreation Needs Technical Report, Visitor Use and Impact Technical Report, Recreation Demand Technical Report, and other reports. These reports also describe that recreational use of all these reservoirs will increase in the future.

The current license includes a condition that the “Licensee shall make every reasonable effort to maintain the water surface in the project reservoirs at as high an elevation as practicable, and with a minimum of fluctuations from May 1 to September 10 of each year, as is consistent with generation of power in order to secure the maximum recreational benefits. Priority shall be given to retention of storage in Rubicon Diversion and Buck Island Reservoirs” (Article 33 of current license).

Reservoir level minimums or other requirements have been developed to allow for continued recreational use of the Project reservoirs, and to maintain the aesthetic quality of the recreation experience, while still meeting other recreational needs, resource objectives, and hydroelectric generation. Factors considered in developing desired reservoir levels included (1) reservoir objectives, as presented in the Recreation Needs Technical Report, (2) maintenance of aesthetic qualities and public perceptions derived from the conclusions presented in the Visual Assessment of UARP Operations Technical Report, (3) maintaining the functionality of facilities and improvements serving recreation visitors, such as boat ramps and picnic areas, (4) continuing to provide for the recreational activities visitors have come to enjoy, and meeting anticipated future uses and trends, (5) historic reservoir levels with associated uses, conflicts, and other management issues, and (6) personal observations of recreation managers from the Eldorado National Forest. For Loon Lake, Union Valley Reservoir, and Ice House Reservoir, reservoir level minimums are presented as minimum monthly averageend-of-month reservoir elevations for the months of July, August, and September. The use of an end-of-month minimum monthly average was selected to meet recreational needs while still providing operational flexibility to the licensee. Other units of measure were considered (see November 2005 Agency/NGO Alternative on file at FERC), including minimum monthly averages; however, based on discussions with the licensee, the use of an end-of-month minimum as the unit of measure was considered to be most easily implemented and forecastable.

Based on the available information, including historic reservoir levels, recreational uses on and around the Project reservoirs, and visitor preferences and perceptions, preliminary minimum reservoir level curves were developed for these three major storage reservoirs. These preliminary minimum reservoir level curves describe the reservoir levels needed to meet the Reservoir Level Objective. The curves were designed to attain full reservoirs near July 1 of most water year types, which had historically been attained 95 percent of the time during the period of record (Devine Tarbell & Associates and Goodavish 2004b). Following peak reservoir levels in July, the curves then allow for drawdown through the high recreation use season (summer), while maintaining levels for recreational uses such as boating and swimming.

However, the preliminary minimum reservoir level curves were replaced with minimum monthly averageend-of-month minimum reservoir levels to provide for greater operational flexibility for the licensee, and still meet the recreation objectives. The end-of-month minimum monthly average reservoir levels allow reservoir levels to be 5 to 10 feet lower than the preliminary reservoir level curves, allow the licensee to meet short-term needs, and reduce the need for the licensee to maintain a reservoir level buffer to avoid noncompliance with a daily reservoir level requirement. These end-of-month minimum reservoir levels have been included in modeling of system operations and were found to be attainable while still meeting the other competing interests, such as ecological streamflows, recreational streamflows, and power generation.

The rationale for specific reservoir minimum elevations is presented below for the major storage reservoirs and the other Project reservoirs for which there is recreation access.

Loon Lake Reservoir

Loon Lake Reservoir provides a popular, high-elevation flat-water opportunity for many visitors. Developed campgrounds, day-use areas, boat ramps, trailheads, and other recreation facilities serve visitors. Loon Lake is also an entrance to the Desolation Wilderness, providing entry for both overnight and day use.

The Eldorado National Forest Land and Resource Management Plan (USDA 1989) states that the eastern portion of Loon Lake Reservoir occurs in Management Area 7, semiprimitive motorized high country, whereas the western portion is in Management Area 20, General Forest visual foreground retention. The visual quality objective for these management areas is retention. Recreation opportunities must blend with the environment, and dispersed activities that have a low impact should be provided. The goal for recreation is to "provide a wide range of developed and dispersed recreation opportunities that meet projected demand at the end of the planning period." The Eldorado National Forest Land and Resource Management Plan goes on to state that the Forest should "stress simpler, more natural recreation experiences over dense, sophisticated developments." Low to moderate interaction between users is the general direction for these management areas. Portions of the area are also within Management Area 9, Existing Developed Recreation Sites, which includes the campgrounds, picnic area, boat ramp, and other developed recreation facilities. The visual quality objective is partial retention. Recreation sites are managed to provide a high-quality experience. A natural appearing setting is to be provided within the context of the types of facilities and recreation uses.

Visitor survey results indicate that 56 percent of visitors fished during their stay at Loon Lake, whereas 43 percent of visitors boated (including power boats and nonmotorized watercraft), 58 percent swam, and 65 percent identified water-based activities as their primary activity (Devine Tarbell & Associates and Louis Berger 2004b). The Visual Assessment of UARP Operations Technical Report describes the results of a study in which recreation visitors were shown a series of photographs of Loon Lake Reservoir, along with Union Valley Reservoir and Ice House Reservoir, in which the water was at different levels, and asked to say whether they were satisfied or dissatisfied with the appearance of the reservoir level. For Loon Lake Reservoir, 50 percent of visitors reported being dissatisfied or very dissatisfied with the reservoir appearance at an elevation of 6,390 feet (drawn down 20 feet). Seven percent of visitors were dissatisfied with the reservoir appearance at a level of 6,399 feet (drawn down 11 feet).

The desired condition for management of Loon Lake Reservoir, from a recreational perspective, is to maintain the reservoir level as high as possible during the recreation season. However, it is also recognized that the rocky and barren nature of the shoreline allows the reservoir level to be lower while still maintaining the aesthetic quality. Additionally, the rocks and obstacles within the reservoir limit high-speed boating, so the reservoir surface is most appropriate for low-speed and nonmotorized watercraft. The recreational use season of Loon Lake Reservoir typically extends from snowmelt (often in late May to early June) through late October. The minimum reservoir level at which the boat ramp is usable is 6,372 feet in elevation. The reservoir elevation has historically fluctuated between 6,410 and 6,370 feet elevation, with the peak typically in late June (Devine Tarbell & Associates and Louis Berger 2004c).

The end-of-month minimum monthly average reservoir level for July in BN, AN, and Wet water years recognizes that the reservoir commonly fills or nearly fills early in the month summer and commonly is drawn down as the month summer progresses. The End-of-month minimum monthly average reservoir levels for August and September in BN, AN, and Wet water years step down each month to support hydroelectric generation, yet provide for summer recreation use and aesthetic quality. End-of-month Minimum minimum monthly average reservoir levels for Dry and CD water years decrease respectively. Modeling runs and the historic record show that the reservoir commonly fills or nearly fills earlier in the year in Dry or CD water years, and so in this settlement, the reservoir is not expected to be full at the beginning of July, and is expected to be drawn down throughout the recreation season. In Dry and CD water years, the end-of-month minimum monthly average reservoir levels allows the reservoir to be drawn down substantially, and still maintain the level above the minimum usable elevation of the Loon Lake boat ramp (6,372 feet).

<u>Union Valley Reservoir</u>

Union Valley Reservoir is the largest of the Project storage reservoirs, with a large number of recreational facilities and a very high level of use, including water skiing, fishing, sailing, and water play. Three developed boat ramps serve this reservoir, with minimum usable boat ramp elevations as follows:

| | | |
|---|---|---|
| Yellow Jacket Boat Ramp | | 4,850 |
| West Point Boat Ramp | (Upper) | 4,848 |
| West Point Boat Ramp | (Lower) | 4,809 |
| Sunset Boat Ramp | | 4,802 |

For comparison, the maximum water surface elevation with the spillway gates closed is 4,870 feet.

The Eldorado National Forest Land and Resource Management Plan (USDA 1989) states that the area immediately around Union Valley Reservoir is in Management Area 20, General Forest visual foreground retention. The visual quality objective for this management area is retention. Recreation opportunities must blend with the environment, and dispersed activities that have a low impact should be provided. The goal for recreation is to “provide a wide range of developed and dispersed recreation opportunities that meet projected demand at the end of the planning period." The Eldorado National Forest Land and Resource Management Plan goes on to state that the Forest should "stress simpler, more natural recreation experiences over dense, sophisticated developments." Low to moderate interaction between users is the general direction for these management areas. Portions of the area are also within Management Area 9, Existing Developed Recreation Sites, which includes the campgrounds, picnic areas, boat ramps, and other developed recreation facilities. The visual quality objective is partial retention. Recreation sites are managed to provide a high-quality experience. A natural-appearing setting is to be provided within the context of the types of facilities and recreation uses.

Visitor survey results indicate that 77 percent of visitors swam during their stay at Union Valley Reservoir , and 61 percent fished, 68 percent of visitors boated (including power boats and nonmotorized watercraft), and more than 70 percent identified water-based activities as their primary activity (Devine Tarbell & Associates and Louis Berger 2004b). The visual assessment of Upper American River Project Operations Technical Report, as described in the previous section, indicates that for Union Valley Reservoir, 70 percent of visitors reported being dissatisfied or very dissatisfied with the reservoir appearance at an elevation of 4,816 feet (drawn down 54 feet). Twenty-two percent of visitors were dissatisfied or very dissatisfied with the reservoir appearance at a level of 4,852 feet (drawn down 17 feet).

The primary recreational use season at Union Valley Reservoir typically extends from snowmelt, often in mid May, through late October. Fishing and boating occur year-round, with West Point Boat Ramp remaining open throughout the winter season due to the licensee's plowing this boat ramp for operational purposes.

The end-of-month minimum monthly average reservoir level for July in AN and Wet water years recognizes that the reservoir commonly fills or nearly fills early in the month summer and commonly is drawn down as the month summer progresses. The end-of-month minimum monthly average reservoir levels for August and September in AN and Wet water years step down each month to support hydroelectric generation, yet provide for summer recreation use and aesthetic quality. End-of-month Minimum minimum monthly average reservoir levels for BN, Dry, and CD water years decrease respectively. Modeling runs and the historic record show that the reservoir commonly fills or nearly fills earlier in the year in Dry or CD water years, and so in this settlement, the reservoir is not expected to be full at the beginning of July, and is expected to be drawn down throughout the recreation season. In Dry and CD water years, the end-of-month minimum monthly average reservoir levels allow the reservoir to be drawn down substantially, while still maintaining the level above the minimum usable elevation of the lowest boat ramp at Union Valley reservoir (elevation 4,802 feet).

Ice House Reservoir

Ice House Reservoir is a popular reservoir for boating, fishing, sailing, swimming, camping, picnicking, and other recreational activities. There are currently several developed campgrounds at this reservoir, along with a developed picnic area, boat ramp, and several areas used by day visitors for access to the reservoir. The primary recreational use season at this reservoir typically extends from snowmelt, often in mid-May, through late October. Ice House Reservoir is also popular for fishing in the late fall. The minimum reservoir elevation that the boat ramp is still usable is 5,423 feet. For comparison, the maximum elevation of the reservoir is 5,450 with the spillway gates closed, and the typical range of fluctuation is between 5,450 and 5,400 feet (Devine Tarbell & Associates and Louis Berger 2004c).

The Eldorado National Forest Land and Resource Management Plan (USDA 1989) states that the area immediately around Ice House Reservoir is in Management Area 20, General Forest visual foreground retention. The visual quality objective for this management area is retention. Recreation opportunities must blend with the environment, and dispersed activities that have a low impact should be provided. The goal for recreation is to "provide a wide range of developed and dispersed recreation opportunities that meet projected demand at the end of the planning period." The Eldorado National Forest Land and Resource Management Plan goes on to state that the Forest should "stress simpler, more natural recreation experiences over dense, sophisticated developments." Low to moderate interaction between users is the general direction for these management areas. Portions of the area are also within Management Area 9, Existing Developed Recreation Sites, which includes the campgrounds, picnic areas, boat ramps, and other developed recreation facilities. The visual quality objective is partial retention. Recreation sites are managed to provide a high-quality experience. A natural appearing setting is to be provided within the context of the types of facilities and recreation uses.

Visitor survey results indicate that 59 percent of visitors swam during their stay at Ice House Reservoir, while and 56 percent fished, 53 percent boated (including power boats and nonmotorized watercraft), and 71 percent identified water-based activities as their primary activity (Devine Tarbell & Associates and Louis Berger 2004b). The visual assessment of Upper American River Project Operations Technical Report, as described in the previous Loon Lake section, indicates that for Ice House Reservoir, 70 percent of visitors reported being dissatisfied or very dissatisfied with the reservoir appearance at an elevation of 5,425 feet (drawn down 25 feet). Twelve percent of visitors were dissatisfied with the reservoir appearance at a level of 5,438 feet (drawn down 12 feet).

The end-of-month minimum monthly average reservoir level for July in BN, AN, and Wet water years recognizes that the reservoir commonly fills or nearly fills early in the month and commonly is drawn down as the month progresses. The end-of-month minimum monthly average reservoir levels for August and September in BN, AN, and Wet water years step down each month to support hydroelectric generation needs, yet provide for summer recreation use and aesthetic quality. End-of-month Minimum minimum monthly average reservoir levels for Dry and CD water years decrease respectively. Modeling runs and the historic record show that the reservoir commonly fills or nearly fills earlier in the year in Dry or CD water years, and so in this settlement, the reservoir is not expected to be full at the beginning of July, and is expected to be drawn down throughout the recreation season. In Dry and CD water years, the end-of-month minimum monthly average reservoir levels allow the reservoir to be drawn down substantially, while still maintaining the level above the minimum usable elevation of the Ice House reservoir boat ramp (elevation 5,423 feet).

Gerle Reservoir

Gerle Reservoir is a relatively small reservoir that provides a non-motorized, flat-water recreation opportunity. In addition, an accessible fishing pier, was placed here because of relatively little fluctuation of the reservoir level, allowing the fishing pier to be usable nearly all the time. A campground, two picnic areas, and an interpretive trail also are at this reservoir. Historically, the reservoir operates within a very narrow range of fluctuation, generally between the maximum pool of 5,231 and 5,226 feet, a range of 5 feet (Devine Tarbell & Associates and Louis Berger 2004c). The purpose of the limited reservoir fluctuation is to maintain the recreation opportunities, particularly the use of the accessible fishing pier and to allow shoreline recreation at the picnic area.

The Eldorado National Forest Land and Resource Management Plan (USDA 1989) states that the area immediately around Gerle Reservoir is in Management Area 20, General Forest visual foreground retention. The visual quality objective for this management area is retention. Recreation opportunities must blend with the environment, and dispersed activities that have a low impact should be provided. The goal for recreation is to "provide a wide range of developed and dispersed recreation opportunities that meet projected demand at the end of the planning period." The Eldorado National Forest Land and Resource Management Plan goes on to state that the Forest should "stress simpler, more natural recreation experiences over dense, sophisticated developments." Low to moderate interaction between users is the general direction for these management areas. Portions of the area are also within Management Area 9, Existing Developed Recreation Sites, which includes the campgrounds, picnic areas, boat ramps, and other developed recreation facilities. The visual quality objective is partial retention. Recreation sites are managed to provide a high-quality experience. A natural appearing setting is to be provided within the context of the types of facilities and recreation uses.

Slab Creek Reservoir

Slab Creek Reservoir provides a lower elevation, flat-water recreation opportunity that is accessible nearly year-round. Two access points to the reservoir were developed by the licensee: one at the upstream end near Forebay Road and a hardened boat ramp upstream from the dam. At the upstream access point, there is a discernable downstream current, even at high reservoir levels (1,850-foot elevation) (Devine Tarbell & Associates and Louis Berger 2004c). The elevation of this reservoir has fluctuated generally not more than 6-7 feet in a day, and reservoir levels are generally between 1,830 and 1,850 feet, based on the historic record. The boat ramp near the dam has a lower usable limit of 1,820-foot reservoir elevation (Devine Tarbell & Associates and Louis Berger 2004c). The objective of maintaining the reservoir above 1,830 feet in elevation and restricting the daily fluctuation to less than 7 feet is to maintain access to the reservoir at the upstream and mid-reservoir access points and to provide for boater safety. As stated in Section 20, detailed surveys of use were not conducted, and use estimates are not available. Use observations by FS indicate that use of the reservoir surface generally occurs during daylight hours, commonly between 10:00 AM and 8:00 PM, although some early morning fishing also occurs. This use most commonly occurs during the summer months.

The Flatwater Boating Flow Study for Chili Bar Reservoir, conducted jointly for SMUD and PG&E, found that there is a demand for low speed and non-motorized flatwater recreation within the vicinity of Slab Creek reservoir and that Slab Creek provided a quality paddling opportunity because of the length of the reservoir, potential for side hiking opportunities and the availability of lunch and camping sites (Devine, Tarbell & Associates and Louis Berger, 2005b).

Available information at this time with regards to potential operations of a pump-storage reservoir at Iowa Hill, and associated changes in reservoir level conditions at Slab Creek Reservoir is inadequate to determine appropriate minimum reservoir elevatins or limitations on reservoir level fluctuation. At such time that the Iowa Hill Reservoir is scheduled to become operational, any modifications of the minimum reservoir elevation and maiximum daily fluctuation of Slab Creek Reservoir would be considered. At that time, more complete and current information will be available with respect to (1) the operation of the proposed Iowa Hill Pump Storage Project, (2) the recreational use at Slab Creek Reservoir, and (3) other applicable factors

Available information at this time with regards to potential operations of the proposed Iowa Hill Reservoir and associated changes in reservoir level conditions at Slab Creek Reservoir is inadequate to determine appropriate minimum reservoir elevations or limitations on reservoir level fluctuation. At such time that the Iowa Hill Reservoir is scheduled to become operational and more complete and current information is available with respect to (1) the operation of the proposed Iowa Hill Pump Storage Project, (2) the recreational use at Slab Creek Reservoir, and (3) other applicable factors, Slab Creek reservoir operations will be determined.

The Eldorado National Forest Land and Resource Management Plan (USDA 1989) states that the area immediately around Slab Creek Reservoir is in Management Area 20, General Forest visual foreground retention. The visual quality objective for this management area is retention. Recreation opportunities must blend with the environment, and dispersed activities that have a low impact should be provided. The goal for recreation is to “provide a wide range of developed and dispersed recreation opportunities that meet projected demand at the end of the planning period.” The Eldorado National Forest Land and Resource Management Plan goes on to state that the Forest should “stress simpler, more natural recreation experiences over dense, sophisticated developments.” Low to moderate interaction between users is the general direction for these management areas.

Other Reservoirs

Recreation occurs at the other Project reservoirs, along the shorelines and on the reservoir surface, except for Camino Reservoir, where no public access is allowed on the reservoir surface. Of these reservoirs, two are within or adjacent to Desolation Wilderness (Rubicon Reservoir and Buck Island Reservoir), which provide high-country, water-based recreational opportunities in a primitive setting. During the recreation season of May 1 through September 10, the minimum operating pool levels of these two reservoirs are increased by 6 feet, effectively narrowing the range of water elevation fluctuations (SMUD 2001). The uses of the reservoirs include fishing, swimming, and shoreline activities such as camping, picnicking, and scenic viewing. (Devine Tarbell & Associates and Louis Berger 2004c). The remaining project reservoirs are located in the canyonlands and have generally year-round access. Recreation on or around these reservoirs consists of fishing, boating, limited swimming, and shoreline or nearby activities including camping, picnicking, hiking, and hunting. Brush Creek Reservoir and Junction Reservoir both have boat ramps (Devine Tarbell & Associates and Louis Berger 2004c).

## Public Information Services

### Objectives Addressed by Public Information Services

Reservoir Level Information
Streamflow Information
Resource Protection
Hydropower Operations
Public Safety, Education, and Visitor information

### Information Used to Establish Public Information Services Conditions

The following information was used to establish the conditions: (a) UARP Application for New License (SMUD 2005), (b) Visitor Use and Impact Technical Report (Devine Tarbell & Associates and Louis Berger 2005d), (c) Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005f), (d) Slab Creek Reach Whitewater Technical Report (Devine Tarbell & Associates and Louis Berger 2004e), (e) Ice House Reach Whitewater Boating Technical Report (Devine Tarbell & Associates and Louis Berger Group, Inc. 2004a), (f) Recreational Flow in the Reach Downstream of Chili Bar Technical Report (Devine Tarbell & Associates and Louis Berger 2005e), (g) Whitewater Boating Feasibility Technical Report (Devine Tarbell & Associates and Louis Berger Group, Inc. 2004d), (e) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (f) The South Fork American River: A Management Plan (BLM 2004), (g) Final Sierra Planning Area Management Framework Plan Amendment and Environmental Assessment (USDI 1988), (h) Sierra Planning Area Management Framework Summary (USDI 1983a), and (i) Folsom Resource Area Sierra Planning Area Management Framework Plan (1983b).

**Rationale for Public Information Services**

The need for and benefits of providing public streamflow information, reservoir level information, and other recreation information were identified in the Application for License submitted by the licensee, along with the Recreation Needs Assessment report. Publicly accessible streamflow information will improve the opportunity to use both natural spill events and managed flows for all recreationists. Public safety and educational information provided to recreationists will assist in minimizing resource impacts from recreation visitors and improve the visitor's experience. Information as to recreation opportunities will aid visitors in utilizing the opportunities in the vicinity of the project, assist in minimizing resource impacts, and inform the public of alternative recreation opportunities.

**O + M Cost Spreadsheet (UARP Relicensing)**

**Area: Crystal Basin Information Services**

| **Personnel:** | **Days** | **CTG*/Day** | **Total** |
|---|---|---|---|
| Crystal Information Station Manager (GS-6) | 120 | $135.00 | $16,200.00 |
| Crystal Info Recreation Tech (GS-5) | 100 | $120.00 | $12,000.00 |
| Crystal Info Recreation Tech (GS-3) | 60 | $120.00 | $7,200.00 |
| Cleveland Corral Recreation Tech (GS-5) | 120 | $120.00 | $14,400.00 |
| Pacific Info Recreation Tech (GS-5) | 120 | $120.00 | $14,400.00 |
| Maintenance Mechanic (WG-8) | 20 | $210.00 | $4,200.00 |
| Maintenance Technician (GS-5) | 15 | $120.00 | $1,800.00 |
| Recreation Manager (GS-9) | 15 | $215.00 | $3,225.00 |
| Recreation Officer (GS-11) | 10 | $305.00 | $3,050.00 |
| Resource Officer (GS-11) | 5 | $310.00 | $1,550.00 |
| Resource Business Manager (GS-6) | 25 | $175.00 | $4,375.00 |
| **Vehicles:** | **Months** | **Cost/Mo** | **Total** |
| Crystal Info Vehicle (206/mo)+(500 miles x .37mo) | 12 | $391.00 | $4,692.00 |
| Maintenance Mechanic (260/mo)+(1500 miles x .57mo) | 1 | $1,115.00 | $1,115.00 |
| Maintenance Technician (260/mo)+(1500 miles x .57mo) | 1 | $1,115.00 | $1,115.00 |
| Recreation Manager (206/mo)+(1000 miles x .37 mo) | 1 | $576.00 | $576.00 |
| Recreation Officer (313/mo) + (1000 miles x .43 mo) | 1 | $743.00 | $743.00 |
| **Note:** Fleet Vehicles require 12 months FOR (some vehicles are split between several projects/areas). | | | |
| **Project Supplies & Materials:** | | | **Total** |
| Misc. Uniforms, Maintenance Materials, Paint, etc.. | | | $2,500.00 |
| New Sign Materials, Copying, etc.. | | | $1,500.00 |
| **Fixed Costs:** | **Months** | **Cost/Mo.** | **Total** |
| Garbage (2 yrds/week) | 5 | $280.00 | $1,400.00 |
| ** $35.00/mo/yd (w/rental fee) | | | |
| Sub-Total: | | | $96,041.00 |
| Overhead (19%): | | | $18,247.79 |
| Total: | | | $114,288.79 |

## Recreational Streamflows

### Objectives Addressed by Recreational Streamflows

Aquatic Biota Objectives
Fisheries Objectives
Temperature
Target Lake Levels
Water Quality
Natural Hydrograph
Geomorphology
Riparian Habitat
Minimum Stream FlowsStreamflows
Recreational Streamflows
Hydropower Operations
Connectivity
Visual Resource
Wilderness and Wild and Scenic River

### Information Used to Establish Recreational Streamflows

The following information was used to establish recommended recreational streamflows for South Fork Silver Creek below Ice House Reservoir Dam, SFAR below Slab Creek Reservoir Dam, and SFAR below Chili Bar Reservoir Dam: (a) Hydrology Technical Report (Devine Tarbell & Associates and Hannaford 2005a), (b) Slab Creek Reach Whitewater Technical Report (Devine Tarbell & Associates and Louis Berger 2004e), (c) Ice House Reach Whitewater Boating Technical Report (Devine Tarbell & Associates and Louis Berger Group, Inc. 2004a), (d) Recreational Flow in the Reach Downstream of Chili Bar Technical Report (Devine Tarbell & Associates and Louis Berger 2005e), (e) Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger Group, Inc. 2005f), (f) Whitewater Boating Feasibility Technical Report (Devine Tarbell & Associates and Louis Berger Group, Inc. 2004d), (g) Recreation Demand Technical Report (Devine Tarbell & Associates and Louis Berger Group, Inc. 2004b), (h) Final Sierra Planning Area Management Framework Plan Amendment and Environmental Assessment (USDI 1988), (i) Sierra Planning Area Management Framework Summary (USDI 1983a), (j) Folsom Resource Area Sierra Planning Area Management Framework Plan (1983b), (k) El Dorado County River Use Report (2004a), (l) personal field observations, and (m) professional judgment.

### Rationale for Recreational Streamflows

The approach for evaluating and developing recreational streamflows for South Fork Silver Creek below Ice House Reservoir Dam, SFAR below Slab Creek Reservoir Dam, and SFAR below Chili Bar Reservoir Dam included four steps focused on the suitability of each reach for whitewater recreation: (a) an evaluation of the potential for whitewater boating opportunities, (b) an evaluation of the demand for whitewater boating, (c) an evaluation of whitewater boating conditions under regulated and unimpaired streamflows, and (d) development of a range of minimum and maximum recreational streamflows and flow regimes in each water year type. The following sections describe this process.

<u>Overview</u>

An overview of the potential for whitewater boating opportunities on all UARP reaches was analyzed in the Whitewater Boating Feasibility Technical Report. The following reaches were rejected for consideration of whitewater boating flow studies because initial analysis and field visits showed substantial issues with gradient and/or obstacles: South Fork Rubicon River below Robbs Peak Reservoir Dam, Rubicon River below Rubicon Reservoir Dam, Silver Creek between Junction and Camino Reservoir Dams, and Gerle Creek below Loon Lake Reservoir Dam and below Gerle Creek Reservoir Dam.

The following reaches were recommended for whitewater boating flow studies: South Fork Silver Creek below Ice House Reservoir Dam, Silver Creek below Camino Reservoir Dam, and SFAR below Slab Creek Reservoir Dam.

The Camino Reach (Silver Creek from below Camino Reservoir Dam into the SFAR to Slab Creek Reservoir), while determined to be boatable, was rejected for development of a boating flow release schedule primarily because of potential conflicts with aquatic objectives, especially sensitive amphibian species.

The Ice House Reach (SF Silver Creek below Ice House Reservoir Dam to Silver Creek at Junction Reservoir) and the Slab Creek Reach (SFAR below Slab Creek Reservoir Dam to White Rock Powerhouse) were determined to have high potential for the development of future whitewater access through specific streamflow releases, development of management plans, and development of adequate ingress and egress.

The potential for whitewater boating opportunities on these reaches—South Fork Silver Creek below Ice House Reservoir Dam, SFAR below Slab Creek Reservoir Dam ,and SFAR below Chili Bar Reservoir Dam—was evaluated based on the quality of the run; ease of the shuttle in terms of time, distance, and quality of the route; access at both put-ins and take-outs; aesthetics or scenic quality; class of difficulty; boatability or the ability to get different types of craft down the river; whitewater challenge or the availability of powerful hydraulics, technical rapids, or playboating features.

Regulated streamflow data were compared with unimpaired streamflow data for South Fork Silver Creek below Ice House Reservoir Dam, SFAR below Slab Creek Reservoir Dam, and SFAR below Chili Bar Reservoir Dam over a 26-year period to determine how hydrological conditions have been affected by Project operations on a seasonal basis, grouped by water year type. Boating access to each reach has been substantially affected by Project operation in very different ways, each of which is described under the particular reach, below.

Minimum, optimum, and maximum recreational streamflows were developed for the Ice House and Slab Creek reaches. A complete minimum base flow and minimum boating flow schedule was developed for the Chili Bar reach, which has almost complete flow dependence year-round on UARP releases because of limited storage at Chili Bar

Reservoir. Monthly flow regimes were developed for all water year types to ensure boating opportunities on UARP-affected reaches while protecting aquatic resources and balancing water availability to meet flat-water recreation objectives and monthly energy release reliability objectives for the UARP.

South Fork Silver Below Ice House Reservoir Dam

***Evaluation of the Potential for Whitewater Boating Opportunities for South Fork Silver Creek below Ice House Reservoir Dam***

Most whitewater runs above 5,000 feet in the Sierra Nevada are class V in difficulty and require expert boating skills. South Fork Silver Creek below Ice House Reservoir Dam represents a very unique opportunity for intermediate and advanced boaters to experience boating in the high Sierra while having to run only moderate class III and IV rapids. The Ice House Reach Whitewater Boating Technical Report (Ice House Flow Report) states that "runs that require intermediate to advanced boating skills are rare at such a high altitude in the Sierra" (p. 31). The six-person boating team that kayaked the reach during the flow study conducted May 1, 2004, found an 11.2-mile run that was predominately class III with a few class IV rapids. According to the Ice House Flow Report, the run has "many attractive attributes, including a short shuttle, challenging whitewater, the presence of numerous play spots and plenty of locations for breaks" (p.1). Boaters involved in the flow study thought the length of shuttle was excellent at approximately 20 minutes (the 9-mile shuttle is actually shorter than the 11.2-mile river reach), and the run had good access although adequate parking would need to be developed (p. 17). The reach is aesthetically pleasing in the upper and lower sections and less so in the middle section that was burned by the Cleveland Fire in 1992 (the burned area was replanted and has the potential to regain much of its aesthetic appeal within the term of the license). In addition to being boatable in a kayak, the flow study indicated that the run would work well for open canoes and inflatable kayaks and, with a reduced amount of large woody debris (LWD), would be suitable for small rafts and catarafts. The Ice House reach was determined to have high potential for development of future whitewater boating opportunities through specific instream boating flow releases, the development of management plans, and the development of adequate ingress and egress.

***Evaluation of the Demand for Whitewater Boating for South Fork Silver Creek below Ice House Reservoir Dam***

The Ice House Flow Report states that whitewater boating runs such as South Fork Silver Creek below Ice House Reservoir Dam "that require intermediate to advanced boating skills are rare at such a high altitude in the Sierra" (p. 31). The Ice House Flow Report goes on to say that boaters felt this was a high-quality reach, rating it an 8 on a 10-point scale and that:

> "It is likely that large numbers of paddlers would be attracted to this reach if flows were provided. As an indicator, currently the run above Ice House Reservoir has seen significant increasing use over the past few years. Members of the study team said that they would return to boat this section if flows coincided with the boatable flows of the run above the Ice House

Reservoir. Additionally, the run has potential for commercial boating use" (p. 31).

The information contained within the Ice House Flow Report strongly indicates that demand would be high for South Fork Silver Creek below Ice House Reservoir if flows were provided.

***Development of Minimum and Maximum Recreational Streamflows and Comparison of Regulated and Unimpaired Recreational Streamflow Data for South Fork Silver Creek below Ice House Reservoir Dam***

Based on the study plan, the minimum acceptable flow is the lowest flow at which 50 percent of the survey respondents would return to paddle the reach. The minimum acceptable flow determined from the study results is approximately 300 cfs. The highest safe flow based on the average response from the participants is 600 cfs. The optimum flow, as defined in the study plan, is between 400 and 550 cfs (Devine Tarbell & Associates and Louis Berger 2004a p. 27).

An analysis of the unimpaired hydrograph was done for the Ice House reach, in which all days from April 1 through October 31 for the 26-year period of record with mean daily flows between 200 and 800 cfs were counted. The range of values from 200 to 800 cfs is used because the unimpaired hydrology is based on mean daily flows. Diurnal flow fluctuation in the Ice House reach almost guarantees that during days with mean daily flows of 200 cfs, there will be several hours in which the peak flow reaches 300 cfs. Similarly, during days of mean daily flows of 800 cfs, there will be several hours when the low flow is 600 cfs. (Devine Tarbell & Associates and Hannaford 2005a).

The periods between November 1 and March 31 were eliminated because of very short days, very cold temperatures, and inaccessibility due to snow on the ground.

Based on this analysis the average number of boatable days for each water year type under unimpaired conditions during the period of record would have been**:**

**CD:5 Dry:17 BN:40 AN:56 Wet:62**

"Under the current operations, boating opportunities would only occur under spill conditions and since the addition of Jones Fork Powerhouse, spills below Ice House Dam have been rare" (Devine Tarbell & Associates and Louis Berger 2004a, p.1). The spill events that do occur have virtually no diurnal fluctuation because it is fully attenuated by Ice House Reservoir. For this reason, only spill events with a mean daily flow of between 300 and 600 cfs provide a boating opportunity. In the 15 years of record since the Jones Fork Powerhouse came on line, there have been a total of 11 days of spill in the boatable range between April 1 and October 31.

***Development of Recreational Streamflows in All Water Year Types for the South Fork of Silver Creek below Ice House Reservoir Dam***

According to the Recreation Needs Technical Report "Regarding whitewater recreation there is a need to consider providing scheduled flow releases in this reach that would be suitable for whitewater boating of approximately 500 cfs. The preferred months for scheduled releases, in order of preference, are July, June (a close second), then May. The preferred days of the week for scheduled releases, in order of preference, are: Saturday, Sunday, Friday, then others." In addition, the Recreation Needs Technical Report states, "To the extent possible, consideration should be given to scheduling releases suitable for whitewater boating at a time, magnitude and duration that may also achieve other resource objectives (i.e., channel morphology)" (Devine Tarbell & Associates and Louis Berger 2005d, p. 126).

All the above factors shaped the development of the proposed recreational streamflow schedule. In addition, the proposed schedule is based on the concept of weekend, holiday, and occasional Friday boating access to the Ice House reach when it is accessible under the unimpaired hydrograph, and when it is physically accessible. Because of unimpaired hydrograph limitations and potential effects to aquatic species, the month of July was eliminated in all years, and the month of June was eliminated in CD and dry years. The months of March and April were eliminated because of the high elevation and probability of snow, both on the ground and as precipitation.

The following factors also apply to the proposed recreational streamflow schedule for the Ice House reach:

- Flow magnitudes were similarly set to stay within the unimpaired hydrograph of each water year type, while staying between the minimum and maximum boating levels.
- Recreational streamflows in Super Dry years were eliminated because of the need to preserve carryover storage in Ice House Reservoir to meet minimum flatwater recreation needs.
- Recreational streamflows will be stopped any time temperature triggers are met to eliminate any potential impacts to amphibians.
- The recreational streamflow schedule in BN, AN, and Wet years will be nested within the channel morphology pulse flow when possible.
- To meet the licensee's interests, a lesser amount of days and slightly reduced streamflows in some cases would be provided in the first 5 years. If monitoring indicates that use is occurring based on triggers that will be developed, boating flows will be increased to meet boaters' interests.

The resulting boating flow days for years 1-5 after license issuance are as follows:

**SD: 0 CD:1 Dry:3 BN:4 AN: 6 Wet:9**

For remaining years after license issuance, if triggers are met, the resulting boating flow days are as follows:

**SD: 0   CD:2   Dry:6   BN:7   AN:11  Wet:16**

South Fork American River Below Slab Creek Reservoir Dam

***Evaluation of the Potential for Whitewater Boating Opportunities for SFAR below Slab Creek Reservoir Dam***

Regarding the quality of the run, the Slab Creek Reach Whitewater Technical Report (Slab Creek Flow Report) states that participants found this run to be "a high quality advanced to expert run" (p. 40). In terms of ease of the shuttle, aesthetics, and whitewater challenge, the Slab Creek Flow Report revealed that "the reach is aesthetically pleasing with many attractive attributes for boating such as length of the run and shuttle, good portage routes, challenging whitewater, play spots, waves and holes, and plenty of locations for breaks" (p. 40). The class of difficulty for the entire reach was determined to be "between class IV and V, and is most suited for boaters with advanced skills or better"(p. 40).  See also Various emails 2006, which describe the experiences of many boaters on this reach.

The Slab Creek Flow Report also considered the potential for commercial boating opportunities, noting that:

> "The high aesthetic values of the run and the close proximity to commercial rafting operations on the SFAR below Chili Bar made this run attractive to the outfitters that were interviewed for this study. Also the possibility of scheduled releases is advantageous for commercial outfitters because it can allow commercial guest to book trips far in advance" (p. 41).

Regarding boatability, the Slab Creek Flow Report remarked that:

> "Boater evaluations indicated that the reach was very boatable. The participants strongly agreed (average 4.7 to 4.8 on a scale of 5) that the Slab Creek Reach is suitable for kayaks at all of the test flows. Participants felt that the 1.068 and 1,597 flows were suitable for rafts. The lowest test flow, 616 cfs, was less suitable for rafts, however it may be suitable for small two-person rafts. The run may also be suitable for catarafts at the test flows, however the participants did not feel that the run was very suitable for open canoes or inflatable kayaks at any of the test flows" (p. 17).

Participants in the flow study found the time to run the shuttle was "good at approximately 30 to 40 minutes" (p. 18). It should be noted that access issues need to be addressed. The gate on Chute Camp Road, the access road to put-in, is currently open and unlocked. However, the Slab Creek Flow Report indicated that El Dorado County may "install locks on the gate and close the gate to restrict public access between dusk and dawn" (p. 18). The three possible take-out locations identified in the Slab Creek Flow Report have gated access.

Overall, the potential opportunity for whitewater boating on the Slab Creek Reach rates very high, as demonstrated in the findings of the Slab Creek Flow Report, which state that the Slab Creek Reach is "a high quality advanced to expert run" and "is aesthetically pleasing with many attractive attributes for boating"(p. 40).

Much of the first section of the Slab Creek Reach, from below Slab Creek Reservoir Dam to the Mosquito take-out, occurs on National Forest System lands. This part of the run (approximately the first third) is unique due to its quality consistent whitewater in the Class IV to IV plus range. In addition, this part of the reach is highly accessible, and a shuttle can easily be used to ferry boaters back to the beginning of the run. Also, this part of the run is unique visually, due to the steep granitic canyon walls that occur in this section. Lower in the run, the canyon walls disappear, and the river widens. Many boaters have described given this section of the reach a high rating due to its scenery, ease of use, access, and fun factor (Various emails 2006).

***Evaluation of the Demand for Whitewater Boating for SFAR below Slab Creek Reservoir Dam***

The Slab Creek Flow Report states that the difficulty class of the Slab Creek Reach "is between class IV and V" and is "a high quality advanced to expert run" (p. 40). According to the Recreation Demand Technical Report, there has been a dramatic increase in private boating use on more difficult runs such as Class V Cherry Creek (p. 28). The report adds that "the Forest Service attributes this increase to a growing demand for more extreme experiences on river reaches that are now accessible because of advances in boating design and paddling techniques" (p. 28).

Even without regularly scheduled releases, the Slab Creek Reach has been in great demand and "has more history of boating activity than any other reach in the UARP," according to the Whitewater Boating Feasibility Technical Report (Whitewater Report) (p. 22). Todd Stanley reported that he ran the Slab Creek Reach 15 times in a 10-year span, and Lars Holbek said he made the run 10 times (Whitewater Report p. B1). The Slab Creek Reach was first run in 1982 and "has been run regularly during peak run-off periods" in better water years and "during winter storm events" (Whitewater Report, p. 22).

The Recreation Demand Technical Report indicates that "increases in population and real income" will have the greatest influence over recreation participation in the next 50 years (p.31). The report also reveals that the majority of visitors to the UARP are from El Dorado and Sacramento Counties and that over the next 50 years the combined population of El Dorado and Sacramento Counties is projected to increase from approximately 1.4 million in the year 2000 to almost 3.1 million by the year 2050, a rate of population increase that is faster than the state of California (pp. 31 and 33). The projected significant increase in growth of nearby population centers, combined with continued advances in boating design and paddling techniques, will result in increased demand for a high-quality advanced to expert run such as the Slab Creek Reach.

***Development of Minimum and Maximum Recreational Streamflows and Comparison of Regulated and Unimpaired Recreational Streamflow Data for SFAR below Slab Creek Reservoir Dam***

The Slab Creek Flow Report indicated the minimum navigable flow for the reach is approximately 400 cfs. Most boaters felt that flows between 500 and 2,000 cfs would provide an acceptable boating experience. Kayakers tended to prefer flows at the lower end of this range, the optimum range of flows being approximately 700 to 1,100 cfs. Rafters tended to prefer flows at the higher end of this range, the optimum range of flows being approximately 1,100 to 1,500 cfs" (Devine Tarbell & Associates and Louis Berger 2005d, p. 171).

Slab Creek Reservoir is effectively the afterbay for the Camino Powerhouse (located less than 1 mile upstream of the reservoir) and the entire UARP project upstream. It is also the forebay for White Rock Powerhouse, which is located approximately 9 miles downstream from Slab Creek Reservoir Dam, and it captures and re-regulates the flow coming down the SFAR above its confluence with Silver Creek, flow that is unregulated by the UARP until it reaches Slab Creek Reservoir. With an active pool storage capacity of approximately 6,000 AF and a diversion capacity of nearly 4,000 cfs through White Rock Powerhouse, Slab Creek Reservoir Dam and White Rock Powerhouse combine to have an enormous affect on the hydrograph of the SFAR below Slab Creek Reservoir Dam.

The UARP has an impact on all flow events regardless of their magnitude. While flood events overtop Slab Creek Reservoir Dam, the UARP has a substantial effect on both the timing and magnitude of flood events. In the 48 days during the period of record (October 1, 1974, to September 30, 2001) when unimpaired mean daily flows were more than 10,000 cfs at Slab Creek Reservoir, the regulated flows were reduced by an average of 50 percent. The greatest percentage reduction was on February 18, 1980, when the unimpaired flow would have been 11,082 cfs and the regulated flow 22 cfs – a reduction in flow of 98.8 percent. The greatest magnitude reduction was 26,114 cfs on January 1, 1997, and the only increases were on January 3, 1997, (3,065 cfs) and January 4, 1997 (386 cfs).

Although the UARP reduces flow during peak events, its greatest impact is when the river is not experiencing high flows. During the entire period of record, flows below Slab Creek Reservoir Dam were reduced by 87 percent. However, during the period in which unimpaired flows were 2,000 cfs or less, the UARP reduced flow by 94 percent immediately below Slab Creek Reservoir Dam. The impact is even more pronounced if one looks at days in which the mean daily unregulated flow below Slab Creek Reservoir Dam was between 500 and 2000 cfs, which is the flow range identified for minimum and maximum boatable flows. During that time, flows were reduced by 97 percent.

Within the period of record, under unimpaired conditions, there were 2,731 days that had flows in the 500 to 2000 cfs range, an average of more than 100 days per year. However, with the UARP in place, only 8 of these same days had flows more than 500 cfs. Furthermore, under regulated conditions, there have been a total of only 203 days in which the mean daily flows were between 500 and 2000 cfs. Even on those days, boating would have been difficult due to the way the UARP is operated. For example, while the mean daily flow may be between 500 and 2000 cfs, there is a large and unpredictable hourly fluctuation of flow during spill periods due to the operation of Camino and White Rock Powerhouses, neither of which has required ramping rates.

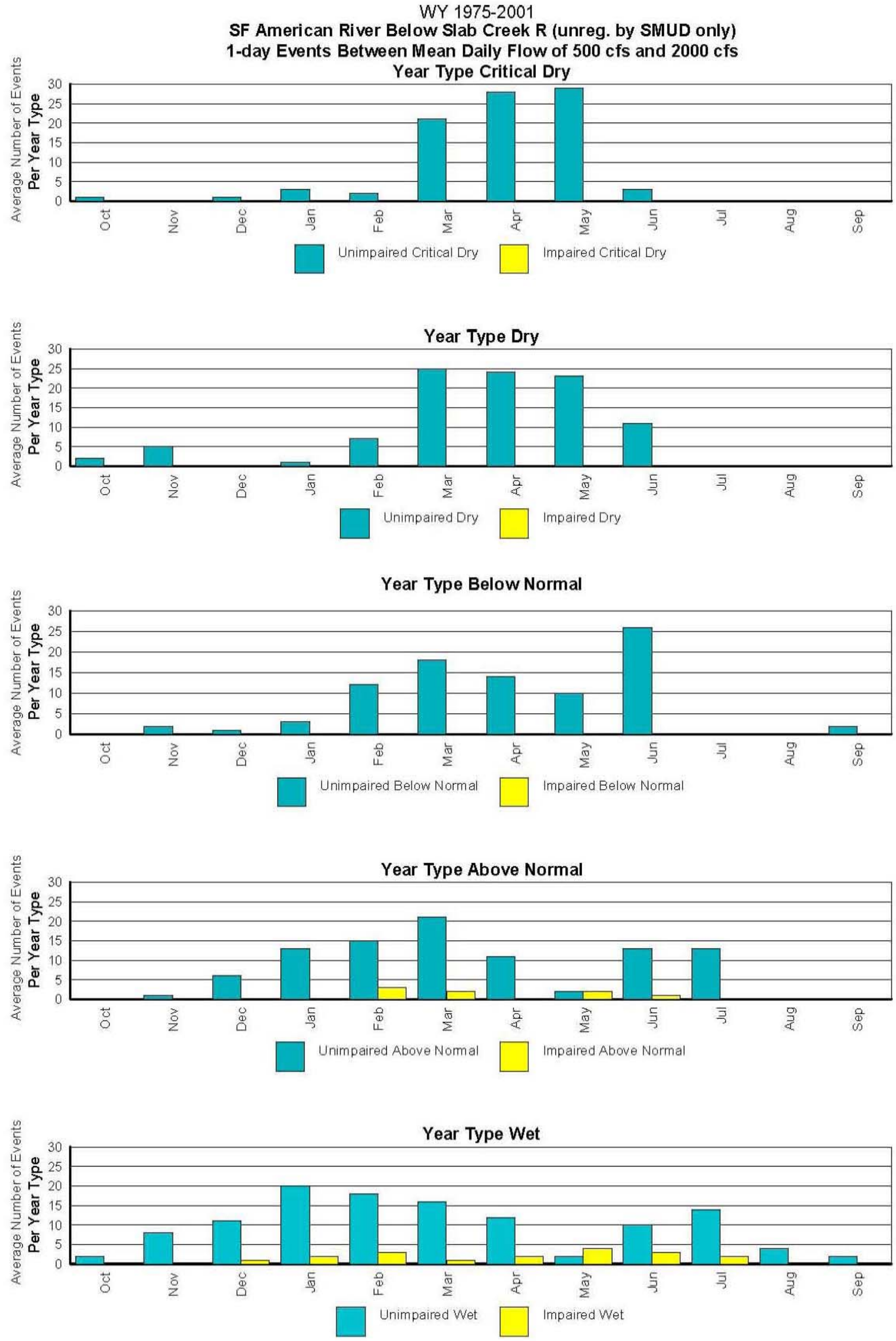



**Figure 4.5-1. Average number of boatable days per month for each water year type under regulated and unimpaired conditions (Whitewater Report, p. 34).**

A review of the regulated flow data for the project "shows that the UARP typically only spills in AN and Wet water year types and while these spill events provide some opportunity, it is less than what would occur if no developments were on the watershed" (Slab Creek Flow Report p. 37).

The Slab Creek Flow Report also demonstrated that "hourly flow data show that while these spill events are usually relatively stable, they can fluctuate enough to affect the boating opportunity. This is due to the fact that flows may vary outside the normal boating range in less time than it takes to complete the run" (p. 37).

An analysis of the unimpaired natural hydrograph was done for the Slab Creek Reach in which all days from March 1 through October 31 for the 26-year period of record with mean daily flows between 500 and 2000 cfs were counted. Based on this analysis, the average number of boatable days for each water year type under unimpaired conditions during the period of record would have been:

**CD:66 Dry:84 BN:73 AN:67 Wet:59**

***Development of Recreational Streamflows in All Water Year Types for SFAR below Slab Creek Reservoir Dam***

Regarding whitewater recreation, there is a need to consider providing scheduled flow releases in this reach that would be suitable for whitewater boating of 3 hours at 1,400 cfs from 10-1, and 3 hours at 800 cfs from 2-5 approximately. The preferred months for scheduled releases, in order of preference, are: August, September, July, June, May, October, April and March. The preferred days of the week for scheduled releases, in order of preference, are: Saturday, Sunday, Friday then others (Devine Tarbell & Associates and Louis Berger 2005d, p. 172).

The above factors shaped the development of the recreational streamflow schedule. In addition, the schedule was based on the concept of weekend, holiday, and occasional Friday boating access to this reach when it would have been accessible under the unimpaired hydrograph. Because of unimpaired hydrograph limitations the month of August was eliminated in all years, and the month of July was eliminated in CD and D years. Flow magnitudes were similarly set to stay within the unimpaired hydrograph of each water year type, while staying between the minimum and maximum boating levels.

The following factors also apply to the proposed recreational streamflow schedule for the Slab Creek reach:

- Because of concerns with potential impacts to amphibians, and to allow a step down of the hydrograph for minimum streamflows, proposed recreational streamflows were eliminated in June and July in all water years, and in May in CD and Dry water years.
- Recreational streamflows will be stopped any time temperature triggers are met to eliminate any potential impacts to amphibians.
- A split flow schedule was created to allow for the preferred kayaking flow in the morning and the preferred rafting flow in the afternoon.

- The number of days was decreased in CD and Dry water years and increased in BN, AN, and Wet water years to minimize the impact to hydroelectric generation and to avoid any impacts to energy reliability release objectives.
- Recognizing that the engineering and placement of a control structure on the diversion tunnel or some other engineered control modification that enables regularly scheduled releases of up to 1,500 cfs will take time, all non-spill scheduled flows were delayed for 15 years, or until Iowa Hill Pumped Storage Project is completed, whichever comes first (initial period).
- Given that natural inflows are sufficient to provide for spills from Slab Creek Dam during BN, AN, and Wet water years, if these water year types occur during the initial period after license issuance, a minimum number of 6 recreational streamflow days will be provided through opportunistic management of spills, accompanied by adequate notification of the boating community.

Because no formal demand and carrying capacity studies have been completed on the Slab Creek Reach, it is proposed that boating use be monitored to allow management and carrying capacity decisions to be reached based on actual use data. The maximum number of proposed days in phase 3 will be used only subsequent to completion of the formal demand and carrying capacity studies and if demand occurs during the initial period that justifies the proposed increase in releases. The resulting number of boating flow days is as follows:

| | | | | | |
|---|---|---|---|---|---|
| **LICENSE YEARS 1-15** | **CD:0** | **Dry:0** | **BN:6** | **AN: 6** | **Wet: 6** |

For remaining years after license issuance, if triggers are met or if Iowa Hill is constructed, the resulting boating flow days are as follows:

| | | | | | |
|---|---|---|---|---|---|
| **ALL REMAINING LICENSE YEARS** | **CD:6** | **Dry:12** | **BN:18** | **AN:18** | **Wet:18** |

South Fork American River Below Chili Bar Reservoir Dam

***Comparison of Regulated and Unimpaired Recreational Streamflow Data for SFAR Below Chili Bar Reservoir Dam***

Pre-project and post-project hydrology for the Chili Bar Reach can be compared in many different ways. The simplest summary of changes caused by the UARP is that the UARP stores water that would normally run down the river in winter and spring and releases it through generators so that it runs down the river in summer and fall. The exact timing of the releases is determined primarily by White Rock and Chili Bar Powerhouse operations.

During winter/spring, typical UARP operations divert water from the SFAR at Slab Creek Reservoir Dam to peak generation at White Rock Powerhouse. Under regulated conditions, flows range up to about 4,000 cfs on a relatively frequent, sometimes daily basis, causing spills at Chili Bar Reservoir Dam of up to about 2,000 cfs in addition to the Chili Bar Powerhouse flow of 2,000 cfs and flow fluctuations in the Downstream Reach. During this period, flood flows have caused temporary spill events with flows much greater than 4,000 cfs.

During summer/fall when the SFAR is regulated, releases from the UARP's upstream storage controls water available to Chili Bar Reservoir. Although no formal operational coordination agreement is now in effect between the UARP and Chili Bar licensees, the licensees have coordinated operations of Chili Bar and White Rock Powerhouses as requested by commercial boating interests. Given a plan for the regular and reliable delivery of water of an agreed-upon daily volume from the UARP, slight adjustment in the daily timing of Chili Bar Powerhouse generation can also accommodate flows for whitewater recreation and minimum streamflows in the Downstream Reach (Devine Tarbell & Associates and Louis Berger 2005e, p. 19).

As a result, flows on the SFAR below Chili Bar Reservoir Dam are currently supplied by the approximately 60 percent of the drainage upstream, which is relatively unregulated in winter and spring, and by the UARP in summer and fall. Prior to the project "(B)oatable flows would not have occurred in the Reach much beyond the first part of June in the Critically Dry water year types and the end of July in Wet water year types" (Devine Tarbell & Associates and Louis Berger 2005e, p. 27).

The following chart shows the last day that the mean daily flow was at 1,300 cfs for each year, utilizing the synthesized unimpaired mean daily flows.

| Year | Last Day |
|---|---|
| 1976 | Never |
| 1977 | Never |
| 1988 | Never |
| 1992 | 18-Apr |
| 1987 | 01-May |
| 1994 | 13-May |
| 2001 | 23-May |
| 1985 | 26-May |
| 1981 | 27-May |
| 1990 | 03-Jun |
| 2000 | 09-Jun |
| 1991 | 12-Jun |
| 1979 | 13-Jun |
| 1989 | 13-Jun |
| 1997 | 18-Jun |
| 1986 | 19-Jun |
| 1996 | 19-Jun |
| 1984 | 21-Jun |
| 1975 | 01-Jul |
| 1993 | 01-Jul |
| 1978 | 02-Jul |
| 1999 | 02-Jul |
| 1980 | 07-Jul |
| 1982 | 08-Jul |
| 1998 | 24-Jul |
| 1995 | 30-Jul |
| 1983 | 02-Aug |

The median for the 27-year period of record is June 13.

As a result of the Projects, flows have become year-round instead of seasonal. In addition, in all but the wettest periods, the natural flows can be interrupted, intercepted, and time shifted by the Projects. This has made it necessary for the licensees to communicate and coordinate with the boating community to have predictable flows.

From 1976 through the mid-1990s, the UARP was dispatched by PG&E, and electricity production from the UARP was integrated into the entire Northern California grid. During this period it was possible for flows to be scheduled for the year as soon as the water year type/quantity was determined. A PG&E executive in the San Francisco office and a representative of the boating community would confer sometime in May, and flows were scheduled through October.

“Specific to the Reach Downstream of Chili Bar, the whitewater boating community established a dialog with Pacific Gas and Electric Company and SMUD’s hydroelectric operations staff in 1976. The purpose of this interaction was to improve communication between the utilities and the boating community, and to the extent possible, improve the timing, magnitude and duration of releases to accommodate suitable flows in the reach to benefit whitewater boating. The key contacts in the boating community who were interviewed reported that there has been less effective interaction between the parties since the late 1990s” (Devine Tarbell & Associates and Louis Berger 2005e, p. 26).

Things became more complicated and less predictable as SMUD became increasingly responsible for scheduling and dispatch, from the mid-1990s on. However, the water years from 1995 through 2000 were all AN or Wet, so close coordination was less important. There was generally lots of water at all times of the year.

In 2001, a Dry winter and energy deregulation led to the California Energy Crisis and resulted in the lowest average monthly flows on the reach downstream of Chili Bar Reservoir Dam of any summer since the UARP was built except for 1977. Use on the reach downstream of Chili Bar Reservoir Dam dropped by more than 50 percent from the previous year. That crisis led to development of an informal system of coordination which continued the following year.

> “Operations during summer/fall of 2002 are an example of coordinated hydroelectric generation and recreational use (see Chili Bar Hydroelectric Project Exhibit B). During that time, SMUD operated White Rock Powerhouse to deliver at least a pre-agreed volume of water to Chili Bar Reservoir in a manner determined in conjunction with commercial whitewater recreation interest groups. Resultant hydroelectric generation flows from Chili Bar Powerhouse assured minimum streamflows and ramping requirements were met” (Devine Tarbell & Associates and Louis Berger 2005e, p. 22).

This coordination has continued to the present and has led to a greater understanding on the part of all parties of the issues regarding flow regulation in the reach downstream of Chili Bar Reservoir Dam. In many ways, the past 5 years have served as a period of test flows that greatly aided in the development of the proposed flow regime for the reach downstream of Chili Bar Reservoir Dam.

***Development of Recreational Streamflows in All Water Year Types for SFAR Below Chili Bar Reservoir Dam***

The SFAR is one of the most popular whitewater rivers in the western United States;, in fact, there are more boaters per mile on the SFAR below Chili Bar Reservoir Dam than on any other reach in the nation, and this reach has the most commercial boaters of any reach in the western United States. The SFAR attracts a large group of users because of its proximity to the Bay Area, Sacramento, and various central valley cities; because of its level of difficulty, which allows users from beginners to those with moderate skill levels to use the river; and because it is one of the few remaining segments of river locally that is boatable during the entire year.

The SFAR is one of the most popular whitewater rivers in the western United States. There are more boaters per mile on the SFAR below Chili Bar Reservoir Dam than on any other reach in the country, and this reach has the most commercial boaters of any reach in the western United States. The SFAR attracts a large group of users because of its proximity to the Bay Area, Sacramento, and various central valley cities; because of its level of difficulty, which allows users from beginners to those with moderate skill levels to use the river; and because it is one of the few remaining segments of river locally that is boatable during summer months. It is critical to have reliable, boatable flows of a long enough duration to provide for a quality river experience to the public, reduce crowding and safety concerns, and reduce resource and management impacts associated with whitewater boating activities.

Annual use by whitewater boaters ranges from 100,000 to 150,000 users. BLM experiences 1,000-1,500 whitewater users on a weekend day during the peak season. BLM has built, maintained, and managed numerous recreation facilities within this 19.1-mile segment of river including remote composting toilet facilities, lunch and camping areas, parking areas, and boating launch and takeout sites to accommodate the large amount of whitewater boating use that occurs in this reach. Currently, private boaters and organized groups are the largest users of public lands, followed by commercial outfitters. Whitewater boaters use the public lands for rest stops, lunch and camping purposes, put-in and take-outs, and parking. Whitewater boaters are the largest group of users of public lands along the SFAR, and most of this use is a result of the regulated streamflows from operations of the UARP and Chili Bar hydroelectric projects. Eighty-five percent of this use occurs between June 15 and November 15, when the unimpaired hydrograph indicates that the river would not have had sufficient flows to support whitewater boating. In the spring months of March to June, only 15 percent of the overall use occurs on the SFAR. Boaters have numerous choices of river segments through out the state to run during the spring season, and the SFAR is used when these other segments become unrunnable.

Whitewater boating is an economic engine to Coloma – Lotus Valley residents. Whitewater boating is estimated to bring in between 17 and 33 million dollars annually to the local community. A substantial number of businesses have been created as a result of this industry, including retail stores, grocery stores, restaurants, campgrounds, commercial operators, private landowners with leases, photographers, gas stations, and even motion pictures. El Dorado County (in particular the Coloma - Lotus Valley area) have come to rely on consistent, regulated flows to bring tourists into the area.

> "Existing information and interviews with key contacts revealed that swimming, fishing, gold panning and gold dredging in the Reach Downstream of Chili Bar are mainly dependent on factors that are not affected by flows in the reach suitable for whitewater boating" (Devine Tarbell & Associates and Louis Berger 2005e, p. 1).
>
> "Unlike the four recreation activities discussed above, whitewater boating is heavily dependent on flows in the Reach Downstream of Chili Bar. Analysis of hydrology information indicated that operation of the UARP and Chili Bar Hydroelectric Project create whitewater boating opportunities in the reach

through the summer and fall seasons when typically there would be no boatable days during this time if the two projects did not exist" (Devine Tarbell & Associates and Louis Berger 2005e, p. 2).

Annual use by whitewater boaters ranges approximately from 60,000 to 150,000 users.

**Table 4.3.1-1. Annual river use from 1992 through 2003.**

| **Year** | **Non-commercial** | **Commercial** | **Total** |
|---|---|---|---|
| 1992 | 37100 | 78800 | 115,900 |
| 1993 | 47000 | 91500 | 138,500 |
| 1994 | 45000 | 73000 | 118,000 |
| 1995 | 42500 | 105000 | 147,500 |
| 1996 | 48700 | 94450 | 143,150 |
| 1997 | 45900 | 90750 | 136,650 |
| 1998 | 32000 | 76900 | 108,900 |
| 1999 | 38000 | 80900 | 118,900 |
| 2000 | 33600 | 89100 | 122,700 |
| 2001 | 15200 | 45750 | 60,950 |
| 2002 | 26500 | 60100 | 86,600 |
| 2003 | 30400 | 59450 | 89,850 |
| **Average Annual River Use** | 36,825 | 78,808 | 115,633 |

**Source**: 2003 Annual Report on the River Management Plan.

The majority of the whitewater users are due to the regulated streamflows that result from operations of the UARP and Chili Bar Hydroelectric Project. Eighty-five percent of this use occurs between June 15 and November 15, a period of time that the unimpaired hydrograph indicates that the river would not have had sufficient flows to support whitewater boating.

The extensive history of use made it unnecessary to conduct the same type of formal flow studies on the reach downstream of Chili Bar Reservoir Dam that were conducted on the Ice House, Camino, and Slab Creek reaches.

Three distinctly different flow regimes were on the reach downstream of Chili Bar Reservoir Dam in the years 2001 through 2005. In 2001, summer flows occurred reliably for only 3 hours at 1,000 cfs on weekends. In 2002, there were regular releases of 1,200 cfs for about 6 hours, except on Mondays. In 2003 through 2005, releases were shortened in duration and increased in magnitude to 1,500 cfs.

These different flow regimes greatly informed the boating community and resource agencies and led to a series of proposed future flow regimes that was presented and discussed extensively between 2002 and 2005, both within the relicensing process and outside in the community.

"The preliminary range of flow scenarios was developed by a sub-group of the Recreation TWG with expertise related to the level and timing of flows that could be considered to provide enhanced boating opportunities in the 19.1-mile Reach

Downstream of Chili Bar. The sub-group approached this task in a step-wise manner beginning with establishing four scenarios, which they characterized as 'Absolute Minimum', 'County Minimum RMP Target', 'Ideal Average Year Minimum', and 'Ideal Daily Flow.' The sub-group believed each successive scenario would provide an incremental improvement over the previous scenario in terms the magnitude of the release, timing and duration of the release or both. The incremental improvement achieved with changes in the magnitude of the flow would consist of an improved boating experience and some difference in difficulty class of the reach. The incremental improvement achieved with changes in the timing and duration of the release would consist of reduced crowding, increased safety and a higher quality experience for visitors when releases would allow boaters to begin their trips over a longer time period.

"Next, the sub-group considered the relative importance of providing whitewater boating opportunities on different days of the week. Recognizing that most boaters participate in this activity during their free time and that historically most of the whitewater boating use on weekends in the Reach Downstream of Chili Bar, the sub-group assigned one of the four flow scenarios to each day of the week; with flow scenarios providing the best opportunities assigned to the weekends.

"As a final step, the sub-group considered the relative quantity of flows provided in different water year types. Under the assumption that more water would be available in wet years, flow scenarios with higher flows and longer releases were assigned accordingly to one of four water year types. These water year types are not defined but are referred to as a spectrum of 'Driest' to 'Wettest'.

The sub-group presented their work to the Recreation TWG in a document entitled, "Strawman Flow Proposal South Fork American River" (Strawman Proposal) at the February 2002 meeting" (Devine Tarbell & Associates and Louis Berger 2005e, p. 12).

In 2003, the Strawman Proposal went through further refinement and a second flow proposal was developed and presented to the Recreational TWG on April 6, 2004. This flow proposal served as the basis for further discussion throughout the boating community and in the formal working groups.

In addition, the following items were taken into consideration in developing the recreational streamflow regime for SFAR below Chili Bar Reservoir Dam:

- EDC currently has a carrying capacity limit that allows no more than 300 boats in any 2-hour period in the various Class II – III rapids along the river (EDC 2001). That equates on average to no more than 2.5 boats entering a rapid in a 1-minute span or approximately one boat every 22 seconds, for 2 consecutive hours. Any more than that causes congestion and constraints on maneuverability that can be hazardous.
- The lower the water level gets the more congested the river becomes. Crowding on the river, where too many people and craft are trying simultaneously to run the rapids without adequate spacing, can cause serious boating safety hazards.

- The EDC carrying capacity limit has been exceeded only when the flows dropped below 1,300 cfs on a weekend day. Thirteen hundred cfs provides a necessary margin, particularly on weekends, to ensure that public safety is protected and the El Dorado County River Management Plan crowding thresholds are not triggered
- It takes 3 to 4 hours for a whitewater boating flow is released from Chili Bar Reservoir Dam to reach the Coloma/Lotus area and 7 to 8 hours to reach Folsom Reservoir. This means a release that achieves 1,300 cfs at Chili Bar Reservoir Dam at 7:00 am will not achieve 1,300 cfs until between 10:00 and 11:00 am in the Coloma/Lotus area and between 2:00 and 3:00 pm at Folsom Reservoir.
- The duration and timing of whitewater boating releases are critical, particular on weekends. Historical use patterns show that the vast majority of trips start after 10:00 am and end before 5:00 pm. A minimum of at least 3 hours of flow is necessary on each reach within this 10:00 am to 5:00 pm time window on summer weekends to accommodate the existing use without risking a violation of the EDC carrying capacity limits. To provide a 3-hour flow window on both the upper and lower reaches, it is necessary for the flow to be at least 6 hours in duration from 7:00 am to 1:00 pm.
- Providing a flow for each river segment that is adequate in duration and magnitude allows a choice to boaters of which segment to run and what time to launch. This diffuses the use so that one segment does not become overused, crowded, and potentially unsafe. This is especially critical on summer weekend days.
- A longer duration of flows also disperses use on the public lands, which thousands of boaters use each summer weekend day for put-in and take-outs, day use, and lunching purposes. Spreading this peak use by having longer flows at higher levels on weekend days substantially reduces overall impacts on the public lands and public land facilities.
- A well-crafted flow regime that tailors the flow duration to the user levels experienced historically provides the appropriate management window to meet the demand in a fashion that minimizes user conflicts, reduces potential boating safety issues, reduces congestion at put-in and take-outs, reduces resource impacts, and reduces congestion on Salmon-Falls Road.
- While extensive work was done to ensure the peak use periods were accommodated in the flow regime, the off-peak periods were also closely examined. It quickly became apparent that predictable flows were highly desirable in two key periods. During September and October, the weather is consistently warm, and demand for boating is substantial, particularly among institutional groups such as schools and churches. Predictable flows during these months, particularly on weekends and adjacent weekdays, are highly desirable. During winter weekends, boaters are on the SFAR whenever flows are sufficient. Again, predictable scheduled flows during this period are highly desirable.

During 2004 and 2005, an extensive review of the base case hydrology was conducted to determine the amount of water that would be available in the reach downstream of Chili Bar Reservoir Dam on a monthly basis for every month and the driest year of every water year type during the period of record.

Based on this analysis it was determined that not all the above objectives could be fully met in the driest years, but could be met in BN and wetter years. A final flow regime was prepared that followed the following principles and process:

- A minimum recreational streamflow of 1,300 cfs was established based on analysis of the actual flows during the last 5 years, including the return rate of river users, crowding, public safety, and carrying capacity.
- Minimum ecological streamflows for all water year types were developed, and the rationale for those minimum flows is provided in the Minimum Streamflows Rationale, above.
- The licensee's minimum energy reliability objective (MERO) release requirements from Union Valley Reservoir were used to establish minimum monthly summertime acre-foot targets, and recreational and ecological streamflows were kept within these targets.
- Upstream reservoir target levels were established to meet recreational and hydroelectric interests, respecting the licensee's MERO.
- The quantity of water available for each month of the period of record was then modeled and calculated.
- Based on that monthly quantity of water, a recreational streamflow regime was developed according to the following principles.
    - Highest priority was given to summer weekend days because the highest volume of use occurs then.
    - The next priority was summer mid-week days.
    - The next priority was spring and fall weekend days.
    - The next priority was spring and fall mid-week days.
    - The next priority was winter weekend days.
    - Summer weekends were given the longest flow duration and magnitudes in order to accommodate the highest amount of use.
    - In drier years weekend flows were reduced in duration and magnitude
    - In drier years mid-week days were reduced in quantity throughout the year

## Fish Stocking

### Objectives Addressed by Fish Stocking

Recreation Management Objective
Lake Fishing Objective

### Information Used to Establish Fish Stocking

The following information was used to establish the measures for fish stocking:: (a) Upper American River Project Initial Information Package (SMUD 2001), (b) Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d), (c) Visitor Use and Impact Technical Report (Devine Tarbell & Associates and Louis Berger 2005f), (d) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (e) Stream Angler Focus Group Technical Report (Devine Tarbell & Associates and Louis Berger 2004), (f) Kyle Murphy, CDFG, personal communication to Stafford Lehr, CDFG (CDFG 2005a), and (g) Reservoir Fisheries Technical Report (Devine Tarbell & Associates and Stillwater Sciences 2004e).

### Rationale for Fish Stocking

The Crystal Basin area of the UARP experiences approximately 330,000 visitor days annually (Devine Tarbell & Associates and Louis Berger 2004d). Visitor surveys indicated that the single most important recreational activity, Project-wide, was reservoir fishing (26.5 percent of the respondents). These responses coupled with the individual visitor use surveys for each of the three main project reservoirs places a huge demand upon the fishery.

CDFG currently stocks 27,000 pounds of catchable size rainbow trout. On average these fish are 12 to 14 inches long and weigh approximately 0.5 pound each. Union Valley Reservoir receives an annual allotment of 7,000 pounds of rainbow trout; Ice House and Loon Lake Reservoirs each receive 10,000 pounds annually. The additional 50,000 pounds would supplement this annual allotment. This would also meet the California Fish and Game Commission’s policy of encouraging CDFG to enter into cooperative stocking programs with public and private entities.

CDFG gages reservoir fishing success by examining the catch-per-unit-effort (CPUE). This is typically expressed in number of fish caught per hour fished. CDFG seeks to attain CPUEs of 1.0 fish per hour or greater and a high level of angler satisfaction for most reservoirs managed as cold water fisheries. A reservoir fishery is classified as good to excellent if the CPUE is 1.0 fish per hour or greater, fair to good if the CPUE is 0.5 to 1.0 fish per hour, and poor to fair if the CPUE is 0.0 to 0.5 fish per hour. As with any gradation scale, some fisheries are difficult to classify; therefore, angler attitudes are also evaluated to determine the satisfaction of their experience. This is very subjective, as anglers ranging from those who catch fish and those who catch no fish rate their experience anywhere from “ok” to “poor.” The angler attitudes are coupled with the CPUE to make an overall determination that the fishery is either satisfactory or could be improved via management.

In 2004, the licensee conducted an angler survey on Loon Lake, Union Valley, and Ice House Reservoirs from March to June, and CDFG surveyed anglers at Loon Lake and Ice House Reservoirs from July through October.

The licensee's survey found CPUEs as follows:

| | |
|---|---|
| Union Valley Reservoir | CPUE = 0.48 fish/hour |
| Loon Lake Reservoir | CPUE = 0.28 fish/hour |
| Ice House Reservoir | CPUE = 0.15 fish/hour |

Angler Satisfaction: 86.5 percent were satisfied with the experience; 13.8 percent were not satisfied.

CDFG's survey found CPUEs as follows (CDFG 2005a):

| | |
|---|---|
| Loon Lake Reservoir | CPUE = 0.85 fish/hour |
| Ice House Reservoir | CPUE = 0.66 fish/hour |

Angler Satisfaction: At Loon Lake Reservoir, 98 percent were satisfied with the experience, and 2 percent were not satisfied with the experience. At Ice House Reservoir, 93 percent were satisfied with the experience, and 7 percent were not satisfied with the experience.

When the complete data set is analyzed, it appears that angling success is correlated to the frequency and timing of CDFG's stocking of catchable trout. CDFG seeks to increase the angling success during periods when stocking is less frequent or during periods of heavy use (holiday weekends and summer months).

The licensee's visitor surveys found that 61.4 percent of respondents at Union Valley Reservoir indicated they had or would be participating in reservoir fishing as an activity during their trip to the UARP. In addition, 28.1 percent of respondents indicated that reservoir angling was the primary recreational activity. At Ice House Reservoir, surveys found 55.6 percent of respondents indicated that angling was an activity they had or would be participating in, with 31.1 percent of all respondents indicating reservoir fishing was their primary recreational activity. Finally, at Loon Lake Reservoir, surveys indicated that 54.9 percent of respondents indicated reservoir fishing was an activity they had or would be participating in, and 33.7 percent of the Loon Lake Reservoir respondents cited reservoir angling as their primary recreational activity. These survey results indicate how significant reservoir-based fishing is to the visitor to the UARP, with the single most important activity at each of the three main storage reservoirs being reservoir fishing (Devine Tarbell & Associates and Louis Berger 2004f).

These CPUE figures, coupled with the data indicating that reservoir angling was the highest recreational activity Project-wide, show a large need for additional angling opportunities. The increased numbers of fish will assist in raising the CPUE closer to CDFG's goal in the three main Project reservoirs. It will also assist in meeting the increased demands that are expected as the population grows in the surrounding areas. Visitor utilization of this area is expected to rise concurrently with the population growth the region is experiencing.

## Visual Resource Protection

### Objectives Addressed by Visual Resource Protection

Visual Resources Objective
Wilderness and Wild and Scenic River Objective
Resource Protection Objective

### Information Used to Establish Visual Resource Protection

The following information was used to establish this condition: (a) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (b) National Forest Landscape Management Volume 1 (USDA 1973c), (c) National Forest Landscape Management Volume 2, Chapter 1, The Visual Management System (USDA 1974), (d) Visual Assessment of UARP Project Features Technical Report (Devine Tarbell & Associates and Goodavish 2004a), (e) Visual Assessment of UARP Project Operations Technical Report (Devine Tarbell & Associates and Goodavish 2004b), (f) The South Fork American River: A Management Plan (USDI 2004), (g) Final Sierra Planning Area Management Framework Plan Amendment and Environmental Assessment (USDI 1988), (h) Sierra Planning Area Management Framework Summary (USDI 1983a), and (i) Folsom Resource Area Sierra Planning Area Management Framework Plan (1983b).

### Rationale for Visual Resource Condition

The Eldorado National Forest Land and Resource Management Plan and The South Fork American River: A Management Plan define visual quality objectives for National Forest System and BLM lands in the Project areas. Some Project facilities and operations are visible on the landscape and contrast with the surrounding forested setting. Project roads, campgrounds, and facilities are obvious to the casual observer. Conditions and recommendations in this section are intended to decrease conflicts with visual management objectives of the National Forests and BLM, yet allow continued operation of the Projects. Where Project facilities cannot be made to comply with the current visual objectives during the environmental review process, altering the VQO/VRM designations can be considered.

Reasons for painting Rubicon Reservoir facilities black are as follows: The Rubicon Reservoir was removed from the Desolation Wilderness in 1969 due to the existence of manmade facilities that made it inconsistent with the Wilderness concept. The bill that removed the reservoir requires that the area be managed in a manner consistent with the adjacent wilderness. The VQO for the adjacent wilderness is Preservation where management activities, except for very low visual impact recreation facilities, are prohibited. The Project facilities are inconsistent with the Preservation VQO. Proposed mitigations will not bring the Project facilities into conformance with the Forest Plan and the 1969 amended Desolation Wilderness Act, but will reduce the existing negative visual condition. The facilities are visible from the Rubicon Trail (16E30) and the reservoir's shoreline. The existing galvanized metal has weathered over the years, reaching a reduced reflective nature, but the light color continues to contrast with the surrounding landscape. Painting the facilities a non-reflective black will allow them to blend into the shadows when viewed from any distance except the immediate proximity. Recreational visitors along the shoreline near the dam will be aware of the facilities to the same degree as currently exists. From the trail, the facilities will be less noticeable.

Reasons for painting facilities are as follows:

The table below lists the visible project facilities, their associated Eldorado National Forest managed viewsheds, the distance they are viewed from, and the assigned VQO.

| **Project Facilities** | **Location Facilities are Visible From (Managed Viewshed)** | **Distance Zone** | **Assigned VQO** |
|---|---|---|---|
| Robbs Peak Forebay Facilities | Ice House Rd. (17N12) | Foreground | Retention |
| Robbs Powerhouse Facilities | Big Hill Vista | Middleground | Retention |
| | Union Valley Reservoir | Foreground Middleground | Retention |
| Union Valley Dam & Sub-station Facilities | Bryant Springs Rd. | Foreground | Partial Retention |
| Loon Lake Sub-station | North Loon Rd. (13N18) | Foreground | Retention |
| Loon Lake Passive Reflector | North Loon Rd. (13N18) | Middleground | Retention |
| Loon Lake Gate Shaft | North Loon Rd. (13N18) | Foreground | Retention |
| Gerle Reservoir Dam Facilities | Gerle Reservoir | Foreground | Retention |
| | Gerle Day Use Rec Site | Middleground | Retention |
| SMUD-owned weather stations | Varies | Varies | Varies |

The retention VQO provides for management activities that are not visually evident. The partial retention VQO allows for management activities that remain visually subordinate to the characteristic landscape. All facilities listed above are out of compliance with their Forest Plan acceptable VQO. The proposed mitigation to darken the colors as stated in the offer of settlement 4e conditions will not bring the project facilities into compliance with the Forest Plan, but will improve the visual quality by reducing the contrast between the facilities and the surrounding natural landscape as viewed from their corresponding viewsheds.

## HERITAGE RESOURCES

### Applicable Sections

Articles 1-28 and 2-17, Heritage Resources
Articles 1-29 and2-18, Heritage Resource Discovery

### Existing Conditions

The FS has identified concerns with current and past cultural resource management resulting from Project-related operations and activities that directly and indirectly affect cultural resource sites within the project's Area of Potential Effect (APE). These project-related impacts include:

- Damage to cultural resource sites from erosion and terracing along the shorelines of the Project reservoirs due to wave action and fluctuating lake levels.
- Damage to cultural resource sites from human impacts such as roads, OHV trails, and foot trails going directly through heritage resource sites; and camping sites and Project reservoirs located directly on cultural resource sites.

### Desired Conditions

The desired condition within the APE is to mitigate damage to significant historic properties pursuant to the National Historic Preservation Act of 1966, as amended.

### Heritage Resources and Heritage Resources Discovery

#### Objectives Addressed by Heritage Resources Measures

Cultural Resources Objective
Resource Protection Objective

#### Information Used to Establish Heritage Resources Measures

The following information was used to establish these conditions: Federal laws, regulations, policies, and procedures related to Cultural Resource Management.

#### Rationale for Heritage Resources Measures

The licensing of the Project is a federal undertaking requiring compliance with Section 106 of the National Historic Preservation Act, which requires any Federal undertaking to consider historic properties and afford the Advisory Council on Historic Preservation an opportunity to comment on the undertaking before issuance of the license (16 U.S.C.). Sections 32 and 33 will fulfill these Federal obligations.

## TRANSPORTATION AND FACILITY MANAGEMENT

### Applicable Sections

Article 1-30, Transportation System Management
Article 1-31, Trails System Management
Article 1-32, Facility Management

### Existing Conditions

- Transportation planning between the licensee and the FS has not been done on all roads used for the Project.
- Road use permits do not include all Project roads.
- Project roads may not meet FS standards.
- The licensee may not be completing its fair share of road maintenance.
- There is no inventory and management plan for Project buildings located on National Forest System lands.

### Desired Conditions

- Develop and implement a Transportation Management Plan.
- Minimize disruption of natural hydrologic flow paths, including diversion of streamflow and interception of surface and subsurface flow.
- Upgrade the surfacing on the FS road system as necessary to protect the road and other resource values.
- Manage the FS transportation system to facilitate resource management activities, protect wildlife, meet water quality objectives, and provide recreational access.
- Review location and design specifications for roads built under permit or license, and require protection of all resources.
- Meet safety standards for protection of the recreating public, downstream property, and affected resources. Road conditions and maintenance shall be appropriate to achieve recreation and resource protection objectives.
- Forest Service handbook 7709.56, Chapter 4 states that the minimum traveled way shall be 12 feet on single lane roads with turnouts.
- Forest Service roads open to the public are also subject to requirements of the Highway Safety Act (FSM 1535.11, Memorandum of Understanding, Federal Highway Administration; FSM 7731, FSM 7733, and FSH 7709.59).
- Project buildings are inventoried and managed according to the Facility Management Plan.

## Transportation System Management Plan, Trails System Management Plan, and Facility Management Plan

### Objectives Addressed by Transportation System Management Plan, Trails System Management Plan, and Facility Management Plan

Transportation Management and Facilities Management
Resource Protection

### Information Used to Establish Transportation System Management Plan, Trails System Management Plan, and Facility Management Plan

The following information was used to establish this condition: (a) Code of Federal Regulations at 36 CFR 212.7, (b) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (c) Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d), (d) Visitor Use and Impact Technical Report (Devine Tarbell & Associates and Louis Berger 2005f), and (e) Project Sources of Sediment Technical Report (Devine Tarbell & Associates 2005c).
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### Rationale for Transportation System Management Plan, Trails System Management Plan, and Facility Management Plan

Pursuant to 36 CFR 212.7 (d), the licensee, as a principal user of National Forest roads is required to share in the maintenance of the road system, commensurate with their use. Project facilities must be inventoried and maintained.

Specific transportation needs were identified that are directly related to the Project or visitation and public use that is a result of the Project facilities and Project operations.

Northshore Loon Lake Road

Northshore Loon Lake Road is a segment of El Dorado County Road ELD 147 and is located along the north side of Loon Lake Reservoir between the bottom of the main dam and the auxiliary dam. This road provides access to Project facilities and Project-provided recreation facilities. This road was constructed by SMUD at the time the main and auxillary dams were raised. Currently, the road is paved from the auxiliary dam to just beyond Northshore Campground, where it drops suddenly and changes to a low standard gravel road, creating a safety hazard. This road receives a substantial amount of public use associated with Project-related recreation and is used by the licensee. Vehicle travel off this road leading to dispersed camping areas and the reservoir shoreline has created resource damage (Devine Tarbell & Associates and Louis Berger 2005f). Control of dispersed camping and access off this road is included in the recreation plan for this area in the Specific Recreation Measures section. The proposal to pave this section of road provides measures to reduce dust within the recreation facilities, allows for service vehicle access to the Ellis Creek Staging Area (which is now limited due to the condition of the road surface and steepness of the road grade), facilitates controlling unauthorized access off of this road, and provides safe appropriate access on this heavily used road.

North Union Valley Road

North Union Valley Road is located along the north side of Union Valley Reservoir and provides access to Project facilities and Project-provided recreation facilities. This road receives a substantial amount of public use associated with Project-related recreation and is used by the licensee. This road also crosses an area of private land, of which there is no easement for public use. Vehicle travel off this road leading to the reservoir shoreline has created resource damage. In addition, fecal coliform levels were high in this and other areas, indicating that water quality may be affected by the high recreational use (Devine Tarbell & Associates & Louis Berger 2005f). The proposed settlement provides measures to control inappropriate vehicle travel off North Union Valley Road to reduce resource damage.

FS Road 12N30D

There is a management need identified by the licensee to restrict vehicle access to the Junction Reservoir Dam, while providing parking spaces for visitors wanting to access the river below the dam. This need is specifically identified in the Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d). Providing an area for parking and vehicle turnaround is essential to meet the needs of public visitors.

Wrights Lake Tie Road

The intersection of the Wrights Lake Tie Road (Forest Road 11N37) and the road accessing Ice House Reservoir (also Forest Road 11N37) is at the entrance to the Ice House Campground. This leads to confusion and additional traffic within the campground from travelers who miss the intersection. In addition, the intersection poses a safety threat because of the proximity of the roads leading to the Ice House Campground Sanitation Station and to the licensee's tunnel access. Numerous near-miss traffic incidents have been reported.

Lakeshore Road (FS Road 11N52)

Lakeshore Road runs along the north side of Ice House Reservoir and provides public access to the reservoir shoreline and to Project-provided recreation facilities. This road receives a significant amount of public use associated with Project-related recreation. Several day-use sites are located off this road along the shoreline with associated resource damage. Vehicles were observed driving off the road and traveling below the reservoir's high-water mark during the studies (Devine Tarbell & Associates and Louis Berger 2005f). The proposed settlement provides measures to control inappropriate vehicle travel off Lakeshore Road to reduce resource damage.

## LAND MANAGEMENT

### Applicable Sections

Article 1-33, Vegetation Management Plan
Article 1-34, Fire Prevention, Response, and Investigation Plan

### Existing Conditions

- Continued emphasis on hydroelectric generation can be expected.
- Licensee studies show that recreational use of the Project is increasing, and is projected to continue to increase (see Recreation resource area above).
- There have been 12 large fires that have occurred near SMUD facilities (1916-1992).
- Fire Risk near Project reservoirs and dispersed areas is rated as “extreme” (Devine Tarbell & Associates and CRS 2004a).

### Desired Conditions

- Promote fire prevention commensurate with resource values at risk
- Treat natural fuels in the following order of priority: (1) public safety, (2) high-investment situations (structural improvements, powerlines, etc.), (3) known high fire occurrence areas, and (4) coordinated resource benefits, i.e., ecosystem maintenance for natural fire regimes
- Manage, construct, and maintain buildings and administrative sites to meet applicable codes and to provide necessary facilities to support resource management
- Inspect dams and bridges at prescribed intervals and provide maintenance necessary to keep them safe
- Provide for continued use of hydroelectric facilities
- Consider volcanic, seismic, flood, and slope stability hazards in the location and design of administrative and recreation facilities.

### Vegetation Management Plan and Fire Prevention Plan

#### Objectives Addressed by Vegetation Management Plan and Fire Prevention Plan Measures

Public Health and Safety
Vegetation Management and Fire Prevention
Resource Protection
Search and Rescue Assistance
Recreation Management
Hydropower Operations

**Information Used to Establish Vegetation Management Plan and Fire Prevention Plan Measures**

The following information was used to develop the Vegetation Management and Fire Prevention Plans measures: (a) Fire Risk and Protection Technical Report (Devine Tarbell & Associates and CRS 2004a) and (b) Eldorado National Forest Land and Resource Management Plan (USDA 1989).

The licensee's Project and watershed lands are within the Crystal Basin recreation area. The Crystal Basin recreation area has high visitor use due to the recreation opportunities created by the UARP. The Project area has a high number of wildland fires that are human-caused when compared to the number of wildland fire starts on the Eldorado National Forest as a whole. Wildland fires in the past (and very likely in the future) have been caused from accidental starts by recreationists using the Project waters and adjacent lands during fire season. Many fires are started in this concentrated area, as compared to the Eldorado National Forest as a whole. Only 21 percent of the forest is rated as "extreme" for fire risk with the Crystal Basin and Loon Lake being part of the 21 percent.

This UARP has created, and continues to create a wildfire threat. Project-related recreation on the reservoirs and Project reaches, including licensee-developed facilities and user-created dispersed sites, pose a substantial fire risk. The number of human-caused fire starts within 1/8 and ¼ of a mile from Project reservoirs and from selected dispersed sites showed values of "extreme" fire risk (Devine Tarbell & Associates and CRS 2004a). Project facilities, including generators, construction equipment, transmission and distribution lines, transformer sites, and other operation and maintenance activities contribute to this risk. The number of fires within 2 miles of transmission lines is also high relative to the general forest and is rated as "high" or "moderate" for fire risk (Devine Tarbell & Associates and CRS 2004a). Additionally, the risk of a catastrophic fire occurring on and from the Project is increasing due to the number of visitors to the Project area that are projected into the future.

While the results of a catastrophic fire cannot be predicted with certainty, there have been two major fires in the project area, Cleveland Fire (23,000 acres in 1992) and Icehouse Fire (18,000 acres in 1959). Those two large fires greatly impacted the Crystal Basin. Future large fires could likely result in damage to UARP facilities; loss of Project recreational facilities and opportunities; destruction of the visual/scenic beauty of the Project area for decades; large increases in sediment to the stream reaches within the Project area, with associated loss of aquatic life and impairment of habitat; large increases in particulate matter from fire and smoke, further impairing El Dorado County air quality; and shut-down of transmission lines and commensurate loss of electrical generation to avoid arcing of lines in smoke. All of these repercussions will result in unacceptable resource damage that will prevent attainment of desired conditions for this area as defined by applicable comprehensive plans as well as lost electrical generation and revenues. Although a wildland fire is inevitable, implementation of mitigations can delay and minimize those effects.

There have been numerous Forest Health fuels treatments completed by the FS in the Crystal Basin area around the Project reservoirs and near some of the transmission line corridors. The areas with fuels treatments will need follow-up treatments and prescribed burning and/or mastication to maintain their condition class into the future. Due to the high number of wildland fires, additional areas around the reservoirs and Project facilities need to be identified for treatment in the future. Partnerships between the FS and licensee on fuels projects will achieve effective treatments in the high fire risk areas in the UARP.

Public safety is another issue to be addressed. The number of visitors brought to the Crystal Basin by the Project facilities and reservoirs has increased the need for increased presence of FS personnel to deal with non-traditional responses, medical aids, and vehicle accidents. FS personnel are usually first on scene of those incidents and manage those incidents.

The Fire Prevention Plan and Vegetation Management Plan will address the objectives of: protecting Project facilities (including recreational facilities), minimizing damage to the resources, and providing for public safety. Given the known high incidence of fire starts and previously treated and untreated fuels in the area, it is necessary for the licensee to take reasonable preventative and pre-suppression actions to provide for these objectives.

## LAW ENFORCEMENT

### Applicable Sections

See Recreation, above.

### Existing Conditions

Project-related facilities and access to those facilities has led to increased public use of the areas within and around Project facilities. This public use includes recreational and commercial use and visitation for other purposes. This public use has led to various law enforcement needs, including incidents and violations related to illegal fires, unauthorized occupancy and use, resource damage, illegal use of roads and trails, vandalism, assistance in search and rescue activities, and investigations related to other criminal or illegal activities.

At this time, the licensee does not provide assistance to address Project-related or Project-caused law enforcement needs. The FS does not have the resources to deal with the level of Project-related law enforcement needed in a manner that meets FS requirements.

### Desired Conditions

Ensure that the law enforcement needed to manage public visitation and use of the Project-related facilities and surrounding areas is provided for public health and safety, protection of public and private resources (such as property, wildlife, and cultural resources), and to assist in search and rescue in a timely and appropriate manner. The appropriate level of licensee responsibility for law enforcement should be determined to assist in providing the law enforcement services needed, and the licensee should provide that level of assistance.

## <u>Law Enforcement</u>

### Objectives Addressed by Law Enforcement

Public Health and Safety
Reduction of human-caused fires
Resource Protection
Search and Rescue Assistance
Recreation Management
Hydropower Operations

### Information Used to Establish Law Enforcement

The following information was used to establish the need for law enforcement and the associated cost: (a) Socioeconomic Study of the Upper American River Project (CSUS 2004), (b) Potential Measures to Address Non-Water Related Impact to El Dorado County, (EDC 2004b), (c) Recreation Needs Technical Report (Devine Tarbell & Associates and Louis Berger 2005d), and (d) Eldorado National Forest Land and Resource Management Plan (USDA 1989).

### Rationale for Law Enforcement

Refer to Rationale for Recreation, Operation, Maintenance, and Administration Measures, above.

There is a need for ongoing law enforcement to provide for public health and safety, resource protection, assistance in search and rescue, and other needs related to public visitation resulting from the Project reservoirs. The Forest Plan (USDA 1989) states that the direction for Law Enforcement Management is to provide a safe forest environment for the public and employees of the FS, to prevent violations, to gather information of suspected violations, to issue citations for violations, and to cooperate with other law enforcement agencies to determine civil and criminal liabilities. The Forest Plan also states that the "primary purpose of law enforcement is to assure that use and occupancy of National Forest System lands is in reasonable compliance with established laws and regulations."

Table 3-11 and Appendix C of the Socioeconomic Study of the Upper American River Project show a large number of law enforcement incidents and violations in 2002 and 2003 in proximity to Project reservoirs in the Crystal Basin area, or associated with visitors attracted by these Project reservoirs. The majority of these incidents and violations involved illegal fires, unauthorized occupancy and use, and illegal use of roads and trails. These incidents and violations occur throughout the year, although the majority occur during the primary use season. The majority of these violations and incidents occur directly around the Project reservoirs.

Providing the necessary level of law enforcement requires one full-time law enforcement officer (LEO) with full peace officer authority, with assistance during peak periods and assistance in pursuing and managing incidents and cases. LEO authority is best suited for addressing situations such as enforcement of alcohol related laws, dealing with unruly or threatening behavior, use of firearms, and night activities. LEOs also work closely with the El Dorado County Sheriff's Office. Funds will provide for Project-wide enforcement of rules and regulations involving resource protection, law enforcement investigations, public protection, response to fires and other emergencies, assistance in search and rescue, and law enforcement administration and planning. Funds provided by the licensee will be used in conjunction with funds provided by the FS.

## Rationale for Protection, Mitigation, and Enhancement Measures – Iowa Hill Pumped Storage Project

The following section describes the scientific information and the rationale for the specific protection, mitigation, and enhancement measures in the settlement.

### Applicable Sections

Article 1-38 - Requirement to Obtain a Forest Service Special-Use Authorization for Additional National Forest System lands and for Certain Activities on National Forest System Lands
Article 1-39 - Compliance with Non-Iowa Hill Measures in this License
Article 1-40 - Aquatic Resources
Article 1-41 - Terrestrial Resources
Article 1-42 - Water Quality and Water Pollution
Article 1-43 - Groundwater
Article 1-44 - Compliance with Visual Quality Standards
Article 1-45 - Heritage Resources Protection
Article 1-46 - Road Use Permit
Article 1-47 - Spoils Disposal
Article 1-48 - Construction Noise
Article 1-49 - Bonds, Performance
Article 1-50 – Future Revisions to the Iowa Hill Pumped Storage Development

### Existing Conditions

- See applicable Existing Conditions, above, particularly those related to Slab Creek Reservoir and SFAR below Slab Creek Reservoir Dam.
- The proposed project does not meet the Eldorado National Forest Land and Resource Management Plan (USDA 1989) visual quality standards.
- There are many construction-related aspects of the project that need to be addressed.

### Desired Conditions

- See applicable Desired Conditions, above, particularly those related to Slab Creek Reservoir and SFAR below Slab Creek Reservoir Dam.
- The proposed project needs to be consistent with the Eldorado National Forest Land and Resource Management Plan (USDA 1989).

**<u>IOWA HILL PUMPED STORAGE PROJECT</u>**

**<u>Requirement to Obtain a Forest Service Special-Use Authorization for Additional National Forest System lands and for Certain Activities on National Forest System Lands</u>**

**Objectives Addressed by Requirement to Obtain a Forest Service Special-Use Authorization for Additional National Forest System lands and for Certain Activities on National Forest System Lands**

Consistency with Plans
Resource Protection

**Information Used to Establish Requirement to Obtain a Forest Service Special-Use Authorization for Additional National Forest System lands and for Certain Activities on National Forest System Lands**

The following information was used to establish this measure: (a) Code of Federal Regulations at 36 CFR 251, (b) Forest Service Manual 2771.1, and (c) Forest Service Handbook 2709.15.

**Rationale for Requirement to Obtain a Forest Service Special-Use Authorization for Additional National Forest System lands and for Certain Activities on National Forest System Lands**

Pursuant to 36 CFR 251.50 (a), all uses of National Forest System lands, improvements, and resources….are designated "special uses." Before engaging in a special use, persons or entities must submit an application to an authorized officer and must obtain a special-use authorization from the authorized officer.

FSH 2709.15 Hydroelectric Handbook, 61.72 – Relicensing (New License). Projects that receive new licenses require special-use authorizations.

**<u>Compliance with Non-Iowa Hill Measures in this License</u>**

**Objectives Addressed by Compliance with Non-Iowa Hill Measures in this License**

Refer to applicable objectives from Articles 1-1 through 1-38.

**Information Used to Establish Compliance with Non-Iowa Hill Measures in this License**

Refer to "Information Used" sections in Articles 1-1 through 1-38.

### Rationale for Compliance with Non-Iowa Hill Measures in this License

This measure is included because the licensee has stated that the Iowa Hill Pumped Storage Project will not affect other parts of the UARP operation. The UARP measures were developed with this intent.

## Aquatic Resources

### Objectives Addressed by Aquatic Resources Measures

Fisheries
Macroinvertebrates
Aquatic Biota
Water Temperature
Amphibians
Reservoir Levels
Hydropower Operations

### Information Used to Establish Aquatic Resources Measures

The following information was used to establish Iowa Hill Aquatic Resources measures: (a) Iowa Hill Fish Entrainment Technical Report (Devine Tarbell & Associates, Stillwater Sciences 2005f), (b) Stream Fisheries Technical Report (Devine Tarbell & Associates, Stillwater Sciences 2005j), (c) Iowa Hill Wetlands Technical Report (Devine Tarbell & Associates 2004p), and (d) Iowa Hill Water Temperature Technical Report (Devine Tarbell & Associates 2005a).

### Rationale for Aquatic Resources Measures

Several aquatic resources concerns surround the Iowa Hill project:

- Flow fluctuations as a result of the Iowa Hill project in the reach downstream of Slab Creek Reservoir may detrimentally affect amphibian and fish populations. Flow fluctuations that occur outside the natural flow regime tend to have consequences for aquatic species to which they are not adapted; for example, stranding spawning gravels or amphibian egg masses out of water or disrupting newly laid eggs by high flow velocities, or unexpected effects as a result of water temperature fluctuations.
- Cooling of flows below 12°C downstream of Slab Creek reservoir during the summer months at a time when foothill yellow-legged frogs may be cued into their reproductive activity may delay it. Foothill yellow-legged frogs could also reproduce sooner because of warmer temperatures and then be affected by water fluctuations during a critical time in their life cycle.
- The distribution of hardhead (FS sensitive species) in Slab Creek Reservoir of any age class may adversely be affected by too cool (or too warm) water from pump discharge.

- The distribution of the hardhead juveniles residing in the edgewaters of Slab Creek Reservoir may adversely be affected by the pump discharge velocities or water temperature changes. According to the Iowa Hill Fish Entrainment Potential Technical Report, hardhead juveniles in Slab Creek Reservoir were found primarily in the downstream shallow sides of the reservoir. Water temperatures at the downstream end of the reservoir (16°C) were 6°C warmer than the upstream end (10°C). If hardhead prefer the downstream end because of the warmer water, then water temperature fluctuations as a result of pump discharge may adversely affect that available habitat.
- Hardhead entrainment of any age class may occur by the Project.

## <u>Terrestrial Wildlife Resources</u>

### Objectives Addressed by Terrestrial Wildlife Resources Measures

Threatened, Endangered, and Sensitive Species and Management Indicator Species

### Information Used to Establish Terrestrial Wildlife Resources Measures

The following information was used to establish Iowa Hill terrestrial resources measures: (a) Iowa Hill Development Bats Technical Report (Devine Tarbell & Associates 2004h), (b) Iowa Hill Development California Spotted Owl Technical Report (Devine Tarbell & Associates 2004i), (c) Iowa Hill Development Mule Deer Technical Report (Devine Tarbell & Associates 2004j), (d) Iowa Hill Development Northern Goshawk Technical Report (Devine Tarbell & Associates 2004k), (e) Iowa Hill Development Valley Elderberry Longhorn Beetle Technical Report (Devine Tarbell & Associates 2004n), (f) Iowa Hill Development Vegetation Mapping and Wildlife Habitat Characterization Technical Report (Devine Tarbell & Associates 2004o), (g) Iowa Hill Wetlands Technical Report (Devine Tarbell & Associates 2004p), (h) Iowa Hill Development Bald Eagle Technical Report (Devine Tarbell & Associates 2005a), (i) Auditory Assessment of Iowa Hill Construction and Operation Technical Report (Devine Tarbell & Associates and CH2MHill 2005a), (j) Eldorado National Forest Land and Resource Management Plan (USDA 1989), and (k) Sierra Nevada Forest Plan Amendment Record of Decision (USDA 2004a).

### Rationale for Terrestrial Wildlife Resources Measures

The Iowa Hill Development will result in a permanent loss of open space and undeveloped habitat available to terrestrial wildlife species, including FS-sensitive species and management indicator species such as deer and black bear. A proposed license condition for in-kind replacement of habitat through land purchase or purchase of conservation easements has been developed to mitigate for habitat loss associated with the development.

## Water Quality and Water Polllution

### Objectives Addressed by Water Quality and Water Pollution Measures

Water Quality Objective
Water Temperature Objective
Aquatic Biota Objective
Recreation Objective

### Information Used to Establish Water Quality and Water Pollution Measures

The following information was used to develop the Iowa Hill water quality and water pollution section: (a) Central Valley Regional Water Quality Control Plan (Basin Plan) (Regional Water Quality Control Board 1998); (b) Clean Water Act at Title 33 U.S.C. sections 1251-1387; (c) California Water Code, Division 7. Water Quality (State Water Resources Control Board 2005); and California Fish and Game Code sections 1600-1616.

### Rationale for Water Quality and Water Pollution Measures

Pursuant to the Federal Water Pollution Control Act (Clean Water Act: Title 33 U.S.C. sections 1251-1387), prior to any activities that may result in discharge to the waters of the nation or may require the dredge or fill of materials into or adjacent to navigable waters, application must be made to the appropriate regulatory agencies for Section 401 Certification and Section 404 Permits. In addition, other state and federal permitting or oversight may be required to ensure that measures are taken to prevent impacts to water quality, fish or other aquatic life, or health of the aquatic-terrestrial interface and wildlife supported therein.

## Groundwater

### Objectives Addressed by Groundwater Measures

Groundwater Objective
Aquatic Biota Objective

### Information Used to Establish Groundwater Measures

The following information was used to develop the Iowa Hill groundwater section: (a) USDA Forest Service Technical Guide to Managing Ground Water (USDA 2005b) and (b) Eldorado National Forest Land and Resource Management Plan (USDA 1989).

**Rationale for Groundwater Measures**

The Eldorado National Forest Land and Resource Management Plan includes the following direction: “Prevent loss of groundwater quality and quantity.” The Forest Plan also states that a geotechnical assessment of any project that might adversely impact the groundwater table shall be conducted.

<u>Completed Survey</u>

A completed survey that encompasses the portion of the Project area that would be potentially affected by the proposed tunnel is necessary because the Technical Guide states… “a careful inventory of the quantity and quality of groundwater on National Forest System lands affected by the proposed project is needed to provide sufficient information to appraise the value and provide appropriate stewardship of these ground water resources.”

Ensuring sustainability of natural resources has become a fundamental requirement for Federal land management. In preparing to manage groundwater resources within this framework, the following independent questions must be addressed:

- How much groundwater is there, where is it, and what is its quality?
- What are the existing uses of groundwater?
- What are the interconnections between the groundwater and the surface water systems?
- To what extent do other natural resources depend on groundwater?
- How vulnerable is the aquifer to contamination or depletion?

To answer these questions, groundwater resources must be inventoried and assessed.

<u>Monitoring of Seeps and Creeks</u>

Monitoring of the springs and creeks for 5 years after the tunneling operation is completed with monitoring data submitted monthly to FS and written monitoring reports submitted biannually to FS by June 1 and December of each year is needed to design inventories and monitoring programs to:

- Gather enough information to develop management alternatives that will protect groundwater resources.
- Evaluate management concerns and issues expressed by the general public.
- Develop estimates of the usable quantity of groundwater in aquifers and monitor to detect over-pumping.
- Define the present situation and detect spatially explicit changes or trends in groundwater quality or quantity and health of groundwater dependent ecosystems; detect impacts or changes over time, and quantify likely effects from human activities.

In addition, the Technical Guide states that the FS shall assign high priorities for survey, inventory, analyses, and monitoring to municipal water supplies, sensitive aquifers, unique groundwater dependent ecosystems, and high value or intensively managed watersheds.

Accurate Quantification of Groundwater Encountered During Tunnel Boring Operations

See "Completed Survey," above.

Method for Verifying that Groundwater Seepage is Not Occurring After Construction

See Forest Plan direction and "Completed Survey," above.

Identification of Corrective Measures

See Forest Plan direction and "Completed Survey," above.

Mitigation of Any and All Identified Impacts

The Technical Guide states that ecological processes and biodiversity of groundwater-dependent ecosystems shall be protected and directs the FS to plan and implement to minimize adverse impacts on groundwater dependent ecosystems by:

- Maintaining natural patterns of recharge and discharge, and minimizing disruption to groundwater levels that are critical for ecosystems.
- Not polluting or causing changes in groundwater quality.
- Rehabilitating degraded groundwater systems where possible.

The Technical Guide also states that groundwater dependent ecosystems shall be managed to satisfy various legal mandates, including but not limited to, those associated with floodplains, wetlands, water quality, dredged and fill material, endangered species, and cultural resources

The Technical Guide further states that the FS shall manage groundwater-dependent ecosystems under the principles of multiple use and sustained yield, while emphasizing protection and improvement of soil, water and vegetation, particularly because of effects upon aquatic and wildlife resources and that preferential consideration to groundwater-dependent resources shall be given when conflicts among land use activities occur.

## Visual Quality Standards

### Objectives Addressed by Visual Quality Measures

Visual Quality Objective

### Information Used to Establish Visual Quality Measures

The following information was used to develop the Iowa Hill visual quality section: (a) Eldorado National Forest Land and Resource Management Plan (USDA 1989), (b) National Forest Landscape Management Volume 1 (USDA 1973c), (c) National Forest Landscape Management Volume 2 (USDA 1974), and (d) Iowa Hill Visual Resources Technical Report (Devine Tarbell & Associates and Goodavish 2005b).
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### Rationale for Visual Quality Measures

The Iowa Hill Pumped Storage Project as proposed does not comply with the visual quality standards in the Eldorado National Forest Land and Resource Management Plan. Specifically, the views of the berm around the Iowa Hill Reservoir do not meet the standards. The development of a new alternative is necessary so that the proposed Iowa Hill Pumped Storage Project meets the visual quality standards of the Eldorado National Forest Land and Resource Management Plan. The plan specifications and simulated views of the new alternative are necessary so the FS can determine whether the new alternative meets Eldorado National Forest Land and Resource Management Plan standards.

## Heritage Resources Protection

### Objectives Addressed by Heritage Resources Measures

Cultural Resources Objective
Resource Protection Objective

### Information Used to Establish Heritage Resources Measures

The following information was used to establish the Iowa Hill heritage resource protection measure: Federal laws, regulations, policies and procedures related to Cultural Resource Management.

### Rationale for Heritage Resources Measures

The licensing of the Project is a Federal undertaking requiring compliance with Section 106 of the National Historic Preservation Act, which requires any Federal undertaking to consider historic properties and afford the Advisory Council on Historic Preservation an opportunity to comment on the undertaking before issuance of the license (16 U.S.C.). Conditions 55 and 56 will fulfill these Federal obligations.

## Road Use Permit

### Objectives Addressed by Road Use Permit

Transportation Management and Facilities Management
Resource Protection

### Information Used to Establish Road Use Permit

The following information was used to establish the Iowa Hill road use permit measure: (a) Code of Federal Regulations at 36 CFR 251; (b) Forest Service Manual 2771.1; and (c) Forest Service Handbook 2709.15.

### Rationale for Road Use Permit

Pursuant to 36 CFR 251.50 (a), all uses of National Forest System lands, improvements, and resources ….are designated "special uses." Before engaging in a special use, persons or entities must submit an application to an authorized officer and must obtain a special-use authorization from the officer.

FSH 2709.15 Hydroelectric Handbook, 61.52e – Roads. Single-purpose roads built in the Project area and used as Project facilities must be included in the hydroelectric special-use authorization. Separate authorizations are required for (1) roads that are to be part of the Forest Development Road System (for access to an area and to be open to the public) and (2) reconstruction and use of existing system roads.

## Spoils Disposal

### Objectives Addressed by Spoils Disposal Measures

Water Quality Objective
Aquatic Biota Objective
Consistency with Plans

### Information Used to Establish Spoils Disposal Measures

The following information was used to develop the Iowa Hill spoils disposal measures: (a) Central Valley Regional Water Quality Control Plan (Basin Plan); (b) Clean Water Act at Title 33 U.S.C. sections 1251-1387; and (c) California Water Code, Division 7. Water Quality (State Water Resources Control Board 2005).

### Rationale for Spoils Disposal Measures

Pursuant to the Porter Cologne-Water Quality Control Act (California Water Code, Division 7. Water Quality, section 13260) and the Federal Clean Water Act, any person discharging waste, or proposing to discharge waste, within any region that could affect the quality of the waters of the state shall file with the appropriate regional water quality control board, a report of the discharge.

## Construction Noise

### Objectives Addressed by Construction Noise Measures

Special Use Authorization Objective
Consistency with Plan Objective
Recreation Management Objective

### Information Used to Establish Construction Noise Measures

The following information was used to develop the Iowa Hill construction noise measures: (a) Auditory Assessment of Iowa Hill Assessment of Construction Operations Technical Report (Devine Tarbell & Associates and CH2MHill 2005a), (b) Eldorado National Forest Land and Resource Management Plan (USDA 1989), and (c) information from concerned members of the public.

### Rationale for Construction Noise Measures

The proposed project is in the vicinity of many private landowners as well as recreationists. The proposed project also has the potential to affect various wildlife specified in the project area (Devine Tarbell & Associates and CH2MHill 2005a).

## Rationale for Other FS and BLM Protection, Mitigation, and Enhancement Measures

The following section describes the scientific information and the rationale for the specific protection, mitigation, and enhancement measures in Appendices 3 and 4 of the settlement.

### OTHER FS AND BLM PROTECTION, MITIGATION, AND ENHANCEMENT MEASURES

### Applicable Sections

Conditions 3-1 and 4-1 - Forest Service Approval of Final Design and BLM Approval of Final Design
Conditions 3-2 and 4-2 - Approval of Changes
Conditions 3-3 and 4-3 - Consultation
Conditions 3-4 and 4-4 - Modification of 4(e) Conditions After Biological Opinion or Water Quality Certification
Conditions 3-5 and 4-5 - Surrender of License or Transfer of Ownership
Conditions 3-6 and 4-6 - Valid Claims and Existing Rights
Conditions 3-7 and 4-7 - Compliance with Regulations on National Forest System Lands and Bureau of Land Management Lands
Conditions 3-8 and 4-8 – Damage to Land, Property, and Interests of the United States
Conditions 3-9 and 4-9, Indemnification
Conditions 3-10 and 4-10 - Surveys, Land Corners
Conditions 3-11 and 4-11 - Hazardous Substances Plan
Conditions 3-12 and 4-12 - Use of Explosives
Conditions 3-13 and 4-13 - Pesticide Use Restrictions
Conditions 3-14 and 4-14 – Risks and Hazards on National Forest System Lands and BLM Lands
Condition 3-15 - Project Access Roads
Condition 3-16 – Traffic Safety
Conditions 3-17 and 4-16 - Access and Road Use By Licensee
Conditions 3-18 and 4-17 – Crossings
Condition 3-19 – Access by the United States
Condition 4-15 – Access and Road Use by Government
Conditions 3-20 and 4-18 - Signs
Conditions 3-21 and 4-19 - Construction Inspections
Conditions 3-22 and 4-20 - Unattended Construction Eqipment,
Conditions 3-23 and 4-2 - Maintenance of Improvements
Conditions 3-24 and 4-22 - Erosion Control Plan
Conditions 3-25 and 4-23 - Solid Waste,and Waste Water Plan, New Construction and Project Maintenance and Operation
Conditions 3-26 and 4-25 - Water Quality and Water Pollution

**Objectives Addressed by Other FS and BLM Protection, Mitigation, and Enhancement Measures**

Consistency with Plans

**Information Used for to Establish Other FS and BLM Protection, Mitigation, and Enhancement Measures**

The following information was used to establish these conditions: (a) Eldorado National Forest Land and Resource Management Plan (USDA 1989) (b) The South Fork American River: A Management Plan (USDI 2004), and (c) Sierra Management Framework Plan Amendment

**Rationale for Other FS and BLM Protection, Mitigation, and Enhancement**

Forest Service Approval of Final Design/BLM Approval of Final Design

Approval of Changes

Consultation

The FS' Eldorado National Forest Land and Resource Management Plan and its amendments and BLM's The South Fork American River: A Management Plan contain numerous requirements that must be met before construction or if changes in Project implementation are proposed. In addition, new information may become available that demonstrates that revision of the Section 4(e) conditions is necessary to accomplish protection and use of National Forest System resources or BLM lands. The standard conditions address these items and ensure that the Project does and will continue to meet the requirements in the Eldorado National Forest Land and Resource Management Plan and The South Fork American River: A Management Plan.

Please see the General Discussion at the end of the list of other conditions.

Modification of 4(e) Conditions After Biological Opinion or Water Quality Certification

This condition is necessary to ensure compliance with the Endangered Species Act and the Clean Water Act. In addition, p. 4-295 of the Eldorado National Forest Land and Resource Management Plan requires the FS to coordinate with the California State Water Quality Control Board regarding instream flows related to fisheries, disturbance of riparian vegetation, water quality maintenance, and recreation needs (USDA 1989).

Surveys, Land Corners

Page 4-106 of the Eldorado National Forest Land and Resource Management Plan (USDA Forest Service 1989) requires that the FS provide for maintenance of property lines.

Pesticide Use Restrictions

Page 4-292 of the Eldorado National Forest Land and Resource Plan requires the FS to consult with the SWRCB regarding all pesticide projects within 100 feet of flowing streams. This requirement is also necessary to comply with EPA standards.

<u>Project Access Roads</u>

<u>Access and Road Use By Government/United States</u>

<u>Traffic Safety</u>

<u>Access and Road Use By Licensee</u>

<u>Crossings</u>

<u>Signs</u>

<u>Road Use</u>

<u>Construction Inspections</u>

Pages 4-107 and 4-108 of the Eldorado National Forest Land and Resource Management Plan describe the requirements for open roads, closed roads, and roads related to licenses.

<u>Erosion Control Plan For New Construction and Measures For Project Maintenance and Operations</u>

<u>Solid Waste and Waste Water Plan, New Construction and Project Operation and Maintenance</u>

<u>Water Quality and Water Pollution</u>

The Eldorado National Forest Land and Resource Management Plan (USDA 1989) contains various requirements addressing erosion control and water quality. In particular, applicable riparian conservation objectives described on pp. 62 through 66 in the Sierra Nevada Forest Plan Amendment Final Supplemental Environmental Impact Statement Record of Decision (USDA 2004a) apply.

<u>General Discussion for all Other FS/BLM Conditions</u>

The "other" conditions include requirements that serve to address the statutory and administrative responsibilities of the Eldorado National ForestForest Service and Bureau of Land Management. These conditions address the FS concerns related to maintenance of the Project improvements; existing valid claims and rights to the land occupied by the Project; compliance with Federal, State, county and municipal laws and regulations; protection of Federal property; indemnification; water pollution; risks and hazards; signs, pesticide use restrictions; access; road use; and hazardous materials. FERC is not the agency responsible for administering National Forest System lands and BLM lands and cannot be expected to condition the Project license relative to the Eldorado National Forest Land and Resource Management Plan (USDA 1989) and the numerous laws, regulations, and agency policies that pertain to this National Forest System land. Including these conditions would ensure that project operations are consistent with management direction for the Forests.

During annual consultation meetings, useful information such as the timing of moving large equipment over Forest roads, spill events, and physical changes to Project features will be addressed. The FS could use the information to minimize user conflicts, particularly in the area of recreation, and schedule Forest personnel time for administration of the ongoing project.

There is a potential concern that Project features could be responsible for damage, injury, or death if the public accesses these features. Since these features are the property of the licensee, and not the FS, a license condition to require the licensee to indemnify the FS against damage, injury, or death associated with the use and/or occupation of National Forest System lands authorized by the Project license will protect the public interest.

Project facilities and activities may pose a threat of fires or other possible destruction of habitat with resultant losses of other resource values, injury, and human life. It is appropriate that the licensee take measures to minimize the risk to federal land and human life. Including license conditions that address these hazards provides an incentive to the licensee to eliminate or minimize risks associated with Project facilities and operations and to provide protection of Forest resources by preparing a plan for responding to wildland fires.

The Surrender of License condition would require the licensee to restore National Forest System lands in the event the license is surrendered. This condition would minimize the risk of Project improvements being abandoned on the Forests.

The remaining license conditions would provide protection for public health and/or safety and Forest resources on National Forest System lands by requiring compliance with laws, regulations, and statutory requirements that guide the FS in managing the Federal land occupied by the Project.

## Energy Generation Comparison

The settlement agreement does not affect the capacity of the UARP or Chili Bar projects, and it is not expected to have a noticeable impact on the licensee’s ability to generate during on-peak periods. As has been described throughout this rationale, the settlement agreement was developed by carefully balancing aquatic streamflow, reservoir recreation, and recreation streamflow objectives with the licensee’s hydropower interests using the HEC-ResSim Model of the projects (UARP Model) developed by resource agency staff (CDFG 2007).

While not specifically designed as an energy generation tool, the UARP Model does report energy generation with sufficient accuracy to be used to evaluate the overall difference in generation between alternatives.  The following table compares the difference in cumulative energy generation between the Base Case alternative and the settlement agreement for the UARP and Chili Bar projects over the period of record from October 1974 through December 2000.

| | **UARP** | **Chili Bar** |
|---|---|---|
| Base Case Alternative | 48,353,056 MWh | 912,385 MWh |
| Settlement Agreement Alt. | 44,982,732 MWh | 915,716 MWh |
| Difference | 3,369,624 MWh | (3,331 MWh) |
| Percent Difference | **7.0% Loss** | **0.4% Gain** |

As can be seen in the table, the settlement agreementis expected to result in an average annual reduction in generation of approximately 7.0 percent for the UARP, and an average annual increase in generation of 0.4% for the Chili Bar Project. (The generation increase for the Chili Bar Project is primarily due to improved coordination between the two projects.) These values are expected to vary and may be more or less depending on the runoff and license requirements applicable to each specific water year.

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## Abbreviations

| | |
|---|---|
| 4WD | Four Wheel Drive |
| ALP | Alternative License Process |
| ALTERNATIVE | Agencies and NGO's Alternative for FERC to use in developing their EIS |
| AN | Above Normal Water Year Type |
| ATV | All Terrain Vehicle |
| BASECASE | UARP Model Simulation of Existing UARP Operations |
| BASIN PLAN | The RWQCB Water Quality Control Board Plan for Sacramento and San Joaquin rivers |
| BEHI | Bank Erosion Hazard Index |
| BLM | Bureau of Land Management |
| BLM PLAN (BLM) | The South Fork American River: A Management Plan |
| BMI | Bentho-Macro Invertabrates |
| BN | Below Normal Water Year Type |
| CD | Critical Dry Water Year Type |
| CDFG | California Department of Fish and Game |
| CHILI BAR HYDRO-ELECTRIC PROJECT | A 7 MW project (FERC 2155), owned and operated by PG&E |
| EDC | El Dorado County |
| EXHIBIT R | Exhibit R of the License for Project 2101 |
| FERC | Federal Energy Regulatory Commission |
| FOREST PLAN (FS) | Eldorado National Forest Land Resource Management Plan |
| FS | Forest Service |
| FYLF | Foothill Yellow Legged Frog |
| GPS | Global Positioning System |
| HPMP | Historic Properties Management Plan |
| HSC | Habitat Suitabilty Curves |
| LEO | Law Enforcement Officer |
| MERO | Minimum Energy Reliablity Objective |
| NF | Natural Flow |
| NGO | Non-Governmental Organization |
| NPS | National Park Service |
| OHV | Off-Highway Vehicle |
| PA | Programmatic Agreement |
| PAOT | Persons At One Time |
| PDEA | Preliminary Draft Environmental Assessment |
| PG&E | Pacific Gas & Electric |
| PHABSIM | Physical Habitat Simulation Models |
| PM&E | Protection Mitigation & Enhancement |
| ROS | Recreation Opportunity Spectrum |
| RV | Recreational Vehicle |
| SD | Super Dry Water Year Type |
| SFAR | South Fork American River |
| SHP | State Historic Park |
| SMUD | Sacramento Municipal Utility District |
| SRA | State Recreation Area |

| | |
|---|---|
| SWRCB | State Water Resources Control Board |
| UARP | Upper American River Project, a 688 MW project ( FERC 2101), owned and operated by SMUD |
| WSL | Water Surface Elevation |
| WSR | Wild and Scenic River |
| WUA | Weighted Usable Area |