4.4.4.5 Juvenile Emigration

Juvenile green sturgeon migrate downstream and feed mainly at night. Juvenile green sturgeon are taken in traps at the RBDD and the GCID diversion in Hamilton City, primarily in the months of May through August. Peak counts occur in the months of June and July (68 FR 4433). Juvenile emigration may reportedly extend through September (Environmental Protection Information Center et al. 2001).

Juvenile green sturgeon have been salvaged at the Harvey O. Banks Pumping Plant and the John E. Skinner Fish Collection Facility in the South Delta, and captured in trawling studies by CDFW during all months of the year (CDFG 2002). The majority of these fish were between 200 and 500 mm long, indicating they were from 2 to 3 years of age based on Klamath River age distribution work by Nakamoto et al. (1995). The lack of a significant proportion of juveniles shorter than approximately 200 mm in Delta captures indicates that juvenile green sturgeon likely hold in the mainstem Sacramento River, as suggested by Kynard et al. (2005).

4.4.4.6 Lifestage-Specific Water Temperature Suitabilities

Since the RMT prepared its November 2010 water temperature objectives memorandum, additional water temperature monitoring in the lower Yuba River has been conducted by the RMT. The RMT (2013) developed the following representative green sturgeon lifestage-specific periodicities and primary locations for water temperature suitability evaluations.

- ❑ Adult Immigration and Holding (mid-February through April) – Daguerre Point Dam and Marysville
- ❑ Spawning and Embryo Incubation (March through July) – Daguerre Point Dam and Marysville
- ❑ Post-Spawning Holding (March through November) – Daguerre Point Dam and Marysville
- ❑ Juvenile Rearing and Outmigration (Year-round) – Daguerre Point Dam and Marysville

Green sturgeon lifestage-specific WTI values are provided in **Table 4-11**.

Table 4-11. Green sturgeon lifestage-specific WTI value ranges and associated periodicities.

Lifestage	Water Temperature Range	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
Adult Immigration and Holding	44°F – 61°F				■	■	■	■	■																
Spawning and Embryo Incubation	46°F – 63°F					■	■	■	■	■	■	■	■	■	■										
Post-Spawning Holding	44°F – 61°F					■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		
Juvenile Rearing and Outmigration	52°F – 66°F	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■

Recent water temperature monitoring data in the lower Yuba River are available for the period extending from 2006 into June 2013, during which time operations have complied with the Yuba Accord. **Figure 4-17** displays water temperature monitoring results from October 2006 through June 2013 at Daguerre Point Dam and Marysville water temperature gages, with the upper end of the green sturgeon lifestage-specific water temperature index value ranges. Water temperature monitoring over the past six years demonstrated that water temperatures remain below the upper WTI values for all lifestages of green sturgeon at Daguerre Point Dam, and for most lifestages at the Marysville Gage. The upper end of the WTI value range for post-spawning adult holding (i.e., 61°F) was exceeded at the Marysville Gage during a portion of this lifestage evaluation period, and the upper end of the WTI range for spawning and incubation was exceeded slightly for a very brief period of time during 2007 and 2013.

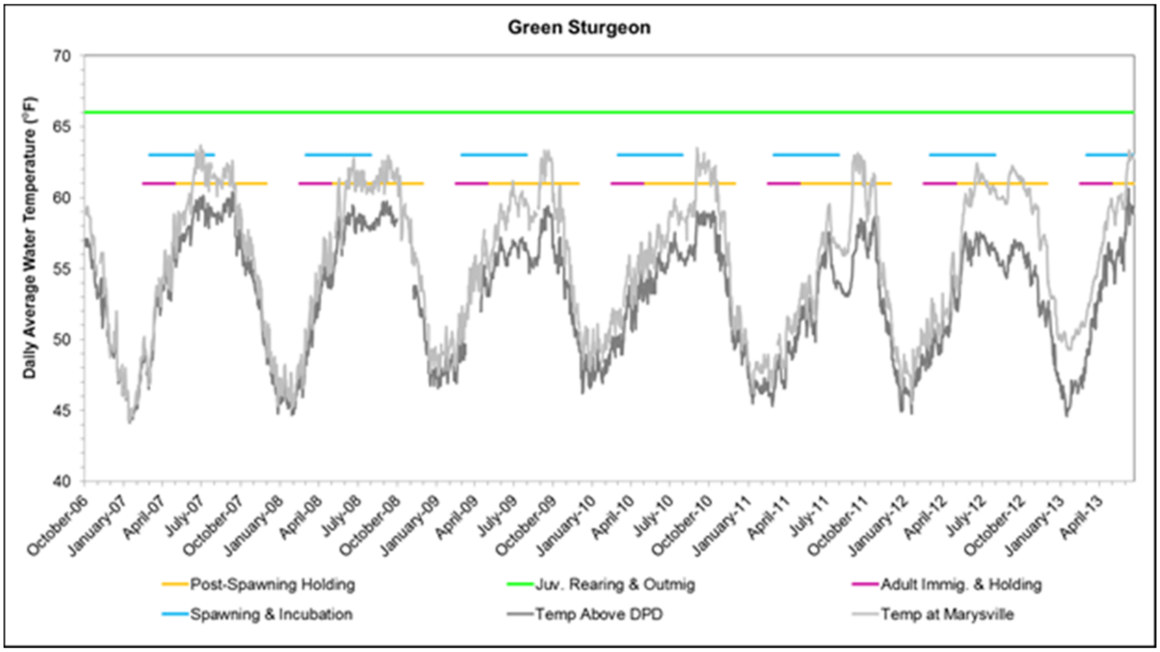

Figure 4-17. Lower Yuba River monitored water temperatures and green sturgeon upper tolerance water temperature index values.

4.4.5 Limiting Factors, Threats and Stressors

4.4.5.1 DPS

Limiting factors and threats to the Southern DPS of North American green sturgeon, both natural and anthropogenic, are presented according to the following five ESA listing factors.

PRESENT OR THREATENED DESTRUCTION, MODIFICATION, OR CURTAILMENT OF HABITAT OR RANGE (REDUCTION IN SPAWNING HABITAT, ALTERATION OF HABITAT)

REDUCTION IN SPAWNING HABITAT

Access to historical spawning habitat has been reduced by construction of migration barriers, such as major dams, that block or impede access to the spawning habitat. The principal factor for the decline of green sturgeon reportedly comes from the reduction of green sturgeon spawning habitat to a limited area of the Sacramento River (70 FR 17391). Although existing water storage dams only block access to about 9% of historically available green sturgeon habitat, Mora et al. (2009) suggest that the blocked areas historically contained relatively high amounts of spawning habitat because of their upstream position in the river system. Adams et al. (2007) hypothesized that significant amounts of historically-utilized spawning habitat may be blocked by Shasta Dam and Oroville Dam on the Feather River, reducing the productive capacity and simplifying the spatial structure of the Sacramento River green sturgeon population.

Keswick Dam is an impassible barrier blocking green sturgeon access to what are thought to have been historic spawning grounds upstream (70 FR 17386). Spawning currently appears to be limited to the upper portion of the mainstem Sacramento River downstream of Keswick Dam. In addition, a substantial amount of what may have been historical spawning and rearing habitat in the Feather River upstream of Oroville Dam has also been lost (70 FR 17386).

Alteration of Habitat

Green sturgeon habitat in the mainstem Sacramento River and the Delta has been greatly modified since the mid-1800s. Based on NMFS (2010d), the following examples illustrate relationships between threats to green sturgeon and specific types of habitat alteration:

- Hydraulic gold mining resulted in the removal of gravel and the deposition of mercury-laced fine sediment within streams, rivers, and the Bay/Delta estuary.
- Agricultural practices have converted tidal and seasonal marshlands and continue to release contaminants into Central Valley waterways.
- Levees have been created extensively along the Sacramento River and the Delta, resulting in the removal of riparian vegetation and the reduction of channel complexity.
- Historical reclamation of wetlands and islands, channelization and hardening of levees with riprap have reduced and degraded in- and off-channel intertidal and sub-tidal rearing habitat for green sturgeon.
- The hydrographs of the Sacramento River and its tributaries have been substantially altered from unimpaired conditions, and may no longer favorably correspond with green sturgeon lifestage periodicities.

- In-river water diversions alter flow and potentially entrain larval/juvenile green sturgeon.
- Introduced and invasive species have likely modified trophic relationships in both freshwater and estuarine habitats, which may have resulted in increased predation on young green sturgeon, as well as reduced growth and fitness as a result of feeding on non-optimal prey resources.

Flows

NMFS (2005c) and USFWS (1995) found a strong correlation between mean daily freshwater outflow (April to July) and white sturgeon year class strength in the Sacramento-San Joaquin Estuary (these studies primarily involve the more abundant white sturgeon; however, the threats to green sturgeon are thought to be similar), indicating that insufficient flow rates are likely to pose a significant threat to green sturgeon (71 FR 17757). Low flow rates affect adult migration and may cause fish to stop their upstream migration or may delay access to spawning habitats. Also, it was posited that low flow rates could dampen survival by hampering the dispersal of larvae to areas of greater food availability, hampering the dispersal of larvae to all available habitat, delaying the transportation of larvae downstream of water diversions in the Delta, or decreasing nutrient supply to the nursery, thus stifling productivity (NMFS 2005c). Very little information is available on the habitat requirements and utilization patterns for early lifestages of green sturgeon (Mora et al. 2009).

Stranding due to flow reduction also may pose a threat to green sturgeon in the Sacramento River system. Green sturgeon that are attracted by high flows in the Yolo Bypass move onto the floodplain and eventually concentrate behind Fremont Weir, where they are blocked from further upstream migration (DWR 2005). As the Yolo Bypass recedes, these sturgeon become stranded behind the flashboards of the weir and can be subjected to heavy illegal fishing pressure. Sturgeon can also be attracted to small pulse flows and trapped during the descending hydrograph (Harrell and Sommer 2003).

Water Temperatures

The installation of the Shasta Dam temperature control device in 1997 is thought to have reduced the previous problems related to high water temperatures in the upper Sacramento River, although Shasta Dam has a limited storage capacity and cold water reserves could be depleted in long droughts (NMFS 2007). Water temperatures at RBDD have not been higher than 62°F since 1995 (NMFS 2007) and have been within the green sturgeon egg and larvae optimum range for growth and survival of 59 to 66°F (Mayfield and Cech 2004). According to Reclamation (2008), water temperatures in the Feather River appear adequate for spawning and egg incubation, contrary to previous concerns that releases of warmed water from Thermalito Afterbay are one reason neither green nor white sturgeon are found in the river in low-flow years (CDFG 2002; SWRI 2003). In some years, water temperatures downstream of the Thermalito Outlet are inadequate for spawning and egg incubation, which has been suggested as a reason why green sturgeon are not found in the river during low flow years (DWR 2007). However, post-Oroville Dam water temperatures are cooler than historic river temperatures during the summer months when early lifestages are likely to be present in the lower Feather River (DWR 2005a in Reclamation 2008). Prior to the construction of the Oroville Dam, water temperatures in the Feather River at Oroville averaged 65-71°F from June through August for the period of 1958-1968 (DWR 2004c). After Oroville Dam construction, water temperatures in the Feather River at the Thermalito Afterbay averaged 60-65°F from June through August for the period of 1993-2002 (DWR 2004c). It is likely that high water temperatures (greater than 63°F) may deleteriously affect sturgeon egg and larval development, especially for late-spawning fish in drier water years (70 FR 17386).

Delayed or Blocked Migration

It has been suggested that the primary effect of construction of large water-storage reservoirs in the Sacramento–San Joaquin river basin has been to curtail the distribution of green sturgeon within the DPS (Mora et al. 2009). For example, water storage dams are hypothesized to be a major factor in the decline of green sturgeon in the Sacramento River (Adams et al. 2007). The existence and ongoing effects of these dams may have reduced the amount and altered the spatial distribution of spawning, rearing and holding habitat available and by restriction to the mainstem Sacramento River, resulting in green sturgeon becoming more vulnerable to environmental catastrophes (Mora et al. 2009).

Other potential adult migration barriers to green sturgeon have been reported to include the Sacramento Deep Water Ship Channel locks, Fremont Weir, Sutter Bypass, and the DCC Gates on the Sacramento River, and Shanghai Bench and Sunset Pumps on the Feather River (71 FR 17757).

DWR (2005) reported that the lock connecting the Sacramento River Deep Water Ship Channel with the Sacramento River blocks the migration of all fish from the deep water ship channel back to the Sacramento River. Thus, if green sturgeon enter the Sacramento River Deep Water Ship Channel, they will be unable to continue their migration upstream in the Sacramento River.

Green sturgeon are attracted by high floodwater flows into the Yolo Bypass, but are restricted from entering the Sacramento River by the Fremont Weir (DWR 2005). Sturgeon also may be attracted to small pulse flows into the Yolo Bypass, and isolated during the descending hydrograph (Harrell and Sommer 2003).

Green sturgeon can become entrained in the Sutter Bypass during storm flow events. During April 2011, several sturgeon (green and white) were stranded behind the Tisdale Weir on the Sutter Bypass when storm flows receded. CDFW, in collaboration with UC Davis, organized a fish rescue operation and returned the sturgeon to the Sacramento River.

According to NMFS (2010d), the DCC, located near Walnut Grove, California, was constructed in 1951 to facilitate the transfer of fresh water from the Sacramento River to the federal and state pumps located in the south Delta. Flow from the Sacramento River into the DCC is controlled by two radial arm gates that can be opened or closed depending on water quality, flood protection, and fish protection requirements. When the gates are open, Sacramento River water is diverted into the Mokelumne and San Joaquin rivers. The gates are closed in fall to protect migrating salmonids, then are opened the following spring. Thirty-percent of the tagged adult green sturgeon migrating down the Sacramento River after spawning entered the DCC (Israel et al. 2010). Most of these fish were able to successfully negotiate their way through the Delta and reach the Pacific

Ocean. However, four fish were detected in the south Delta, with only one surviving to reach the Pacific Ocean. Juvenile green sturgeon may also be entrained into the interior delta during the summer when the DCC is open. Further studies are necessary to investigate the threat this alternative route through the Delta poses for these fish (NMFS 2010d).

NMFS (2009d) stated that potential physical barriers to adult green sturgeon migration in the Feather River are located at Shanghai Bench (RM 25) and at the Sutter Extension Water District's Sunset Pumps (RM 39). Although Shanghai Bench was breached during 2011, it is uncertain whether or not it still imposes a migration barrier or impediment to adult green sturgeon. Each of these barriers could impede adult upstream migration during low flows (USFWS 1995a). Impediments to migration may cause fish to stop their natural upstream migration or may delay access to spawning habitats (Moser and Ross 1995). Natural (Shanghai Bench) and man-made (Sunset Pumps) impediments to upstream movements in the Feather River during low flow years might also limit significant spawning activities of green sturgeon above these obstacles to wet, high flow water years when they are most likely to be able to pass these obstacles (Beamesderfer et al. 2004).

IMPAIRED WATER QUALITY

Exposure of green sturgeon to toxics has been identified as a factor that can lower reproductive success, decrease early lifestage survival, and cause abnormal development, even at low concentrations (USFWS 1995). Contamination of the Sacramento River increased substantially in the mid-1970s when application of rice pesticides increased (70 FR 17386). Additionally, water discharges containing metals from Iron Mountain Mine, located adjacent to the Sacramento River, have been identified as a factor affecting survival of sturgeon downstream of Keswick Dam. However, treatment processes and improved drainage management in recent years have reduced the toxicity of runoff from Iron Mountain Mine to acceptable levels. It has been reported that white sturgeon may accumulate PCBs and selenium (White et al. 1989 as cited in Reclamation 2008). While green sturgeon spend more time in the marine environment than white sturgeon and, therefore, may have less exposure, the NMFS BRT for North American green sturgeon concluded that contaminants also pose some risk for green sturgeon. However, this risk has not been quantified or estimated (NMFS 2007).

Additionally, events such as toxic oil or chemical spills in the upper Sacramento River could result in the loss of both spawning adults and their progeny, and lead to year-class failure (BRT 2005).

DREDGING AND SHIP TRAFFIC

Hydraulic suction dredging is conducted in the Sacramento and San Joaquin rivers, navigation channels within the Delta, and Suisun, San Pablo, and San Francisco bays. Juvenile green sturgeon residing within the Delta and the San Francisco Bay Estuary may be entrained during hydraulic suction dredging, which is conducted to maintain adequate depth within navigation areas or to mine sand for commercial use (NMFS 2010d). Additionally, the disposal of dredged material at aquatic sites within the estuary might bury green sturgeon or their prey, and expose green sturgeon to elevated levels of contaminated sediments (NMFS 2010d).

OCEAN ENERGY PROJECTS

According to NMFS (2010d), projects that harness the ocean's energy are currently being considered along the entire west coast. Potential concerns for green sturgeon include, but are not limited to, exposure to electromagnetic field (EMF) emissions, blade strikes, turbine entrainment, and ocean energy facilities functioning as fish aggregation devices. One of the primary concerns involves the exposure of green sturgeon to EMF generated from project cables, turbine structures, and junction boxes, because green sturgeon use electroreceptors for feeding and perhaps migration, and these activities may be affected by EMF.

NMFS (2010d) suggested that the proposed installation and operation of energy-generating turbines at the mouths of several estuaries, including San Francisco Bay, may lead to injury and mortality as a result of potential blade strikes in association with turbine operation. Additionally, wave buoy and tidal turbine arrays may act as artificial reefs (e.g., DuPont 2008) or fish aggregation devices for marine mammals, fish, and invertebrates. If so, related changes to the local marine community, predator-prey interactions (i.e., increased presence of sea lions), or the distribution and abundance of marine species around ocean energy installation sites are also possible, and these sites are within the migratory corridors of green sturgeon (NMFS 2010d).

Commercial, Recreational, Scientific, or Educational Overutilization

While this factor was not considered the primary factor causing the decline of the Southern DPS of North American green sturgeon, it is believed that past and present commercial and recreational fishing is likely to pose a threat to green sturgeon (71 FR 17757).

Commercial, tribal, and recreational fishing probably had negative impacts on green sturgeon in the past. Current fishing regulations in Washington, Oregon, and California prohibit retention of green sturgeon in all commercial and recreational fisheries, although a small number of tribes still retain green sturgeon captured in some coastal bays and estuaries (NMFS 2010d).

Coastal groundfish trawl fisheries have been substantially reduced since the 1990s due to increasingly restrictive management measures (NMFS 2010d). These include reduced trip limits, increased gear restrictions, and a vessel buyback program, all of which are expected to reduce green sturgeon bycatch. Recent modifications to existing fishing regulations have almost certainly reduced overall green sturgeon take, but the impact of discard mortality and sublethal effects of capture remain unknown (NMFS 2010d).

As a long-lived, late maturing fish with relatively low fecundity and only periodic spawning, the green sturgeon is particularly susceptible to threats from overfishing (Musick 1999 as cited in Reclamation 2008). Green sturgeon are vulnerable to recreational sport fishing with the Bay-Delta estuary and Sacramento River. Green sturgeon are primarily captured incidentally in California by sport fishermen targeting the more desirable white sturgeon, particularly in San Pablo and Suisun bays (Emmett et al. 1991). Since the listing of the Southern DPS of green sturgeon, new federal and state regulations, including the June 2, 2010 NMFS take prohibition (75 FR 30714), mandate that no green sturgeon can be taken or possessed in California (CDFG 2007a). If green sturgeon are caught incidentally and released during fishing for white sturgeon, the event must be reported to CDFW. The level of hooking mortality that results following release of green sturgeon by anglers is unknown. CDFG (2002) indicates that sturgeon are highly vulnerable to the fishery in areas where sturgeon are concentrated, such as the Delta and Suisun and San Pablo Bays in late winter and the upper Sacramento River during spawning migration. In March 2010, CDFW prohibited fishing for either white or green sturgeon within the upper mainstem Sacramento River between Keswick Dam and Butte Bridge (Hwy 162) in an effort to protect adult green sturgeon during their spawning runs (NMFS 2010d).

The demand for sturgeon caviar continues to increase both nationally and globally, and enforcement to protect sturgeon from poaching within the Central Valley is a high priority (CDFG 2002), as indicated by the number of sturgeon poaching operations that have been discovered there in recent years (NMFS 2010d). However, the degree to which poaching of green sturgeon occurs is largely unknown.

Poaching (illegal harvest) of sturgeon is known to occur in the Sacramento River, particularly in areas where sturgeon have been stranded (e.g., Fremont Weir), as well as throughout the Bay-Delta. Catches of sturgeon are thought to occur during all years, especially during wet years. The small population of green sturgeon inhabiting the San Joaquin River experiences heavy fishing pressure, particularly from illegal fishing (USFWS 1995). Areas just downstream of Thermalito Afterbay Outlet, Cox's Spillway, and several barriers impeding migration on the Feather River may be areas of high adult mortality from increased fishing efforts and poaching.

Poaching pressure is expected to remain high because of the increasing demand for caviar, coupled with the decline of other sturgeon species around the world, primarily the beluga sturgeon (71 FR 17757). Presently, however, poaching rates in the rivers and estuary and the impact of poaching on green sturgeon abundance and population dynamics are unknown.

The amount of green sturgeon take associated with scientific research has recently become a concern. NMFS (2010d) suggested that any project (or suite of projects) that allows green sturgeon to be taken be carefully reviewed and evaluated.

Disease and Predation

A number of viral and bacterial infections have been reported for sturgeon in general (Mims et al. 2002), however specific issues related to diseases of green sturgeon have not been studied or reported. Therefore, it is not known if disease has played a role in the decline of the Southern DPS of green sturgeon.

The significance of predation on each lifestage of green sturgeon has not been determined. There has been an increasing prevalence of nonnative species in the Sacramento and San Joaquin rivers and the Delta (CDFG 2002) and this may pose a significant threat (NMFS 2010d). Striped bass, an introduced species, may affect the population viability of Chinook salmon (Lindley et al. 2004), and probably preys on other species, such as sturgeon (Blackwell and Juanes 1998). It is likely that sea lions consume green sturgeon in the San Francisco Bay estuary, but the extent to which this occurs is unknown (NMFS 2010d).

Inadequacy of Existing Regulatory Mechanisms

Inadequacy of existing regulatory mechanisms has contributed significantly to the decline of green sturgeon and to the severity of threats they currently face (NMFS 2010d). During the process of developing the 4(d) rule for the Southern DPS of green sturgeon (70 FR 17386), NMFS noted several Federal, State, and local regulatory programs that have been implemented to help reduce historical risk, including the AFRP of the CVPIA and the CALFED ERP. However, growing conflicts between the protection of other species (e.g., Sacramento River winter-run Chinook salmon and sea lions) may prove problematic for green sturgeon (NMFS 2010d). Although some effort has been made to improve habitat conditions across the range of the Southern DPS of green sturgeon, less progress has been accomplished through regulatory mechanisms to reduce threats posed by water diversions or blocked passage to spawning habitat (NMFS 2010d).

Other Natural or Man-Made Factors Affecting the Species' Continued Existence (Non-Native Invasive Species, Entrainment)

Non-Native Invasive Species

This factor was not considered a primary factor in the decline of the Southern DPS of green sturgeon. However, non-native species are an ongoing problem in the Sacramento and San Joaquin rivers and the Delta (CDFG 2002). One risk for green sturgeon associated with the introduction of non-native species involves the replacement of relatively uncontaminated food items with those that may be contaminated (70 FR 17386). Sturgeon regularly consume overbite and Asian clams, which is of particular concern because of the high bioaccumulation rates of these clams (Doroshov 2006 in BDCP 2010). The significance of this threat to green sturgeon is unclear (NMFS 2007). Green sturgeon also are likely to experience predation by introduced species including striped bass, but the actual impacts of predation have yet to be estimated (70 FR 17392). Introductions of non-native invasive plant species such as water hyacinth and Brazilian waterweed have altered habitat and have affected local assemblages of fish within the Bay-Delta estuary (Nobriga et al. 2005), and may also affect green sturgeon through habitat alteration and potential increased predation rates on juveniles.

Entrainment

Larval and juvenile green sturgeon entrainment or impingement from screened and unscreened agricultural, municipal, and industrial water diversions along the Sacramento River and within the Delta is still considered an important threat (71 FR 17757). The threat of screened and unscreened agricultural, municipal, and industrial water diversions in the Sacramento River and Delta to green sturgeon is largely unknown because juvenile sturgeon are often not identified and current CDFW and NMFS screen criteria do not address sturgeon. Based on the temporal occurrence of juvenile green sturgeon and the high density of water diversion structures along rearing and migration routes, NMFS (2005) found the potential threat of these diversions to be serious and in need of study.

In 1997, NMFS and CDFW developed screening criteria designed to prevent entrainment and impingement of juvenile salmonids. Similar criteria for larval and juvenile green sturgeon have not been developed and, although discussions regarding their development are occurring, there has been no timeline created for when guidelines will be available (NMFS 2010d).

The largest diversions within the Delta are the SWP and CVP export facilities, located in the southern Delta. Juvenile and sub-adult green sturgeon are recovered year-round at the CVP/SWP facilities, and have higher levels of salvage during the months of July and August compared to the other months of the year. The reason for this distribution is unknown. Based on salvage data, it appears that green sturgeon juveniles are present in the Clifton Court Forebay year round, but in varying numbers. NMFS (2009a) expects that predation on green sturgeon during their stays in the forebay is minimal, given their size and protective scutes, but this has never been verified.

4.4.5.2 Lower Yuba River

Given the extremely infrequent sightings of green sturgeon in the lower Yuba River, and the lack of green sturgeon life history information for the lower Yuba River, the foregoing discussion regarding threats and stressors for the DPS is assumed to be generally applicable to the lower Yuba River.

Moreover, according to NMFS (2008a), the lower Yuba River downstream of Daguerre Point Dam is subject to the same management considerations as the lower Feather River, which include operation of dams and water diversion operations resulting in the alteration of water flow and reduced water quality, in-water construction or alterations (e.g., bridge repairs, gravel augmentation, bank stabilization), and NPDES activities and other activities resulting in non-point source pollution (e.g., agricultural pesticide application, agricultural runoff and outfalls).

4.4.6 Summary of the Current Viability of the Southern DPS of North American Green Sturgeon

Although McElhany et al. (2000) specifically addresses viable populations of salmonids, NMFS (2009a) suggested that the concepts and viability parameters in McElhany et al. (2000) also could be applied to the Southern DPS of green sturgeon. Therefore, NMFS (2009a) applied the concept of VSP and reviewed population size, abundance, spatial distribution and diversity in the 2009 NMFS OCAP BO, and also applied the VSP concepts to green sturgeon in the 2009 Oroville FERC Relicensing NMFS BO (2009d).

4.4.6.1 DPS

Abundance

Currently, there are no reliable data on population sizes and population trends are lacking. The Oroville FERC Relicensing BO (NMFS 2009d) stated that the only existing information regarding changes in abundance of green sturgeon includes changes in the numbers of green sturgeon salvaged at the federal and state facilities in the South Delta. NMFS (2009d) stated that, before 1986, an average of 732 green sturgeon were taken annually at the John E. Skinner Fish Collection Facility. From 1986 to 2006, the average per year was 47. NMFS (2009d) also stated that for the Harvey O. Banks Pumping Plant, the average number prior to 1986 was 889, and from 1986 to 2001 the average was 32. In consideration of increased water exports in recent years, NMFS (2009d) concluded that the abundance of green sturgeon has declined.

According to NMFS (2009a), the current population status of green sturgeon is unknown. Based on captures of green sturgeon during surveys for the sympatric white sturgeon in the San Francisco Bay estuary, NMFS (2009a) suggested that the population is relatively small, ranging from several hundred to a few thousand adults. However, these estimates are very uncertain, and limited by the inherent biases of the sampling methods (NMFS 2009a).

Green sturgeon in the Sacramento River have been documented and studied more widely than those in either the Feather River or the Yuba River. In general, sturgeon year class strength appears to be episodic with overall abundance and dependent on a few successful spawning events. Genetic techniques were used to estimate the number of green sturgeon spawners contributing to juvenile production between 2002 and 2006 in the upper segment of spawning habitat above RBDD. Based upon these techniques, it was estimated that between 10 and 28 individuals contributed to juvenile production (Israel and May 2010). Because populations appear to be not in equilibrium, conclusions regarding equilibrium dynamics are uncertain given the lack of information (NMFS 2010d).

Green sturgeon occasionally range into the Feather River, but numbers are low. NMFS (71 FR 17757) concluded that an effective population of spawning green sturgeon does not exist in the Feather River at the present time.

PRODUCTIVITY

There is insufficient information to evaluate the productivity of green sturgeon (NMFS 2009d). Recruitment data for green sturgeon are essentially nonexistent (NMFS 2009a). Incidental catches of larval green sturgeon in the mainstem Sacramento River and juvenile fish at the CVP and SWP pumping facilities in the South Delta suggest that green sturgeon are successful at spawning, but that annual year class strength may be highly variable (Beamesderfer et al. 2007; Adams et al. 2002). Recent declines in the number of larvae captured in the RSTs near the RBDD may indicate a reduction in spawning success in the past several years, with resulting depressions in the year class strengths for those years. However, green sturgeon are iteroparous and long-lived, so that spawning failure in any one year may be rectified in a succeeding spawning year (NMFS 2009a).

SPATIAL STRUCTURE

Historical green sturgeon spawning habitat may have extended up into the three major branches of the upper Sacramento River above the current location of Shasta Dam - the Little Sacramento River, the Pit River, and the McCloud River (NMFS 2009a; NMFS 2009d). Additional spawning habitat is believed to have once existed above the current location of Oroville Dam on the Feather River (NMFS 2009a). The Southern DPS of green sturgeon population has been relegated to a single spawning area, which is, for the most part, outside of its historical spawning area.

According to NMFS (2009a), the reduction of green sturgeon spawning habitat into one reach on the Sacramento River between Keswick Dam and Hamilton City has increased the vulnerability of this spawning population to catastrophic events. One spill of toxic materials into this reach of river, similar to the Cantara Loop spill of herbicides on the upper Sacramento River, could remove a significant proportion of the adult spawning broodstock from the population, as well as reduce the recruitment of the exposed year class of juvenile fish. Additionally, extended drought conditions could imperil the spawning success for green sturgeon, particularly those that are restricted to the river reaches below RBDD (NMFS 2009a).

Diversity

Diversity, both genetic and behavior, provides a species the opportunity to track and adapt to environmental changes. The reduction of the Southern DPS of green sturgeon population to one extant spawning population has reduced the potential variation of life history expression and genetic diversity within this population (NMFS 2009d). In addition, the closed gate configuration at RBDD from mid-May to September may have altered the genetic diversity of the population by separating the population into upstream and downstream spawning groups based on run timing (NMFS 2009a).

Green sturgeon stocks from the northern and southern DPSs are genetically differentiated (Israel et al. 2004; Israel et al. 2009). Genetic differentiation is moderate and statistically similar between the southern and northern DPSs (NMFS 2010d). However, the genetic diversity of the Southern DPS is not well understood (NMFS 2009d).

Summary of the Current Viability of the Southern DPS of North American Green Sturgeon

The Southern DPS of green sturgeon is at substantial risk of future population declines (Adams et al. 2007). The principal threat to green sturgeon in the Southern DPS is the reduction in available spawning habitat due to the construction of barriers on Central Valley rivers (NMFS 2009d). According to NMFS (2009a), the potential threats faced by the green sturgeon include enhanced vulnerability due to the reduction of spawning habitat into one concentrated area on the Sacramento River, lack of good empirical population data, vulnerability of long-term cold water supply for egg incubation and larval survival, loss of juvenile green sturgeon due to entrainment at the project fish collection facilities in the South Delta and agricultural diversions within the Sacramento River and the Delta, alterations of food resources due to changes in the Sacramento River and Delta habitats, and exposure to various sources of contaminants throughout the basin to juvenile, sub-adult, and adult lifestages. In summary, NMFS (2009d) concluded that the Southern DPS of green sturgeon remains at a moderate to high risk of extinction.

A recent study (Thomas et al. 2013) provided additional analysis regarding population-level impacts due to stranding of green sturgeon. During April 2011, 24 green sturgeon were rescued that had been stranded behind two weirs (Fremont and Tisdale) along the Sacramento River. Those 24 green sturgeon were acoustically tagged and their survival and migration success to their spawning grounds was analyzed. Additionally, population viability modeling and analysis was conducted to show the potential impacts of stranding and the benefits of conducting rescues at the population level. Population viability analyses of rescue predicted a 7% decrease below the population baseline model over 50 years as opposed to 33% without rescue (Thomas et al. 2013).

4.4.6.2 Lower Yuba River

As previously discussed, very few observations of green sturgeon have occurred in the Yuba River historically or in recent years. The few occasions when confirmed observations have occurred were downstream of Daguerre Point Dam and consisted of adult green sturgeon. Green sturgeon acoustic tag detections do not indicate substantive use of the Yuba River (YCWA 2013).

Monitoring and studies of green sturgeon in the Delta, the Sacramento River and its tributaries continue to be undertaken by a variety of agencies implementing numerous different programs. The CFTC continues to monitor acoustically tagged green sturgeon throughout the system, and fixed-station acoustic monitors and roving hydrophonic surveys continue to be conducted on the lower Yuba River by both the RMT and CDFW's Heritage and Wild Trout and the Steelhead Management and Recovery Programs. The AFRP is continuing to fund ongoing sturgeon videographic monitoring efforts in the Feather River Basin, including the lower Yuba River. Additionally, the Sturgeon IEP Project Work Team coordinates green sturgeon research, disseminates information and is overseeing the development of a green sturgeon population model, and the Corps' LTMS for the Placement of Dredged Material in the San Francisco Bay Region Program includes green sturgeon tracking, evaluation of susceptibility to suction dredging and development of entrainment models. Available results from these and other programs may provide additional information regarding green sturgeon in the Central Valley and lower Yuba River. However, despite the contribution resulting from these and other studies conducted to date, knowledge of the population biology and dynamics of green sturgeon remains limited.

Limited information regarding green sturgeon abundance, distribution, movement and behavioral patterns, as well as lifestage-specific habitat utilization preferences, is available for the Sacramento and Feather rivers. According to NMFS (2009a), the current population status of the Southern DPS of North American green sturgeon is unknown. Currently, there are no reliable data on population sizes, and population trends are lacking (NMFS 2009d). There is insufficient information to evaluate the productivity of green sturgeon (NMFS 2009d), and recruitment data for green sturgeon are essentially nonexistent (NMFS 2009a). Essentially no information regarding these topics is available for the lower Yuba River.

Hence, it is not practicable to attempt to apply the VSP concepts developed for salmonids to green sturgeon in the lower Yuba River. Moreover, the lack of information pertaining to abundance, productivity, habitat utilization, life history and behavioral patterns in the lower Yuba River, due to infrequent sightings over the past several decades, does not provide the opportunity for reliable alternative methods of viability assessment of green sturgeon in the lower Yuba River.

4.4.7 Recovery Considerations

In November 2009, NMFS (74 FR 58245) announced its intent to develop a recovery plan for the Southern DPS of North American green sturgeon. NMFS is required by the ESA to develop and implement recovery plans for the conservation and survival of ESA-listed species. As part of the process, NMFS will be coordinating with state, Federal, tribal, and local entities in California, Oregon, Washington, Canada, and Alaska to develop the recovery plan.

Presently, NMFS is in the process of preparing the draft recovery plan, and has prepared an outline of the plan (NMFS 2010d). As stated in the outline, the goal is to set out a plan to conserve and recover green sturgeon by identifying actions that may improve its potential for recovery. These include, but are not limited to, the following:

- Improve existing research and initiate novel research and monitoring on distribution, status, trends, and lifestage survival of the Southern DPS of green sturgeon at the population level.
- Establish better inter- and intra-agency coordination regarding scientific research conducted on green sturgeon under ESA sections 7, 10, and 4(d).
- Evaluate the significance of green sturgeon bycatch in commercial fisheries through the implementation of directed surveys.
- NMFS Office of Law Enforcement (OLE) should monitor and collaborate with state enforcement agencies along the west coast related to illegal retention of green sturgeon in recreational fisheries.
- NMFS OLE should collaborate with CDFW wardens to address sturgeon poaching in the Central Valley.
- Assess the potential for establishing independent spawning populations in areas outside of the mainstem Sacramento River (e.g., Feather, Yuba, Russian rivers, as well as tributaries of San Joaquin River).
- Address the need to develop a multiple species water flow and temperature management plan for Shasta, Keswick, Oroville and Englebright dams.
- Address the application of pesticides (Carbaryl and others) and herbicides applied to control burrowing shrimp and non-native plants in estuaries.
- Identify and prioritize potential contaminants of concern in the Central Valley.
- Ensure that screens are placed on water diversions on the upper mainstem Sacramento River below Keswick Dam and that they are designed to be protective of larval and juvenile green sturgeon. Research on screening criteria should be initiated as soon as feasible.
- Continue to support the removal of the Red Bluff Diversion Dam.

- ❑ Monitor hydraulic suction dredges for potential entrainment of juvenile green sturgeon.
- ❑ Determine the impact of non-native species.
- ❑ Determine if electromagnetic fields produced by offshore energy projects alter green sturgeon migration patterns.

The draft recovery plan outline (NMFS 2010d) further states that recovery actions will be refined in the recovery plan and will be specific to several regions, including the Sacramento River, the Delta/Estuary, and coastal marine areas, which include several estuaries/bays. Actions specific to lifestages in each region will be identified to address more localized factors that currently suppress potential for recovery for green sturgeon (NMFS 2010d).

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3.0 Description of the Action Area

3.1 Action Area Definition and Description

The regulations governing consultations under the federal ESA define the "action area" as "*all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action*" (50 CFR §402.02). Direct effects are defined as "*the direct or immediate effects of the project on the species or its habitat*" (USFWS and NMFS 1998). Indirect effects are defined as "*those [effects] that are caused by the proposed action and are later in time, but still are reasonably certain to occur*" (50 CFR §402.02).

Consistent with 50 CFR 402.02, the Action Area for this consultation is determined considering the extent of the direct and indirect effects of the Proposed Action. As described in Chapter 2, the Proposed Action includes the Corps' authorized discretionary O&M of the fish passage facilities at Daguerre Point Dam and specified conservation measures. O&M activities of the Proposed Action would indicate that the Action Area would be restricted to the immediate vicinity adjacent to Daguerre Point Dam. Similarly, administration of the licenses to CDFW and Cordua Irrigation District also would be restricted to the immediate vicinity adjacent to Daguerre Point Dam. However, the conservation measures in the Proposed Action have a broader geographic extent of potential direct and indirect effects.

The LWMMP does not specifically indicate the upstream and downstream boundaries for potential wood placement in the lower Yuba River. By contrast, the gravel augmentation project specifies that the gravel placement site is located within the first 300-feet downstream of Englebright Dam, downstream of the Narrows II Powerhouse. The project site is less than one-acre and is confined to the river channel within the Englebright Dam Reach, a 0.89-mile long bedrock reach starting at Englebright Dam and ending at the junction with Deer Creek.

The Daguerre Point Dam Fish Passage Sediment Management Plan includes excavation of sediment immediately upstream of Daguerre Point Dam and placement of excavated materials on a downstream bank of the lower Yuba River approximately ¼ mile downstream of Daguerre Point Dam. Materials will be placed in a location that will provide an opportunity for the gravel to be mobilized by the river during high flow conditions and transported downstream to augment downstream spawning gravels. Although fate and transport studies of the excavated materials have not been conducted, it is reasonable to assume that some of these materials may be transported as far downstream as the confluence with the lower Feather River.

Therefore, the Action Area for this Proposed Action includes the lower Yuba River starting at the upstream extent of where in-river gravel placement has occurred, an area which is located within the first 300 feet downstream of Englebright Dam (39°14'18"N, 121°16'07"W, Yuba River (RM 23.9), downstream to the confluence with the lower Feather River (39°07'46"N, 121°35'56"W, Yuba River mile 0) (**Figure 3-1**).

The descriptions that follow identify prominent features and characteristics of the Action Area. Specific information related to physical habitat conditions and species-specific utilization within the Action Area, as well as throughout the respective ESU/DPS is provided in Chapter 4.0 – Status of the Species and in Chapter 5.0 – Environmental Baseline.

3.1.1 Daguerre Point Dam

Daguerre Point Dam is located about ten miles east of Marysville, California, in the Yuba Goldfields (Figure 3-1). The dam is located on a bedrock bench in the piedmont plain of the ancestral Yuba River. A cut 600 feet wide and 25 feet deep was dug in the bedrock bench for the footing of the dam, which was completed in 1910 (Hunerlach et al. 2004). The current configuration of Daguerre Point Dam is an overflow concrete ogee ("s-shaped") spillway with concrete apron and concrete abutments. The ogee spillway section is 575 feet wide and 24 feet tall. The purpose of Daguerre Point Dam was to retain hydraulic mining debris. This purpose was later modified to include diversion of

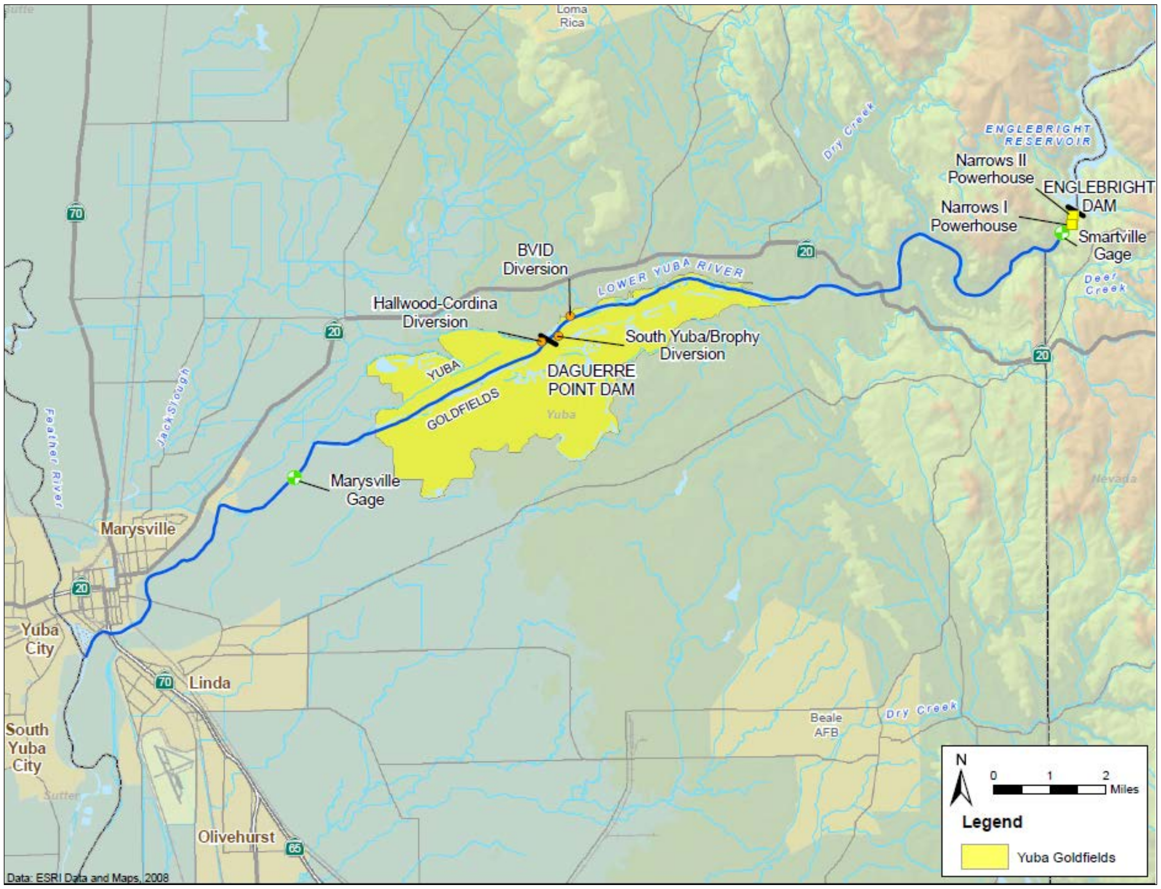

Figure 3-1. The lower Yuba River including the Action Area, which extends from downstream of the Narrows II Powerhouse, downstream to the lower Yuba River confluence with the lower Feather River.

water for irrigation purposes. The dam is not operated for flood control and there is no water storage capacity as the entire reservoir has been filled with hydraulic mining debris and sediments.

3.1.2 Lower Yuba River

The lower Yuba River consists of the approximately 24-mile stretch of river extending from Englebright Dam, downstream to the confluence with the Feather River near Marysville.

Recently, the RMT (2013) conducted specific studies to rigorously investigate spatial structure in the lower Yuba River by developing an approach to identify the fluvial-geomorphologic dynamics affecting: (1) adult spatial structure components, including the availability of fish habitat for immigrating, holding, and spawning adult salmonids; and

(2) the seasonal availability of rearing habitat for juvenile salmonids. The RMT (2013) morphological unit and mesohabitat classification studies: (1) identified morphological units throughout the lower Yuba River; (2) evaluated the quality, number, size and distribution of mesohabitats for various lifestages of adult and juvenile anadromous salmonids; and (3) evaluated the maintenance of watershed processes in the lower Yuba River. Part of the RMT (2013) process included the identification of morphological reaches in the lower Yuba River, identified and described in **Table 3-1**.

Table 3-1. Morphological reaches and delineating transparent geomorphic features in the lower Yuba River.

Reach Name	Reach Description
Englebright Dam Reach	Englebright Dam to confluence with Deer Creek
Narrows Reach	Deer Creek to onset of emergent gravel floodplain
Timbuctoo Bend Reach	Emergent gravel floodplain to upstream of Blue Point Mine
Parks Bar Reach	Upstream of Blue Point Mine to Highway 20 Bridge
Dry Creek Reach	Highway 20 Bridge to Yuba River confluence with Dry Creek
Daguerre Reach	Yuba River confluence with Dry Creek downstream to Daguerre Point Dam
Hallwood Reach	Daguerre Point Dam downstream to Eddie Drive aims at Slope Break
Marysville Reach	Eddie Drive aims at Slope Break downstream to the mouth of the lower Yuba River
Source: RMT 2013	

3.2 Other Aquatic Habitat Areas Affecting the Species' Status in the ESU/DPS

The discussion of the status of each species includes appropriate information on the species' life history, current known range and habitat use, distribution, and other data regarding factors necessary to the species' survival (USFWS and NMFS 1998). Because many listed species are declining throughout their range, the overall population trend of a species has implications for new proposals that could result in additional effects on the species (USFWS and NMFS 1998). The trends of the remaining populations of listed species form the basis for evaluating the effects of a proposed action on that species. USFWS and NMFS (1998) further state that "*Unless a species' range is wholly contained within the action area, this analysis* [describing the status of a species within the action area] *is a subset of the preceding rangewide status discussion*."

Because the listed fish species (i.e., spring-run Chinook salmon, steelhead and green sturgeon) that inhabit the lower Yuba River are anadromous, they do not reside in the lower Yuba River for their entire lifecycles. On an ESU/DPS scale, aquatic habitat conditions throughout each species' range, including the Feather River, the Sacramento River, and the Sacramento-San Joaquin Delta (Delta) affect spring-run Chinook salmon, steelhead, and green sturgeon (**Figure 3-2**). Although these areas are not contained within the Action Area, they are briefly described here to provide context regarding the lower Yuba River.

3.2.1 Feather River

The Feather River Basin encompasses an area of about 5,900 square miles (DWR 2007). The Feather River is considered to be a major tributary to the Sacramento River and provides about 25 percent of the flow[1] in the Sacramento River (DWR 2007). The lower Feather River extends from the Fish Barrier Dam (RM 67.25) near Oroville Reservoir downstream to the confluence of the Feather and Sacramento rivers (RM 0) (Figure 3-2).

Flows in the lower Feather River are influenced by releases from Oroville Dam and Reservoir, which is operated by the California Department of Water Resources (DWR) as part of the SWP). Downstream of Oroville Dam, water is diverted in several directions to: (1) the Thermalito Complex; (2) the Feather River Fish Hatchery (FRFH); and (3) the Low Flow Channel. The sources combine below the Thermalito Afterbay, creating the High Flow Channel. The Low Flow Channel is highly regulated and contains the majority of the anadromous salmonid spawning habitat. The Yuba and Bear rivers are both tributaries to the Feather River. The Yuba River flows into the Feather River near the

[1] As measured at Oroville Dam.

Figure 3-2. Other aquatic habitat areas affecting Yuba River spring-run Chinook salmon, steelhead and green sturgeon throughout the ESU/DPS (Source: YCWA et al. 2007).

City of Marysville, 39 RM downstream of the City of Oroville. The Bear River flows into the Feather River about 55 RM downstream of the City of Oroville. Approximately 67 RM downstream of the City of Oroville, the Feather River flows into the Sacramento River near the town of Verona (DWR 2007).

3.2.2 Sacramento River

The Sacramento River (Figure 3-2) is the largest river system in California, yielding 35 percent of the state's water supply. Most of the Sacramento River flow is controlled by Reclamation's Shasta Dam and Reservoir, and river flow is augmented by transfer of Trinity River water through Clear and Spring Creek tunnels to Keswick Reservoir. Immediately below Keswick Dam, the river is deeply incised in bedrock with very limited riparian vegetation.

The upper Sacramento River is often defined as the portion of the river from Princeton (RM 163; downstream extent of salmonid spawning in the Sacramento River) to Keswick Dam (the upstream extent of anadromous fish migration and spawning). The Sacramento River is an important corridor for anadromous fishes moving between the ocean and Delta and upstream river and tributary spawning and rearing habitats. The upper Sacramento River is differentiated from the river's "headwaters" which lie upstream of Shasta Reservoir. The upper Sacramento River provides a diversity of aquatic habitats, including fast-water riffles and shallow glides, slow-water deep glides and pools, and off-channel backwater habitats (Reclamation et al. 2004).

The lower Sacramento River is generally defined as the portion of the river from Princeton to the Delta at approximately Chipps Island (near Pittsburg). The lower Sacramento River is predominantly channelized, leveed and bordered by agricultural lands. Aquatic habitat in the lower Sacramento River is characterized primarily by slow water glides and pools, is depositional in nature, and has lower water clarity and habitat diversity, relative to the upper portion of the river.

3.2.3 Sacramento-San Joaquin Delta

The Delta is a vast, low-lying inland region located east of the San Francisco Bay Area, at the confluence of the Sacramento and San Joaquin Rivers. Geographically, this region forms the eastern portion of the San Francisco estuary, which includes San Francisco, San Pablo, and Suisun Bays (Figure 3-2). An interconnected network of water channels and man-made islands, the Delta stretches nearly 50 miles from Sacramento south to the City of Tracy, and spans almost 25 miles from Antioch east to Stockton (Public Policy Institute of California 2007). The Delta is a complex area for both anadromous fisheries production and distribution of California water resources for numerous beneficial uses. The Delta also includes the federal CVP Jones Pumping Plant and the SWP Banks Pumping Plant in the south Delta (export pumps). Water withdrawn from the Delta provides for much of California's water needs, including both drinking water and water for agricultural irrigation purposes.

2.0 Description of the Proposed Action

The Corps' identification and definition of an "action" must comply with the procedural and substantive requirements of the ESA. A comprehensive project description is vital to determining the scope of the proposed action. The ESA Section 7 regulations define "action" as: *"…all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or upon the high seas. Examples include, but are not limited to: …(d) actions directly or indirectly causing modifications to the land, water, or air"* (50 CFR 402.02).

The Corps' authorized O&M and planning activities associated with the Proposed Action includes making minor modifications to the fish ladders at Daguerre Point Dam. The Corps' O&M of the fish ladders at Daguerre Point Dam does not include major ladder reconfigurations or reconstruction. According to the Corps Regulation (No. 1165-2-119) titled "Modifications to Completed Projects" (Corps 1982), such activities would require additional Congressional authorization and appropriation of necessary funding. Consequently, the Proposed Action is comprised of O&M of the existing fish passage facilities at Daguerre Point Dam, and specified conservation measures.

When used in the context of the ESA, "conservation measures" represent actions pledged in the project description that the action agency (in this case, the Corps) will implement to further the recovery of the species under review (USFWS and NMFS 1998). Such measures should be closely related to the action, and should be achievable within the authority of the action agency. For the present consultation, such measures correspond to the "Protective Conservation Measures" described below.

Because conservation measures are part of a proposed action, their implementation is required under the terms of the consultation. However, NMFS can make conservation recommendations, which are discretionary suggestions for consideration by the Corps. For the present consultation, the "Voluntary Conservation Measures for Habitat Enhancement Purposes" generally correspond to conservation recommendations, because although these measures are planned for implementation, they are subject to funding availability.

The beneficial effects of conservation measures are taken into consideration for both jeopardy and incidental take analyses by NMFS. However, USFWS and NMFS (1998) caution that… *"the objective of the incidental take analysis under section 7 is minimization, not mitigation. If the conservation measure only protects off-site habitat and does not minimize impacts to affected individuals in the action area, the beneficial effects of the conservation measure are irrelevant to the incidental take analysis."*

2.1 Proposed Action Components

The formal Section 7 consultation, for which this BA has been prepared, includes Corps discretionary actions pertaining to O&M of the fish passage facilities at Daguerre Point Dam, including administration of outgrants associated with O&M of the facilities, and conservation measures. The Proposed Action is consistent with the Congressional authorization (Rivers and Harbors Act of 1935) for Daguerre Point Dam, and consists of the following components:

- ❑ Operation and maintenance of the fish passage facilities at Daguerre Point Dam
- ❑ Maintenance of the staff gage at Daguerre Point Dam
- ❑ Administration of a right-of-way (license) issued to CDFW for VAKI Riverwatcher operations at Daguerre Point Dam
- ❑ Administration of a right-of-way (license) issued to Cordua Irrigation District for flashboard installation, removal and maintenance at Daguerre Point Dam

Protective Conservation Measures (annual funding availability and ongoing implementation is reasonably certain to occur based on past operations).

- ❑ Implementation of the Daguerre Point Dam Fish Passage Sediment Management Plan
- ❑ Administration of a long-term Flashboard Management Plan at Daguerre Point Dam
- ❑ Implementation of a Debris Monitoring and Maintenance Plan at Daguerre Point Dam

Voluntary Conservation Measures for Habitat Enhancement Purposes (planned for implementation, but less certain and subject to funding availability).

- Gravel Injection in the Englebright Dam Reach of the lower Yuba River
- Large Woody Material Management Program

In addition, Corps discretionary activities also include the review of requests for temporary right-of-ways (permits) or use of portions of Corps owned right-of-ways associated with Daguerre Point Dam. All requests for permits for temporary right-of-ways or use of portions of the Government owned right-of-ways are carefully reviewed to determine that such use will not adversely affect maintenance operations, or the safety and functioning of the project structures (Corps 1966). Each request is processed on a case-by-case basis. No specific requests are presently identified, and the Corps review of such requests is not included in formal consultation for this BA.

It also is important to note that, for this consultation, the Corps has no water rights or authority to regulate water rights on the Yuba River. Because water right issues on the Yuba River are not within the Corps' authority or discretion to regulate, they are not part of the Proposed Action.

2.1.1 Operation and Maintenance of the Fish Passage Facilities at Daguerre Point Dam

Daguerre Point Dam (**Figure 2-1**) is located on the lower Yuba River approximately 11.5 River Miles (RM) upstream from the confluence of the lower Yuba and lower Feather rivers. Concrete fish ladders are located on both the North and South abutments of the Dam **(Figure 2-2, Figure 2-3).** The park personnel of the Corps administer the operation and maintenance of the fish ladders, in coordination with CDFW.

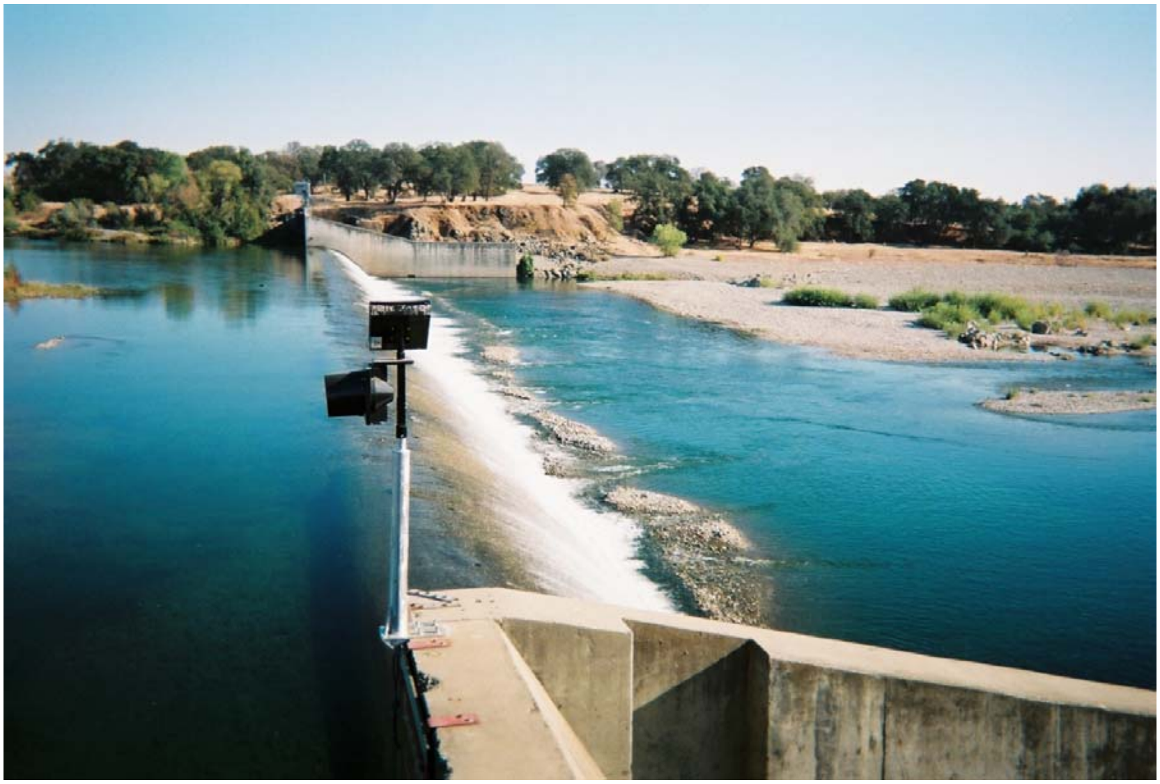

Figure 2-1. Daguerre Point Dam (photo by D. Simodynes, October 9, 2009).

2.1.1.1 Fish Ladder Operations

Fish ladder operations consist of adjusting the fishway gates, within-ladder flashboards, and the fish ladder gated orifices. Fishway gates allow water to enter the fish ladders, and the fish ladder gated orifices regulate the point where upstream migrating fish can most easily enter the ladders (Corps 1966). Within-ladder flashboards influence flow hydraulics within the bays of the ladders.

The Corps continues to operate the fish ladders at Daguerre Point Dam to improve fish passage. The Corps' past operational criteria required that the fish ladders at Daguerre Point Dam be physically closed when water elevations reached 130 feet, or when flows were slightly less than 10,000 cfs (SWRCB 2003), and to keep them closed until the water recedes to an elevation of 127 feet (CALFED and YCWA 2005). Presently, the Corps is collaborating with resource agencies (CDFW, NMFS) and the Yuba Accord River Management Team (RMT) to improve fish passage by keeping the ladders open at

Figure 2-2. North fish ladders at Daguerre Point Dam (Corps 2012c).

Figure 2-3. South fish ladders at Daguerre Point Dam (Corps 2012c).

all river elevations. The Proposed Action includes continuation of this collaboration, and keeping the ladders open.

Within-ladder flashboards were installed in the lower bays of the south fish ladder during June 2010 by CDFW. Adjustment of these within-ladder flashboards influence hydraulics and have been shown to improve adult anadromous salmonid attraction flows to the south ladder (Grothe 2011). The Proposed Action includes the continued collaboration with CDFW regarding adjustment of these within-ladder flashboards.

2.1.1.2 Fish Passage Facility Maintenance

The Corps coordinates with CDFW and NMFS to determine when maintenance of the fish passage facilities at Daguerre Point Dam is to be conducted, which is when it is least stressful to fish. Corps and CDFW joint maintenance activities include cleaning the bays of the fish ladders, cleaning the grates covering the fish ladder bays, and other minor maintenance activities. Since the spring of 2010, the Corps and NMFS have been holding monthly meetings to coordinate regarding maintenance activities and other issues pertaining to the lower Yuba River. The Proposed Action includes the continuation of the Corps-NMFS coordination meetings.

CDFW is responsible for inspecting and clearing debris from the upper portion of the ladders containing the VAKI Riverwatcher devices (see Section 2.1.3), and the Corps is responsible for all other parts of the ladders. Presently, Pacific States Marine Fisheries Commission (PSMFC) staff, in collaboration with CDFW, operating the VAKI Riverwatcher devices make observations of the fish ladders on an approximately daily basis, and the Corps coordinates with them regarding observations of debris or blockages, and/or adult salmonid upstream passage observations. Any debris that could affect fish passage is removed as soon as possible when personnel can safely access the area. Since August 2010, the Corps has also conducted sub-surface inspections of the ladders, after NMFS advised the Corps of the possibility of sub-surface blockage. The Proposed Action includes continuation of the routine maintenance of removal of debris from the fish ladders.

2.1.1.3 Daguerre Point Dam Fish Passage Sediment Management Plan

The Corps routinely removes the gravel and sediment that accumulates upstream of Daguerre Point Dam. The Corps, through collaboration with NMFS, CDFW, and USFWS, developed an updated Daguerre Point Dam Fish Passage Sediment Management Plan in February 2009 (Corps 2009). The purpose of the plan is to describe the methods used to manage the sediment that accumulates upstream of Daguerre Point Dam in order to improve flows to the ladders at Daguerre Point Dam, to provide suitable adult salmonid migratory habitat conditions upstream of the Daguerre Point Dam fish ladders, and to provide attraction to the ladders downstream of Daguerre Point Dam. Details of the plan include the following.

Upstream of Daguerre Point Dam, adequate water depth will be maintained across the upstream face of the dam to allow unimpeded fish passage from the ladders to the main channel of the lower Yuba River upstream from Daguerre Point Dam. An adequate water depth is defined as a "channel" at least 30 feet wide when measured from the face of the dam upstream, and 3 feet deep when measured from the crest of the dam to the riverbed.

Water depth measurements will be taken across the upstream face of the dam to determine the depth of the channel during June of each year. If the flows are too high in June to take the measurements, they will be taken as soon as conditions are safe. If the water depth measurements show that the channel is still at least 30 feet wide by 3 feet deep, no sediment removal is required for that year. If the water depth measurements show that sediment has encroached and the channel has filled in to less than 30 feet wide by 3 feet deep, sediment removal will be conducted during the month of August. During sediment removal, the channel will be widened to 45 feet and deepened to 5 feet.

A tracked excavator will be used to remove the sediment/gravel (**Figure 2-4**). The excavator will be cleaned of all oils and greases, and will be inspected and re-cleaned daily as necessary to insure no contaminants are released into the lower Yuba River. All hydraulic hoses and fittings also will be inspected to insure there are no leaks in the hydraulic system.

Figure 2-4. Excavator removing sediment above Daguerre Point Dam during August 2011.

Material removed shall be managed in one of two ways. If all required permits can be obtained (expected to occur during the summer of years when excavation is necessary), then it is anticipated that the excavated material will be placed on a downstream bank of the lower Yuba River approximately ¼ mile downstream of Daguerre Point Dam (Grothe, Corps, pers. comm. 2013). Materials will be placed in a location that will provide an opportunity for the gravel to be mobilized by the river during high flow conditions and transported downstream to augment downstream spawning gravels. If permits cannot be obtained or conditions do not allow for the downstream placement, then the material will be removed and stored above the ordinary high water mark until both permits are obtained and it can be moved downstream to a location where the gravel can be mobilized by the river during high flow conditions and transported downstream.

The Proposed Action includes continued implementation of the Daguerre Point Dam Fish Passage Sediment Management Plan.

2.1.2 Staff Gage Maintenance

Hydrologic facilities consist of a staff gage on the right abutment of Daguerre Point Dam. As described in the Daguerre Point Dam O&M Manual (Corps 1966), the Corps' Engineering Division is responsible for maintaining, reading, and filing all records obtained from this gage. The Proposed Action includes continuation of the routine maintenance activities associated with the staff gage.

2.1.3 Administration of a License Issued to CDFW for VAKI Riverwatcher Operations at Daguerre Point Dam

The Corps administers a license to CDFW (DACW05-3-03-550) to install and operate electronic fish counting devices, referred to as a VAKI Riverwatcher infrared and photogrammetric system, in the fish ladders at Daguerre Point Dam and is revocable at will by the Corps (Amendment 2 to License DACW05-3-03-550). The Proposed Action includes continued administration of this license, which remains in effect until 2018.

The license specifies that CDFW shall pay the cost, as determined by the Corps, of producing and/or supplying any utilities and other services furnished by the Government or through Government-owned facilities for the use of CDFW, including CDFW's proportionate share of the cost of operation and maintenance of the Government-owned facilities by which such utilities or services are produced or supplied. The Government is under no obligation to furnish utilities or services.

The license further specifies that CDFW shall keep the premises in good order and in a clean, safe condition by and at the expense of CDFW. CDFW is responsible for any damage that may be caused to property of the United States by CDFW activities and shall exercise due diligences in the protection of all property located on the premises against fire or damage from any and all other causes.

The Proposed Action includes continued administration of the license to CDFW to operate the VAKI Riverwatcher infrared and photogrammetric system in the fish ladders at Daguerre Point Dam.

2.1.4 Administration of a License Issued to Cordua Irrigation District for Flashboard Installation, Removal and Maintenance at Daguerre Point Dam

To benefit listed fish species by improving the ability of the fish to locate the fish ladders and migrate upstream to spawning and rearing habitats the Corps, in coordination with CDFW and NMFS, developed and implemented a Daguerre Point Dam Flashboard Management Plan in 2011. The Plan addresses the use, placement, monitoring and removal of flashboards at Daguerre Point Dam. To improve management of the flashboards at Daguerre Point Dam on a long-term basis, the Flashboard Management Plan was incorporated into the September 27, 2011 license amendment issued by the Corps to Cordua Irrigation District. The Proposed Action includes continued administration of the license issued to Cordua Irrigation District which incorporates the Flashboard Management Plan, until the license expires in 2016.

Installation of these flashboards directs some sheet flow from over the top of Daguerre Point Dam into the fish ladders. In accordance with the terms of the 2011 amended license, which will continue to be administered by the Corps as part of the Proposed Action, Cordua Irrigation District will install, remove and maintain the anchoring system, supporting brackets and flashboards and must coordinate its activities with the Corps, NMFS, and CDFW. These agencies will work with Cordua Irrigation District to direct the placement, timing and configuration of the flashboards to best manage flows to benefit fish (Grothe 2011). The long-term flashboard operations plan developed by the Corps includes the following.

- <u>Conditions of Placement</u>. Flashboards will be used in periods of low flow to direct water toward the fish ladders to provide optimal flow conditions. Because there is no recorded flow information at this time to set a flow-based trigger, the flashboards will be set in place when the flows recede to a point that only part of the dam has water flowing over it. Flows will be recorded at the time of placement to determine the flow rate trigger for future placement.

- Period of Placement. Flashboards and brackets will be installed as described above, but only after April 15 and will be removed before November 1 of each year. Further, flashboards will be removed within 24 hours, if directed by the Corps, NMFS or CDFW.

- Flashboard Adjustments. Flashboards will be closely monitored in accordance with monitoring and inspection activities (see below) to ensure they have been placed in a manner that leads to actual improvement in fish passage and will be adjusted accordingly based on such monitoring. All adjustments will be coordinated with NMFS and CDFW. Any recommended adjustments will be made within 24 hours of notification unless flow conditions prohibit them. In that case, the adjustments will be made as soon as conditions allow.

- Method of Placement. Flashboards will be installed using metal brackets that are attached to the dam with anchor bolts. The brackets will be fabricated of material that is light enough that it will break away if the flows increase too rapidly before the brackets can be removed.

- Location of Placement. When flashboard placement is required, they will be placed in the center portion of the dam in such a way that the flows are directed toward both fish ladders. This will ensure adequate flows through the fish ladders to promote optimal flow conditions and attraction flows to the fish ladders. The number of boards placed and the exact location will be determined based upon flow conditions and channel position. Adjustments will be made as necessary to provide optimal fish attraction and passage. All adjustments will be coordinated with NMFS and CDFW.

- Flashboard Material. Flashboard material will be 2” x 10” Douglas Fir or equal material. Material will be free of preservatives and other contaminants – no pressure treated material will be used.

- Monitoring and Inspection. Once the flashboards have been placed, fish passage will be closely monitored for the first week after placement to confirm that the flashboard installation improves fish passage. This monitoring will be conducted via the VAKI in coordination with the RMT. Additionally, during the period that flashboards are installed in accordance with this plan, the flashboards will be monitored at least once per week to make sure that the flashboards have not collected debris that might contribute to juvenile fish mortality. The flashboards will be cleared within 24 hours of finding a blockage, or as soon as it is safe to clear them.

- Updates. The Corps will update and adjust this plan as required based upon new information generated through monitoring efforts.

As part of future Cordua Irrigation District license renewal and approval processes after 2016, the Corps will refine the description of specific operations addressing the placement, timing and configuration of the flashboards at Daguerre Point Dam and incorporate changes to the Flashboard Management Plan into the terms and conditions for the Corps license to be re-issued to Cordua Irrigation District (Grothe 2011), and Cordua Irrigation District will remain responsible for implementing the flashboard operations.

In addition to the aforementioned description of the long-term flashboard operations developed by the Corps, additional refinements for the license may include the following.

- The flow conditions in the lower Yuba River flow that will prompt the placement and removal of the flashboards.
- The responsibility of Cordua Irrigation District for monitoring the flashboards at least once a week to make sure that they have not collected debris that might contribute to juvenile fish mortality.
- The responsibility of Cordua Irrigation District for monitoring the effects of the flashboards on juvenile salmonids and the potential for direct mortality due to entrainment or concentrating juveniles in a manner that promotes predation.

If the Corps does not renew the license to Cordua Irrigation District or another entity when it expires in 2016, then the Corps will assume responsibility for implementing the operations and maintenance activities addressing the placement, timing and configuration of the flashboards at Daguerre Point Dam that are described in the Flashboard Management Plan on a long-term basis.

2.1.5 Protective Conservation Measures

The ESA mandates Federal agencies to utilize their authorities to carry out programs for the conservation and survival of Federally-listed endangered and threatened species (Corps 1996).

The Corps has committed to incorporate several conservation measures into its activities for this Proposed Action (**Appendix C**). These measures are intended to improve conditions for listed salmonids in the lower Yuba River. The Corps will implement the following protective conservation measures under the Corps' obligation to Section 7(a)(1) of the ESA for the conservation of threatened and endangered species.

2.1.5.1 Implementation of the Daguerre Point Dam Fish Passage Sediment Management Plan

The Proposed Action includes continued implementation of the 2009 Fish Passage Sediment Management Plan (see Section 2.1.1.3). The Corps considers the Fish Passage Sediment Management Plan to be a protective conservation measure because it includes activities beyond those specified in the Daguerre Point Dam O&M Manual (Corps 1966).

2.1.5.2 Management of a Long-term Flashboard Program at Daguerre Point Dam

The Proposed Action includes implementation of the Flashboard Management Plan (see Section 2.1.4) through the administration of a license issued to Cordua Irrigation District. If the Corps does not renew the license to Cordua Irrigation District, or another entity, when it expires in 2016, then the Corps will assume responsibility for implementing the operations and maintenance activities addressing the placement, timing and configuration of the flashboards at Daguerre Point Dam that are described in the Flashboard Management Plan on a long-term basis.

2.1.5.3 Implementation of a Debris Monitoring and Maintenance Plan at Daguerre Point Dam

Through coordination with CDFW and NMFS, the Corps will implement the Debris Monitoring and Maintenance Plan for clearing accumulated debris and blockages in the fish ladders at Daguerre Point Dam. This plan specifies that CDFW is responsible for inspecting and clearing the portion of the ladders containing the VAKI device, and that the Corps is responsible for all other parts of the ladders. Inspections will include sub-surface inspections of the ladders. The Corps will conduct weekly inspections of the Daguerre Point Dam fish ladders for surface and subsurface debris. The Corps also will routinely inspect the fish ladder gates to ensure that no third parties close them. Routine inspections shall occur at least weekly, and may be conducted under agreement with CDFW. This plan also specifies that routine inspection and clearing of debris from the two fish ladders at Daguerre Point Dam may be conducted by CDFW pursuant to agreement with the Corps, or by other parties (e.g., PSMFC) under CDFW direction. Routine inspections and debris clearing will occur weekly, although more frequent inspections and debris clearing activities may be conducted by CDFW, or other parties (e.g., PSMFC) under CDFW direction.

When river flows are 4,200 cfs or greater, the Corps or other designated parties as described above, will conduct daily manual inspections of the Daguerre Point Dam fish ladders. Upon discovering debris in the ladders, the debris will be removed within twelve hours, even if the Corps or CDFW determines that flow levels are adequate for fish passage. If conditions do not allow for safe immediate removal of the debris, the debris will be removed within twelve hours after flows have returned to safe levels.

The Corps will reconsider the need for specific provisions, and may modify the Debris Monitoring and Maintenance Plan upon issuance by NMFS of a BO for the Proposed Action.

2.1.6 Corps' Voluntary Conservation Program

With respect to the conservation of Federally-listed endangered and threatened species on existing Corps' project lands, the Corps' Environmental Stewardship and Maintenance

Guidance and Procedures (Corps 1996) state that identified conservation activities will be accomplished when funds are available through the budget priority process presented in the Annual O&M Budget Guidance. Therefore, conservation measures contained within the Corps' Voluntary Conservation Program are subject to the availability of funding. Limited financial resources are presently available for the Corps to proceed with implementing the Voluntary Conservation Program measures described below. In the past, the Corps has been successful in obtaining the additional funding as it places a high priority on these measures. These voluntary conservation measures were previously identified in the Corps' 2012 BA, and the Corps will continue to diligently seek opportunities for future implementation, subject to available funding (**Appendix D**).

2.1.6.1 Gravel Injection in the Englebright Dam Reach of the Lower Yuba River

The Corps has been injecting a mixture of coarse sediment in the gravel (2-64 mm) and cobble (64-256 mm) size ranges into the lower Yuba River below Englebright Dam, as part of their voluntary conservation measures associated with ESA consultations regarding Daguerre Point Dam. Four separate gravel injection efforts have been undertaken from 2007-2013, with approximately 15,500 tons of gravel/cobble placed into the Englebright Dam Reach.

Future gravel injections are anticipated as one of the Corps voluntary conservation measures associated with the current ESA consultation. The Corps' Gravel Augmentation Implementation Plan (GAIP) provides guidance for a long-term gravel injection program to provide Chinook salmon spawning habitat in the bedrock canyon downstream of Englebright Dam. The Corps has contracted bathymetric survey monitoring to compare volumetric differences between pre- and post- gravel injection distributions, to further evaluate the disposition of the injected gravels. Additionally, the Corps has funded PSMFC to conduct redd surveys in the Englebright Dam Reach to investigate whether Chinook salmon and steelhead are utilizing areas where gravel placement occurred. If the monitoring suggests alterative locations or gravel injection methods, then the Corps will continue the long-term gravel injection program accordingly. In addition, the frequency of gravel injection will be dependent upon annual monitoring results.

The GAIP (Pasternack 2010) describes present and proposed future gravel injection efforts, based on information available in 2010. The long-term plan calls for continuing gravel/cobble injection into the Englebright Dam Reach until the estimated coarse sediment storage deficit for the reach is eradicated, and then it calls for subsequent injections as needed to maintain the sediment storage volume in the event that floods export material downstream of the reach. The Corps does not currently have the authority to completely eradicate the deficit created by various causes in one placement, nor is that the intent of the Corps gravel injection program.

2.1.6.2 Large Woody Material Management Program

The Corps has prepared the Large Woody Material Management Plan (LWMMP), which includes the implementation of a Pilot Study in order to enhance rearing conditions for spring-run Chinook and Central Valley steelhead (Corps 2012d). The Corps proposed to initiate a pilot study to determine an effective method of replenishing the supply of large woody material (LWM) back into the lower Yuba River. As described in the LWMMP, the Pilot Study will use LWM from existing stockpiles at New Bullards Bar Reservoir for placement at selected sites along the lower Yuba River. The Pilot Study would include monitoring of placed materials, and used to assess the effectiveness of LWM placement in the lower Yuba River in order to develop a long-term program (Corps 2012d).

As part of this conservation measure, the Corps will: (1) refine the draft plan that was prepared for management of LWM, consistent with recreation safety needs; (2) conduct a pilot project to identify suitable locations and evaluate the efficacy of placing large in-stream woody material to modify local flow dynamics to increase cover and diversity of instream habitat for the primary purpose of benefitting juvenile salmonid rearing; and (3) based upon the outcomes of the pilot program, develop and implement a long-term large woody material management plan for the lower Yuba River, anticipated to occur within one year following completion of the pilot program, and subject to available funding.

2.2 Interrelated Actions

Interrelated actions are those that are part of a larger action and depend on the larger action for their justification (50 C.F.R. 402.02). There are no anticipated interrelated actions associated with the Proposed Action.

2.3 Interdependent Actions

Interdependent actions are those that have no independent utility apart from the action under consideration (50 C.F.R. 402.02). There are no anticipated interdependent actions associated with the Proposed Action.

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1.0 Introduction and Background

1.1 Introduction

The U. S. Army Corps of Engineers, Sacramento District (Corps), as the Action Agency, is submitting this Biological Assessment (BA) to the National Marine Fisheries Service (NMFS) as part of a consultation process pursuant to Section 7(a)(2) of the Endangered Species Act (ESA). This BA was prepared in accordance with legal requirements set forth in Section 7 of the ESA (16 U.S.C. 1536; see also 50 CFR Part 402), as well as in the NMFS and the United States Fish and Wildlife Service (USFWS) Endangered Species Act Consultation Handbook, Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act (USFWS and NMFS 1998). This BA defines and evaluates the potential effects of the Corps' limited ongoing discretionary activities at Daguerre Point Dam on threatened and endangered species and their designated critical habitats in the lower Yuba River. Specifically, the Corps' discretionary activities at Daguerre Point Dam are: (1) the operation and maintenance of the fish ladders; (2) an outgrant to the California Department of Fish and Wildlife (CDFW) [formerly California Department of Fish and Game] for VAKI Riverwatcher operations; and (3) a license to Cordua Irrigation District for flashboard operations. These activities constitute the Proposed Action for purposes of this consultation.

Although previous consultations have been conducted addressing various Corps activities in the lower Yuba River, this BA has been prepared to more clearly define and deconstruct the Proposed Action, and potential effects on listed species and their designated critical habitats attributed to the Proposed Action, in response to the considerations presented below regarding the background associated with the Proposed Action. There are many Corps actions on the lower Yuba River. This BA provides detailed information regarding the Corps' authorities and describes the Proposed Action for which the Corps is currently seeking Section 7 consultation, and also describes other actions that are not covered by the BA for clarification. To help illustrate the deconstruction of Corps' lower Yuba River activities (refer to Figure 1-1 in Section 1.3), the following categories have been created: (1) future actions requiring separate ESA consultation; (2) non-discretionary actions; (3) discretionary actions with no effect; (4) Englebright Dam and Reservoir discretionary actions that are not likely to adversely affect listed species, and are included in a separate informal ESA consultation; and (5) operations and maintenance (O&M) of existing fish passage facilities at Daguerre Point Dam included in the formal ESA consultation for this Proposed Action.

1.2 Background

The Section 7 ESA consultation process between the Corps and NMFS associated with Corps activities in the lower Yuba River extend back to 2000. Biological opinions (BOs) were issued by NMFS in 2002, 2007, and 2012. This section presents a description of the project history and an overview of the consultation history related to the NMFS BOs.

1.2.1 Consultation History

1.2.1.1 2002 Consultation

The Corps' proposed action that was evaluated in the 2000 Corps BA and the 2002 NMFS BO included the following actions:

ENGLEBRIGHT DAM

- O&M of Englebright Dam.
- Administration of License No. DACW05-9-95-604 to the Pacific Gas & Electric Company (PG&E) granting access for the Narrows I powerhouse near Englebright Dam. Narrows I is operated and maintained under Federal Energy Regulatory Commission (FERC) License No. 1403.
- Administration of Easement No. DACW05-2-75-716 to the Yuba County Water Agency (YCWA) granting a right-of-way for the Narrows II near Englebright Dam. Narrows II is operated and maintained under FERC License No. 2246.

- Administration of the March 28, 1994 Agreement with PG&E for the operation and maintenance of the Narrows I FERC licensed hydroelectric project. The 1994 Agreement states that the Corps is responsible for maintaining Englebright Dam and the outlet facilities in good order and repair, while PG&E is responsible for the O&M of the FERC licensed hydroelectric facility.

Although recreation at Englebright Reservoir was briefly mentioned in both the 2000 Corps BA and the 2002 NMFS BO, detailed descriptions of the Corps' specific operations and maintenance activities pertaining to recreation at Englebright Reservoir were not presented in the proposed action.

DAGUERRE POINT DAM

- O&M of Daguerre Point Dam and the North and South fish ladders.
- Administration of License No. DAW05-3-97-549 issued to the Hallwood Irrigation Company for a diversion in the vicinity of Daguerre Point Dam.
- Administration of License No. DACW05-3-85-537 granting a right-of-way for access to the South Yuba/Brophy Diversion Canal and Facilities in the vicinity of Daguerre Point Dam.

Although generally identified, specific Corps operations and maintenance activities pertaining to Daguerre Point Dam, including work with CDFW to maintain the two fish ladders at Daguerre Point Dam by clearing debris, were not presented in detail in the proposed action.

The following is a chronology of key events in the ESA consultation history that culminated with the 2002 BO.

- *June 22, 2000.* The Corps prepared a BA titled "*Biological Assessment of the Effects of Operations of Englebright Dam/Englebright Lake and Daguerre Point Dam on Central Valley ESU Spring-Run Chinook Salmon and Steelhead Trout*".
- *December 18, 2000.* The Corps prepared a revised BA titled Biological Assessment of the Effects of Operations of Englebright Dam and Reservoir and

Daguerre Point Dam on Central Valley ESU Spring-Run Chinook Salmon and Steelhead Trout.

- *March 27, 2002.* NMFS issued a non-jeopardy 5-year interim BO that analyzed the effects of the Corps' operation of Englebright Dam and Daguerre Point Dam on the threatened Central Valley spring-run Chinook salmon (*Oncorhynchus tshawtscha*), Central Valley steelhead (*O. mykiss*), and the respective designated critical habitats for these species. The 2002 NMFS BO concluded that the project was not likely to jeopardize the continued existence of the listed species, and was not likely to destroy or adversely modify designated critical habitat for these species, over the 5-year time period.

After 5 years, the Corps was required to reinitiate formal consultation on the effects of operations of Englebright Dam and Daguerre Point Dam on any species listed at that time.

The reason for the establishment of the 5-year time limit in the 2002 NMFS BO was that several programs and investigative studies (e.g., Daguerre Point Dam Preliminary Fish Passage Improvement Study (Corps 2001), Upper Yuba River Studies Program[1] (DWR 2007)) were underway, which were anticipated to provide new information affecting the Yuba River water management operations and the status of Yuba River fisheries resources (e.g., Chinook salmon and steelhead). In addition, the 2002 NMFS BO stated that recent changes to operational procedures as well as the physical structures associated with Englebright and Daguerre Point dams have provided a level of improvement to the situation for listed salmonids and their critical habitat within the lower Yuba

[1] Since 2008, the CALFED Ecosystem Restoration Program and the Fish Passage Improvement Program have been unable to fund continued work on the Upper Yuba River Studies Program (DWR 2011a).

River, and that additional actions planned for implementation within the next year were expected to further improve conditions for listed salmonids and their critical habitat. NMFS (2002) concluded that it is reasonable to expect that the recent and near-term improvements will at least stabilize population levels if not slightly increase them during the 5-year term of the BO as a result of decreases in the chronic effects of reduced survival of these species under past operations. NMFS (2002) therefore determined that the level of impacts over the 5-year period covered by the BO is unlikely to reduce the population numbers, reproductive success or the distribution of listed salmonids in the Yuba River to the point of reducing these populations' likelihood of survival and recovery. NMFS (2002) also concluded that the proposed action will not diminish the value of designated critical habitat for the survival and recovery of the Central Valley steelhead and spring-run Chinook salmon. The 2002 NMFS BO expired on March 27, 2007.

1.2.1.2 2007 Consultation

The Corps' proposed action that was evaluated during the 2007 Corps BA and the 2007 NMFS BO included the following actions:

ENGLEBRIGHT DAM

- O&M of Englebright Dam.
- Administration of Outgrant No. DACW05-9-95-604 to PG&E granting access for the Narrows I powerhouse near Englebright Dam. Narrows I is operated and maintained under FERC License No. 1403.
- Administration of Easement No. DACW05-2-75-716 to YCWA granting a right-of-way for the Narrows II powerhouse near Englebright Dam. Narrows II is operated and maintained under FERC License No. 2246.
- Administration of the March 28, 1994 Agreement with PG&E for the operation and maintenance of the Narrows I FERC licensed hydroelectric project. The 1994 Agreement states that the Corps is responsible for maintaining Englebright Dam and the outlet facilities in good order and repair, while PG&E is responsible for the O&M of the FERC licensed hydroelectric facility.

Recreation at Englebright Reservoir was not included in the 2007 Corps BA or the 2007 NMFS BO as part of the proposed action.

Daguerre Point Dam

- O&M of Daguerre Point Dam and the North and South fish ladders.
- Administration of License No. DAW05-3-97-549 issued for access to the Hallwood-Cordua diversion in the vicinity of Daguerre Point Dam.

Although License No. DACW05-3-85-537, granting access to the South Yuba/Brophy Diversion Canal and Facilities in the vicinity of Daguerre Point Dam was discussed, it was unclear to what extent, if any, administration of this license was included in the proposed action. Also, although generally identified, specific Corps operations and maintenance activities pertaining to Daguerre Point Dam, including work with CDFW to maintain the two fish ladders at Daguerre Point Dam by clearing debris, were not presented in detail in the proposed action.

The following is a chronology of key events in the ESA consultation history that culminated with the 2007 NMFS BO.

- *April 7, 2006.* NMFS issued a Final Rule to list the Southern DPS of North American green sturgeon (*Acipenser medirostris*) as a threatened species under the ESA.
- *February 28, 2007.* The Corps requested reinitiation of consultation for the species listed in the previous 2002 NMFS BO, and extension of the incidental take statement in the 2002 BO. The Corps also requested an incidental take statement for the Southern DPS of North American green sturgeon until NMFS issued a new BO and incidental take statement.
- *March 23, 2007.* The Corps delivered an initiation package including a cover letter requesting the initiation of formal consultation under Section 7 of the ESA for the proposed action along with a new BA and an Essential Fish Habitat (EFH) assessment for the proposed action to NMFS. Included in the Corps' March 23, 2007 cover letter was a request for the extension of the timeframe covered by the

2002 NMFS BO to maintain coverage for the proposed action until the current consultation could be completed and a final, long-term BO issued.

- *April 27, 2007*. NMFS issued a non-jeopardy BO that analyzed the effects of continuation of operation of the project for a period of up to one year.
- *November 21, 2007*. NMFS issued a non-jeopardy long-term BO (2007 NMFS BO) that analyzed the effects of operations of Englebright Dam and Daguerre Point Dam on threatened Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley steelhead (*O. mykiss*), the respective designated critical habitats for these salmonid species, as well as the threatened Southern DPS of North American green sturgeon. The long-term BO superseded the April 27, 2007 NMFS BO and was intended to be the final BO for the project.

NMFS (2007) stated that it would be likely that the facilities and operational procedures used in the past, if left uncorrected, would cause continued declines in population viability of these species and in the conservation value of critical habitat. However, NMFS also stated that there had been several recent changes to the facilities (e.g., fish screens at the Hallwood-Cordua diversion) and operational procedures (e.g., flashboard management, regular inspections and maintenance of the fish ladders, sediment management) at Daguerre Point Dam related to the Corp's Yuba River operations which were expected to improve conditions for Yuba River fisheries. Additionally, NMFS (2007) stated that recent salmonid monitoring data, while insufficient to allow detection of definite trends, did not suggest any significant, ongoing decline of salmonid populations or habitat variables in the lower Yuba River.

The 2007 NMFS BO concluded that the level of effects caused by Corps operations would be unlikely to cause a reduction in the population numbers, reproductive success or the distribution of listed fish in the Yuba River to the point of appreciably reducing these populations' likelihood of survival into the future. NMFS also concluded that there were several other actions and programs which were at varying stages of planning and implementation that were intended to produce significant improvements to the accessibility and quality of the habitat and viability of the populations of listed species on the Yuba River, and if fully implemented, would greatly increase the likelihood of significant recovery of these populations. Thus, the 2007 NMFS BO concluded that it was reasonable to expect that the Corps' proposed operations on the Yuba River should at least maintain, if not slightly improve the value of critical habitat for the conservation of spring-run Chinook salmon and steelhead above the value that was present when critical habitat was designated on the Yuba River in 2005.

However, review of the 2007 Corps BA and the 2007 NMFS BO suggests that effects of the proposed action were confused with effects of the environmental baseline.

The environmental baseline was accurately defined in the 2007 NMFS BO, based on the ESA regulations, to include "*the past and ongoing human and natural factors leading to the current status of the species and designated critical habitat within the action area*." The 2007 NMFS BO explained that the environmental baseline comprises all past impacts, including the effects of the proposed action up to the present.

The 2007 NMFS BO further explained that the assessment of "future" effects of the proposed action, by contrast to environmental baseline effects, should "*include the impacts to listed species and their critical habitat which will continue to be caused by operations of the projects in the future*." In the view of the Corps, effects of Englebright and Daguerre Point dams, that were due to the mere existence of the dams and not a result of the Corps' proposed action, should have been part of the environmental baseline and not attributed to the Corps proposed action. The 2007 NMFS BO did not distinguish between the future effects caused by the operations and maintenance of Englebright and Daguerre Point dams, and the future effects caused by the continued presence of the dams.

The 2007 NMFS BO discussion of critical habitat takes a similar approach, and described effects resulting from the continued presence of both dams in the analysis of the effects of the proposed action on critical habitat.

The 2007 NMFS BO included the existence of the dams and water diversions as effects of the proposed action. In the Corps' view, this approach to effects assessment was not consistent with the ESA regulations, ESA guidance, or the environmental baseline approached by NMFS in BOs for other ongoing water projects such as the New Hogan Dam and Lake BO dated December 5, 2002, the FERC Yuba River Development Amendment BO dated November 4, 2005, and the Central Valley Project/State Water Project BO dated June 4, 2009.

The 2007 NMFS BO determined that many future effects solely attributable to the presence of Englebright and Daguerre Point dams also were effects of the proposed action, which was not correct. In summary, the species-specific effects resulting from the presence of Englebright Dam, which the 2007 NMFS BO previously attributed to the Corps' operation and maintenance of Englebright Dam, should be included in the environmental baseline. Similarly, most of the effects that the 2007 NMFS BO previously attributed to the Corps' operation and maintenance of Daguerre Point Dam, as well as the associated fish ladders, should be included in the environmental baseline. Only those effects of Corps facilities that the Corps has the authority to change through its discretionary operation and maintenance activities at Englebright and Daguerre Point dams and the fish ladders at Daguerre Point Dam should be included in the effects of the proposed action. For these and other reasons (see below), the Corps voluntarily reinitiated consultation during 2011.

Two environmental groups, South Yuba River Citizen's League (SYRCL) and Friends of the River (FOR), sued NMFS, the Corps, and YCWA, alleging that NMFS' BO was arbitrary and capricious and that the Corps' operations of Englebright and Daguerre Point dams are causing take of protected salmon and steelhead. The *SYRCL v. NMFS* case was filed in the United States District Court, Eastern District of California, Case No. Civ. S-06-2845 LKK/JFM.

On June 16, 2010, the court entered a stipulated settlement order dismissing all the claims and relief sought against YCWA.

On July 8, 2010, the court issued an order, which concluded that NMFS acted arbitrarily and capriciously in reaching the BO's no-jeopardy and no adverse modification conclusions, and in issuing the incidental take statement. On April 29, 2011, the Court ordered that the 2007 Biological Opinion be remanded to NMFS and a new Biological Opinion be prepared.

On July 26, 2011, the Court granted, in part, Plaintiffs' Motion for Final Remedies ordering the Corps to take several actions, including: (1) develop a flashboard management plan; (2) conduct weekly inspections of the fish ladders at Daguerre Point Dam and removal of accumulated debris; (3) inspect and manage sediment accumulation in the channel upstream of Daguerre Point Dam after high flow events; and (4) install locking metal grates over the Daguerre Point Dam fish ladders.

On February 29, 2012, the Federal Defendants (NMFS) filed a notice of completion and issued a new Biological Opinion to the Corps. On May 31, 2012, the Court terminated the case.

1.2.1.3 2012 Consultation

The Corps voluntarily reinitiated formal consultation with NMFS on the Corps' ongoing operation and maintenance of Englebright Dam and Daguerre Point Dam and associated facilities in October 2011 with transmission of a draft BA to NMFS. In January 2012, a final BA (referred to herein as the 2012 BA) was prepared to, among other things, describe the proposed action and analyze the effects of that action on listed species and designated critical habitat.

As discussed in the 2012 BA, the Corps' responsibilities, as well as its ability to conduct operations- and maintenance-related actions at Englebright Dam and Reservoir and at Daguerre Point Dam, are primarily governed by each of the facilities' respective authorizations and appropriations. Consequently, the Corps' actions that were proposed and evaluated in the 2012 BA, which could potentially affect listed fish species in the lower Yuba River, were more clearly defined and limited relative to the previous two consultations. Additionally, review of Corps and NMFS documents previously prepared in association with the 2002 and 2007 consultation processes suggests that several issues pertaining to the characterization of the Corps' proposed action and other environmental baseline considerations potentially affecting listed fish species in the action area were inadvertently conflated during the previous two consultation processes.

By contrast to the assessments presented in the 2002 and 2007 consultation documents, a different approach was undertaken for the 2012 BA. Primarily, the analysis provided in the 2012 BA attempted to more clearly distinguish between the potential effects to listed fish species that are attributable to the environmental baseline (see Chapter 6.0 in the 2012 BA), compared to those that are expected to occur as a result of the proposed action (see Chapter 8.0 in the 2012 BA). The 2012 BA also provided information that the United States District Court, Eastern District of California identified as inadequacies in the 2007 NMFS BO.

The July 8, 2010 order of the United States District Court, Eastern District of California, in Case No. Civ. S-06-2845 LKK/JFM, held that the 2007 NMFS BO failed to address five stressors related to the Corps' proposed action: (1) effects in the action area from the Feather River Fish Hatchery (FRFH); (2) effects in the action area from conditions in the Delta; (3) effects based on the species overall viability; (4) effects in the action area from global warming; and (5) effects in the action area from poaching.

The 2012 BA addressed whether the Corps has authority to reduce the future effects from these potential stressors through its operation and maintenance activities. With the possible exceptions of effects related to poaching, and effects of fish ladder performance that are associated with authorized routine maintenance activities, the Corps determined that it did not have the ability to lessen other stressors associated with the Corps facilities. Therefore, the 2012 BA determined that many of the ongoing and future effects from the identified stressors were associated with the environmental baseline, and not the proposed action.

The 2012 BA attributed species-specific effects resulting from the presence of Englebright Dam, which the 2007 NMFS BO previously attributed to the Corps' operation and maintenance of Englebright Dam, to the environmental baseline. Also, in the 2012 BA, the anticipated potential direct and indirect effects associated with the

South Yuba/Brophy diversion were considered in the effects assessment for the proposed action, to the extent that the Corps has authority to mitigate these effects through conditions specified in the easement proposed at that time.

Additionally, several changed conditions had occurred since 2007 when the earlier consultation with NMFS was completed, including:

- *March 2008.* The State Water Resources Control Board (SWRCB) approved the petitions to change the water right permits of YCWA that were necessary to implement the Yuba Accord.
- *June 2009.* YCWA entered into Settlement Agreement with Plaintiffs (SYRCL and FOR) in their lawsuit against NMFS et al., which resulted in improvements to the maintenance and operations of the South Yuba/Brophy Diversion Canal and Facilities.
- *June 2009.* NMFS issued its Biological Opinion and Conference Opinion on the Long-term Operations of the Central Valley Project (CVP) and State Water Project (SWP).
- *October 2009.* NMFS issued the Draft Recovery Plan for the ESUs of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon, and the DPS of Central Valley Steelhead.
- *October 2009.* NMFS issued its final rulemaking to designate critical habitat for the threatened Southern DPS of North American green sturgeon.

Because the aforementioned changed conditions have the potential to influence the status of listed fish species and their habitats throughout each species' respective ESU (Evolutionary Significant Unit) or DPS (Distinct Population Segment), as well as within the action area, each of these changed conditions was considered in the Corp's 2012 BA, as appropriate.

The following is a chronology of key events in the ESA consultation history that culminated with the 2012 BO.

- *October 9, 2009.* NMFS issued a Final Rule designating critical habitat for the Federally threatened Southern DPS of North American green sturgeon.

- *June 2, 2010.* NMFS issued a Final ESA Section 4(d) Rule establishing take prohibitions for the Federally threatened Southern DPS of North American green sturgeon.
- *December 17, 2010.* The Corps and YCWA met to discuss the proposed ESA consultation approach, components of the proposed action, the environmental baseline, as well as the general content and organizational format of the revised BA.
- *January 5, 2011.* The Corps and YCWA met to discuss components of the proposed action, the environmental baseline and other ESA compliance issues.
- *February 10, 2011.* Coordination meeting between the Corps and NMFS to discuss current activities regarding the status of the terms and conditions of the 2007 BO and updates for the 2012 BA.
- *March 24, 2011.* Coordination meeting between the Corps and NMFS to discuss current activities regarding the status of the terms and conditions of the 2007 BO and updates for the 2012 BA.
- *April 13, 2011.* The Corps and YCWA met to discuss environmental baseline considerations and other effects of YCWA's facilities associated with Daguerre Point Dam and Englebright Dam, and YCWA's request for an easement for the South Yuba/Brophy Diversion Canal and Facilities.
- *April 28, 2011.* Coordination meeting between the Corps and NMFS to discuss current activities regarding the status of the terms and conditions of the 2007 BO and updates for the 2012 BA.
- *May 9, 2011.* YCWA submitted a letter to the Corps describing YCWA's view of the legal requirements for ESA consultation on Englebright Dam and Daguerre Point Dam.
- *June 28, 2011.* YCWA submitted a letter to the Corps requesting non-Federal applicant status for the Yuba River consultation.

- *June 29, 2011.* Coordination meeting between the Corps and NMFS to discuss current activities regarding the status of the terms and conditions of the 2007 BO and updates for the 2012 BA.
- *July 28, 2011.* Coordination meeting between the Corps and NMFS to discuss current activities regarding the status of the terms and conditions of the 2007 BO and updates for the 2012 BA.
- *August 25, 2011.* Coordination meeting between the Corps and NMFS to discuss current activities regarding the status of the terms and conditions of the 2007 BO, updates for the 2012 BA, and status of the Corps' implementation of the interim measures required by the District Court's July 26, 2011 Order.
- *September 22, 2011.* Coordination meeting between the Corps and NMFS to discuss current activities regarding the status of the terms and conditions of the current BO, updates for the 2012 BA, and status of the Corps' implementation of the interim measures required by the District Court's July 26, 2011 Order.
- *October 5, 2011.* NMFS wrote a letter to the Corps requesting that the Corps expedite preparation of the draft BA.
- *October 17, 2011.* The Corps transmitted to NMFS the draft BA for the U.S. Army Corps of Engineers' Ongoing Operation and Maintenance of Englebright Dam and Reservoir and Daguerre Point Dam on the lower Yuba River.
- *October 27, 2011*. Coordination meeting between the Corps and NMFS to discuss current activities regarding the status of the Corps' compliance with the terms and conditions of the 2007 BO incidental take statement and issues related to completion of the 2012 BO.
- *December 2, 2011.* NMFS sent a letter to the Corps identifying what NMFS believed to be deficiencies in the Corps draft BA.
- *January 10, 2012.* NMFS provided the Corps draft versions of the "action area" and "project description" portions of the 2012 BO for review and comment.
- *January 12, 2012.* Coordination meeting between the Corps and NMFS to discuss issues related to completion of the 2012 BO.

- *January 19, 2012.* The Corps provided comments to NMFS on the draft versions of the "action area" and "project description" portions of the 2012 BO.
- *January 27, 2012.* A meeting was held among the Corps, YCWA and NMFS regarding the ESA consultation for the Corps' operations on the lower Yuba River.
- *January 27, 2012.* The Corps responds to NMFS's December 2, 2011 letter and requests initiation of formal consultation on the proposed action. As part of the consultation request, the Corps submits the final 2012 BA to NMFS.
- *February 1, 2012.* NMFS provides the Corps with draft Reasonable and Prudent Alternative (RPA) options for review and comment.
- *February 2, 2012.* NMFS and the Corps meet to discuss Corps comments on NMFS draft project description for the BO.
- *February 8, 2012.* YCWA submits comments to NMFS on the Corps' final BA, requests a copy of the draft BO. YCWA also requests that the Corps ask that NMFS modify the present consultation schedule to allow sufficient time for YCWA to meaningfully participate in the consultation as well as review and offer comments on the draft BO.
- *February 27, 2012.* NMFS provides a draft BO to the Corps and YCWA, and allows a 24-hour period for review and comment on the draft BO.
- *February 28, 2012.* The Corps submits comments to NMFS on the draft BO.
- *February 28, 2012.* YCWA submits comments to NMFS on the draft BO.
- *February 29, 2012.* NMFS issued its Final BO (2012 BO) regarding the effects of Englebright Dam and Daguerre Point Dam on the Yuba River in Yuba and Nevada Counties, California on threatened Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley steelhead (*O. mykiss*), the threatened Southern distinct population segment of North American green sturgeon (*Acipenser medirostris*), and their designated critical habitat in accordance with Section 7(a)(2) of the ESA of 1973, as amended (16 U.S.C. 1531 et seq.).

The February 29, 2012 Final BO concluded that the operation and maintenance of these two dams would likely jeopardize the continued existence of spring-run Chinook salmon, steelhead, and green sturgeon, and result in the adverse modification of critical habitat for each of these species. The BO includes an RPA that modified the proposed action to avoid jeopardizing the species and adversely modifying their critical habitat. The RPA was divided into eight categories containing almost 60 specific actions to be implemented by the Corps (NMFS 2012).

The 2012 NMFS BO provided a summary of the authorities NMFS believed would allow the Corps to implement the various measures described in the 2012 NMFS BO RPA. However, in many instances, the 2012 NMFS BO failed to acknowledge or mention the significant constraints associated with the cited authorities that might have precluded immediate action by the Corps. See **Appendix A** for a discussion/explanation of the Corps' Authorities.

1.2.1.4 2013 Consultation

On July 3, 2012 the Corps transmitted a letter to NMFS memorializing the Corps' concerns regarding the 2012 BO. The Corps' concerns regarding the 2012 BO were related to the description of the proposed action and action area, NMFS' approach to baseline effects, the scientific basis for the analysis and conclusions, the scope and breadth of the RPA and the Reasonable and Prudent Measures (RPMs) associated with the incidental take statement, and the limitations of the Corps' authorities (Corps 2012b). This letter is attached as **Appendix B**.

On February 26, 2013, the Corps notified NMFS of its intent to reinitiate consultation with NMFS to address the impacts of the Corps' discretionary activities on Central Valley spring-run Chinook salmon, Central Valley steelhead, North American green sturgeon and their associated critical habitats. The Corps' February 26, 2013 letter stated that reinitiation of consultation is appropriate when *"…new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered," as well as when "…the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion*." 50 CFR §402.16(b)-(c). The Corps' letter further stated that reinitiation of consultation is appropriate in order for the Corps to provide NMFS with additional information and clarification on subjects that include the following:

1. The scope of the Corps' authorities and discretion, for purposes both of appropriately defining the proposed action and ensuring that any RPMs or RPA are "within the scope of the [Corps'] legal authority and jurisdiction." *See* 50 C.F.R. §402.02.
2. The scope of the action area and the determination of which other activities are interrelated and interdependent with the proposed action.
3. Additional information regarding the nature of the Corps' proposed activities at Englebright and Daguerre Point dams.
4. Scientific and technical information regarding the listed species and the effects of the proposed action on them.

The Corps' stated that it would prepare a revised BA to support the reinitiation of consultation. The following is a chronology of key events leading up to, and contributing to the consultation history for the 2013 ESA consultation process.

- *March 14, 2012.* Meeting to discuss the February 29, 2012 Final BO with NMFS, the Corps, YCWA and Pacific Gas and Electric Company (PG&E).
- *May 29, 2012.* Clarification Workshop No. 1 regarding the February 29, 2012 Final BO with NMFS, the Corps, YCWA and PG&E.
- *June 22, 2012.* The Corps and NMFS meet to discuss the content and conclusions presented in the February 29, 2012 Final BO.
- *June 25, 2012.* The Corps submits technical comments to NMFS on the February 29, 1012 Final BO.
- *June 29, 2012.* YCWA submits comments and requested clarifications to NMFS on the February 29, 2012 Final BO.
- *July 3, 2012.* The Corps sends a letter to NMFS acknowledging receipt of the February 29, 2012 Final BO. Although the Corps conditionally accepted the RPA

described in the Final BO, the Corps expressed serious concerns about various aspects of the BO that need to be resolved.

- *July 12, 2012.* PG&E submits comments to NMFS on the February 29, 2012 Final BO.
- *July 19, 2012.* Clarification Workshop No. 2 regarding the February 29, 2012 Final BO with NMFS, the Corps, YCWA and PG&E.
- *September 11, 2012.* Coordination meeting between the Corps and NMFS to discuss the status of revising the BA and reinitiating consultation.
- *September 19, 2012.* Clarification Workshop No. 3 regarding the February 29, 2012 Final BO with NMFS, the Corps, YCWA and PG&E.
- *September 25, 2012.* YCWA submits a letter to NMFS regarding the Yuba River BO clarification process and the status of NMFS's responses to comments submitted by the Corps, YCWA and PG&E.
- *October 4, 2012.* Corps submits a letter to NMFS requesting schedule adjustments pertaining to the implementation of certain actions of the RPA described in the February 29, 2012 Final BO.
- *October 30, 2012.* Yuba River BO Technical Meeting No. 1 with representatives from NMFS, the Corps, YCWA and PG&E.
- *November 16, 2012.* Yuba River BO Technical Meeting No. 2 with representatives from NMFS, the Corps, YCWA and PG&E.
- *November 27, 2012.* NMFS responds to the Corps' October 4, 2012 letter regarding implementation of certain RPA actions, and recognizes that several of measures in the RPA contain deadlines that cannot be met for practical reasons, such as a lack of appropriations, the length of time required to comply with the National Environmental Policy Act (NEPA), and other implementation challenges. The NMFS letter also extends the required implementation dates of several of the measures in the RPA.

- *November 29, 2012*. Yuba River BO Technical Meeting No. 3 was held among representatives from NMFS, the Corps, YCWA and PG&E.
- *December 11, 2012*. Yuba River BO Technical Meeting No. 4 was cancelled per NMFS's request.
- *January 24, 2013*. Yuba River BO Technical Meeting No. 5 was cancelled per NMFS's request.
- *February 26, 2013*. The Corps submits a request to NMFS advising of the Corps' intent to reinitiate consultation for the Corps' discretionary activities on the Yuba River.
- *April 11, 2013*. NMFS responds to the Corps February 26, 2013 request for reinitiation of consultation under Section 7 of the ESA (16 U.S.C. 1536(a) and the Magnuson-Stevens Fishery Conservation and Management Act (Public Law 94-541). To meet the requirements of CFR 402.14(c) to initiate formal consultation, and 50 CFR 402.l4(d) to provide the best scientific and commercial data available, NMFS recommended that the Corps develop an updated BA to evaluate the potential effects of the action on listed species and designated critical habitat, pursuant to 50 CFR 402.12.
- *April 17, 2013*. YCWA submits a letter to the Corps requesting non-Federal applicant status due to its pending June 28, 2011 application for a new easement related to operation and maintenance of the South Yuba/Brophy Diversion Canal and Facilities.
- *July 18, 2013*. The Corps and NMFS meet to discuss the characterization of the Proposed Action, the Action Area, the Environmental Baseline and the project schedule.
- *July 25, 2013*. The Corps, NMFS and YCWA meet to discuss YCWA's applicant status regarding the South Yuba/Brophy Diversion Canal and Facilities.
- *August 30, 2013*. The Corps and NMFS meet to discuss comments on the draft status of the species chapter and the draft effects assessment methodology chapter of the Corps' BA.

- *September 26, 2013*. The Corps and NMFS meet to discuss the scope of the Corps' authorities, as well as non-discretionary actions and discretionary actions within the scope of those authorities.

1.3 Deconstruction of Corps Activities

NMFS uses a series of sequential analyses to assess the effects of Federal actions on endangered and threatened species and designated critical habitat (NMFS 2009a). According to the document titled *An Assessment Framework for Conducting Jeopardy Analyses Under Section 7 of the Endangered Species Act* (NMFS 2004c), one of the early steps in NMFS evaluation process is to "deconstruct" the Proposed Action into its constituent parts. As part of the 2013 consultation between the Corps and NMFS, it was agreed that this BA would undertake a "deconstruction" process to more clearly define the Proposed Action, and distinguish the Proposed Action from other Corps' activities in the Yuba River Basin, to assist NMFS in its jeopardy analysis.

Given the suite of Corps activities in the Yuba River Basin and perplexity associated with the previous consultations, the "deconstruction" step in this BA clearly distinguishes between discretionary actions that may affect listed species and their critical habitat in the lower Yuba River and: (1) future actions requiring separate ESA consultation; (2) non-discretionary actions; (3) discretionary actions with no effect; and (4) Englebright Dam and Reservoir discretionary actions that are not likely to adversely affect listed species (**Figure 1-1**). Appropriately, this BA does not include consultation on future actions requiring separate ESA consultation and non-discretionary actions. Also, the Corps is not required to consult with NMFS on actions that have no effect on listed species and critical habitat. Englebright Dam and Reservoir discretionary actions that are not likely to adversely affect listed species or critical habitat concludes with informal consultation, and are addressed in a separate ESA consultation. Discretionary actions in the lower Yuba River that are likely to adversely affect listed species or critical habitat are carried forward for formal consultation in this BA. Each of these categories of actions in the Yuba River Basin is described below.

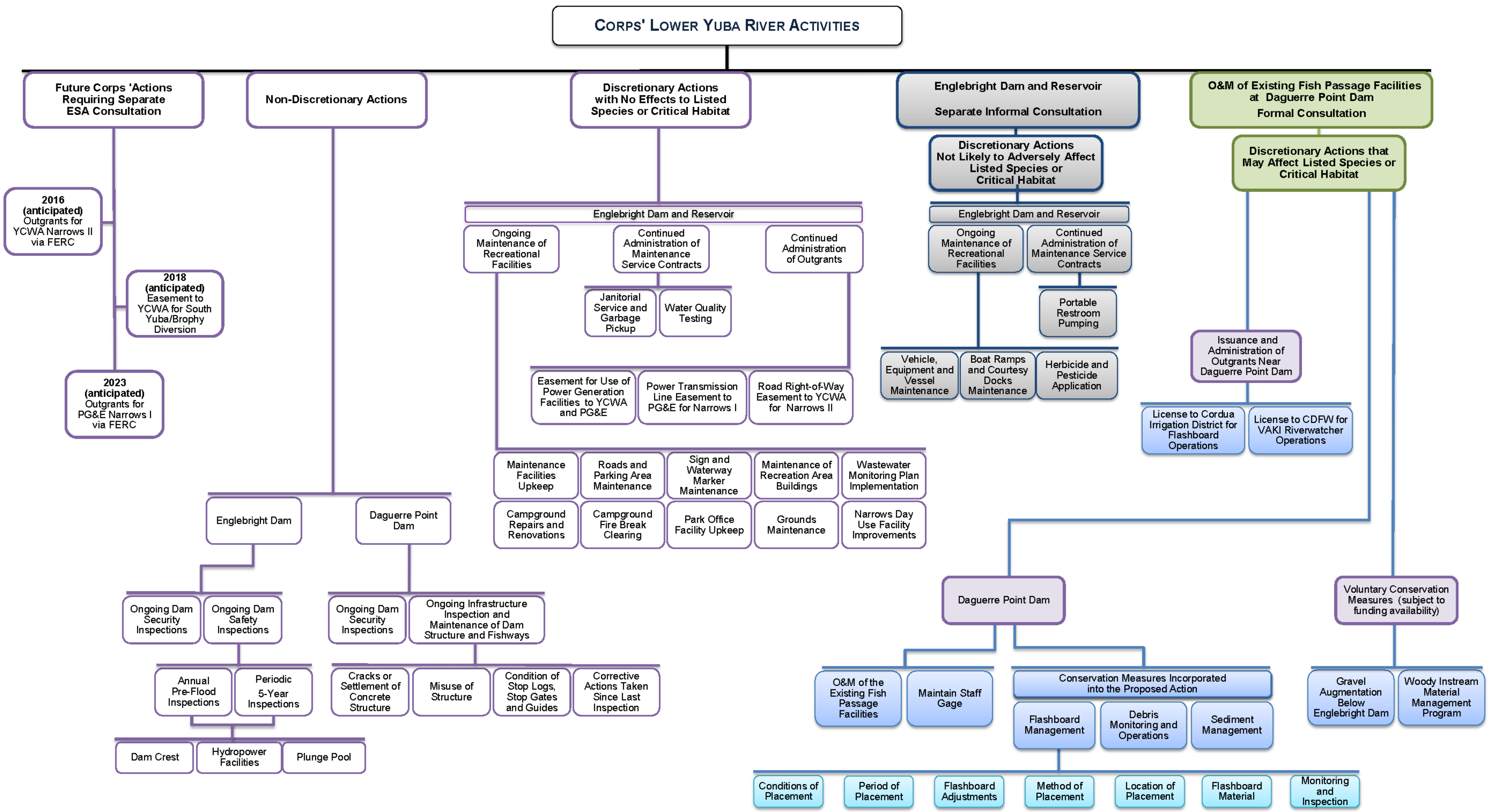

Figure 1-1. Deconstruction of the Corps' lower Yuba River activities and the Proposed Action (i.e., discretionary actions that may affect listed species).

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1.3.1 Corps Non-Discretionary Activities Not Subject to ESA Consultation

One of the key considerations emanating from the 2012 consultation process was the need for clear distinctions between Corps discretionary and non-discretionary actions regarding Englebright and Daguerre Point dams. As stated in 50 CFR §402.03, "*Section 7 and the requirements of this part apply to all actions in which there is discretionary Federal involvement or control*". Therefore, non-discretionary activities at Englebright and Daguerre Point dams are not subject to ESA consultation.

The responsibility to maintain Civil Works structures so that they continue to serve their Congressionally authorized purposes is inherent in the authority to construct them and is therefore non-discretionary. Only Congressional actions to de-authorize the structures can alter or terminate this responsibility and thereby allow the maintenance of the structures to cease. Congress authorized Englebright and Daguerre Point dams on the Yuba River to prevent hydraulic mining debris from washing downstream and blocking the navigation channel of the Sacramento River. The Corps inspects Englebright and Daguerre Point dams to ensure their safety and integrity, and to take the minimal maintenance actions needed to ensure that the dams can continue to serve their Congressionally authorized purposes. Corps non-discretionary activities and associated authorities pertinent to Englebright and Daguerre Point dams on the lower Yuba River are described below.

1.3.1.1 Background Regarding Corps' Authorities Related to Dam Inspections and Hydropower Facilities on Federal Lands

NATIONAL DAM INSPECTION ACT OF 1972

In the early 1970s, several dam failure events prompted the passage of legislation aimed at establishing a national program to protect human life and property from the hazards of improperly constructed or poorly maintained dams (GAO 1977). Consequently, the U. S. Congress enacted Public Law 92-367, which is known as the National Dam Inspection Act of 1972. Under this law, the Secretary of the Army, acting through the Corps of

Engineers, was directed to inspect all dams in the United States except: (1) dams under the jurisdiction of the Bureau of Reclamation, the Tennessee Valley Authority, and the International Boundary and Water Commission; (2) dams constructed pursuant to licenses issued under the authority of the Federal Power Act; (3) dams that had been inspected by a State agency within the 12-month period immediately preceding the enactment of the law and for which the Governor of the respective State requested exclusion; and (4) dams that the Secretary of the Army determined do not pose any threat to human life and property (GAO 1977).

Public Law 92-367 defined the term "dam" to mean any artificial barrier, including appurtenant works, which impounds or diverts water, and which: (1) is twenty-five feet or more in height from the natural base of the stream or watercourse measured at the downstream toe of the barrier, or from the lowest elevation of the outside limit of the barrier, if it is not across a stream channel or watercourse, to the maximum water storage elevation; or (2) has an impounding capacity at maximum water storage elevation of fifty acre-feet (AF) or more.

For the purpose of determining whether a dam (including the waters impounded by such dam) constitutes a danger to human life or property, the law states that the Secretary of the Army shall take into consideration the possibility that the dam might be endangered by overtopping, seepage, settlement, erosion, sediment, cracking, earth movement, earthquakes, failure of bulkheads, flashboard, gates on conduits, or other conditions which exist or which might occur in any area in the vicinity of the dam (Public Law 92-367).

The law also states that as soon as practicable after inspection of a dam, the Secretary of the Army shall notify the Governor of the State in which such dam is located the results of such investigation. The Secretary of the Army shall immediately notify the Governor of any hazardous conditions found during an inspection. The Secretary of the Army shall provide advice to the Governor, upon request, relating to timely remedial measures necessary to mitigate or obviate any hazardous conditions found during an inspection (Public Law 92-367).

NATIONAL DAM SAFETY PROGRAM ACT OF 1996

The National Dam Safety Program Act was signed into law on October 12, 1996 as part of the Water Resources Development Act of 1996 (PL 104-303) and authorized the Secretary of the Army to undertake a national program of inspection of dams.

The objectives of the National Dam Safety Program (Program) are to: (1) ensure that new and existing dams are safe through the development of technologically and economically feasible programs and procedures for national dam safety hazard reduction; (2) encourage acceptable engineering policies and procedures to be used for dam site investigation, design, construction, operation and maintenance, and emergency preparedness; (3) encourage the establishment and implementation of effective dam safety programs in each State based on State standards. The Federal element of the Program shall incorporate the activities and practices carried out by Federal agencies under Section 7 of the Act to implement the Federal Guidelines for Dam Safety.

Public Law 109–460 (December 22, 2006; 109th Congress) amended the National Dam Safety Program Act to reauthorize the National Dam Safety Program. Section 6 of Public Law 109–460 states "*The Secretary of the Army shall maintain and update information on the inventory of dams in the United States. Such inventory of dams shall include any available information assessing each dam based on inspections completed by either a Federal agency or a State dam safety agency.*"

The Corps continues to implement its dam safety program under Engineer Regulation (ER) 1110-2-1156.

1.3.1.2 Englebright Dam Non-Discretionary Activities

Englebright Dam and Reservoir are located downstream of New Bullards Bar Dam on the Yuba River and is part of the Sacramento River and Tributaries project, which was authorized by the Rivers and Harbors Act of August 30, 1935 (P. L. 409, 74th Congress, 1st Session, 49 Stat. p. 1028-1049). The Sacramento River and Tributaries project was constructed by the California Debris Commission in 1941. The Rivers and Harbors Act of 1935 also authorized the development of power at Englebright Dam.

Englebright Dam is 260 feet high, and the storage capacity of Englebright Reservoir was 69,700 AF at the time of construction, as estimated by the U.S. Geological Survey (USGS) using a pre-dam elevation model (Childs et al. 2003 as cited in YCWA 2010). However, due to sediment buildup since construction, the gross storage capacity was more recently estimated at approximately 50,000 AF (USGS 2003).

Upon decommissioning of the California Debris Commission by Section 1106 of the 1986 Water Resources Development Act (P. L. 99-662, 99th Congress, 2nd Session, November 7, 1986), administration of Englebright Dam was assumed by the Corps.

Because Englebright Dam was constructed as a sediment retention facility (debris dam) it does not contain a low-level outlet. Unregulated flood flows spill over Englebright Dam. Following construction of Englebright Dam in 1941 and extending until approximately 1970, controlled flow releases from Englebright Dam were made through the PG&E Narrows I hydropower facilities. Since about 1970 to the present, controlled flow releases from Englebright Reservoir into the lower Yuba River have been made from the PG&E Narrows I and the YCWA Narrows II power plants, both FERC licensed facilities.

The Corps' ongoing activities of Englebright Dam infrastructure pertain to dam maintenance, safety and security. The Corps does not have authority or discretion to control Narrows I, Narrows II, or Englebright Reservoir operations regarding water releases. The water stored in Englebright Reservoir provides recreation and hydroelectric power, and YCWA and PG&E administer water releases for hydroelectric power, irrigation, and other beneficial uses (e.g., instream flow requirements).

Ongoing Infrastructure Inspection and Security at Englebright Dam

Ongoing infrastructure inspections and security at Englebright Dam includes dam safety and dam security inspections, as described below.

Dam Inspection

The Corps' general responsibilities and activities associated with dam maintenance and safety, which are applicable to Englebright Dam, are described in the document titled USACE - Engineering and Design Safety of Dams – Policy and Procedure ER 1110-2-1156 Regulation No. 1110-2-1156 (Corps 2003). The Corps conducts two different types of regular inspections: (1) annual pre-flood inspections; and (2) periodic inspections every 5 years. These inspections are conducted to address the legal requirement that the Corps shall maintain in good order and repair Englebright Dam and outlet facilities in accordance with its authorized purposes.

The purpose of the Corps' periodic inspections is to evaluate the condition of the critical components of Englebright Dam in order to assure the safety, continuing structural integrity, and operational adequacy of the structure (Corps 2004). Periodic inspections conducted from 1970 to date include the inspections described in the following reports.

- Periodic Inspection and Continuing Evaluation Report No. 1, November 1970
- Periodic Inspection and Continuing Evaluation Report No. 2, December 1975
- Periodic Inspection and Continuing Evaluation Report No. 3, June 1981
- Periodic Inspection and Continuing Evaluation Report No. 4, March 1985
- Periodic Inspection and Continuing Evaluation Report No. 5, August 1987
- Periodic Inspection and Continuing Evaluation Report No. 6, December 1993
- Periodic Inspection and Continuing Evaluation Report No. 7, July 1999
- Periodic Inspection and Continuing Evaluation Report No. 8, June 2004

The Corps also conducts Pre-flood Inspections for Englebright Dam. A report of the most recent of these inspections was published in 2012.

At the onset of each inspection, Englebright Reservoir water surface elevation and the maximum pool elevation attained during the season, as well as mean total outflow, weather conditions and air temperature, are recorded. Based upon Corps observations and information provided from past inspections (Corps 2004; Corps 2008a; Corps 2012), examples of the Englebright Dam facilities and appurtenant features addressed as part of the Pre-flood Inspection process generally include the following:

Crest

- Overflow and non-overflow sections of the crest are checked for signs of distress, surface delamination, concrete deterioration and movement of the training wall.

- ❑ The downstream face of the dam is inspected for signs of cracking, seepage, and other structural problems that could affect the structural integrity of the dam.
- ❑ Upstream and downstream areas of the left and right abutments are checked for notable movement, instability, seepage and debris.
- ❑ Corps gatehouse interior and gate chamber, and the bulkhead gate are inspected for signs of concrete deterioration, distress, and misalignment.
- ❑ The adit portal, including internal and external examination of the concrete bulkhead wall, the projecting conduit and the riveted dished head closure of the projecting conduit are inspected for possible structural or corrosion problems.
- ❑ The reservoir rim is inspected from a Corps patrol boat.
- ❑ New and/or previously identified relief landslides are located, photographed, compared to aerial photos and occasionally identified for further monitoring to determine whether a landslide has the potential to present a hazard to the dam from slope-failure induced seiches or to affect nearby roadways.

Hydropower Facilities

- ❑ The PG&E Narrows I Hydropower Project intake structure, trash rack, and the first 700 feet of the conduit are regularly inspected on a 5-year cycle by the Corps.

  The Corps' inspections are limited to: (1) the Narrows I intake structure; (2) the trash rack; and (3) the first 700 feet of the conduit because these three components are owned and maintained by the Corps. These three components extend to the structure known as the "adit". The remaining portion of the conduit, extending from the adit to the Narrows I power plant, including all appurtenances in the plant, is owned and maintained by PG&E. PG&E conducts separate inspections of its Narrows I facility for hydropower purposes.
- ❑ Because the Narrows II penstock extends through the abutment of the dam, the Corps also inspects the YCWA Narrows II hydropower penstock on a 5-year cycle to ensure that the penstock is in good condition and will not threaten the

stability and safety of Englebright Dam. YCWA conducts separate inspections of its Narrows II facility for hydropower purposes.

Plunge Pool

- A visual inspection of the plunge pool and downstream overflow sections at Englebright Dam are conducted periodically. It was recommended that the Corps map the plunge pool area (Corps 2008a), which will be accomplished after receiving appropriations by Congress.

Based on the above criteria, the overall condition of Englebright Dam was rated as **Very Good** during the Corps' 2012 Pre-flood Inspections.

Project Safety Plan and Hazard Communication Program

In addition to dam safety, the Englebright Project Safety Plan (Corps 2008b) provides a safety plan for the Englebright Reservoir recreation area to: (1) minimize employee, volunteer, contractor and visitor accidents by establishing procedures and responsibilities relative to safety; (2) assist employees, volunteers, contractors and visitors in the development of a safety attitude; and (3) identify precautionary measures to be taken to eliminate unsafe conditions. The Hazard Communication Program (Corps 2007b) ensures that all field offices within the Sacramento District of the Corps comply with the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard as defined by Title 29 CFR Part 1910.1200. This program provides information for the use of Material Safety Data Sheets, chemical product labeling, handling and storage, training, documentation, and record keeping requirements.

If a need for maintenance repairs or other corrective actions is identified during the inspection process, authorization and funding to conduct the repairs or corrective actions will be included in the Corps' budget two years later.

DAM SECURITY

The baseline security posture for Corps dams will be based on the completion of project specific Vulnerability and Risk Assessments which take into account project criticality, threat (criminal or terrorist), current physical security posture, and law enforcement response capabilities. Once established, the baseline security posture will become the norm (Corps 1992).

All dams will have project-specific Physical Security Plans. The format for these plans should follow the format detailed in Appendix F of the USACE Engineering and Design Safety of Dams – Policy and Procedure ER 1110-2-1156 Regulation No. 1110-2-1156 (Corps 2003).

Inspections are conducted when no prior physical security inspection exists, at regularly scheduled intervals, and when directed by competent authority. Whenever possible, security should be included in annual, periodic, and special inspections of projects. In addition, Corps dams will have dam security systems, which also are inspected during regular dam safety inspections. Dam security inspections are conducted to determine whether the features are safe from vandalism, sabotage, acts of terrorism, or any other acts that could cause the project to fail to function properly and safely for its intended purpose.

In addition to dam security, the 2008 Englebright Lake Security Plan (Corps 2008c) provides for the physical security of Englebright Reservoir during normal operations, and during periods of increased security. Physical security threats include terrorism, natural disasters, civil disturbances, theft and vandalism.

These Corps dam safety and security activities are Federally mandated actions, and are not subject to ESA consultation. Activities conducted as part of the Corps' regular inspections of infrastructure maintenance at Englebright Dam are restricted to the physical facilities at Englebright Dam and do not extend downstream to the lower Yuba River. Additionally, the continuation of these activities will have no effect on listed fish species or critical habitat in the lower Yuba River.

1.3.1.3 Daguerre Point Dam Non-Discretionary Activities

Ongoing Infrastructure Inspection and Security at Daguerre Point Dam

Ongoing infrastructure inspections at Daguerre Point Dam include dam safety and dam security inspections. Specific inspection activities at Daguerre Point Dam are specified in the Corps' O&M Manual, Yuba River Debris Control Project" (Corps 1966), which is used in conjunction with Corps' Engineering Manuals EM 1130-2-203 - Project Operation Maintenance Guide, and EM 385-1-1 - General Safety Requirements.

Inspection and Maintenance

The Daguerre Point Dam O&M Manual states that periodic inspections shall be made as required, to determine maintenance measures necessary to insure serviceability of the facility during flood conditions. Such inspections shall be made immediately prior to the beginning of the flood season, and immediately after each high water period. Immediate steps shall be taken to correct dangerous conditions observed during such inspections, and regular maintenance repair measures shall be accomplished during the appropriate season as determined by the Corps. The ongoing non-discretionary inspection and maintenance activities address the following.

Daguerre Point Dam Structure

- Condition of the concrete (e.g., erosion, pop-out, movement and vibration, cracks in or settlement of concrete in overflow and non-overflow sections).
- Excessive abrasion of concrete.
- Rock and derrick stone backfills.
- Foundation and backfill drainage. The outlets of all drains shall be inspected when river stages permit access to them, and shall be cleaned a minimum of every 5 years or more often if required. At other times the drainage manholes at either end of the overflow section shall be inspected and cleaned a minimum of every 3 years or more often if required.
- Record water level in drainage manholes, and check drainage pipe outlets, if accessible.
- Roadways and parking areas (e.g., condition of pavement, shoulders and ditches, sloughing, slides).
- Corrective action taken since the last inspection.

- Cracks or settlement of concrete structures.
- Misuse of structures, such as burning of debris in them.
- Condition of the stop logs, stop gates and guides.
- Corrective action taken since the last inspection.

If dam safety and dam security maintenance repairs are necessary, the Corps' Chief, Construction-Operations Division will request the Corps' Chief, Engineering Division, to prepare plans, specifications, and cost estimates for the repairs. All dam safety and dam security maintenance cost estimates will be submitted to the State of California for approval. After approval, the Corps' Construction-Operations Division will accomplish the maintenance work, and the cost of the work will be shared equally by the Government and the State of California.

These Corps safety and security activities at Daguerre Point Dam are Federally mandated actions, and are not subject to ESA consultation.

1.3.2 Corps' Discretionary Activities that have No Effects to Listed Species or Critical Habitat

Another key consideration emanating from the 2012 consultation process was the need to clearly identify Corps discretionary actions that have no effects to listed species or critical habitat. The Action Area for this consultation (see Chapter 3) is determined considering the extent of the direct and indirect effects of the Proposed Action. The Action Area is defined as "*all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action*" (50 CFR § 402.02).

The Corps conducts discretionary activities upstream of the Action Area. These activities are conducted in locations that are not occupied by any of the listed species addressed in this BA, and are not designated as critical habitats. Although these discretionary Corps activities occur upstream of the Action Area, they are evaluated to demonstrate that they do not have the potential to transmit effects downstream to the lower Yuba River.

These discretionary activities upstream of the Action Area are those associated with maintenance of recreational facilities and continued administration of maintenance service contracts on and around Englebright Reservoir, and continued administration of outgrants at or near Englebright Dam. The Corps is not required to consult with NMFS on actions that have no effect on listed species and critical habitat (USFWS 2013; USFWS and NMFS 1998). For clarification, these discretionary activities that have no effects to listed species or critical habitat are described below.

1.3.2.1 Englebright Dam and Reservoir Discretionary Activities

Ongoing Maintenance of Recreational Facilities on and around Englebright Reservoir

Recreation-related operations and maintenance activities on and around Englebright Reservoir, as identified and described in the 2007 Harry L. Englebright Lake Operational Management Plan (Corps 2007) are discretionary actions. The types of discretionary ongoing activities described in the 2007 Harry L. Englebright Lake Operational Management Plan (Corps 2007) include:

- Maintenance Facilities Upkeep
- Grounds Maintenance
- Sign and Waterway Marker Maintenance
- Roads and Parking Area Maintenance
- Narrows Day Use Facility Improvements
- Maintenance of Recreation Area Buildings
- Wastewater Monitoring Plan Implementation
- Campground Repairs and Renovations
- Park Office Facility Upkeep
- Campground Fire Break Clearing

Along the 24 miles of Englebright Reservoir's shoreline, the Corps has developed facilities including: (1) 96 campsites; (2) 9 picnic sites; (3) 1 group picnic shelter with 4 tables; (4) 2 boat launching ramps (Narrows and Joe Miller Ravine) maintained by the Corps; (5) a private marina operated by a concessionaire; and (6) 5 parking lots containing a total of 163 parking spaces. During the May 1 to September 30 recreation season, daily maintenance/safety inspections are conducted in all developed recreation areas. Facilities receiving consistent use and open to the public outside this time frame are also inspected daily (Corps 2007). The Corps also inspects these recreation facilities during the October 1 to April 30 off-season to determine whether it needs to make repairs or rehabilitate campsites during this period.

The 800-acre Englebright Reservoir attracts large numbers boaters and campers during the summer months and has an excellent year-round trout fishery[2] (Corps 2007). Even though there are ten other reservoirs within a 50-mile radius, the boat-in-only style of camping and the scenic steep canyons make it a popular destination. Unlike most area reservoirs that are affected by summer draw-downs, Englebright Reservoir water surface levels remain fairly constant throughout the year. This results in an influx of park users during the late summer months, especially during drought years (Corps 2007).

The Narrows and Joe Miller Recreation Areas are the primary visitor access points to the lake. Both have launch ramps, restrooms, and parking areas, but only Narrows has a picnic area with individual tables and a reservable group shelter. Privately-owned Skipper's Cove Marina is situated adjacent to these areas, and provides mooring to hundreds of houseboats and pleasure craft at its facility (Corps 2007).

[2] Englebright Reservoir is currently managed as a cold water and warm water fishery under the direction of CDFW, and the fish stocking program at Englebright Reservoir is conducted and directed by CDFW, or by PG&E in coordination with CDFW. The Corps does not conduct or direct fish stocking at Englebright Reservoir.

Continued Administration of Maintenance Service Contracts at Englebright Dam and Reservoir

According to the 2007 Harry L. Englebright Lake Operational Management Plan (Corps 2007), the types of maintenance service contracts currently in use at Englebright Reservoir include the following:

- Garbage Pickup
- Water Quality Testing
- Janitorial Service

Continued Administration of Outgrants Described in the 2007 Harry L. Englebright Lake Management Plan

According to the 2007 Harry L. Englebright Lake Operational Management Plan (Corps 2007), the Corps administers outgrants, which include permits, licenses, leases, and easements on project lands used to maintain public utilities and for right-of-way purposes. The administration of ongoing outgrants include:

- Road Right-of-Way Easement to YCWA for Narrows II
- Power Transmission Line Easement to PG&E for Narrows I
- Easements for Use of Power Generation Facilities to YCWA and PG&E

For the purposes of this BA, the "*administration of existing permits, licenses, leases and easements*" is defined as the activities related to the safety and inspection of facilities by the Corps.

Assessment of the Corps' Discretionary Activities at and around Englebright Dam and Reservoir that have No Effects to Listed Species or Critical Habitat

The proposed action evaluated in the Corps' 2012 BA included the Corps' discretionary activities associated with Englebright Dam and Reservoir. However, further review of the effects analysis presented in the Corps 2012 BA indicates that several discretionary activities have no effect on listed fish species or critical habitat in the lower Yuba River. Consequently, these activities are not carried forward for Section 7 consultation because they have no effects on the listed species. Each of these activities is further discussed below.

Ongoing Maintenance of Recreational Facilities on and around Englebright Reservoir

Recreation-related operations and maintenance activities conducted by the Corps on and around Englebright Reservoir are restricted to the 800-acre Englebright Reservoir, the 24 miles of Englebright Reservoir shoreline, and various upland campsite areas in the vicinity of the reservoir.

Project maintenance is accomplished by using service contracts, maintenance staff and ranger staff in a variety of ways, including: (1) service contract specifications; (2) scheduled inspections of facilities, equipment, grounds, and resources; (3) specific job assignments to park staff; (4) specific assignments to park staff for inspection of contractor performance and maintenance/safety inspections; and (5) general project inspections by all employees during the course of daily activities. Work areas are cleaned at the end of each workday, with tools and materials put in their proper place. Clean, safe, and properly stored and maintained tools represent an important step toward efficient maintenance facilities.

During the May 1 to September 30 recreation season each year, daily maintenance/safety inspections are conducted by the Corps in all developed recreation areas around Englebright Reservoir. Facilities are cleaned, serviced, repaired, or replaced as applicable in order to maintain them in proper working condition. Facilities receiving consistent use and open to the public outside this time frame also are inspected daily.

Corps maintenance staff are responsible for miscellaneous repairs to existing roadways. Potholes, depressions and sub-grade failures to pavements are repaired promptly. With the recent addition of the computerized road inventory program at Englebright Reservoir, all roadways are inspected annually and minor repairs made and major overlay needs reported.

Campground repairs and renovations are periodically needed at the campsites around Englebright Reservoir. Common types of improvements include site leveling and pad enlargement, tie replacement, table and fire ring replacement, installing stairs, trail improvement, tree removal, and bulletin board replacement. Occasionally, campground fire breaks also need to be cleared of trees and vegetation.

With respect to grounds maintenance, most areas are mowed to minimize and prevent fire danger in and around recreation areas. Day use areas are also mowed and trimmed for visitor use and aesthetics. The Corps conducts periodic inspections of turf areas during the recreation season and maintenance is scheduled as needed for repair of holes, ruts, depressions, erosion, bare areas, overuse, weeds, disease, debris, and litter.

The Corps also conducts a project sign inventory each fall to determine signage needs for the following year. All signs are inspected for damage, vandalism, deterioration, fading, placement, secure fastening, and appropriateness. Repairs and replacements are made as necessary.

The foregoing activities are primarily conducted in upland areas around Englebright Reservoir and have limited or no potentiality to affect aquatic habitat in the reservoir. These maintenance activities do not have the potential to transmit physical habitat alteration effects downstream to the lower Yuba River. Listed fish species do not inhabit Englebright Reservoir and there is no fisheries-related critical habitat designated in or around the reservoir. The continuation of the Corps' ongoing maintenance of recreational facilities on and around Englebright Reservoir will have no effect on listed fish species or critical habitat in the lower Yuba River. Consequently, these activities are not carried forward for Section 7 consultation because they have no effects on the listed species.

Continued Administration of Maintenance Service Contracts at Englebright Dam and Reservoir

The Corps' discretionary activities include administration of the following maintenance service contracts at Englebright Reservoir: (1) garbage pickup; (2) janitorial service; and (3) water quality testing. Maintenance activities associated with these contracts would occur at and around Englebright Reservoir and at various upland campsite areas in the vicinity of the reservoir.

The administration of these maintenance service contracts constitutes ministerial actions, and not activities that have the potential to affect listed species or their critical habitats in the lower Yuba River. Any potential effects associated with the conduct of these activities would be locally constrained, and would not extend to the lower Yuba River. These maintenance activities are primarily conducted in upland areas around Englebright Reservoir and have limited or no potentiality to affect aquatic habitat in the reservoir. These maintenance activities do not have the potential to transmit physical habitat alteration effects downstream to the lower Yuba River. The Corps' continuation of the maintenance of service contracts at and around Englebright Reservoir would have no effect on listed fish species or critical habitat in the lower Yuba River. Consequently, these activities are not carried forward for Section 7 consultation because they have no effects on the listed species.

Continued Administration of Outgrants Described in the 2007 Harry L. Englebright Lake Management Plan

The Corps' discretionary activities include the continued administration of permits, licenses, leases, and easements related to the Corps' outgrants for project lands used to maintain public utilities and right-of-way purposes. Outgrants have been issued to various entities, examples of which include: (1) road right-of-way permits and easements; (2) telephone line license; (3) power transmission line easements; and (4) concessionaire lease at the Englebright Dam marina.

The Corps conducts annual compliance inspections on outgranted lands, including lands outgranted for commercial concessions. Major purposes of the inspections are to establish a good liaison with outgrantee, to provide assistance to outgrantee handling problems and planning, and to ascertain outgrantee compliance with terms of the outgrant (Corps 2007). These inspections constitute administrative actions, and not activities that have the potential to affect listed species or their critical habitats in the lower Yuba River. Moreover, inspection activities conducted by the Corps are restricted to locations that do not extend to the lower Yuba River. Therefore, the Corps' continued administration of permits, licenses, leases, and easements is anticipated to have no effect on listed fish species or critical habitat in the lower Yuba River. Consequently, these activities are not carried forward for Section 7 consultation because they have no effects on the listed species.

1.3.3 Corps' Discretionary Activities at and around Englebright Dam and Reservoir that May Affect but are Not Likely to Adversely Affect Listed Species or Critical Habitat

The proposed action evaluated in the Corps' 2012 BA included the Corps' discretionary activities associated with Englebright Dam and Reservoir. However, further review of Corps' authorizations and the effects analysis presented in the Corps 2012 BA indicates that the discretionary activities at Englebright Dam and Reservoir identified below may affect, but are not likely to adversely affect listed species or critical habitat in the lower Yuba River. The "*may affect, but is not likely to adversely affect*" conclusion is appropriate when effects to the species or critical habitat are expected to be beneficial, discountable, or insignificant. The Corps has prepared a separate BA for their discretionary activities at and around Englebright Dam and Reservoir. In that BA, the Corps has determined that their activities are not likely to adversely affect listed species or critical habitat. If NMFS agrees with that determination, informal consultation on these activities can be concluded with a concurrence letter. For clarification purposes, each of these activities are briefly discussed below.

The Corps conducts discretionary actions at and around Englebright Dam and Reservoir that have a remote possibility of transmitting contaminants downstream to the lower Yuba River. The types of discretionary ongoing activities described in the 2007 Harry L. Englebright Lake Operational Management Plan (Corps 2007) with the potential to transmit contaminants downstream include:

- Vehicle, Equipment and Vessel Maintenance
- Boat Ramps and Courtesy Docks Maintenance
- Herbicide and Pesticide Application

Additionally, nine separate buoy lines are located on the lake surface at Englebright Reservoir. Maintenance and repair of these waterway markers are performed by the Corps, as needed.

The Corps engages in some activities associated with herbicide and pesticide application, and also administers contracts for application. Thus, potential effects associated with herbicide and pesticide application are briefly summarized below in the next section titled "*Continued Administration of Maintenance Service Contracts at Englebright Dam and Reservoir*".

1.3.3.1 Ongoing Maintenance of Recreational Facilities on and around Englebright Reservoir

Maintenance of recreational facilities on and around Englebright Reservoir only has the potential to impact the lower Yuba River through the inadvertent release of contaminants into Englebright Reservoir. Recreation-related areas in the vicinity of Englebright Reservoir that may be subject to a contaminant spill include: (1) areas with high public visitation such as campgrounds, marinas, and launch ramps; (2) petroleum products storage and delivery points; (3) water intake points; and (4) septic distribution, pumping, and treatment systems.

Corps personnel are required to perform a walk-a-round inspection of their vehicle at least once a day and also to check oil, water, battery and tires when fueling the vehicle or at the start of their shift each day. When not in use, vehicles are parked inside the Corps' secure Maintenance Shop Facility compound. Maintenance of all vehicles operated by the Corps is accomplished off-site at an authorized dealer. The maintenance of gasoline and diesel powered equipment is conducted by Corps' contractor personnel, maintenance staff and equipment operators. All equipment is scheduled for routine maintenance by Corps maintenance personnel at prescribed intervals. Equipment operations are required to conduct equipment inspections prior to operating equipment at each use. Corps maintenance personnel also conduct periodic equipment inspections for quality of operation and safety purposes. The Corps also maintains three 20-21 foot aluminum jet boats and one 40-foot aluminum utility barge.

Boat ramps at Englebright Reservoir are located at the Narrows and Joe Miller Recreation Areas. Each boat ramp has a courtesy dock adjacent to it for visitor convenience. These ramps are inspected daily by the Corps, and kept clean of debris, driftwood and sediment. All parts are inspected and replaced or repaired as needed including decking, framing, flotation, fasteners, cables, and anchors. Docking is maintained with a slip-free surface. After flood waters recede, all launch ramps are inspected for damage or undercut concrete and repaired as needed. Signs are maintained at each boat ramp to prohibit parking on the ramps and swimming in their vicinity. The courtesy docks are repaired by the Corps, as necessary.

There have been few recreation-related hazardous materials release incidents at Englebright Reservoir. However, there have been minor instances including vehicles ending up in the lake during boat launching, and sinking boats. Notable spill incidents are as follows:

- On July 3, 1996, a water line on a boat broke while it was being trailered at the boat launch. The boat sank and released several quarts of oil that was contained with spill containment booms.
- On July 25, 1996, gasoline was spilled from a leaking fuel delivery line at the private marina's fuel float. Emergency shut-off valves were quickly closed which limited the spill to approximately one gallon.
- On August 27, 1999, a Nevada County sanitation truck leaked hydraulic oil on the boat ramp and into the reservoir. Marina personnel who were first to arrive at the scene successfully deployed absorbent pads and containment booms.

Vehicle and equipment maintenance activities generally occur in the Corps' Maintenance Shop Facility compound, which is not proximal to Englebright Reservoir. Although vessel maintenance, and boat ramp and courtesy dock maintenance have a remote potential for hazardous materials or other hydrocarbon-based contaminants to be released and enter Englebright Reservoir, it is reasonable to expect that potential spills would be locally constrained, and the volume of contaminants resulting from a spill would be relatively minor in comparison to the total volume of water in the reservoir. For example and contextual purposes, given the descriptions of the above occurrences of minor contamination incidences, one gallon of contaminant spilled into Englebright Reservoir with an estimated storage capacity of about 50,000 AF would result in a concentration of less than about 1 part per 16 billion.

Long-term sublethal effects of oil pollution refer to interferences with cellular and physiological processes such as feeding and reproduction, and do not lead to immediate death of an organism (EPA 1986). Disruption of such behavior apparently can result from petroleum product concentrations in the range of 10 to 100 ug/L (EPA 1986). In addition to sublethal effects reported at the 10 to 100 ug/L level, it has been shown that petroleum products can harm aquatic life at concentrations as low as 1 ug/L (Jacobson and Boylan 1973 in EPA 1986).

For comparison purposes, 1 part per billion (ppb) is a microgram (μg or ug), or 1/1,000,000th of a gram, of a contaminant present in one liter of water or one kilogram of soil (ADEC 2009). Therefore, a petroleum product concentration of less than 1 part per 16 billion is considerably below the EPA (1986) thresholds of: (1) 10 to 100 ug/L (i.e., 10 to 100 ppb) that has been identified as having the potential to cause sublethal (e.g., behavioral) disruptions to aquatic life; and (2) 1 ug/L (1 ppb) shown to potentially harm aquatic life.

Additionally, Corps employees working at Englebright Reservoir are routinely trained in the storage and handling of hazardous materials. The Corps also implements the Harry L. Englebright Lake Operational Management Plan (Corps 2007) for Englebright Reservoir, which includes a Hazardous Materials Plan and a Spill Prevention and Response Plan to address potential hazards associated with the accidental release of hydrocarbons into aquatic habitat in Englebright Reservoir. Although contaminants accidentally entering Englebright Reservoir would be subject to dilution, the containment procedures were developed to further restrict the movement of a spill to soil or water. Therefore, it is not reasonable to suggest that adverse effects to listed species in the lower Yuba River would occur as a result of Corps activities related to: (1) vehicle, equipment, and vessel maintenance; and (2) boat ramps and courtesy docks maintenance.

Overall, although the possibility is extremely remote given all of the above considerations, the continuation of these Corps' activities associated with ongoing maintenance of recreational facilities on and around Englebright Reservoir do have the potential to transmit contaminants downstream to the lower Yuba River. For this reason, the Corps has determined through a separate ESA consultation process that these activities may affect, but are not likely to adversely affect, listed fish species and critical habitat in the lower Yuba River.

1.3.3.2 Continued Administration of Maintenance Service Contracts at Englebright Dam and Reservoir

The Corps' discretionary activities include administration of: (1) portable restroom pumping; and (2) herbicide application maintenance service contracts in areas surrounding Englebright Reservoir. These maintenance activities have a remote possibility to impact the lower Yuba River, as discussed below.

Sewage from portable restroom pumping around the lake is recognized in the Englebright Operations Management Plan as a common hazardous material found on Corps' project lands (Corps 2007), which could pose a threat to public and environmental health. For these reasons, portable restroom pumping is managed as part of the Corps' Wastewater Monitoring Plan, which addresses the management of wastewater from Corps' maintained facilities and monitoring of wastewater generated by houseboats on Englebright Reservoir. As described in Corps (2007), the Corps has established a Hazardous Materials Plan and a Spill Prevention and Response Plan that provide spill response guidance and containment procedures to be implemented in the event of an emergency at or around Englebright Reservoir. Although wastewater accidentally entering Englebright Reservoir would be subject to dilution, the containment procedures were developed to further restrict the movement of a spill to soil or water.

Poison oak is a problem in day use areas, campgrounds, trails, roadsides, and operations areas. Because the presence of poison oak in high-use recreation and operations areas is an unacceptable nuisance and health hazard, exposure must be controlled or eliminated to reduce risk to visitors and Corps employees. Annual and perennial grasses, as well as assorted noxious herbaceous weeds, also are common to the area. This vegetation has the potential to grow very tall, blocking facilities, harboring insects in recreation sites and creating an extreme fire hazard when dry. Consequently, herbicide application is conducted, on an as-needed basis, around Englebright Reservoir, primarily at campsites, firebreaks and nature trails.

The areas of herbicide and pesticide application are generally located in more upland areas not proximal to Englebright Reservoir. Moreover, herbicides are applied in relative dilute quantities that would not represent significant contributions affecting water quality in Englebright Reservoir. Annual herbicide application around Englebright Reservoir is relatively minor. For example, a usage report dated January 29, 2008 indicates that 2 gallons of herbicide were used on 8 acres of land, and 3 gallons used on 10 acres of recreation and operation areas to control weeds, grasses and poison oak. Thus, any potential effects associated with the conduct of these activities would be locally constrained, and would not extend to the lower Yuba River. Also, the Corps Operations Management Plan for Englebright Reservoir includes a Hazardous Materials Plan and a Spill Prevention and Response Plan to address potential hazards associated with herbicide application. Given the minor amounts and upland areas of herbicide application, it is reasonable to conclude that adverse effects to listed species in the lower Yuba River would not occur.

Overall, the Corps has determined through a separate ESA consultation process that the continuation of activities associated with administration of maintenance service contracts at Englebright Dam and Reservoir that have the potential to transmit contaminants downstream to the lower Yuba River may affect, but are not likely to adversely affect listed fish species or critical habitat in the lower Yuba River.

1.3.4 Future Corps Actions in the Yuba River Basin Requiring Separate ESA Consultation

Future Corps' actions in the Yuba River Basin requiring separate ESA consultation have been identified in this BA for clarification and informational purposes. Within the foreseeable future, the Corps has identified three projects that are expected to occur within the Yuba River Basin, as follows.

- ❑ Corps' Issuance of a right-of-way to PG&E for access to the PG&E Narrows I via a separate FERC Relicensing Process (anticipated to occur in 2023)

- Corps' Issuance of a right-of-way to YCWA for access to the YCWA Narrows II via a separate FERC Relicensing Process (anticipated to occur in 2016)
- Corps' Issuance of right-of-way to YCWA for access to the South Yuba/Brophy Diversion Canal and Facilities (anticipated to occur in 2018)

Once the technical investigations and regulatory compliance documentation for these projects are completed, these projects would likely require a Federal approval from the Corps. At this time, however, none of these three projects are at the appropriate level of completion to allow the Corps to become involved through the appropriate mechanism associated with each respective regulatory compliance process (e.g., FERC relicensing, 404 permitting). Hence, these three projects represent future actions requiring separate ESA consultation, and are not included in the consultation for this Proposed Action.

1.3.4.1 Hydroelectric Generation Facilities in the Vicinity of Englebright Dam

Besides flood flow spills over the top of Englebright Dam, releases from Englebright Reservoir are made through two FERC licensed hydroelectric power facilities, one of which (YCWA's Yuba River Development Project (YRDP) Narrows II) is located just below the base of the dam, and the other of which (PG&E's Narrows I) is located approximately 0.2 mile downstream (Corps 2007; NMFS 2007) (**Figure 1-2**).

Narrows I

PG&E's operations of Narrows I are authorized by a license for these facilities issued by FERC under the Federal Power Act.

On February 11, 1993, PG&E received License No. 1403-004 from the FERC, which grants PG&E the right to conduct the continued operation and maintenance of the Narrows I Hydroelectric Project.

On March 28, 1994, the Corps issued a right-of-way (license) No. DACW05-9-95-604 to PG&E for Narrows I, granting access to the FERC licensed powerhouse and for PG&E to utilize Corps outlet facilities and storage space between elevation 450 and 527 in Englebright Reservoir. The 1994 agreement (assigned License No. DACW05-9-95-604

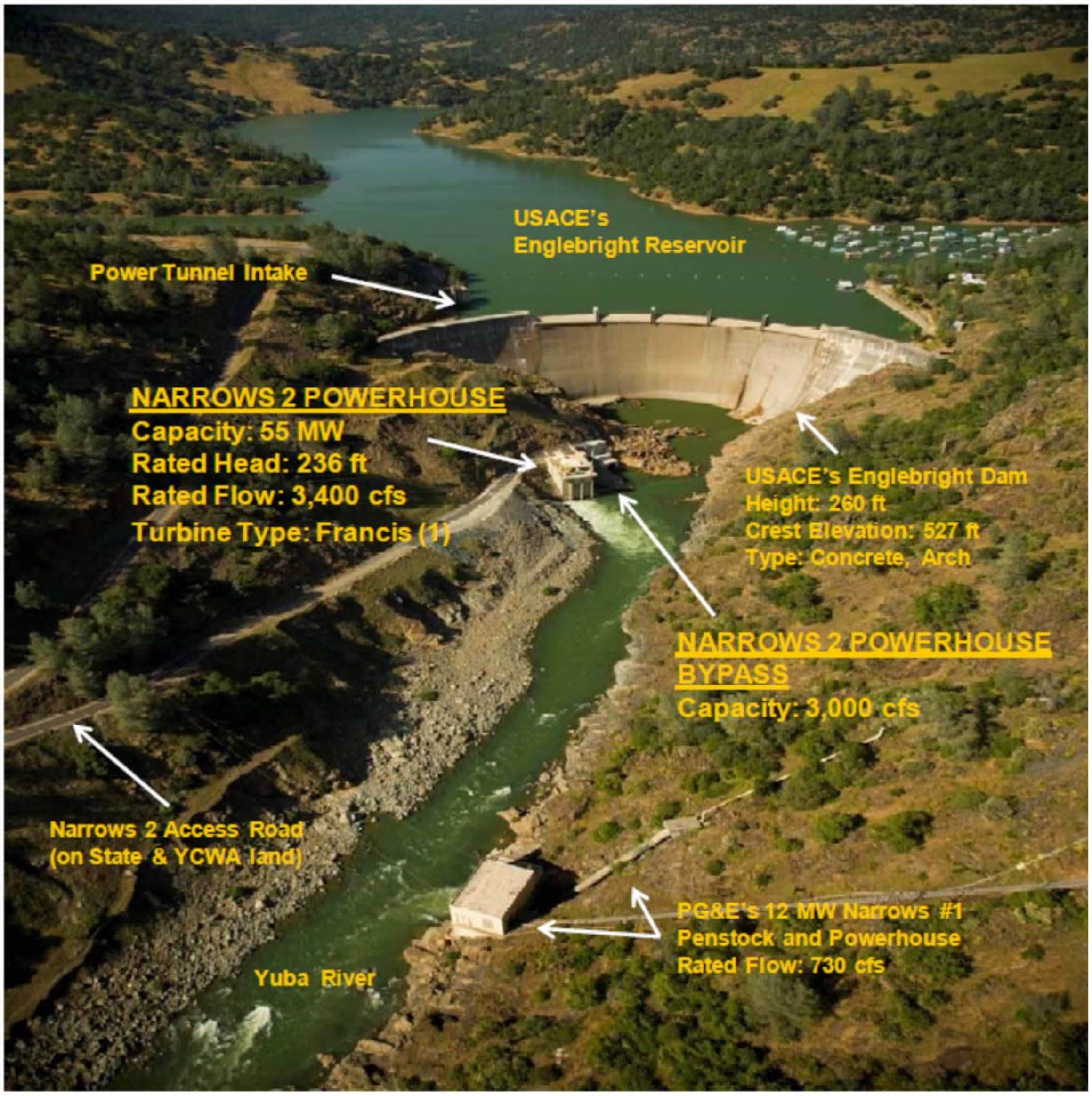

Figure 1-2. Hydroelectric generation facilities in the vicinity of Englebright Dam.

by the Corps) between the Corps and PG&E for access to the Narrows I Hydroelectric Project states that the Corps is responsible for maintaining Englebright Dam and the outlet facilities, including the first 700 feet of the outlet tunnel (Corps and PG&E 1994), in good order and repair, while PG&E is responsible for the operation and maintenance of the hydroelectric facility (Corps 2007).

The Corps also has issued a right-of-way (easement) No. DACW05-2-95-587 making lands available for PG&E's electric transmission lines that run from the Corps' gatehouse (where the control for the bulkhead gate is located) to the Narrows 1 substation, and right-of-way No. DACW05-2-69-102 to PG&E for power transmission lines that run from the Narrows I substation to Narrows II.

Related to ongoing operations and maintenance responsibilities for the power transmission line easements, Corps personnel perform compliance inspections on outgranted lands pursuant to Engineer Regulation 405-1-12, Chapter 8. The compliance inspections are performed on an annual basis, or more often if circumstances dictate. Corps personnel also perform interim inspections on outgrants in connection with day-to-day administration, and instances of unsatisfactory outgrantee performance are noted and reported immediately. Corrective actions will be immediately taken if emergency health or safety is involved (Corps 2007).

NARROWS II

YCWA's operations of Narrows II are authorized by a license for these facilities issued by FERC pursuant to the Federal Power Act.

On February 14, 1966, the Corps entered into an agreement (Contract No. DA-04-167-CIVENG-66-95) with YCWA regarding the use of Englebright Dam and Reservoir for the generation of power at the Narrows II powerplant. The term of the 1966 Agreement extends through the term of the license for FERC Project No. 2246 (April 30, 2016), and may be extended annually according to the conditions and provisions included in the agreement.

The 1966 Agreement specifies that operations and maintenance of the intake works, tunnel, power plant, access roads and appurtenances are the responsibility of YCWA, and are not the responsibility of the Corps.

In 1975, the Corps issued a right-of-way (easement) No. DACW05-2-75-716 to YCWA for access to the construction site of the Narrows II powerplant, intake works and tunnel which is associated with the FERC license. The term of this easement is for a fifty-year period beginning August 14, 1967 and ending August 13, 2017. Also, in 1975, the Corps issued right-of-way (easement) No. DACW05-2-75-715 to YCWA for access to the construction site, use and maintenance of access roads, including culverts and other drainage facilities, associated with the FERC license. The term of this easement is for a fifty-year period beginning August 14, 1967 and ending August 13, 2017. The Corps has no ongoing operation and maintenance responsibilities associated with these two easements (D. Grothe, Corps, pers. comm. 2011).

In 2005, the Corps issued a Right of Entry (No. DACW05-9-06-510) to YCWA for the construction of the Narrows II Full Flow Bypass, which is associated with the FERC license. In 2006, YCWA constructed a full-flow bypass on Narrows II powerhouse which allows approximately 3,000 cfs (or 88 percent of the full 3,400 cfs capacity of the powerhouse) to be bypassed around the power generation facilities to maintain river flows during emergencies, maintenance, and accidental shut-downs of the powerhouse. Although emergency and maintenance shutdowns occur infrequently, the full-flow bypass was designed to eliminate most flow fluctuations that would result from such shutdowns. Since the flow bypass system was installed in 2006, YCWA has been able to more consistently operate the Narrows II facility to reduce most short-term flow fluctuations by providing nearly instantaneous restoration of flows to the lower Yuba River. The full-flow bypass has resulted in an overall improvement in conditions for listed anadromous salmonids and green sturgeon by reducing the potential for severe flow reductions and fluctuations to adversely affect these species in the lower Yuba River (FERC 2005). The Corps has no ongoing operation and maintenance responsibilities associated with this Right of Entry.

Presently, the Corps is simply administering the existing rights-of-way associated with FERC licenses to PG&E for the Narrows I facility and to YCWA for the Narrows II facility. At the time of this consultation, the Corps is not proposing to take any actions related to the aforementioned, pre-existing rights-of-way, and these rights-of-way will remain in effect until the existing FERC licenses for both the PG&E and YCWA FERC hydropower projects expire in 2023 and 2016, respectively.

An example of a license article that FERC has recently included in FERC project licenses that would use Corps' facilities (T. Mansholt, FERC Office of the General Counsel – Energy Projects, pers. comm. 2013) is:

> *"Article 309. Agreement with Corps. The licensee shall within 90 days from the issuance date of the license, enter into an agreement with the*

U.S. Army Corps of Engineers (Corps) to coordinate its plans for access to and site activities on lands and property administered by the Corps so that the authorized purposes, including operation of the Federal facilities, are protected…"

The Corps will re-evaluate the rights-of-way during the FERC relicensing processes. These evaluations will be conducted as part of separate, future ESA consultations, and are not included in the consultation for the Proposed Action.

1.3.4.2 Right-of-Way to YCWA for the South Yuba/Brophy Diversion Canal and Facilities Near Daguerre Point Dam

Approximately 1,000 feet upstream of Daguerre Point Dam on the south side of the Yuba River, the South Yuba/Brophy Diversion Canal and Facilities divert water through an excavated channel from the Yuba River's south bank. The South Yuba/Brophy diversion facility includes a 450-foot long porous rock weir fitted with a fine-mesh barrier (geotextile cloth) within the weir, intended to protect juvenile fish from becoming entrained into the canal (Corps 2007). Over the years, various rights-of-way (permits, licenses, easements) have been issued to provide access to the diversion facilities.

The Corps issued a right-of-way (license), No. DACW05-3-83-593, to Brophy Water District on August 29, 1983. This license is no longer in force because it was discovered to be a duplicate. License No. DACW05-3-85-537 was issued to South Yuba Water District on March 15, 1985, for the South Yuba/Brophy diversion. This license is currently in a hold-over status, because it expired in March 2000.

The Corps issued a 50-year right-of-way (easement), No. DACW05-2-98-612, to YCWA on October 19, 1998. The Corps subsequently retracted this easement in March 1999 because of land administration issues associated with Bureau of Land Management (BLM) lands (Corps 2000).

A BLM right-of-way (Serial No. CACA 44390) to YCWA was issued by BLM on June 24, 2002. It grants YCWA the right to operate, maintain, and terminate an existing canal on public lands until December 31, 2031 (30-year term). YCWA's activities under the grant are limited to operations and maintenance of the existing facilities.

Although the diversion structure addressed CDFW fish screening requirements at the time of construction in 1985, fish screening requirements have changed over time and the diversion structure does not meet current NMFS and CDFW screening criteria. The potential replacement or modification of the rock gabion fish screen at the South Yuba/Brophy Diversion Canal and Facilities has been under consideration for many years. A collaborative process to undertake a feasibility assessment was initiated by YCWA and CDFW in late 2005. A final feasibility study titled *"Feasibility Study for the South Canal Fish Screen"* (Feasibility Study) was issued in April 2009.

In August 2009, YCWA initiated the environmental review process pursuant to the California Environmental Quality Act (CEQA) for the South Diversion Canal Screening Project. For a variety of reasons (including uncertainty regarding various aspects of the litigation regarding Daguerre Point Dam), YCWA suspended the CEQA process in July 2010.

Since July 2010, YCWA has worked with local stakeholders, water users and water right holders to address concerns about the cost and reliability of a new water diversion structure. YCWA has engaged a consultant team to undertake an Enhanced Feasibility Assessment, to expand on the feasibility work previously completed by YCWA and CDFW. YCWA will re-initiate the CEQA process, as well as a parallel NEPA process with the Corps after completion of the Enhanced Feasibility Assessment. Final permitting and final design work for the preferred alternative will be undertaken after the completion of the full CEQA/NEPA process.

At such time as YCWA develops the final plan for a new water diversion structure and completes any required permitting (including 404) and ESA consultation, the Corps plans to issue a right-of-way (easement) to YCWA for access to the diversion facilities and canal, located near Daguerre Point Dam. The Corps will have no responsibility for designing such facilities, or operating or maintaining the South Yuba/Brophy Diversion Canal and Facilities. This project represents a future action that may require separate ESA consultation(s), and is not included the Corps' consultation for this Proposed Action.

APPENDIX G

Analytical Results Used to Support the Assessment of Potential Effects to Green Sturgeon in the Lower Yuba River

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ANALYTICAL RESULTS USED TO SUPPORT THE ASSESSMENT OF POTENTIAL EFFECTS TO GREEN STURGEON IN THE LOWER YUBA RIVER

Table G-1. Green sturgeon deepwater pool habitat availability metrics for the lower Yuba River downstream of Daguerre Point Dam.

Marysville Flow (cfs)	Minimum Depth (feet)	Maximum Depth (feet)	Mean Depth (feet)	Standard Deviation (feet)	Change in Depth Per Change in Flow (inch/100 cfs)	
					Maximum	Mean
530	10.0	23.1	12.2	2.0	n/a	n/a
600	10.0	23.2	12.2	2.0	1.1	0.1
622	10.0	23.2	12.2	2.0	0.5	0.2
700	10.0	23.2	12.2	2.0	1.3	0.3
800	10.0	23.3	12.2	2.0	1.0	0.2
880	10.0	23.4	12.3	2.0	1.1	0.3
930	10.0	23.4	12.3	2.0	1.0	0.2
1000	10.0	23.5	12.3	2.0	1.1	0.2
1300	10.0	23.8	12.3	2.0	1.1	0.3
1500	10.0	24.1	12.4	2.0	1.6	0.1
1700	10.0	24.2	12.4	2.1	1.1	0.1
2000	10.0	24.5	12.4	2.1	1.1	0.0
2500	10.0	25.0	12.4	2.2	1.1	0.0
3000	10.0	25.4	12.4	2.2	1.1	0.0
4,000	10.0	26.4	12.6	2.3	1.1	0.3
5,000	10.0	26.9	13.1	2.3	0.6	0.5
7,500	10.0	27.6	14.1	2.6	0.3	0.5
10,000	10.0	28.3	15.1	2.8	0.3	0.5
15,000	10.0	31.2	17.2	3.3	0.7	0.5
21,100	10.2	34.7	19.5	3.7	0.7	0.5
30,000	11.2	38.9	22.3	4.4	0.6	0.4
42,200	12.2	44.0	25.4	5.2	0.5	0.3

Table G-2. Long-term and water year type average pool depth in the lower Yuba River below Daguerre Point Dam under the Cumulative Condition and the Environmental Baseline.

Analysis Period	Average Pool Depth (ft)									
	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov
Long-term										
Full Simulation Period[2]										
Environmental Baseline	12.8	12.8	12.6	12.7	12.5	12.1	12.1	12.1	12.2	12.2
Cumulative Condition	12.7	12.8	12.6	12.7	12.4	12.1	12.1	12.1	12.2	12.2
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Difference[3]	-0.1	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0
Water Year Types[1]										
Wet										
Environmental Baseline	13.4	13.4	13.0	13.4	13.0	12.4	12.4	12.2	12.2	12.2
Cumulative Condition	13.4	13.4	13.0	13.4	12.9	12.4	12.3	12.2	12.2	12.2
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Difference[3]	-0.1	0.0	0.0	-0.1	-0.2	-0.1	-0.1	-0.1	0.0	0.0
Above Normal										
Environmental Baseline	12.6	12.7	12.6	12.6	12.4	12.3	12.3	12.2	12.2	12.3
Cumulative Condition	12.5	12.7	12.5	12.5	12.4	12.3	12.3	12.2	12.2	12.3
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Difference[3]	0.0	-0.1	-0.1	-0.2	-0.1	-0.1	-0.2	-0.1	0.0	0.0
Below Normal										
Environmental Baseline	12.4	12.4	12.3	12.3	12.3	12.2	12.3	12.2	12.2	12.2
Cumulative Condition	12.4	12.4	12.3	12.3	12.2	12.2	12.3	12.2	12.2	12.2
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Difference[3]	-0.1	-0.1	0.0	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.0
Dry										
Environmental Baseline	12.3	12.3	12.2	12.3	12.2	12.2	12.2	12.2	12.2	12.3
Cumulative Condition	12.3	12.3	12.2	12.3	12.2	12.2	12.2	12.2	12.2	12.3
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Difference[3]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Critical										
Environmental Baseline	12.3	12.3	12.1	12.3	11.8	10.9	10.9	11.4	12.2	12.2
Cumulative Condition	12.3	12.3	12.1	12.3	11.8	10.9	10.9	11.4	12.2	12.2
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Percent Difference[3]	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

1 As defined by the Sacramento Valley 40-30-30 Index Water Year Hydrologic Classification (SWRCB 1995)

2 Based on the WY 1922-2007 simulation period

3 Relative difference of the monthly average

Table G-3. Areal extent of green sturgeon deepwater pool habitat availability in the lower Yuba River downstream of Daguerre Point Dam.

Marysville Flow (cfs)	Wetted Pool Area (sq. ft.)	Areal Extent of Pools (% of wetted channel)
300	249,453	2.6%
350	261,441	2.6%
400	274,005	2.7%
450	284,508	2.8%
530	301,644	2.9%
600	316,044	3.0%
622	320,400	3.0%
700	335,484	3.1%
800	354,501	3.2%
880	370,296	3.3%
930	380,070	3.4%
1,000	395,181	3.5%
1,300	456,930	3.8%
1,500	499,626	4.0%
1,700	548,487	4.3%
2,000	634,266	4.8%
2,500	804,861	5.8%
3,000	1,000,071	6.8%
4,000	1,400,292	8.8%
5,000	1,579,815	10.3%
7,500	1,859,247	15.1%
10,000	1,920,357	18.7%
15,000	1,936,989	24.7%
21,100	1,938,600	29.5%
30,000	1,938,465	36.7%
42,200	1,938,600	44.8%

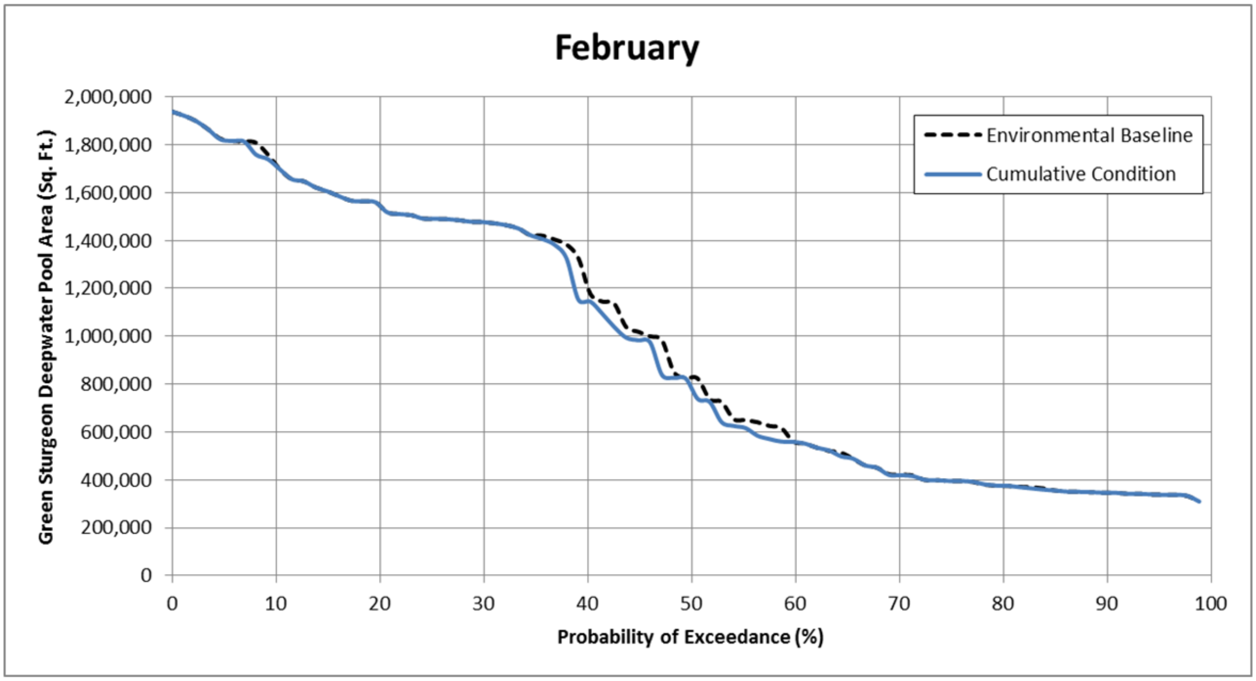

Figure G-1. Simulated adult green sturgeon deepwater holding habitat exceedance during February for 1922 through 2008.

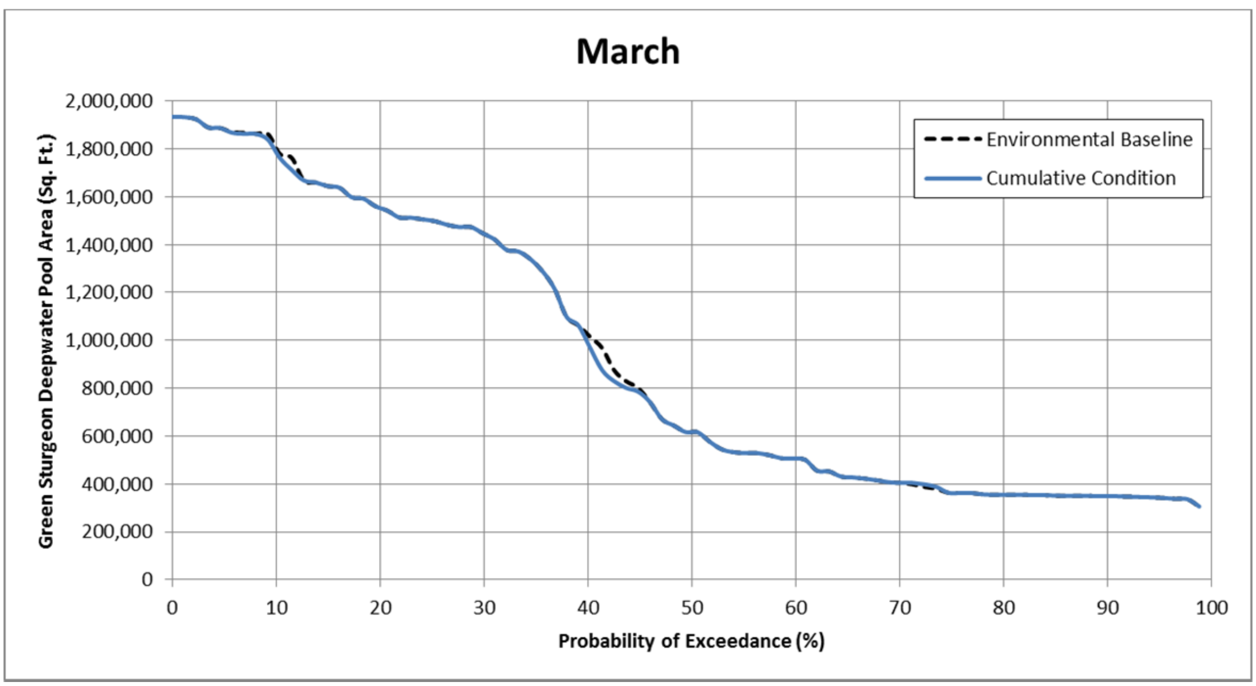

Figure G-2. Simulated adult green sturgeon deepwater holding habitat exceedance during March for 1922 through 2008.

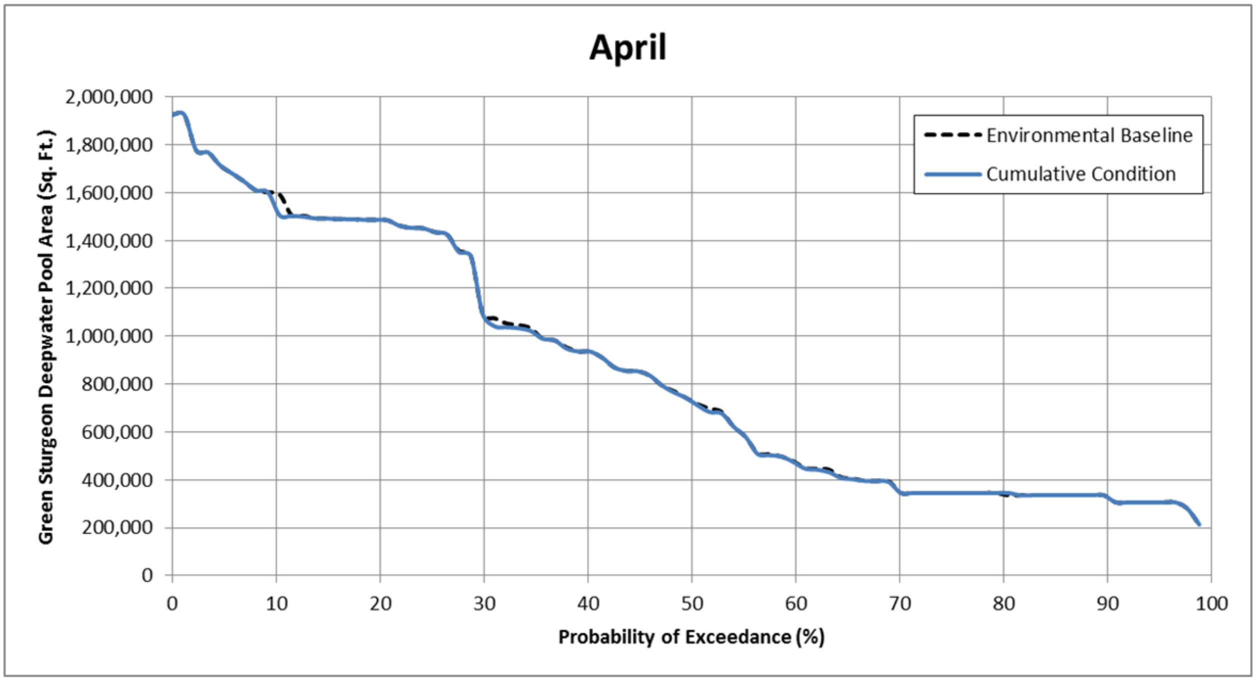

Figure G-3. Simulated adult green sturgeon deepwater holding habitat exceedance during April for 1922 through 2008.

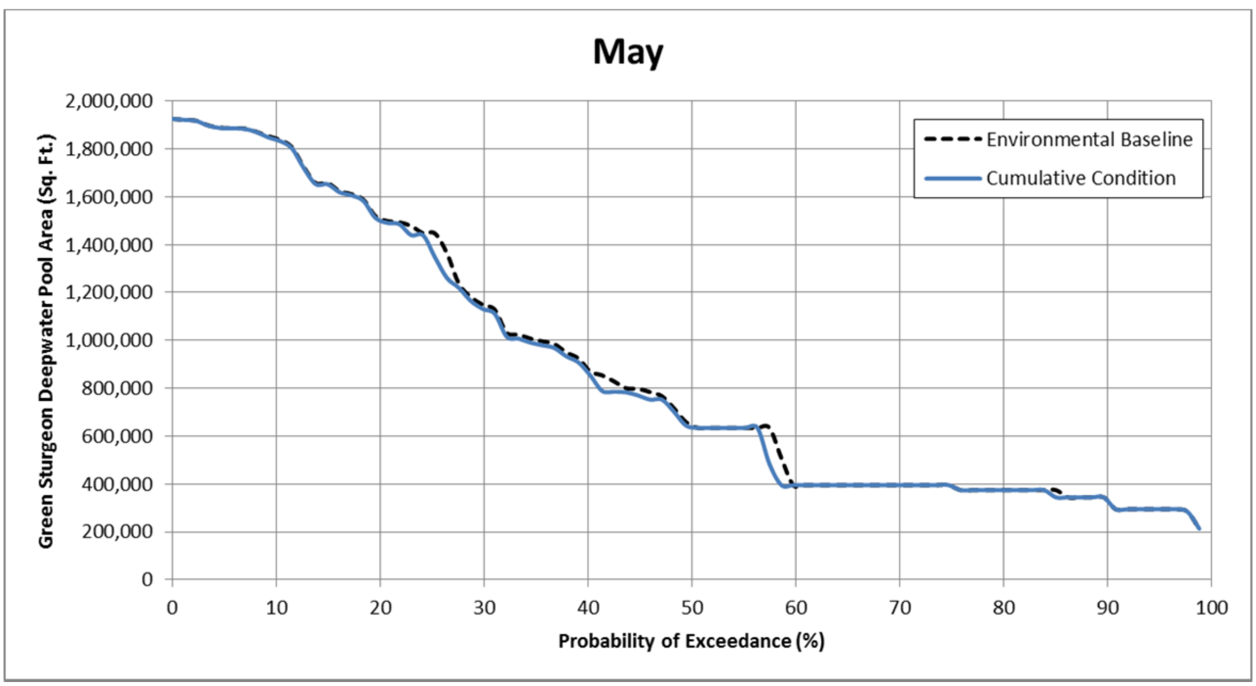

Figure G-4. Simulated adult green sturgeon deepwater holding habitat exceedance during May for 1922 through 2008.

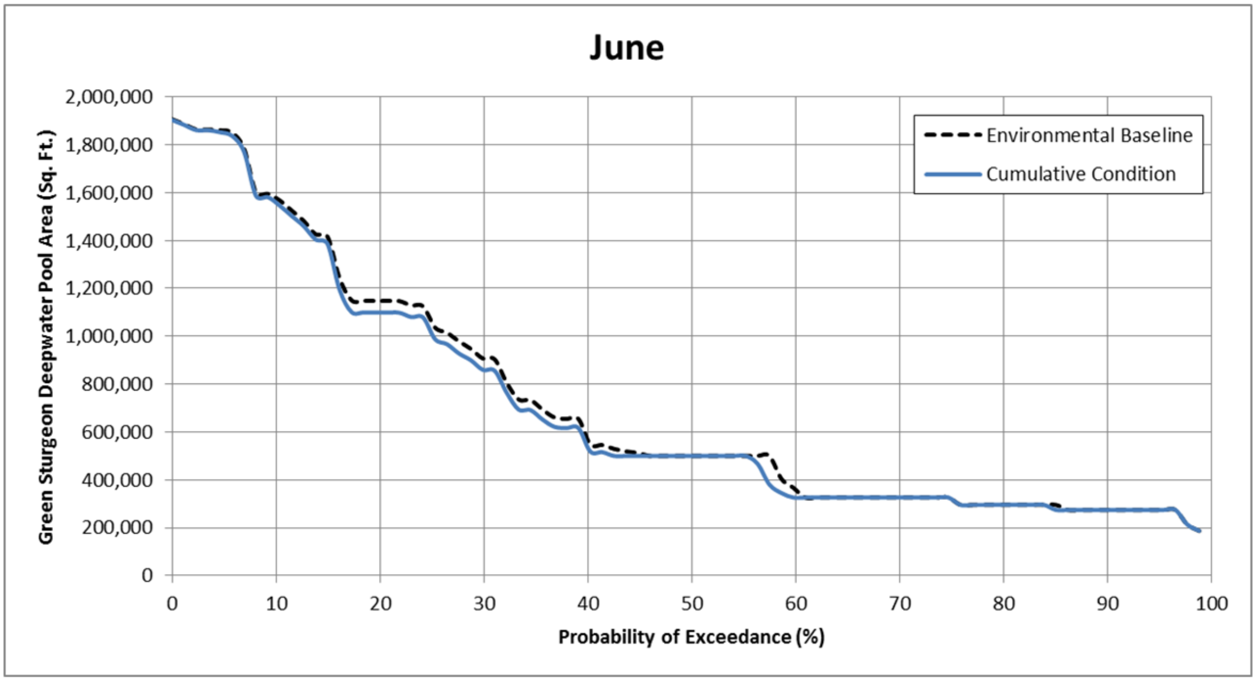

Figure G-5. Simulated adult green sturgeon deepwater holding habitat exceedance during June for 1922 through 2008.

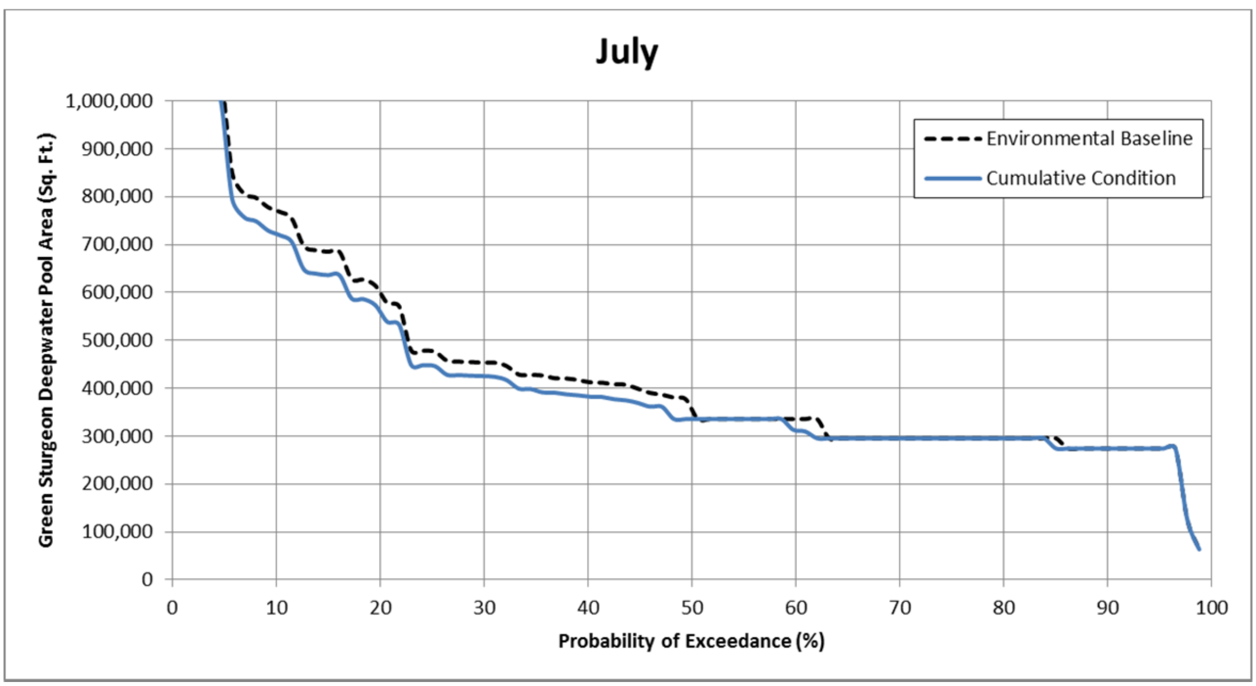

Figure G-6. Simulated adult green sturgeon deepwater holding habitat exceedance during July for 1922 through 2008.

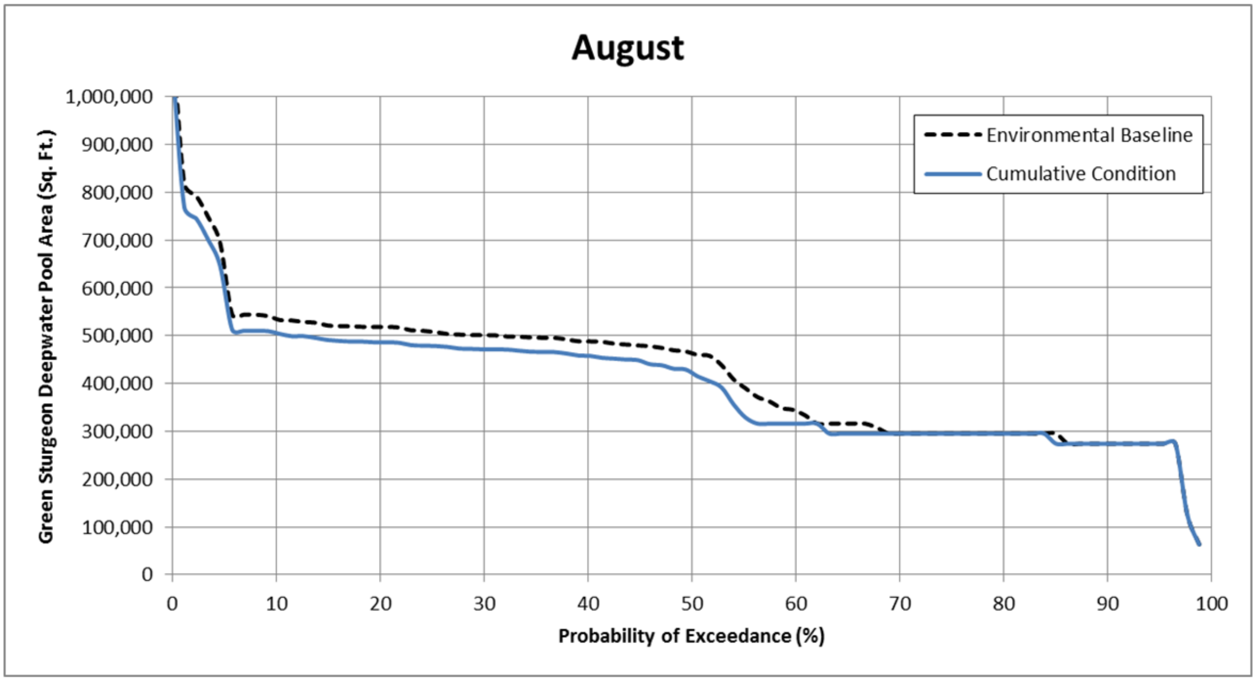

Figure G-7. Simulated adult green sturgeon deepwater holding habitat exceedance during August for 1922 through 2008.

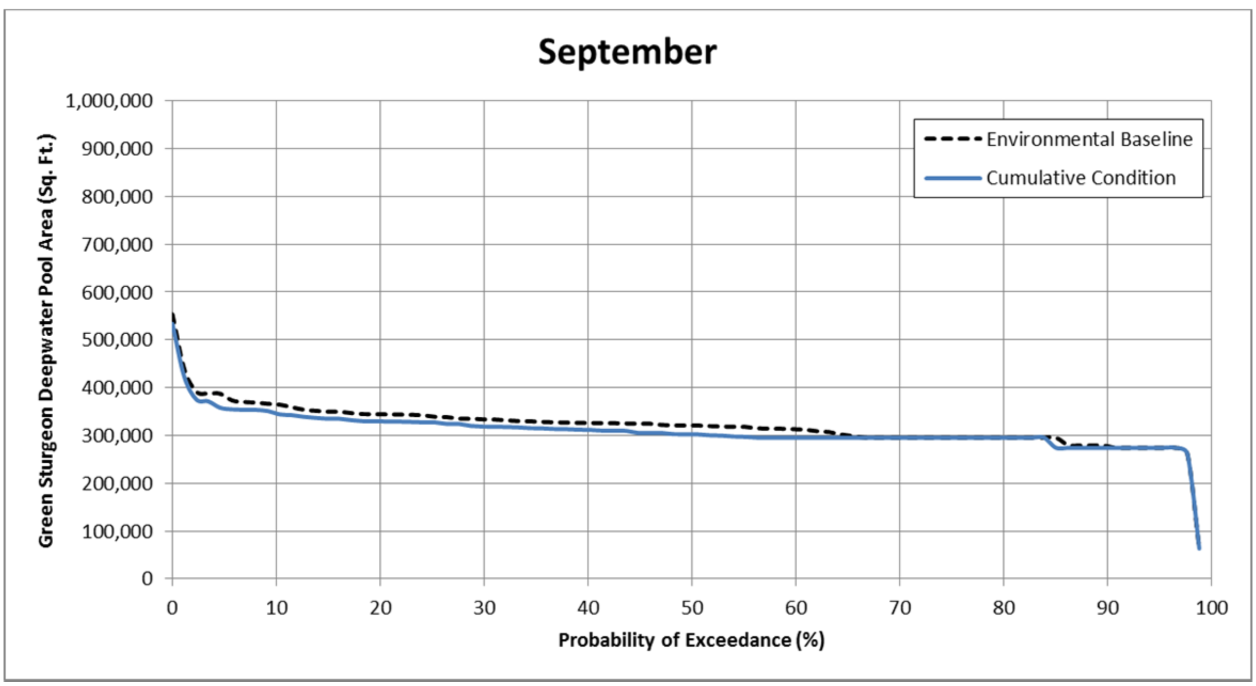

Figure G-8. Simulated adult green sturgeon deepwater holding habitat exceedance during September for 1922 through 2008.

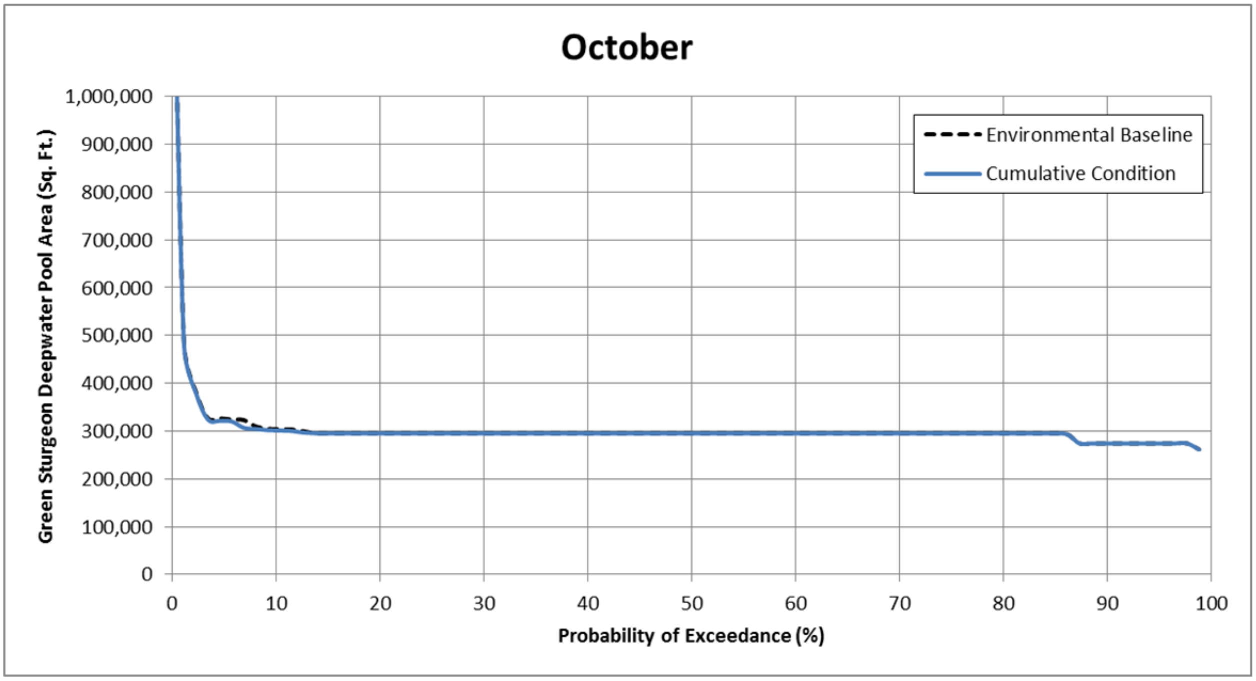

Figure G-9. Simulated adult green sturgeon deepwater holding habitat exceedance during October for 1922 through 2008.

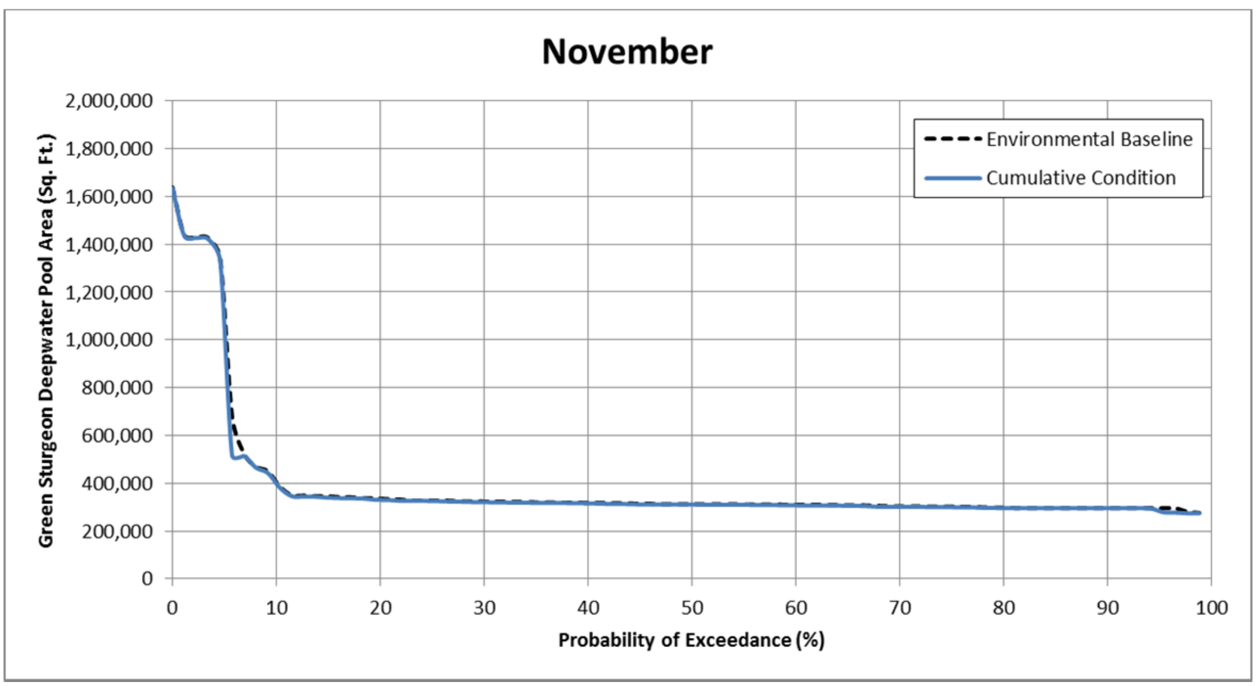

Figure G-10. Simulated adult green sturgeon deepwater holding habitat exceedance during November for 1922 through 2008.

APPENDIX F

Simulation of Lower Yuba River Flow and Temperatures for ESA Analysis of Continued Operation of Daguerre Point Dam

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Simulation of Lower Yuba River Flow and Temperatures for ESA Analysis of Continued Operation of Daguerre Point Dam

Prepared by Stephen Grinnell, P.E.

The purpose of this memo is to provide modeling output data in support of the preparation of a Biological Assessment pertaining to continued operation of Daguerre Point Dam. Modeling of two scenarios was completed to provide monthly average flows and water temperatures on the lower Yuba River for two comparative conditions. The modeling was completed using two models, a water balance/operations model and a stochastic water temperature model. The water balance/operations model simulates the hydrology of the lower Yuba River and operations of the Yuba River Development Project, owned and operated by the Yuba County Water Agency (YCWA) on a monthly time step. The water temperature model predicts average monthly water temperatures at three locations on the lower Yuba River and uses statistically derived relationships between meteorology, flow, reservoir water storage levels and resulting water temperatures. Both of these models were used in the preparation of the lower Yuba River Accord EIR and are documented in a technical memorandum that was an appendix to the EIR, and which is provided as Appendix B to this memorandum.

For the water balance/operations model, Appendix B documents the significant attributes of the model. Three items were changed in the assumptions and modeling conditions from the model used for the Accord EIR and described in the documentation. These items are: 1) the maximum release capacity of Colgate Powerhouse, which is the primary release point for New Bullards Bar Reservoir, has been corrected to be 3,430 cfs where previously it was modeled as 3,700 cfs: 2) the hydrologic period of record used for the simulations has been extended and is now from water year 1922 to 2008, where previously it included water year 1922 through 2005 and 3) the irrigation diversion demands were changed as described in the following paragraphs.

Simulation Scenario Irrigation Demands

For the analysis of flows and water temperatures only one simulation element is varied between the two scenarios, which is the irrigation diversion demand at Daguerre Point Dam. The two scenarios are labeled “Environmental Baseline” and “Cumulative Condition”. For the Environmental Baseline, the irrigation demands are those of the seven Member Units of YCWA that receive water from the Yuba River in amounts and flow rates that represent current land use conditions as of 2005, which is the most recent land use survey data available. These Member Units are: Hallwood Irrigation Company, Cordua Irrigation District, Browns Valley Irrigation District, Ramirez Water District (these preceding Member Units divert water at or just upstream of Daguerre Point Dam to lands north of the Yuba River), Brophy Water District, South Yuba Water District and Dry Creek Mutual Water Company (these preceding Member Units divert water at Daguerre Point Dam to lands south of the Yuba River). The Cumulative Condition scenario includes the irrigation demands for the Member Units listed previously plus the irrigation demands of Wheatland Water District, which began receiving surface water through a new canal extension in 2010. The monthly amounts of irrigation demand for the Member Units were derived by taking the Department of Water Resources (DWR) 2005 land use data for irrigated lands within these Member Units, and multiplying the various land use areas by their respective crop type applied water rates as determined by DWR for Yuba County. The applied water rates for two different years are used, 1999 to represent a wet year condition and 2001 to represent a dry year condition. Wet year conditions are assumed to occur in Wet and Above Normal years, and dry conditions are assumed for Below Normal, Dry and Critical years, where the year types are defined by the Yuba River Index of SWRCB Decision 1644. Previously the Accord EIR irrigation demands were derived based on 1995 land use data and field adjusted applied water rates published in DWR's Bulletin 113-4. In the previous calculation the differentiation of wet and dry conditions was made by reducing the Bulletin 113 applied water rates for the spring months of wet years to represent the wetter soil conditions that occur in those years. Table 1 lists the monthly irrigation demands used in the new model simulations. Table 2 is the diversion amounts separated into the amounts diverted north and south of the Yuba River.

The total irrigation diversion demands used for this analysis differ only slightly from the amounts used in the Accord EIR. For example, the future irrigation demand used in the Accord EIR, which included the demands of Wheatland Water District, totaled 344,736 acre-ft for the dry condition, while the Cumulative Condition total annual irrigation dry year demand is 346,922 acre-ft, an increase of less than one percent.

Modeling Results

Appendix A of this document provides output results of the modeling. Resulting flows at two locations are provided in a summary table and as exceedance plots. The locations are: Smartsville gage, just below Englebright Dam that includes irrigation delivery flows, and Marysville Gage, 5.6 miles upstream from the mouth of the Yuba River which is the flow in the Yuba River below the diversions at Daguerre Point Dam. Average monthly water temperatures for three locations are provided in a summary table and as exceedance plots. The three locations are: Smartsville gage, just below Englebright Dam, Daguerre Point Dam at river mile 11.5, and Marysville Gage, 5.6 miles upstream from the mouth of the Yuba River.

Table 1: Monthly Irrigation Demands by Yuba River Index Year Type for the Environmental Baseline and Cumulative Condition scenarios

Environmental Baseline Scenario (acre-ft)

Year Type (YRI)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
Wet	27,005	21,932	14,271	3,805	415	501	2,902	37,230	49,916	63,909	55,441	19,339	**296,666**
Above Normal	27,005	21,932	14,271	3,805	415	501	2,902	37,230	49,916	63,909	55,441	19,339	**296,666**
Below Normal	23,252	21,993	14,771	8,124	1,182	1,345	20,093	46,306	53,596	60,940	43,131	16,452	**311,185**
Dry	23,252	21,993	14,771	8,124	1,182	1,345	20,093	46,306	53,596	60,940	43,131	16,452	**311,185**
Critical	23,252	21,993	14,771	8,124	1,182	1,345	20,093	46,306	53,596	60,940	43,131	16,452	**311,185**

Cumulative Condition (acre-ft)

Year Type (YRI)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
Wet	27,884	23,161	14,512	4,228	415	501	2,906	39,820	57,183	72,697	64,003	23,976	**331,286**
Above Normal	27,884	23,161	14,512	4,228	415	501	2,906	39,820	57,183	72,697	64,003	23,976	**331,286**
Below Normal	24,153	23,471	15,581	8,172	1,182	1,345	20,910	52,931	60,450	68,670	50,246	19,812	**346,922**
Dry	24,153	23,471	15,581	8,172	1,182	1,345	20,910	52,931	60,450	68,670	50,246	19,812	**346,922**
Critical	24,153	23,471	15,581	8,172	1,182	1,345	20,910	52,931	60,450	68,670	50,246	19,812	**346,922**

Note: The Yuba River Index (YRI) Year Type is defined in State Water Resource Control Board Decision 1644

Table 2: Monthly Irrigation Demands by Yuba River Index Year Type at the North and South Diversion Locations for the Environmental Baseline and Cumulative Condition scenarios

North Diversion Environmental Baseline Scenario (acre-ft)

Year Type (YRI)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
Wet	18,992	13,641	9,193	1,644	139	103	628	21,913	28,064	34,480	30,474	9,296	**168,567**
Above Normal	18,992	13,641	9,193	1,644	139	103	628	21,913	28,064	34,480	30,474	9,296	**168,567**
Below Normal	15,973	13,317	8,474	5,214	126	372	11,753	26,918	29,912	33,302	22,536	9,057	**176,956**
Dry	15,973	13,317	8,474	5,214	126	372	11,753	26,918	29,912	33,302	22,536	9,057	**176,956**
Critical	15,973	13,317	8,474	5,214	126	372	11,753	26,918	29,912	33,302	22,536	9,057	**176,956**

South Diversion Environmental Baseline Scenario (acre-ft)

Year Type (YRI)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
Wet	8,013	8,291	5,078	2,161	277	398	2,274	15,317	21,851	29,429	24,967	10,043	**128,099**
Above Normal	8,013	8,291	5,078	2,161	277	398	2,274	15,317	21,851	29,429	24,967	10,043	**128,099**
Below Normal	7,278	8,676	6,297	2,910	1,056	973	8,339	19,388	23,684	27,638	20,595	7,395	**134,229**
Dry	7,278	8,676	6,297	2,910	1,056	973	8,339	19,388	23,684	27,638	20,595	7,395	**134,229**
Critical	7,278	8,676	6,297	2,910	1,056	973	8,339	19,388	23,684	27,638	20,595	7,395	**134,229**

North Diversion Cumulative Condition Scenario (acre-ft)

Year Type (YRI)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
Wet	18,992	13,641	9,193	1,644	139	103	628	21,913	28,064	34,480	30,474	9,296	**168,567**
Above Normal	18,992	13,641	9,193	1,644	139	103	628	21,913	28,064	34,480	30,474	9,296	**168,567**
Below Normal	15,973	13,317	8,474	5,214	126	372	11,753	26,918	29,912	33,302	22,536	9,057	**176,956**
Dry	15,973	13,317	8,474	5,214	126	372	11,753	26,918	29,912	33,302	22,536	9,057	**176,956**
Critical	15,973	13,317	8,474	5,214	126	372	11,753	26,918	29,912	33,302	22,536	9,057	**176,956**

South Diversion Cumulative Condition Scenario (acre-ft)

Year Type (YRI)	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
Wet	8,892	9,521	5,319	2,583	277	398	2,277	17,907	29,118	38,217	33,529	14,680	**162,719**
Above Normal	8,892	9,521	5,319	2,583	277	398	2,277	17,907	29,118	38,217	33,529	14,680	**162,719**
Below Normal	8,179	10,154	7,106	2,958	1,056	973	9,157	26,013	30,538	35,368	27,709	10,755	**169,966**
Dry	8,179	10,154	7,106	2,958	1,056	973	9,157	26,013	30,538	35,368	27,709	10,755	**169,966**
Critical	8,179	10,154	7,106	2,958	1,056	973	9,157	26,013	30,538	35,368	27,709	10,755	**169,966**

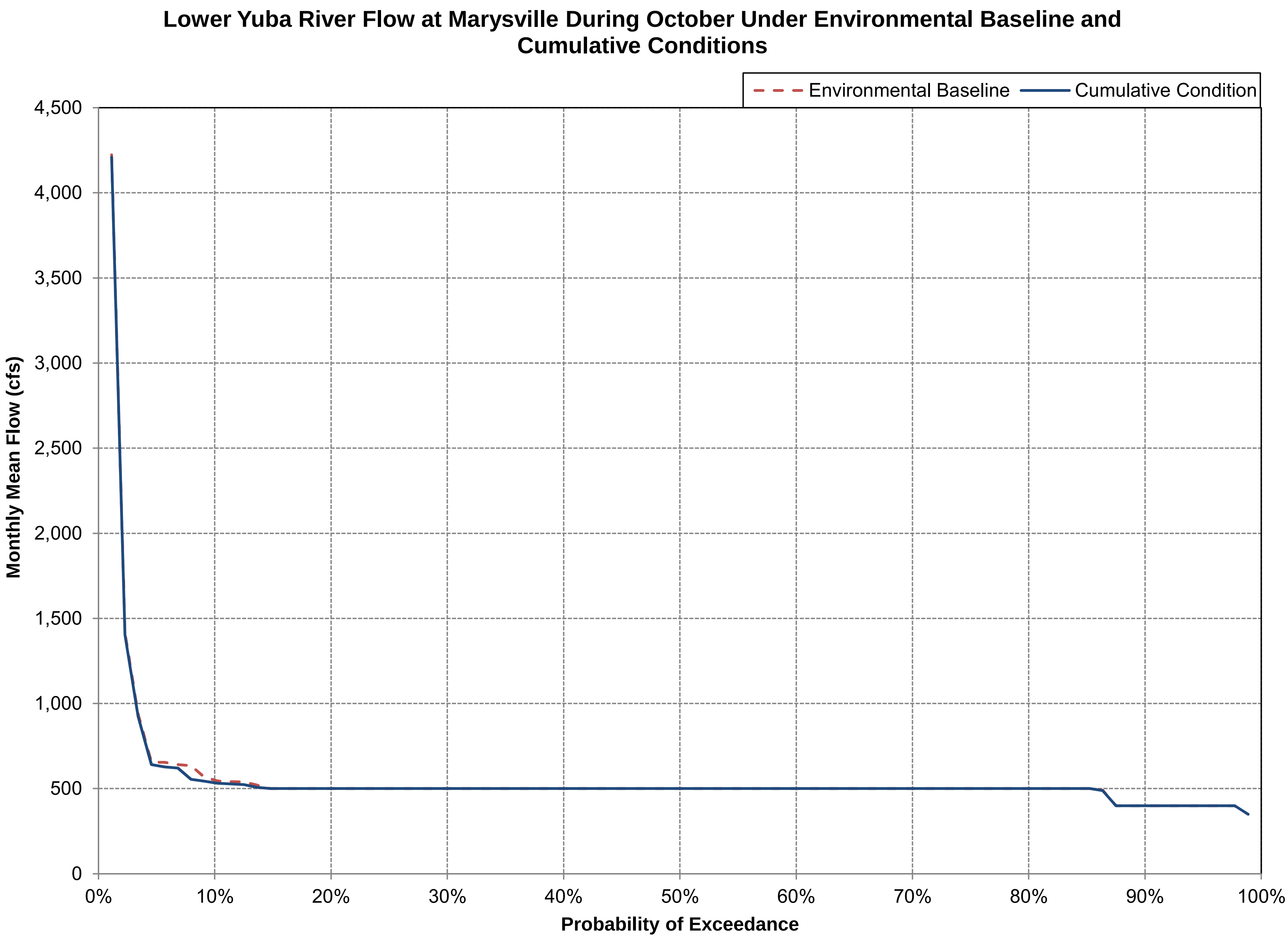
Note: North Diversion includes Cordua ID, Hallwood IC, Ramirez WD and BVID. South Diversion includes Brophy WD, South Yuba WD, Dry Creek MWC, and for the Cumulative Condition also includes Wheatland WD

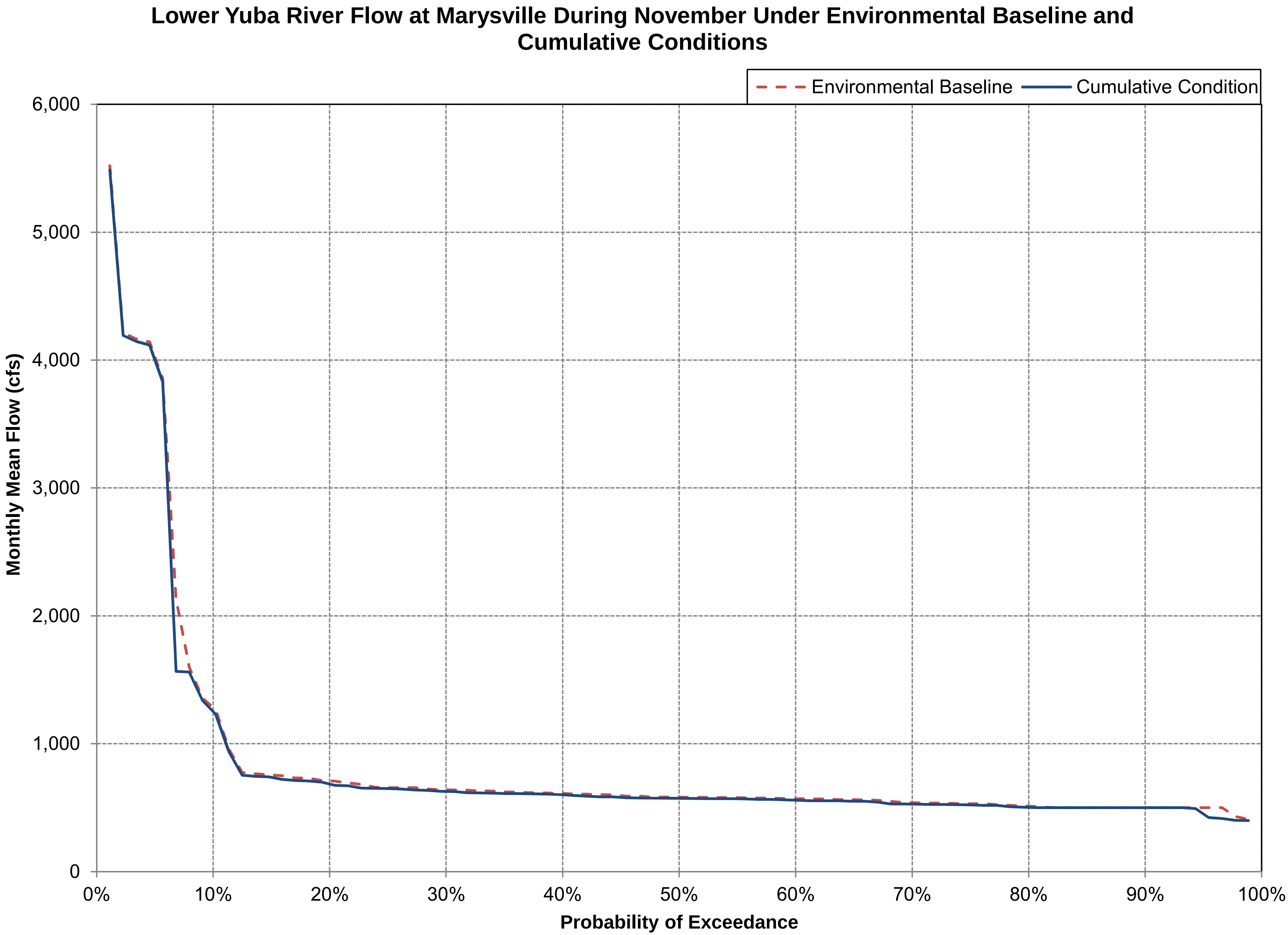
Appendix A: Modeling Simulation Output

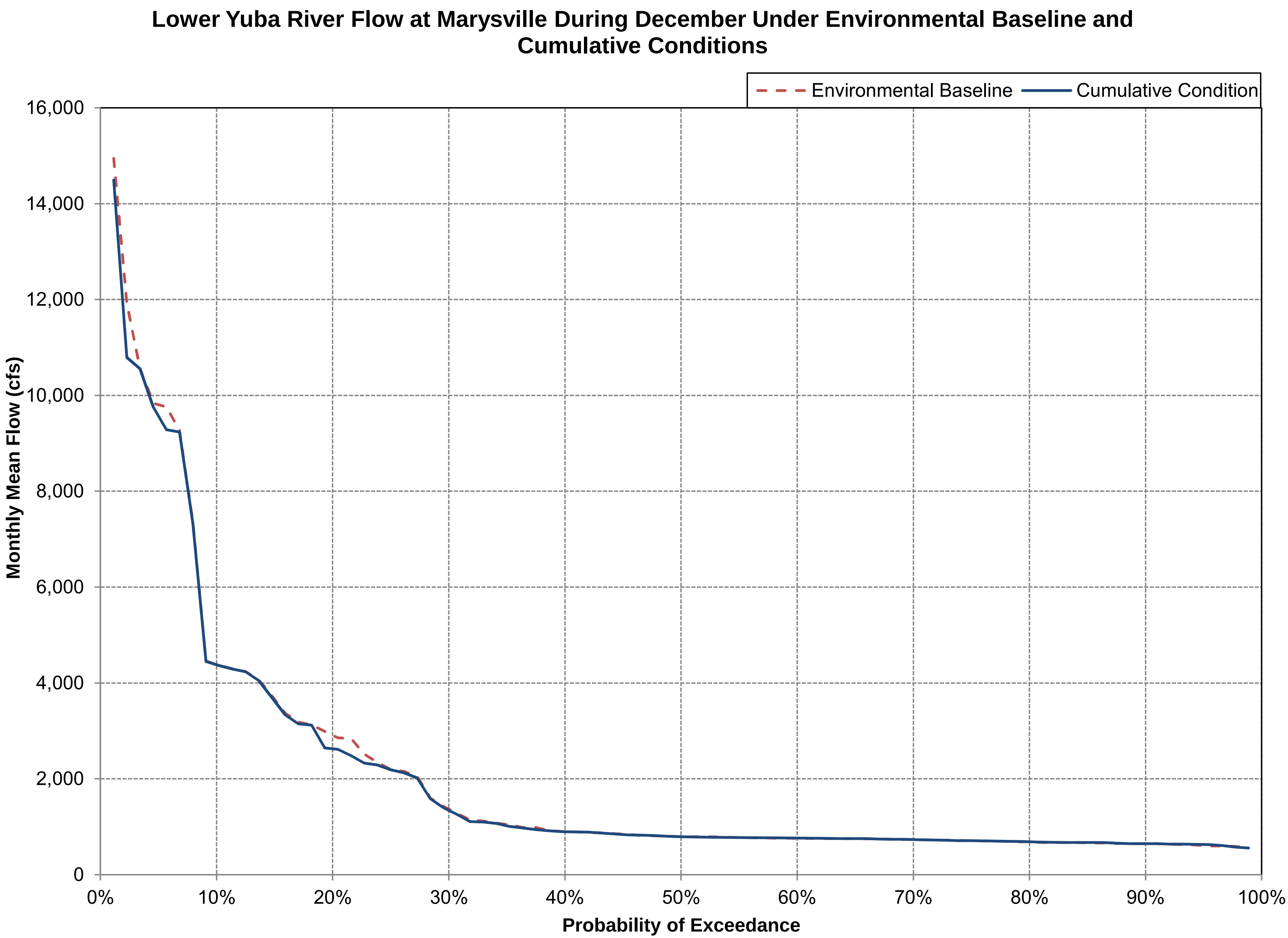
Long-term Average Flow, and Average Flow by Water Year Type in the Lower Yuba River at Marysville under the Environmental Baselin and Cumulative Conditions

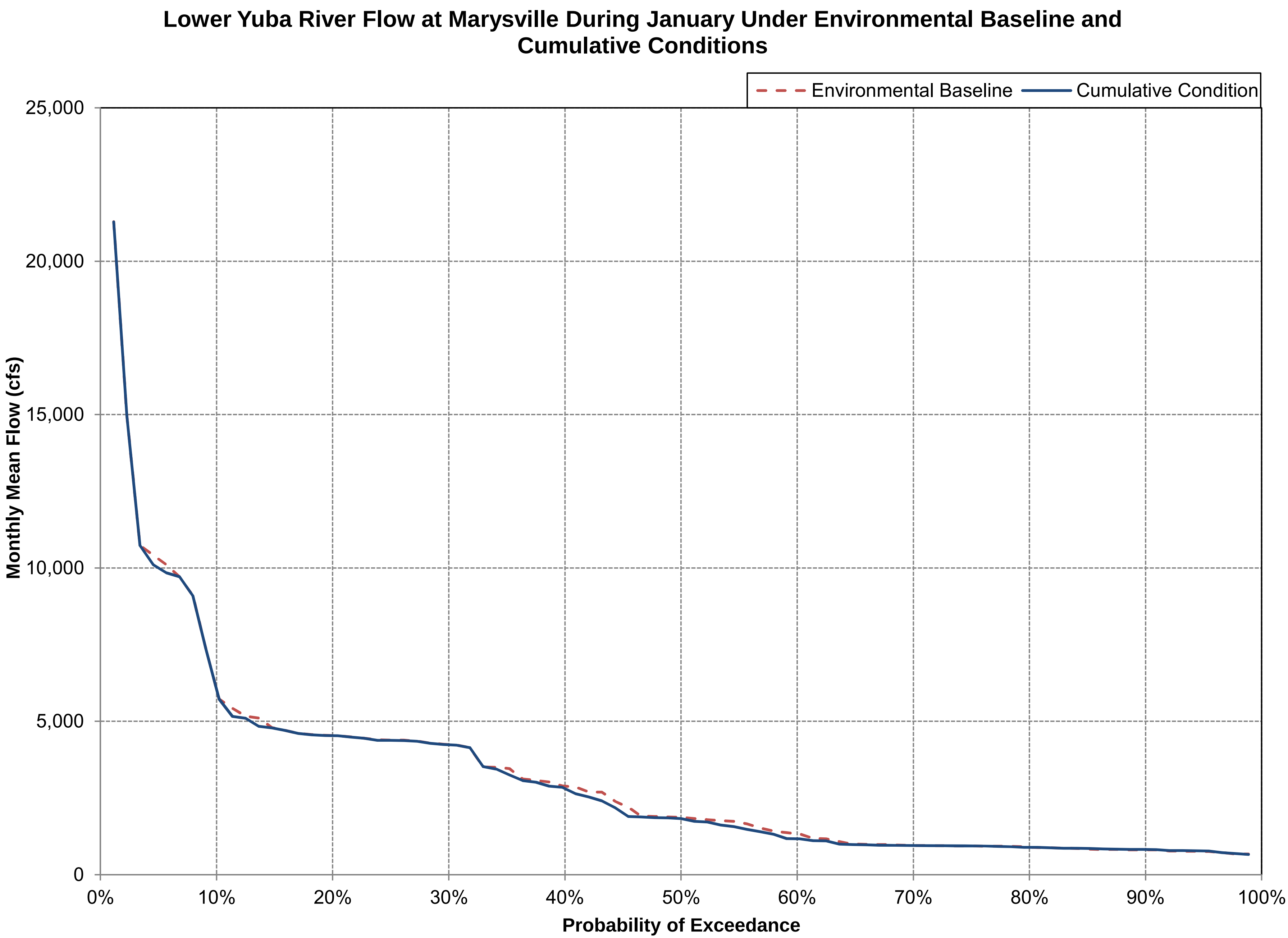
	Average Flow (cfs)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[1]												
Environmental Baseline	554	853	2,053	3,147	3,240	3,174	2,669	3,000	2,204	1,132	1,119	635
Cumulative Conditions	551	831	2,010	3,095	3,194	3,154	2,658	2,953	2,134	1,051	1,016	579
Difference	-3	-21	-43	-52	-46	-20	-11	-48	-70	-81	-103	-56
% Difference	-0.6%	-2.5%	-2.1%	-1.7%	-1.4%	-0.6%	-0.4%	-1.6%	-3.2%	-7.1%	-9.2%	-8.7%
Water Year Types[2]												
Wet												
Environmental Baseline	669	1,317	4,148	6,159	5,763	5,536	4,422	5,476	4,189	1,921	1,611	779
Cumulative Conditions	667	1,286	4,038	6,097	5,735	5,534	4,422	5,440	4,085	1,793	1,472	697
Difference	-3	-31	-110	-62	-28	-1	0	-37	-104	-127	-140	-82
% Difference	-0.4%	-2.4%	-2.6%	-1.0%	-0.5%	0.0%	0.0%	-0.7%	-2.5%	-6.6%	-8.7%	-10.5%
Above Normal												
Environmental Baseline	487	577	1,280	2,502	2,816	3,295	3,216	3,293	2,243	1,093	1,289	657
Cumulative Conditions	486	556	1,261	2,426	2,706	3,261	3,173	3,214	2,162	997	1,122	589
Difference	-1	-22	-19	-76	-110	-35	-43	-79	-82	-95	-168	-68
% Difference	-0.2%	-3.7%	-1.5%	-3.0%	-3.9%	-1.1%	-1.3%	-2.4%	-3.6%	-8.7%	-13.0%	-10.3%
Below Normal												
Environmental Baseline	484	666	864	1,287	2,093	1,827	1,661	1,295	965	714	992	616
Cumulative Conditions	482	653	860	1,240	2,030	1,760	1,647	1,201	877	628	900	566
Difference	-2	-13	-4	-47	-62	-67	-14	-93	-89	-87	-91	-50
% Difference	-0.4%	-1.9%	-0.5%	-3.6%	-3.0%	-3.7%	-0.8%	-7.2%	-9.2%	-12.2%	-9.2%	-8.1%
Dry												
Environmental Baseline	504	587	768	1,139	1,264	1,091	750	889	510	480	499	499
Cumulative Conditions	507	582	776	1,093	1,252	1,091	748	889	510	480	480	480
Difference	3	-5	8	-47	-12	0	-1	0	0	0	-19	-19
% Difference	0.6%	-0.9%	1.1%	-4.1%	-1.0%	0.0%	-0.2%	0.0%	0.0%	0.0%	-3.8%	-3.8%
Critical												
Environmental Baseline	507	596	739	926	937	815	583	606	399	379	379	398
Cumulative Conditions	494	576	733	917	935	815	587	594	391	371	371	387
Difference	-13	-20	-7	-9	-2	0	4	-12	-8	-8	-8	-12
% Difference	-2.6%	-3.4%	-0.9%	-1.0%	-0.2%	0.0%	0.7%	-2.0%	-1.9%	-2.0%	-2.0%	-2.9%

[1] Period of Record is Water Year 1922 - 2008
[2] As defined by the Yuba River Index described in SWRCB RD-1644


Lower Yuba River Flow at Marysville During October Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Monthly Mean Flow (cfs)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

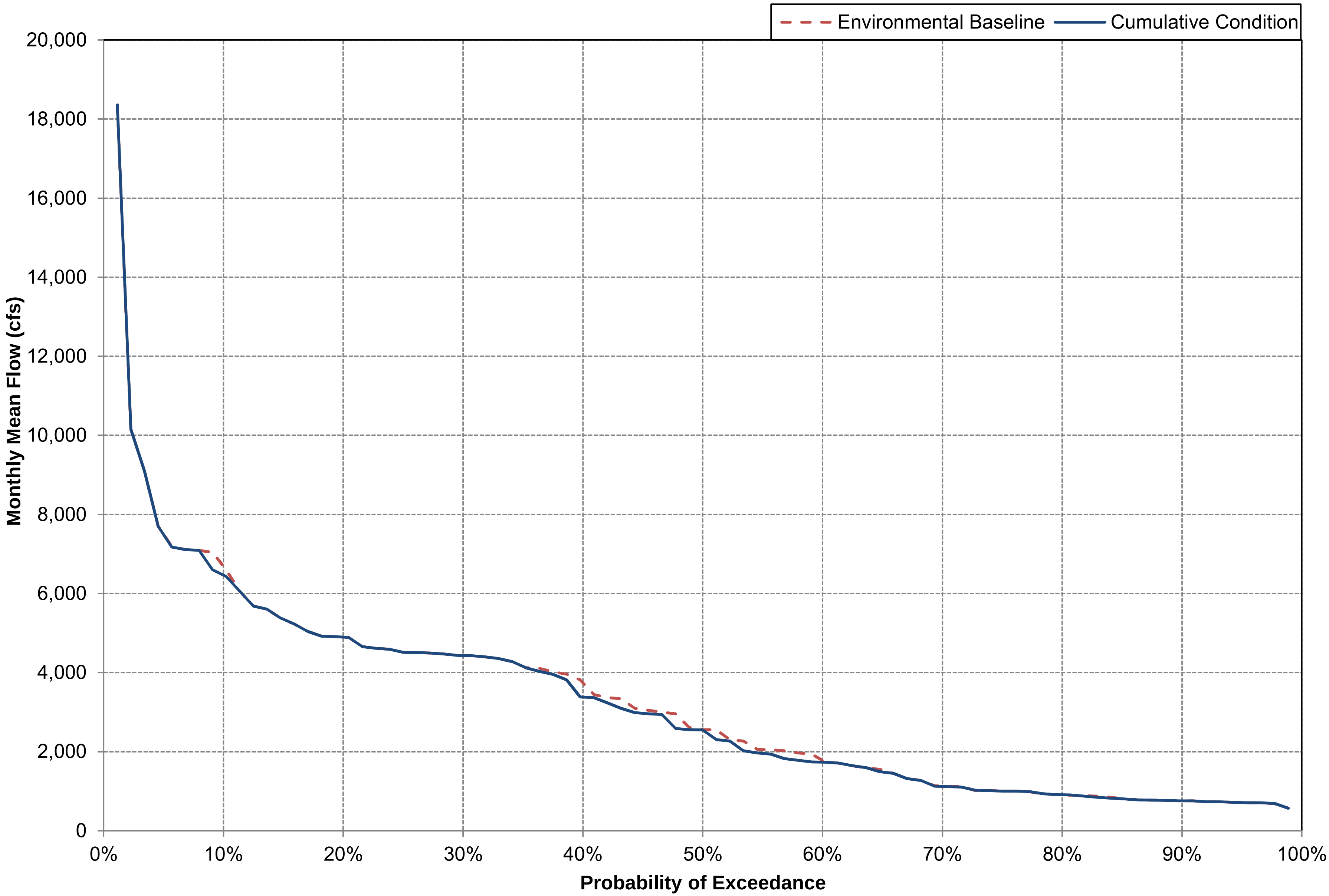

Lower Yuba River Flow at Marysville During November Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Monthly Mean Flow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance


Lower Yuba River Flow at Marysville During December Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Monthly Mean Flow (cfs)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

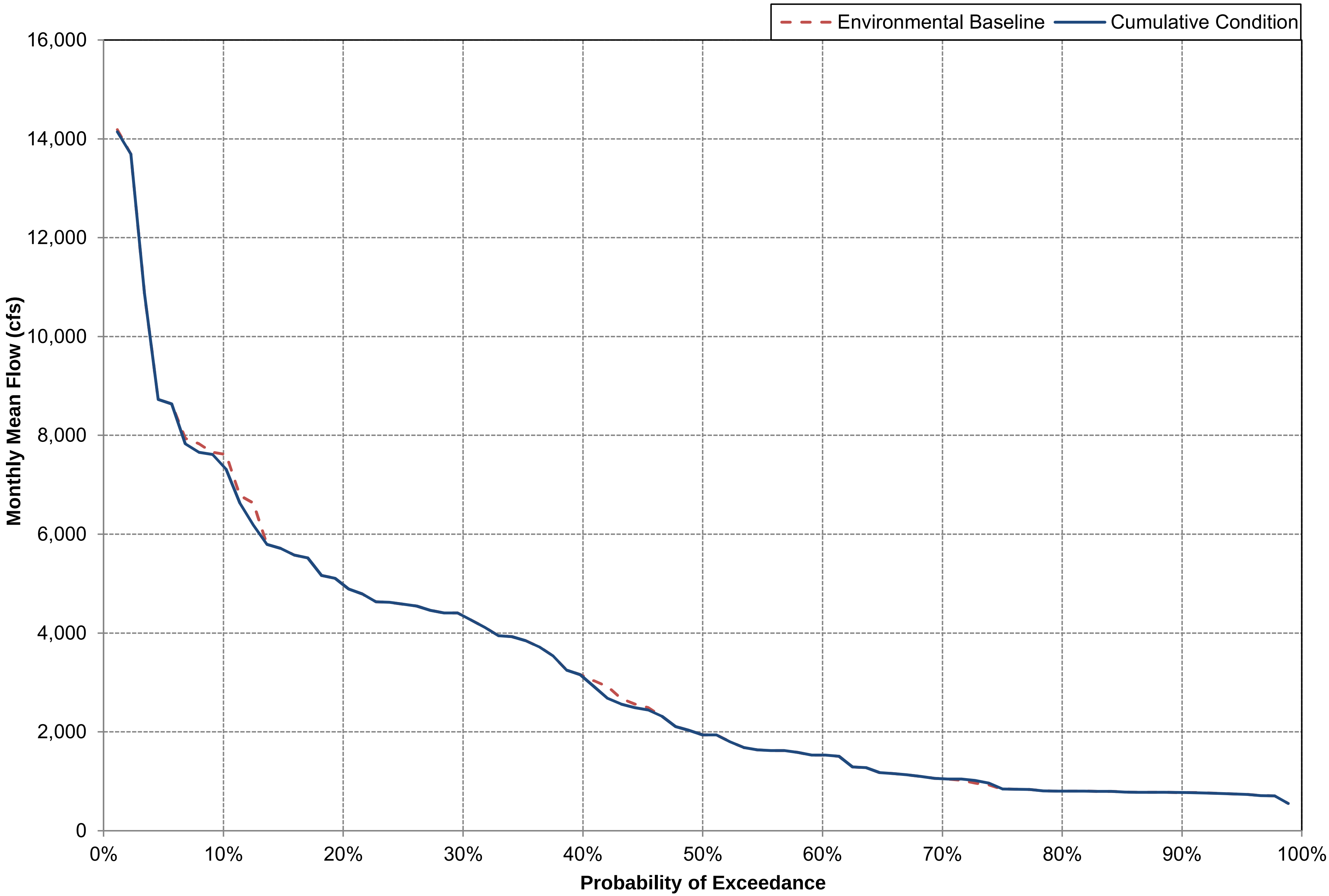


Lower Yuba River Flow at Marysville During January Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
25,000
20,000
15,000
10,000
5,000
0
Monthly Mean Flow (cfs)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

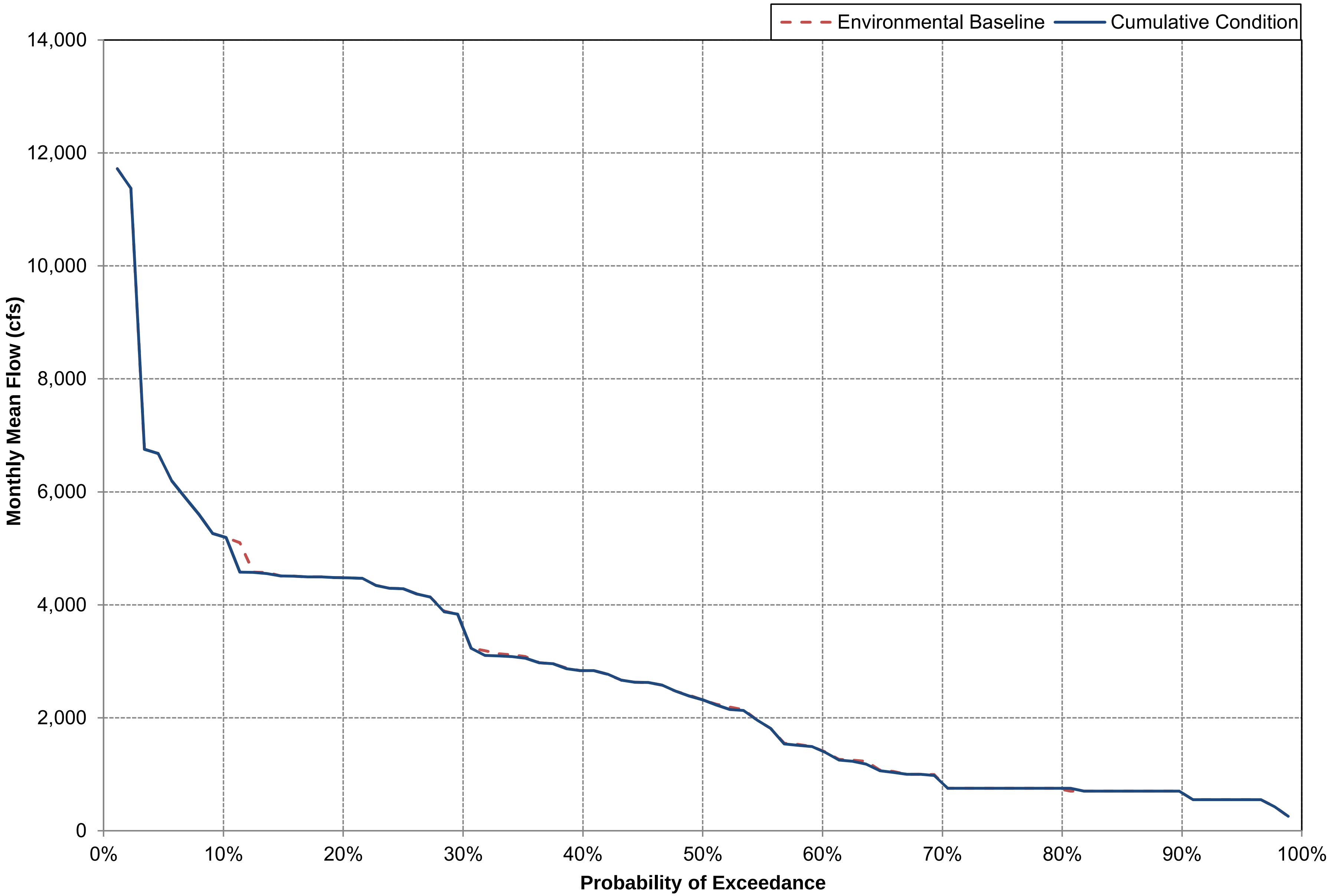
Lower Yuba River Flow at Marysville During February Under Environmental Baseline and Cumulative Conditions



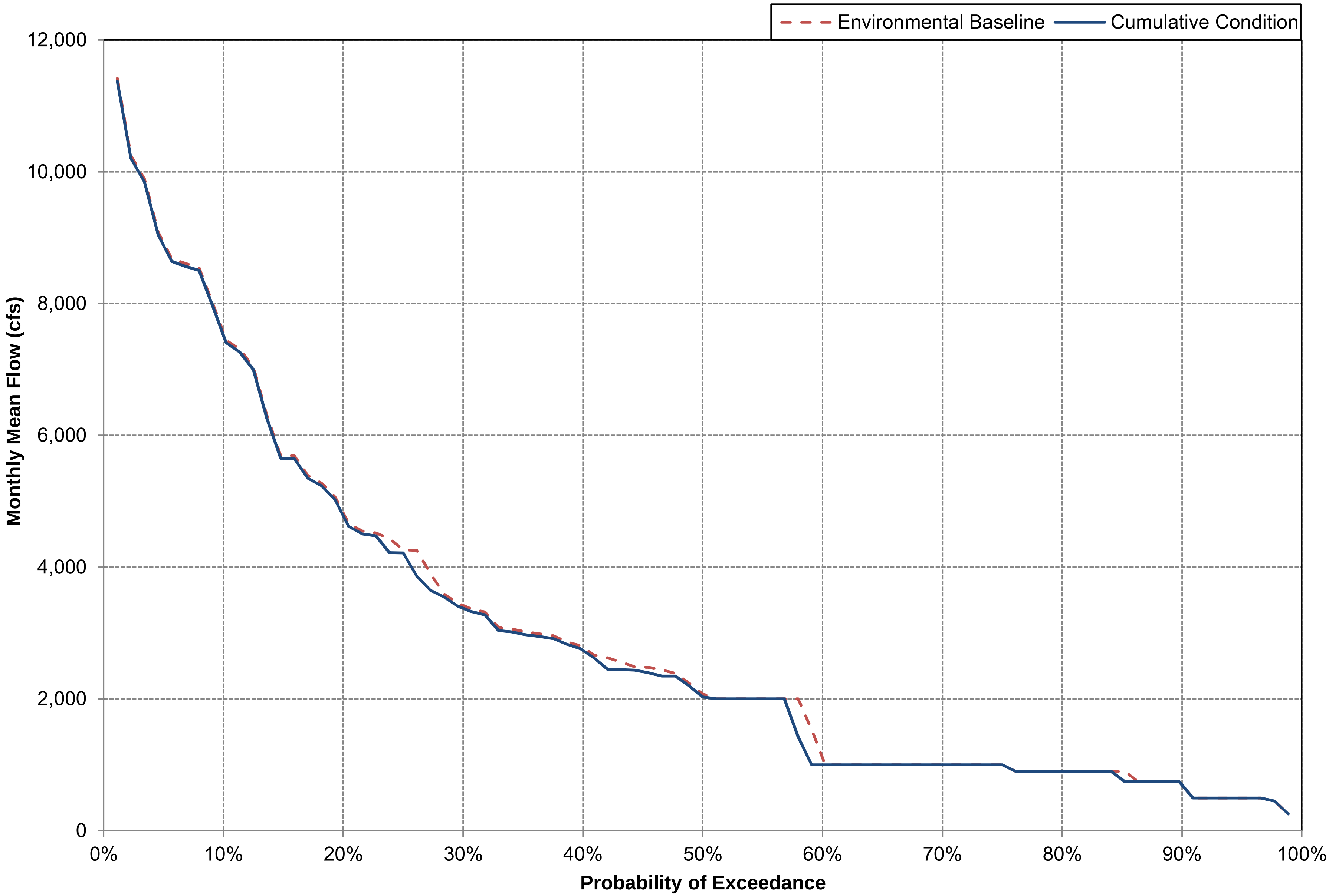
Lower Yuba River Flow at Marysville During March Under Environmental Baseline and Cumulative Conditions

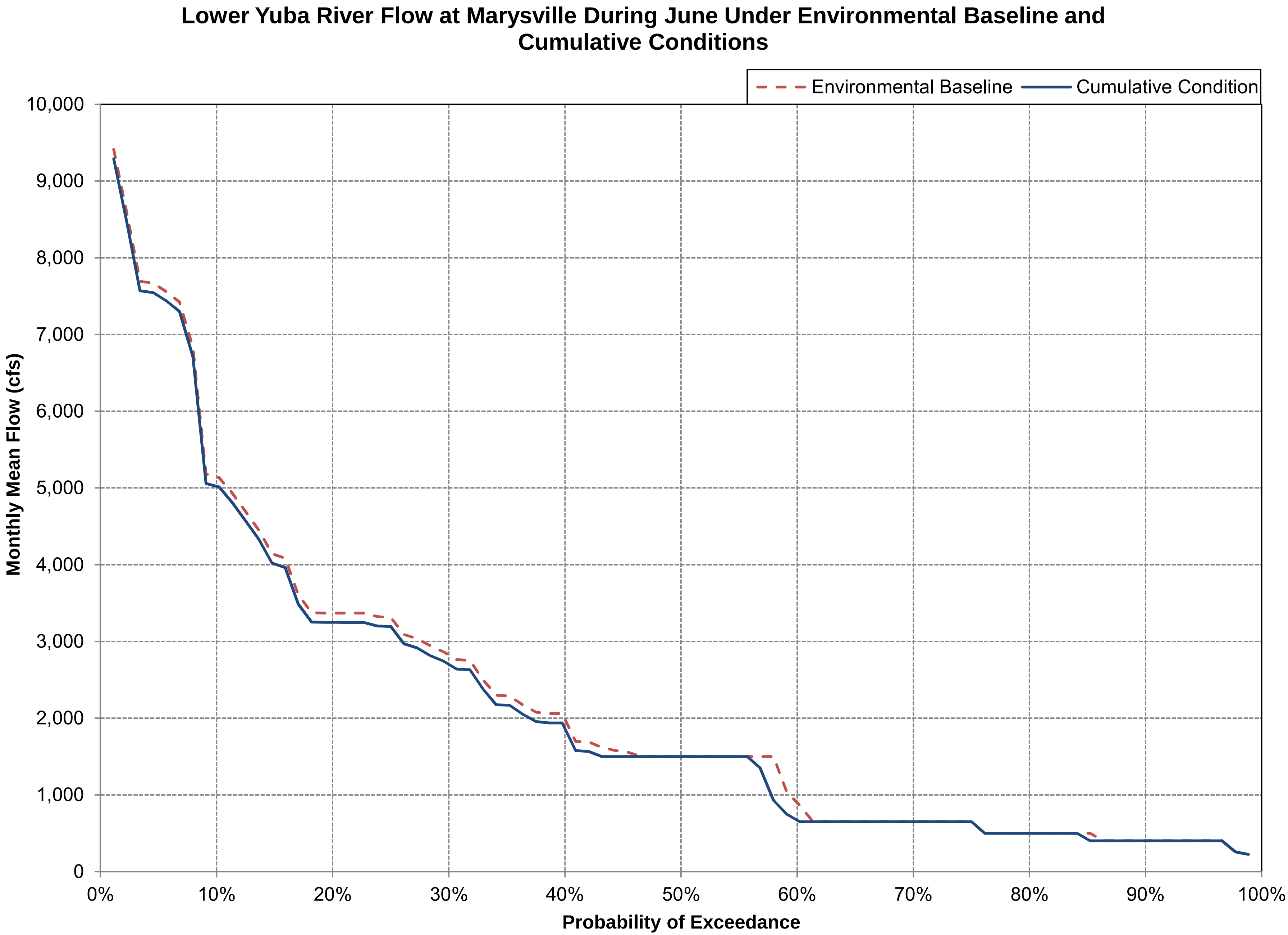


Lower Yuba River Flow at Marysville During April Under Environmental Baseline and Cumulative Conditions

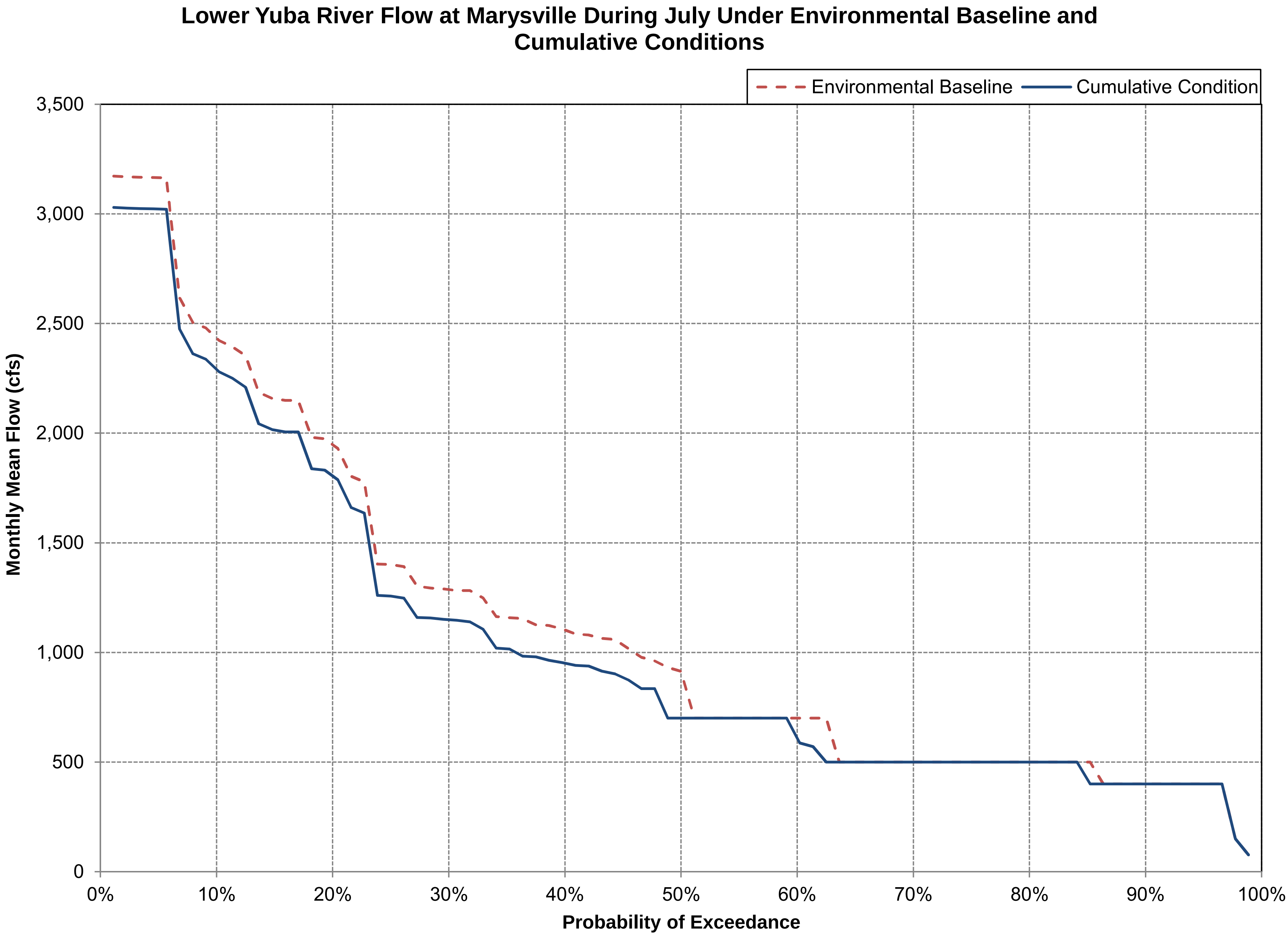


Lower Yuba River Flow at Marysville During May Under Environmental Baseline and Cumulative Conditions

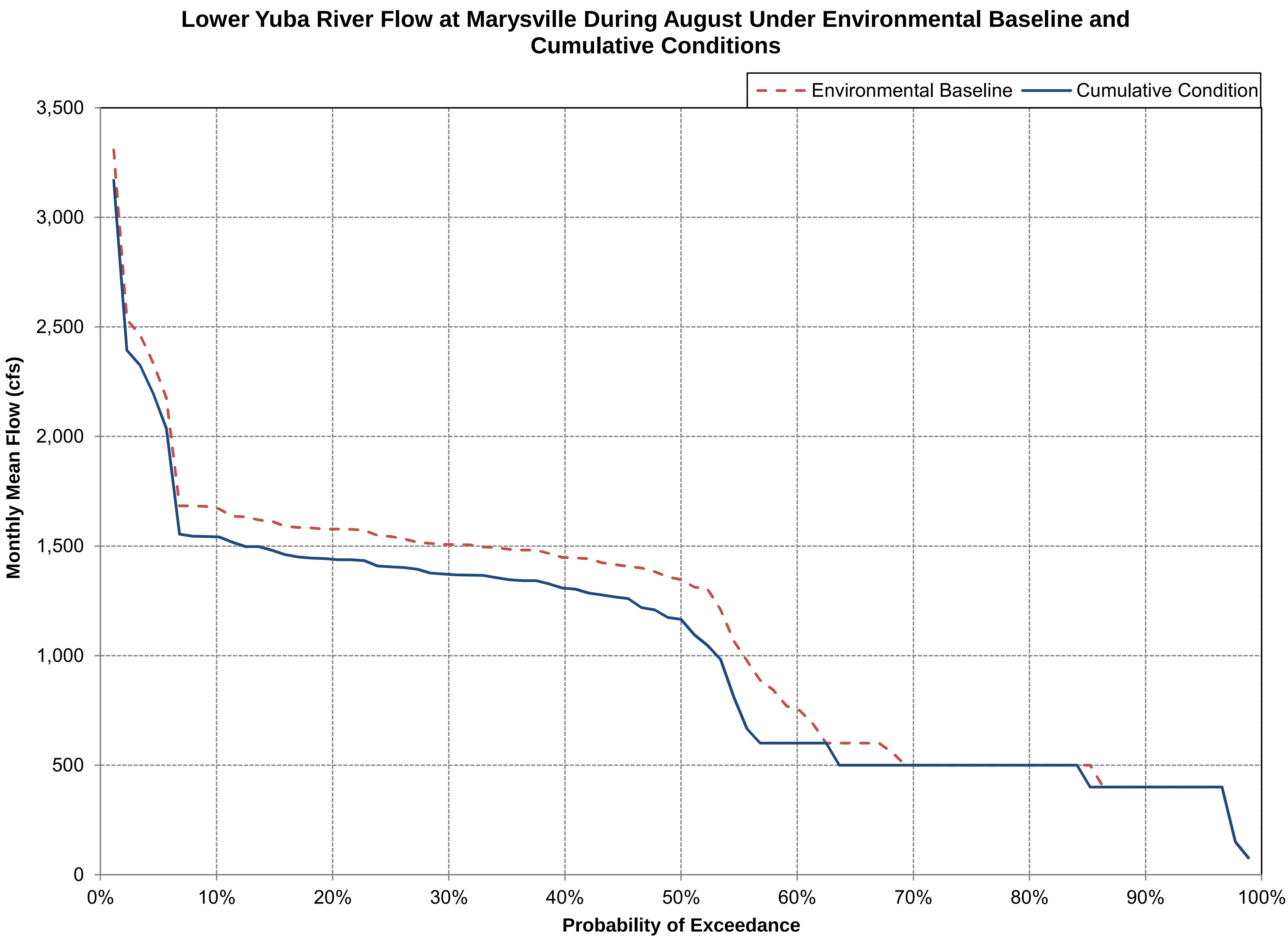




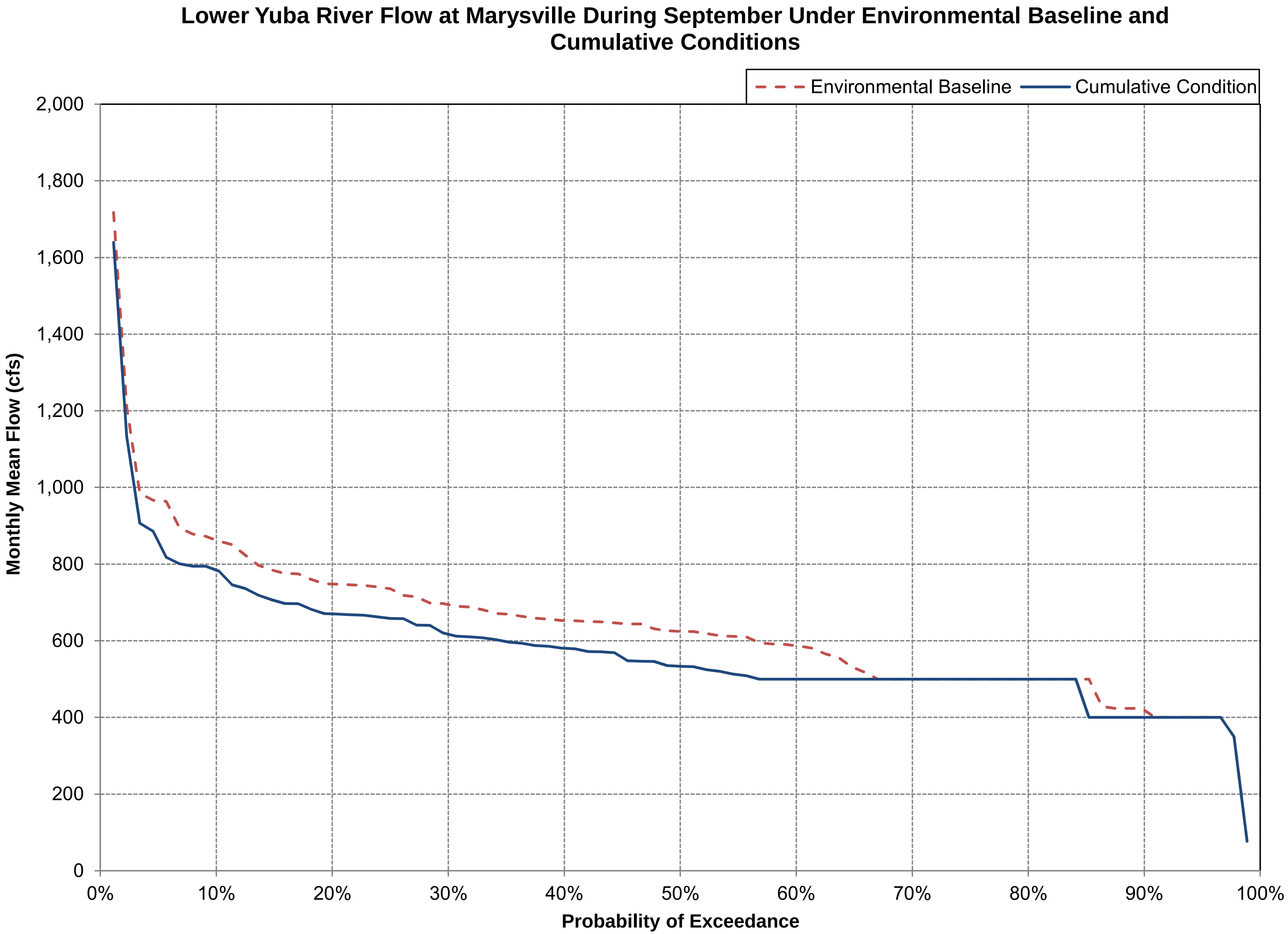
Lower Yuba River Flow at Marysville During June Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Monthly Mean Flow (cfs)
10,000
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance



Lower Yuba River Flow at Marysville During July Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Monthly Mean Flow (cfs)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance



Lower Yuba River Flow at Marysville During August Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Monthly Mean Flow (cfs)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

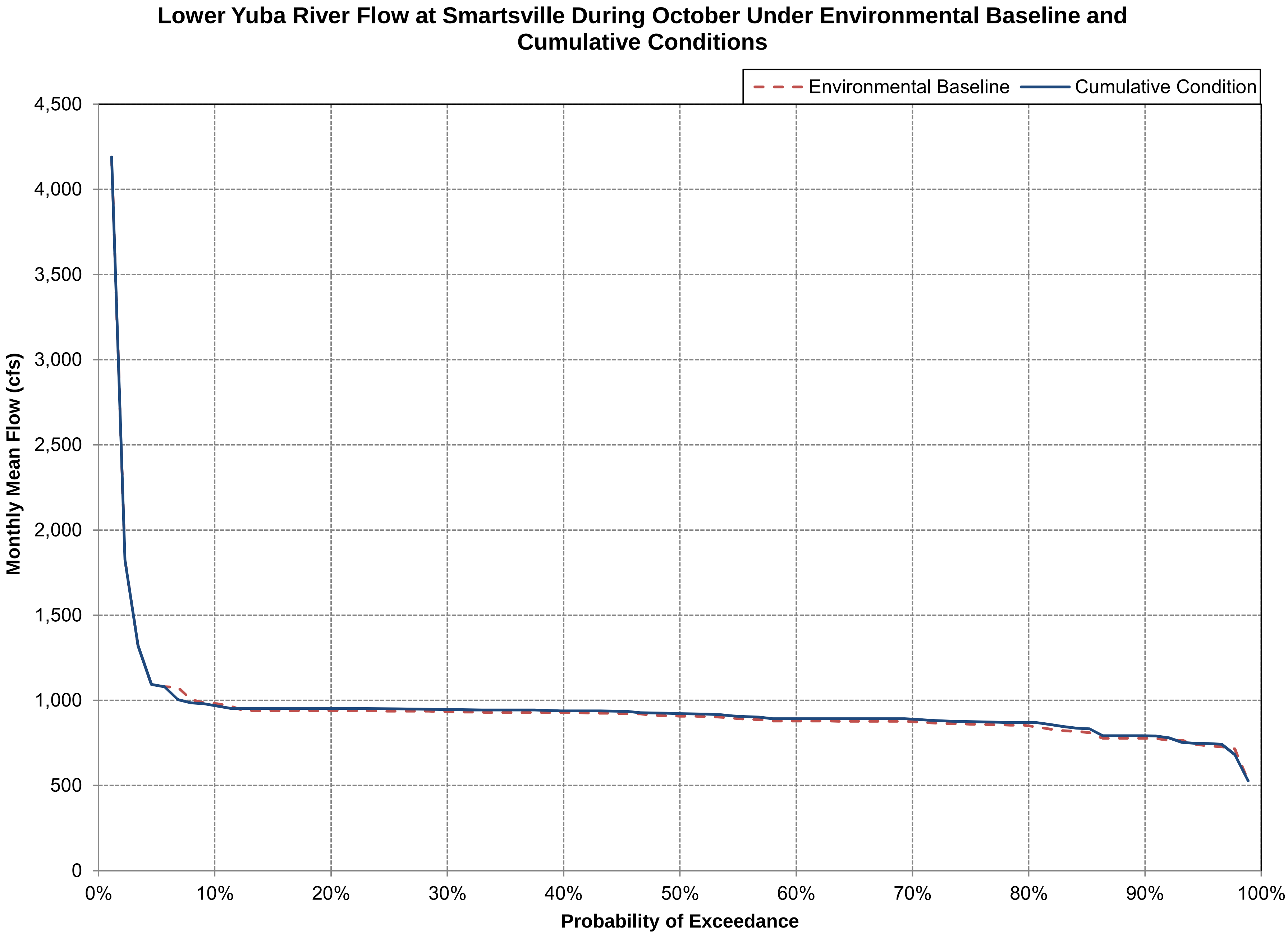


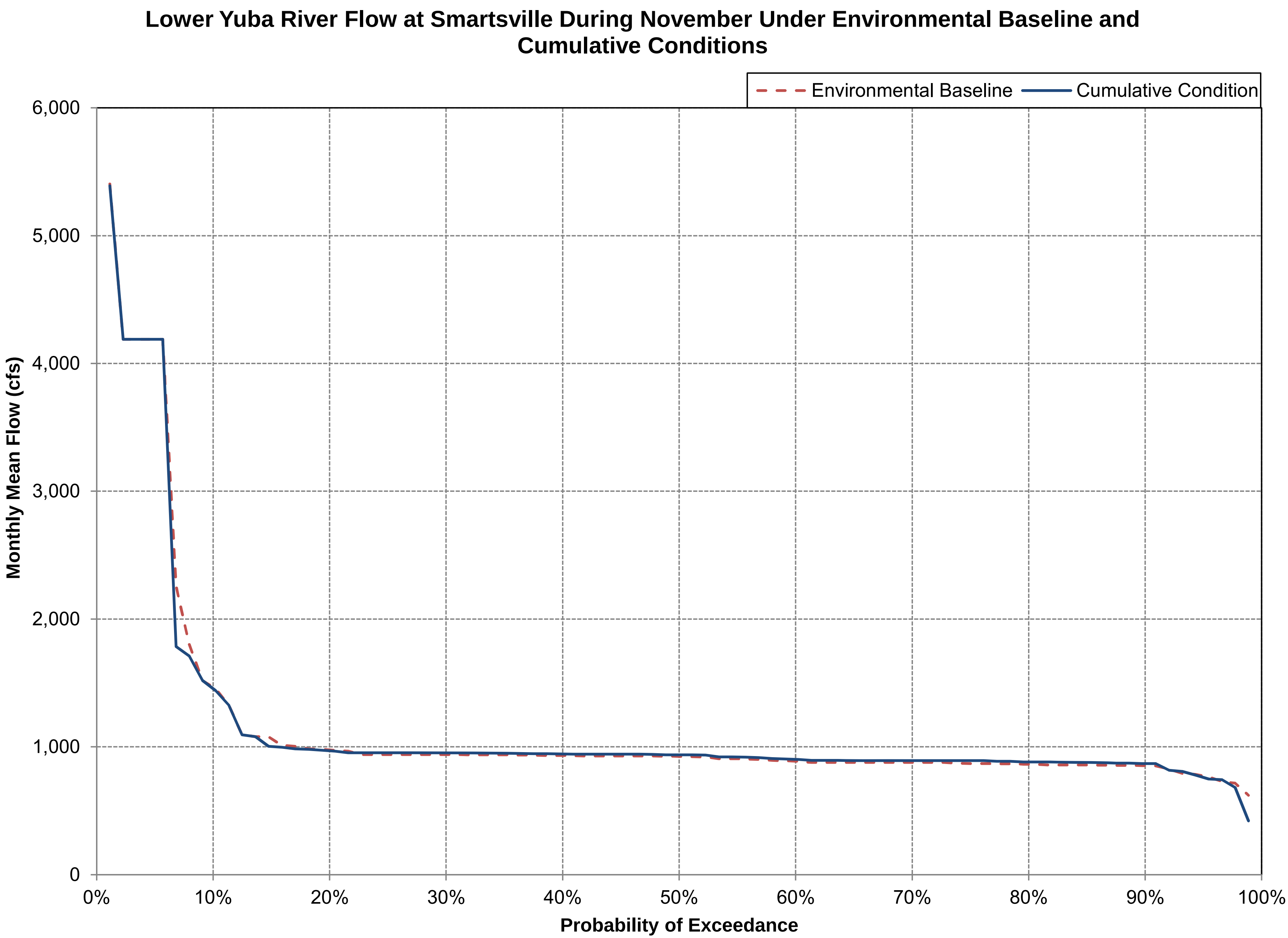
Lower Yuba River Flow at Marysville During September Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Monthly Mean Flow (cfs)
2,000
1,800
1,600
1,400
1,200
1,000
800
600
400
200
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

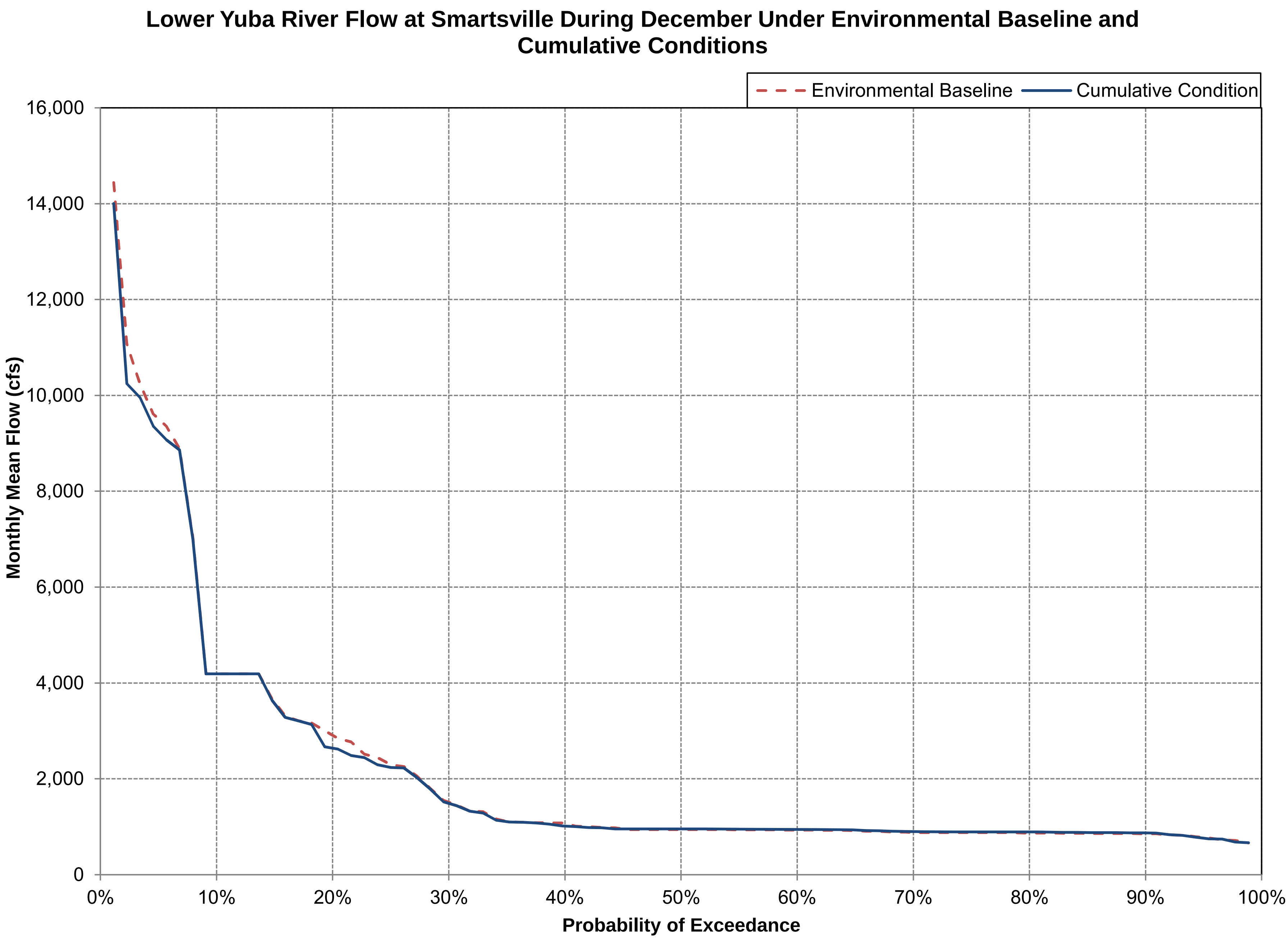
Long-term Average Flow, and Average Flow by Water Year Type in the Lower Yuba River at Smartsville under the Environmental Baselin and Cumulative Conditions

Analysis Period	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
					Average Flow (cfs)							
					Long-term							
Full Simulation Period[1]												
Environmental Baseline	942	1,148	2,131	2,990	2,938	2,895	2,663	3,595	3,042	2,126	1,912	929
Cumulative Conditions	952	1,148	2,095	2,942	2,893	2,875	2,657	3,616	3,088	2,176	1,934	940
Difference	10	0	-35	-48	-46	-20	-6	20	45	50	22	11
% Difference	1.1%	0.0%	-1.7%	-1.6%	-1.6%	-0.7%	-0.2%	0.6%	1.5%	2.4%	1.2%	1.2%
					Water Year Types[2]							
Wet												
Environmental Baseline	1,059	1,564	4,079	5,775	5,263	5,069	4,141	5,957	5,004	2,942	2,494	1,090
Cumulative Conditions	1,071	1,554	3,976	5,718	5,235	5,067	4,141	5,962	5,023	2,958	2,493	1,085
Difference	12	-9	-103	-57	-28	-1	0	6	19	15	0	-4
% Difference	1.1%	-0.6%	-2.5%	-1.0%	-0.5%	0.0%	0.0%	0.1%	0.4%	0.5%	0.0%	-0.4%
Above Normal												
Environmental Baseline	855	879	1,402	2,360	2,522	3,020	3,072	3,824	3,060	2,116	2,176	978
Cumulative Conditions	867	879	1,391	2,287	2,413	2,985	3,028	3,788	3,101	2,164	2,148	988
Difference	13	-1	-11	-73	-110	-35	-43	-36	40	48	-29	10
% Difference	1.5%	-0.1%	-0.8%	-3.1%	-4.3%	-1.1%	-1.4%	-1.0%	1.3%	2.2%	-1.3%	1.0%
Below Normal												
Environmental Baseline	886	980	1,011	1,281	1,864	1,632	1,902	2,023	1,849	1,693	1,687	892
Cumulative Conditions	893	985	1,012	1,237	1,801	1,565	1,902	2,037	1,875	1,732	1,712	899
Difference	8	5	1	-44	-62	-67	0	14	26	39	24	6
% Difference	0.9%	0.5%	0.1%	-3.4%	-3.4%	-4.1%	0.0%	0.7%	1.4%	2.3%	1.4%	0.7%
Dry												
Environmental Baseline	912	925	941	1,138	1,162	982	1,039	1,610	1,398	1,470	1,199	774
Cumulative Conditions	929	942	956	1,096	1,150	982	1,051	1,718	1,513	1,596	1,296	812
Difference	17	17	15	-42	-12	0	12	108	115	126	97	37
% Difference	1.9%	1.8%	1.6%	-3.7%	-1.1%	0.0%	1.2%	6.7%	8.2%	8.6%	8.1%	4.8%
Critical												
Environmental Baseline	886	937	937	964	839	732	873	1,293	1,224	1,293	1,027	653
Cumulative Conditions	887	940	940	959	837	732	884	1,366	1,307	1,384	1,114	689
Difference	2	3	3	-6	-2	0	11	74	82	91	86	35
% Difference	0.2%	0.3%	0.3%	-0.6%	-0.2%	0.0%	1.2%	5.7%	6.7%	7.0%	8.4%	5.4%

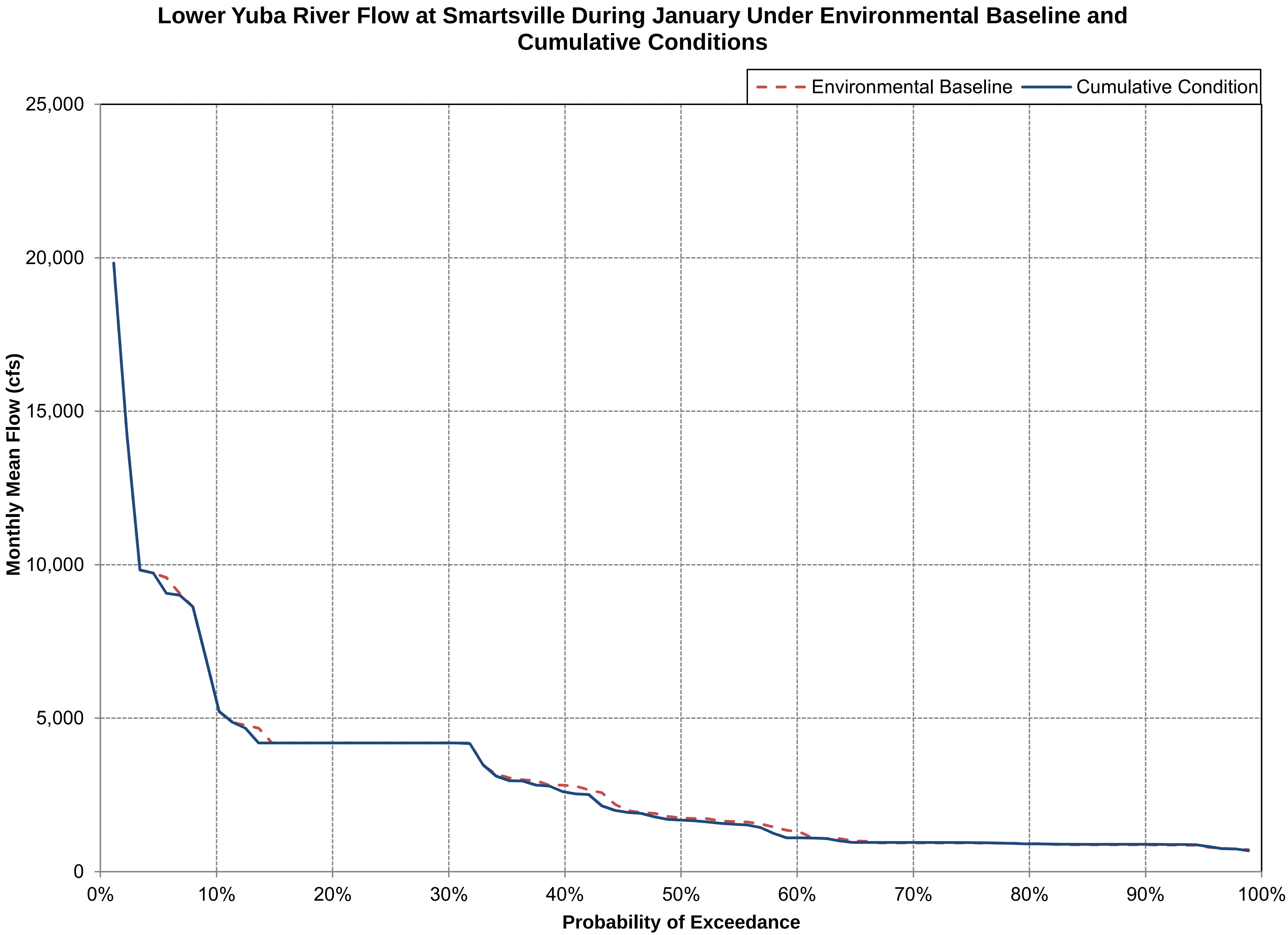
[1] Period of Record is Water Year 1922 - 2008
[2] As defined by the Yuba River Index described in SWRCB RD-1644


Lower Yuba River Flow at Smartsville During October Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Monthly Mean Flow (cfs)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

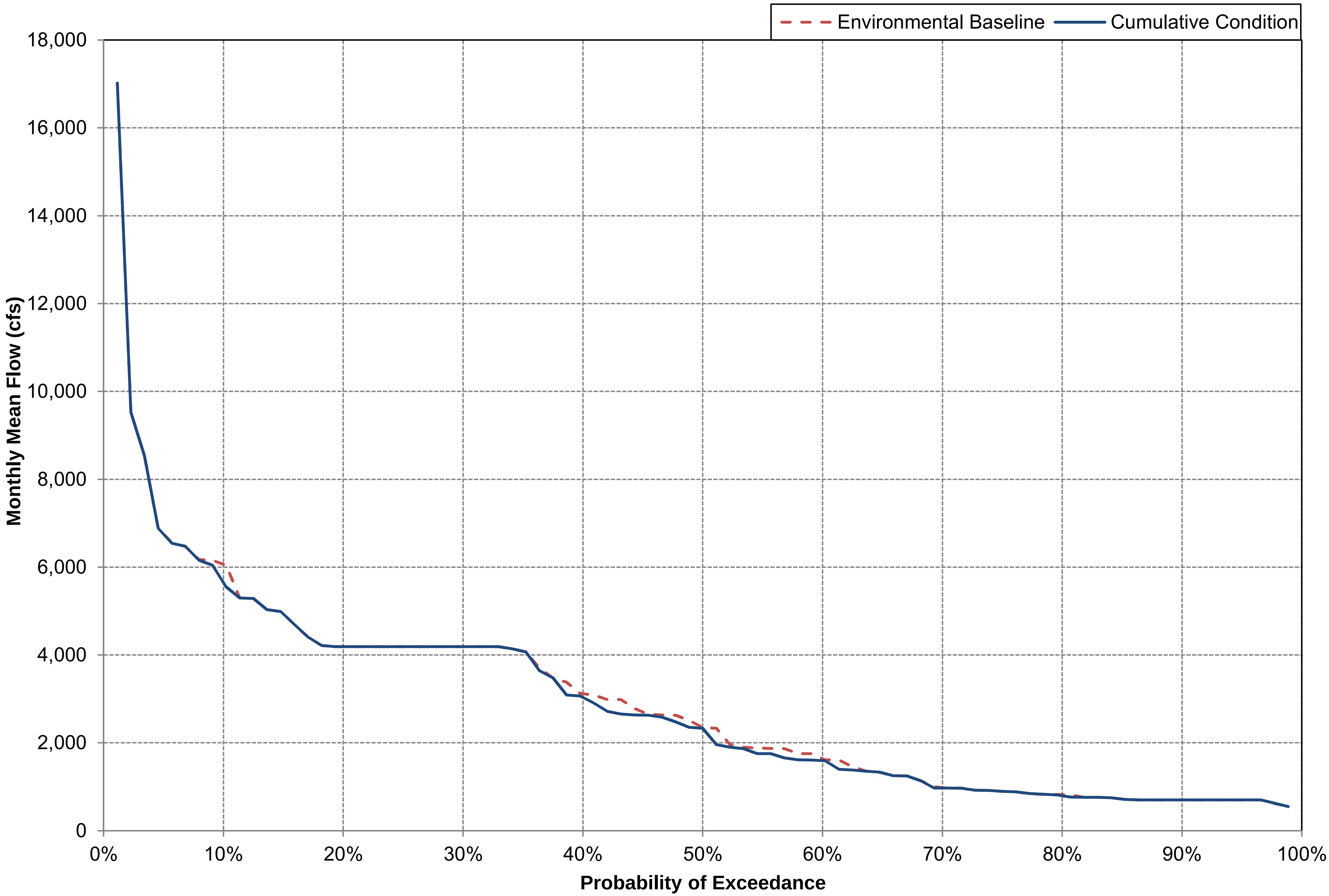

Lower Yuba River Flow at Smartsville During November Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Monthly Mean Flow (cfs)
6,000
5,000
4,000
3,000
2,000
1,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance



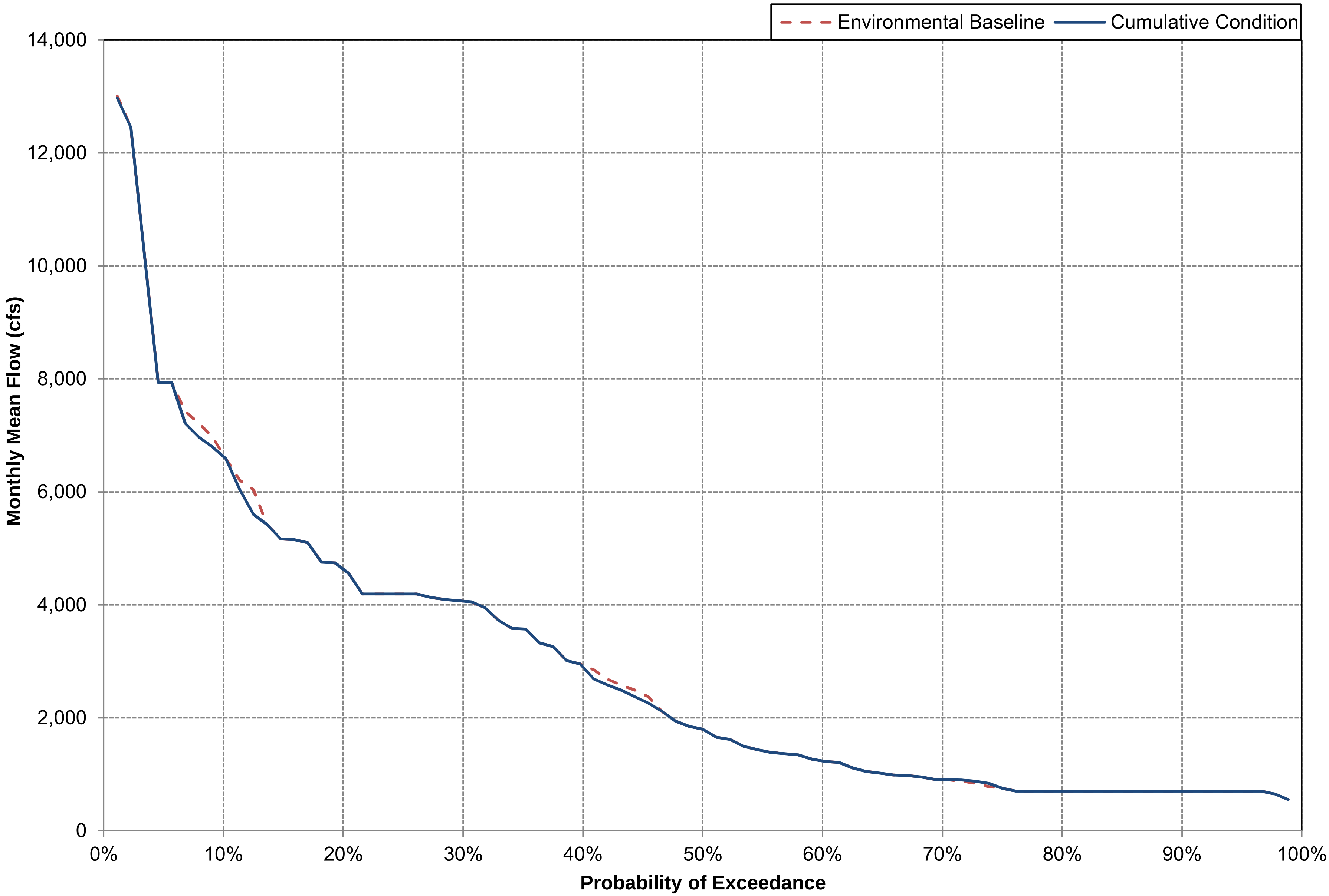
Lower Yuba River Flow at Smartsville During December Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Monthly Mean Flow (cfs)
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

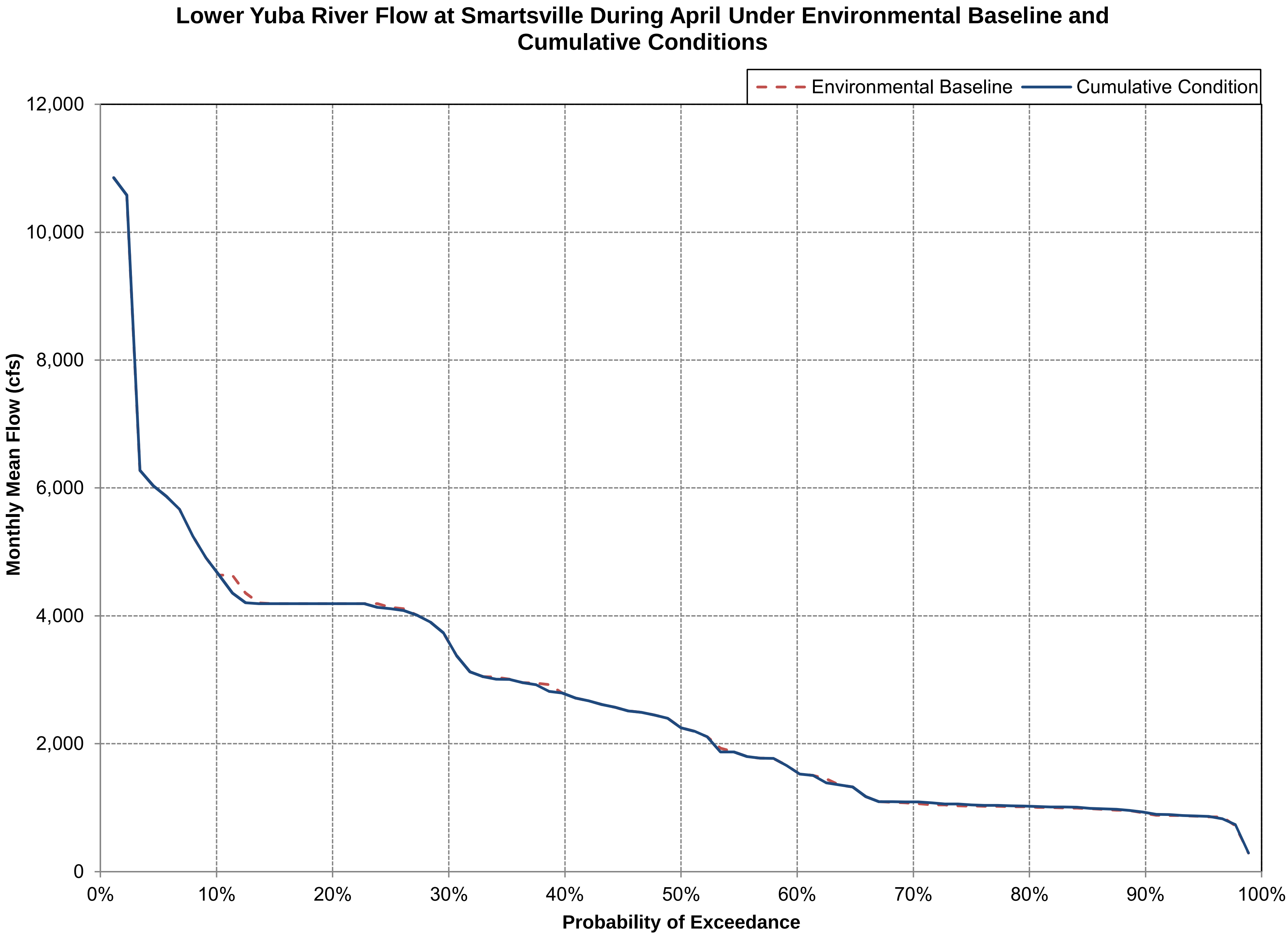

Lower Yuba River Flow at Smartsville During January Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Monthly Mean Flow (cfs)
25,000
20,000
15,000
10,000
5,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

Lower Yuba River Flow at Smartsville During February Under Environmental Baseline and Cumulative Conditions



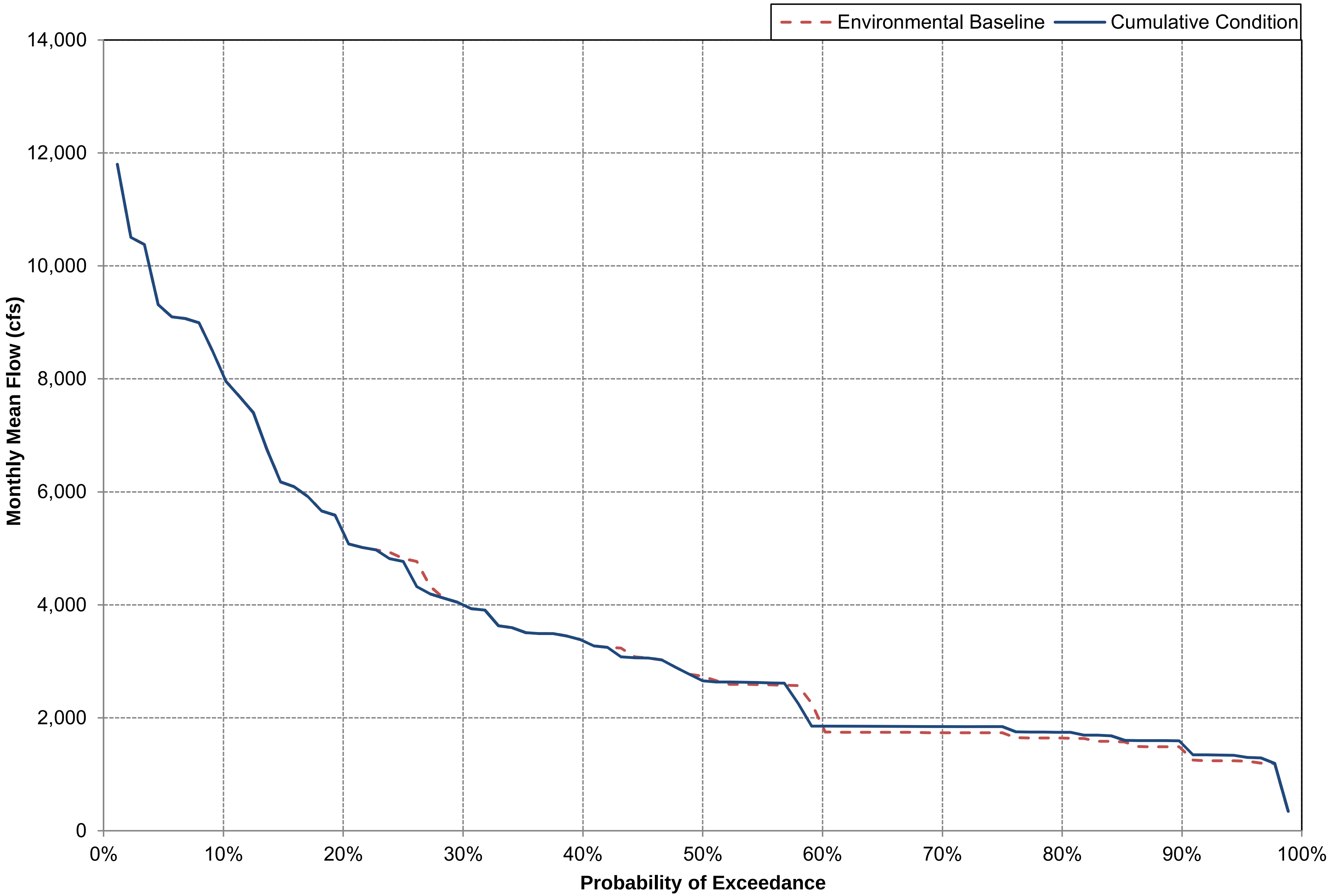
Lower Yuba River Flow at Smartsville During March Under Environmental Baseline and Cumulative Conditions

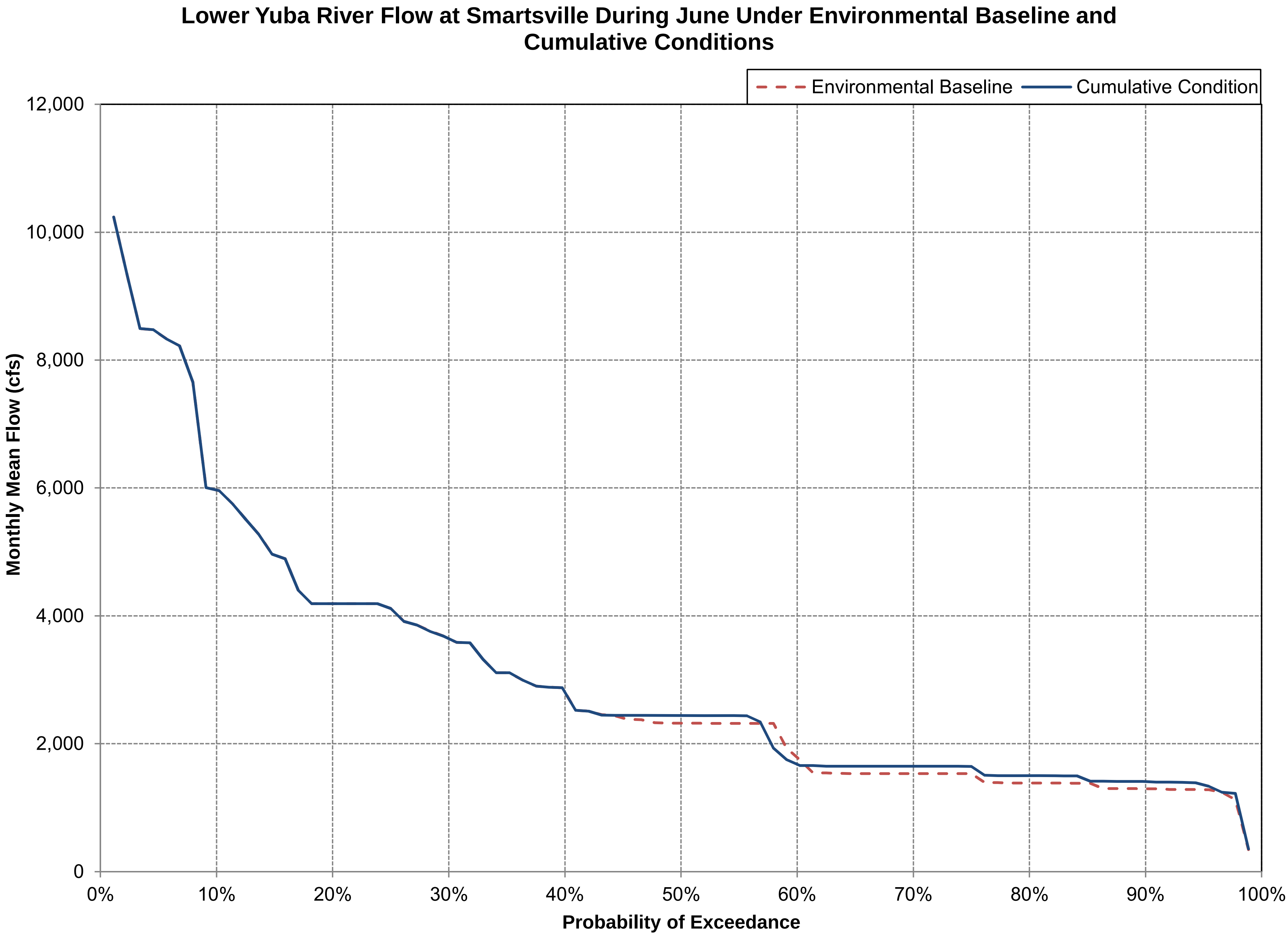




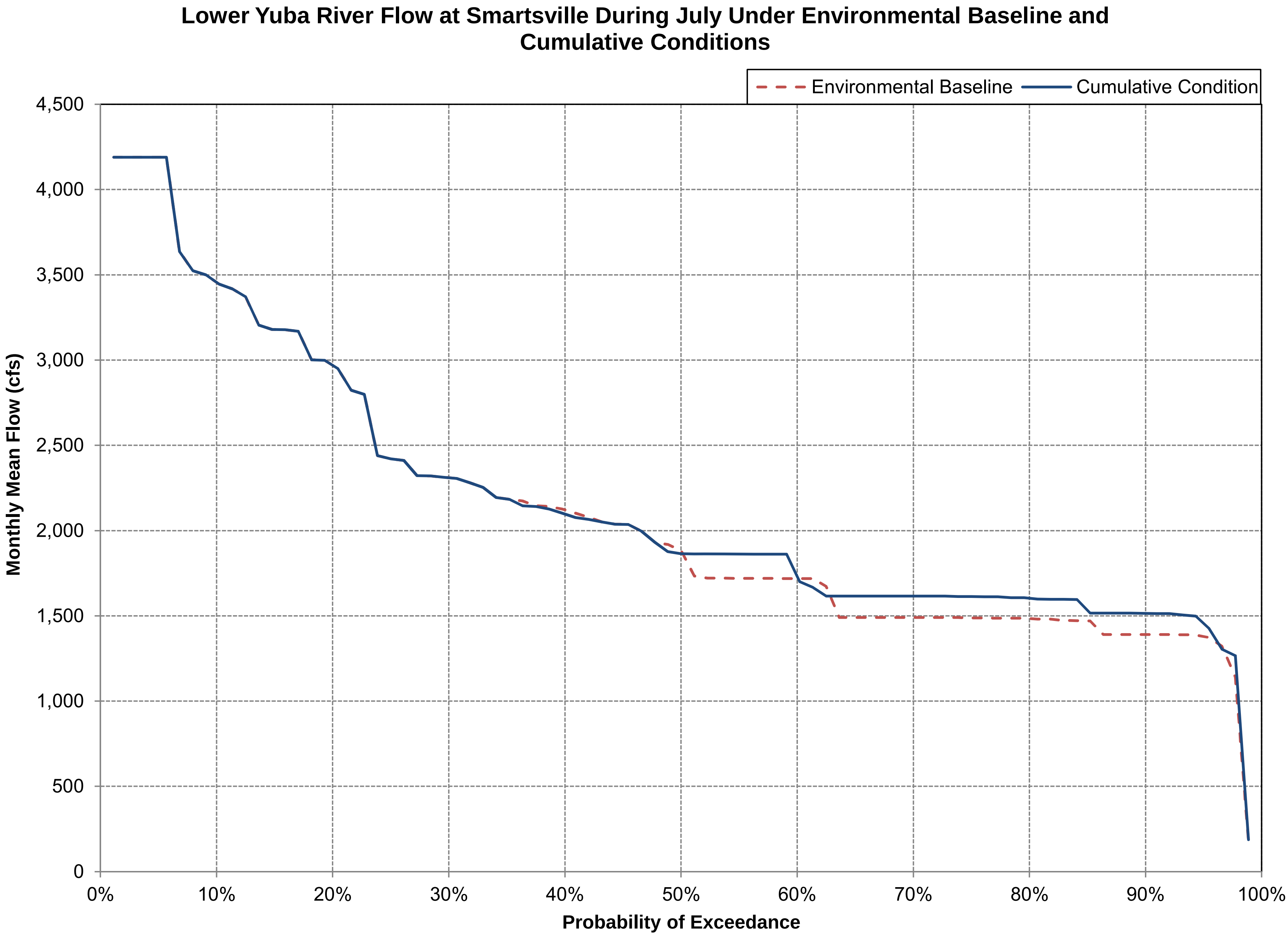
Lower Yuba River Flow at Smartsville During April Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
12,000
10,000
8,000
6,000
4,000
2,000
0
Monthly Mean Flow (cfs)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

Lower Yuba River Flow at Smartsville During May Under Environmental Baseline and Cumulative Conditions

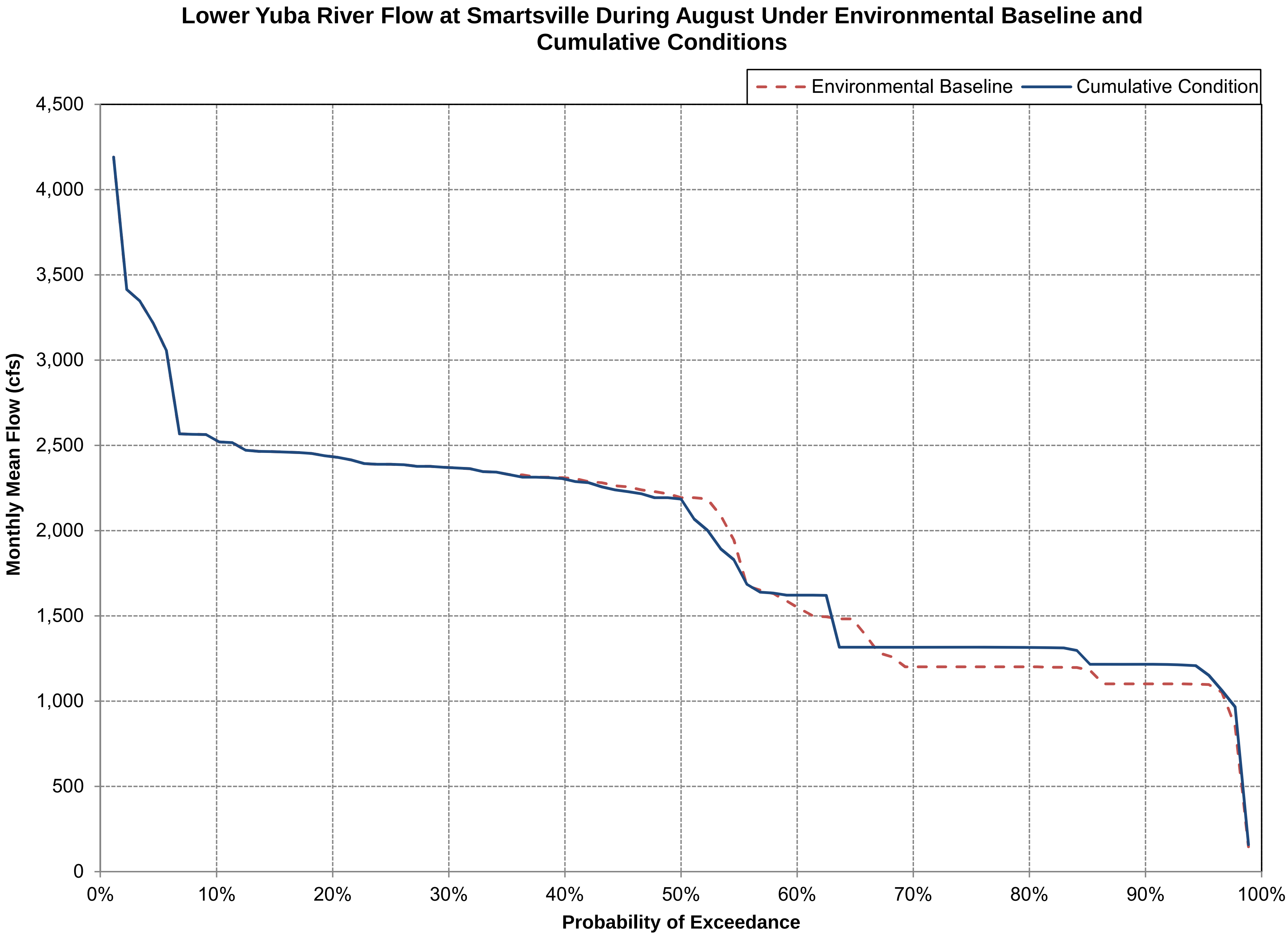


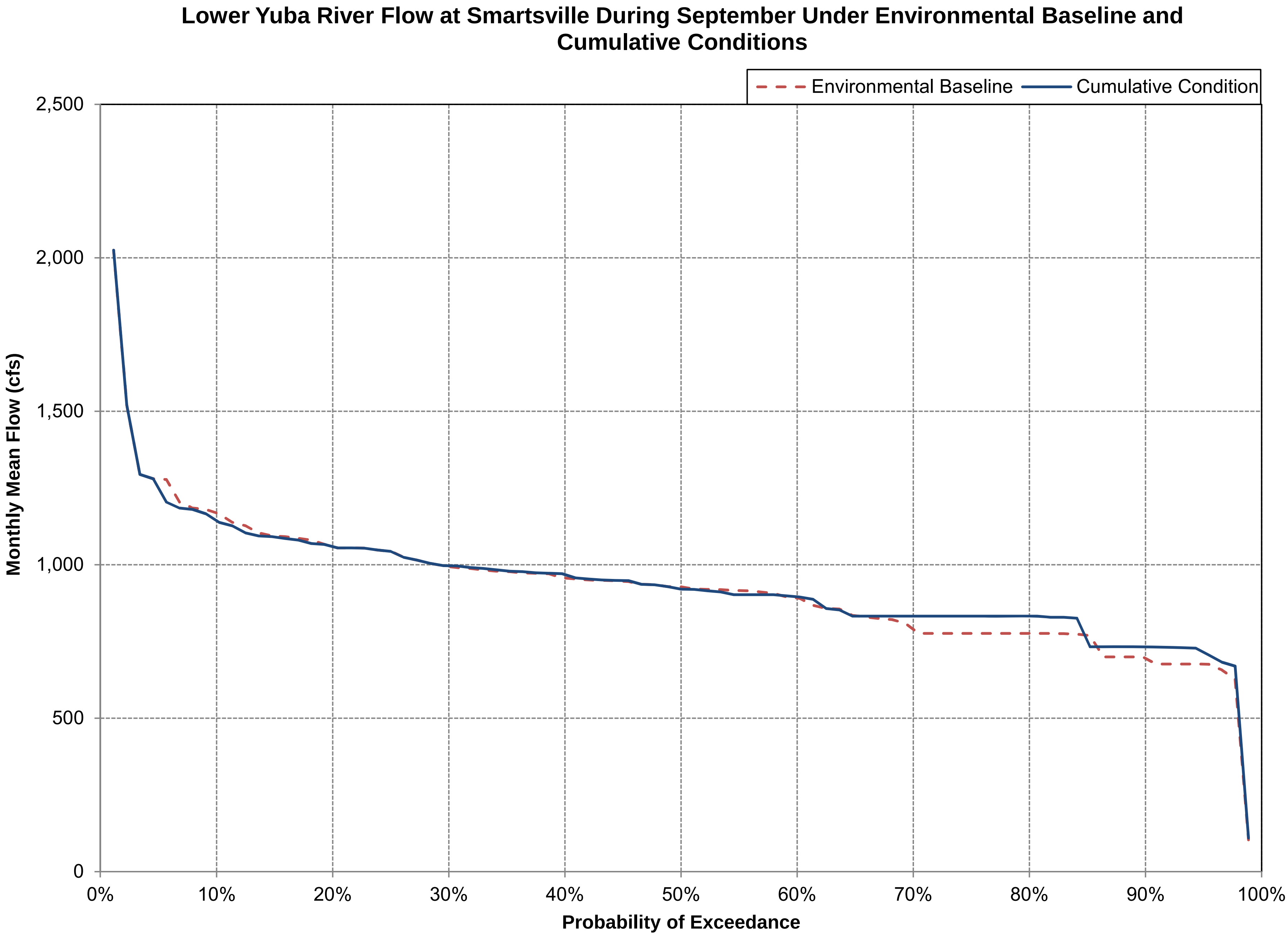


Lower Yuba River Flow at Smartsville During June Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Monthly Mean Flow (cfs)
12,000
10,000
8,000
6,000
4,000
2,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance



Lower Yuba River Flow at Smartsville During July Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Monthly Mean Flow (cfs)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance


Lower Yuba River Flow at Smartsville During August Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Monthly Mean Flow (cfs)
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

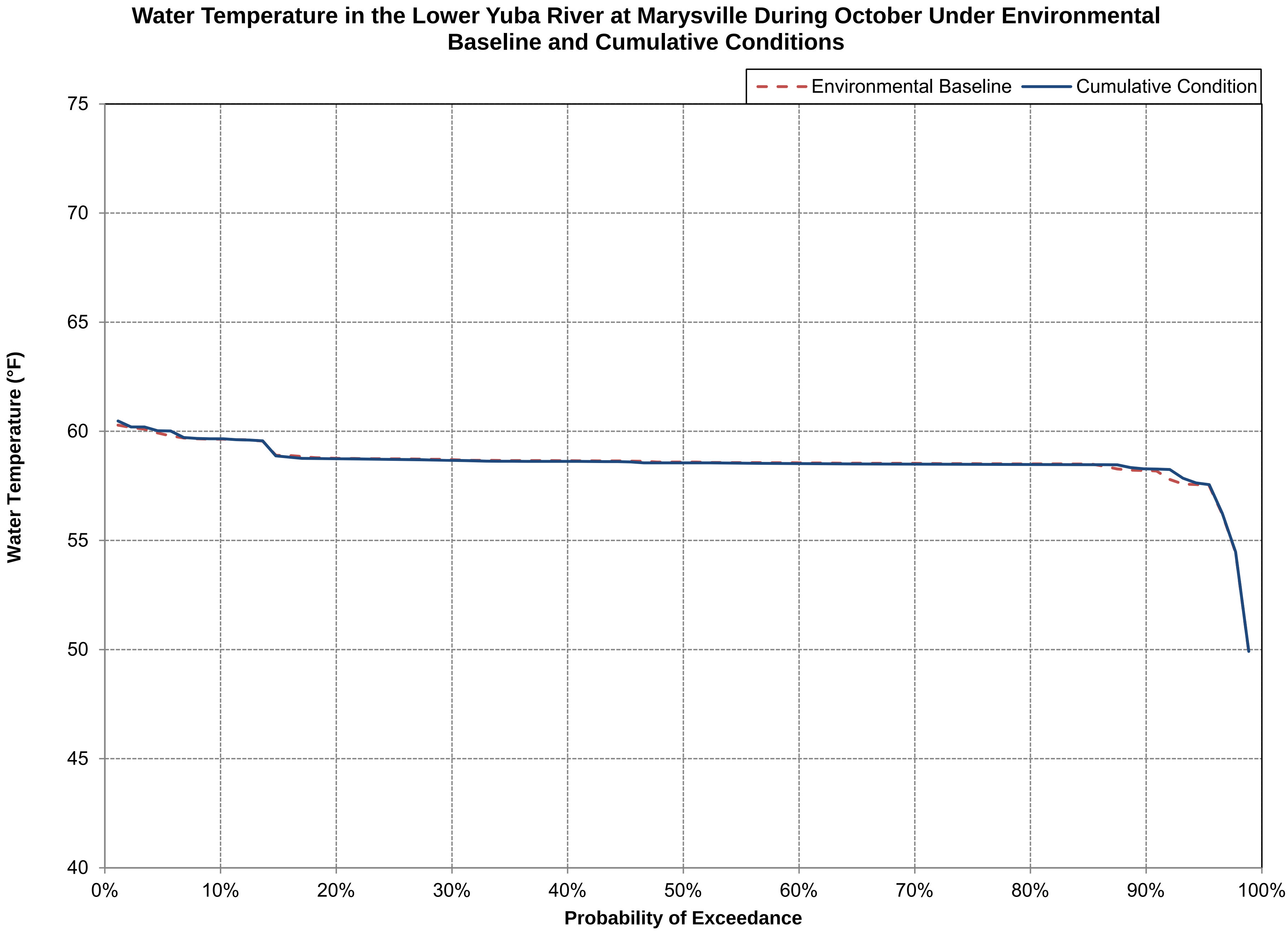

Lower Yuba River Flow at Smartsville During September Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Monthly Mean Flow (cfs)
2,500
2,000
1,500
1,000
500
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

Long-term Average Water Temperature, and Average Water Temperature by Water Year Type in the Lower Yuba River at Marysville under the Environmental Baseline and Cumulative Conditions

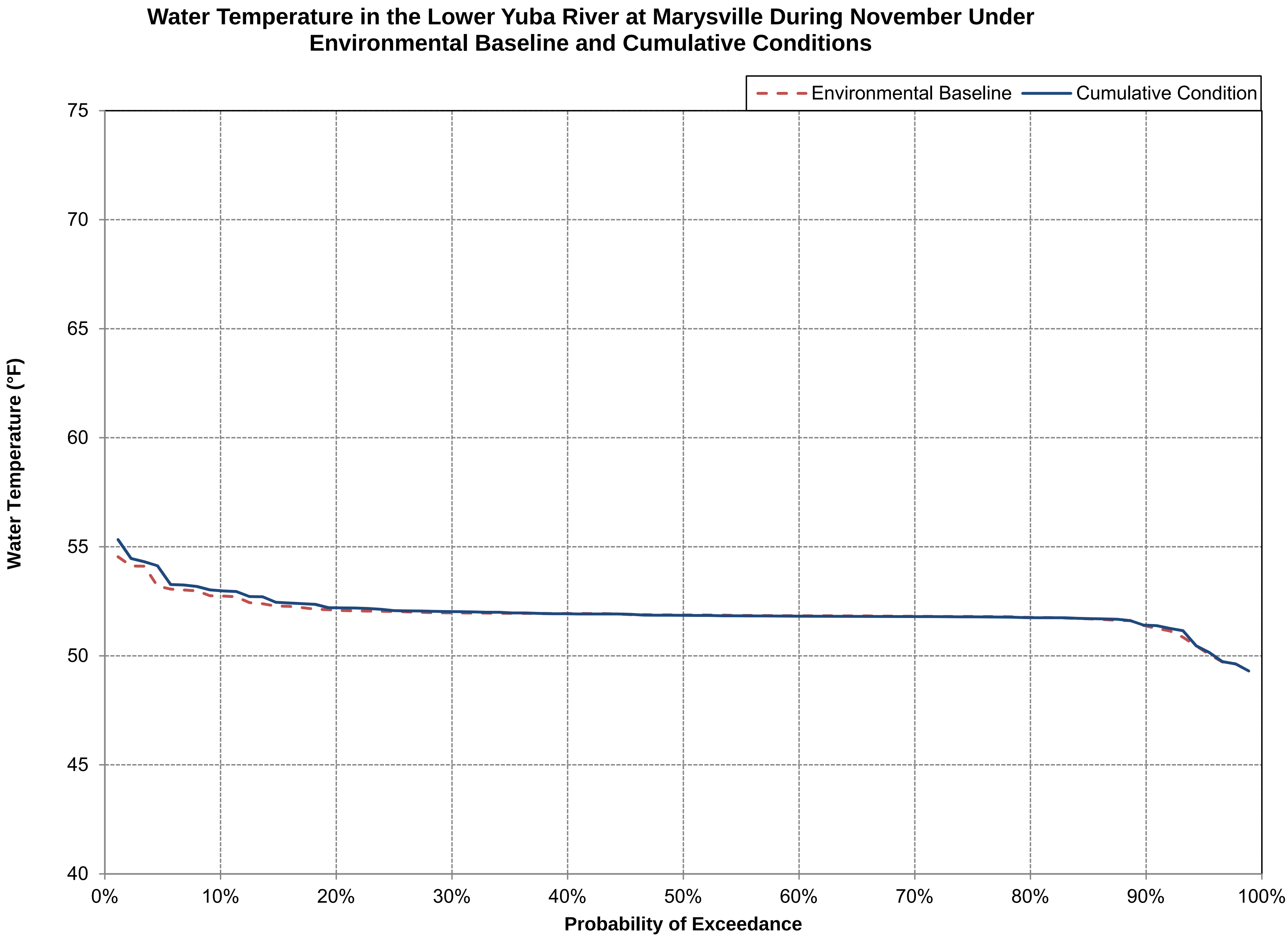
	Average Temperature (°F)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[1]												
Environmental Baseline	58.5	51.9	49.0	47.9	48.8	50.8	53.6	56.4	60.0	61.5	59.9	62.0
Cumulative Conditions	58.5	52.0	49.0	47.9	48.9	50.8	53.6	56.5	60.1	61.6	60.3	62.3
Difference	0.0	0.1	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.4	0.4
Water Year Types[2]												
Wet												
Environmental Baseline	58.1	51.5	48.7	47.3	46.5	48.3	54.1	54.1	56.1	57.6	57.6	60.9
Cumulative Conditions	58.1	51.5	48.8	47.4	46.5	48.3	54.1	54.1	56.2	57.8	58.1	61.4
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.5
Above Normal												
Environmental Baseline	58.9	52.2	49.1	48.1	49.1	50.5	53.8	55.1	58.3	60.7	58.6	61.6
Cumulative Conditions	58.9	52.4	49.1	48.2	49.2	50.5	53.8	55.2	58.4	60.9	59.2	62.1
Difference	0.0	0.2	0.0	0.0	0.2	0.0	0.0	0.1	0.1	0.2	0.6	0.5
Below Normal												
Environmental Baseline	58.8	52.2	49.2	48.1	50.0	52.2	53.4	57.8	62.1	63.1	60.2	61.9
Cumulative Conditions	58.8	52.3	49.2	48.2	50.1	52.3	53.4	58.0	62.4	63.4	60.7	62.3
Difference	0.0	0.1	0.0	0.0	0.1	0.1	0.0	0.2	0.2	0.2	0.5	0.4
Dry												
Environmental Baseline	58.6	51.9	49.2	48.1	50.5	53.1	52.9	58.7	64.2	64.9	62.9	62.9
Cumulative Conditions	58.6	52.0	49.2	48.1	50.5	53.1	53.0	58.8	64.1	64.5	62.9	63.0
Difference	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	-0.1	-0.4	0.1	0.1
Critical												
Environmental Baseline	58.7	52.1	49.2	48.2	51.1	53.5	52.8	60.0	65.3	67.0	64.5	64.3
Cumulative Conditions	58.7	52.2	49.2	48.2	51.1	53.5	52.8	60.1	65.3	66.7	64.5	64.3
Difference	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-0.2	0.0	0.0

[1] Period of Record is Water Year 1922 - 2008

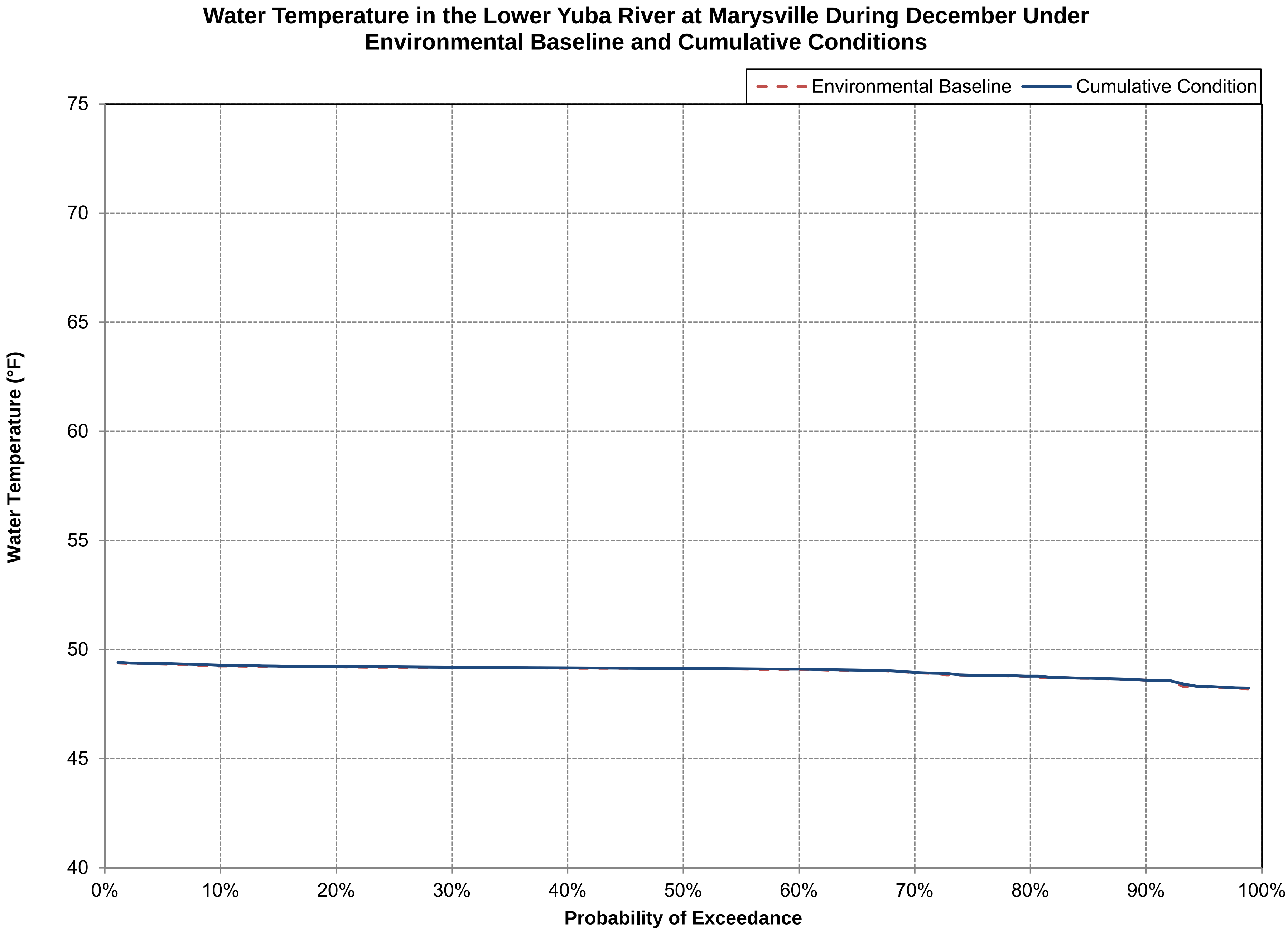
[2] As defined by the Yuba River Index described in SWRCB RD-1644



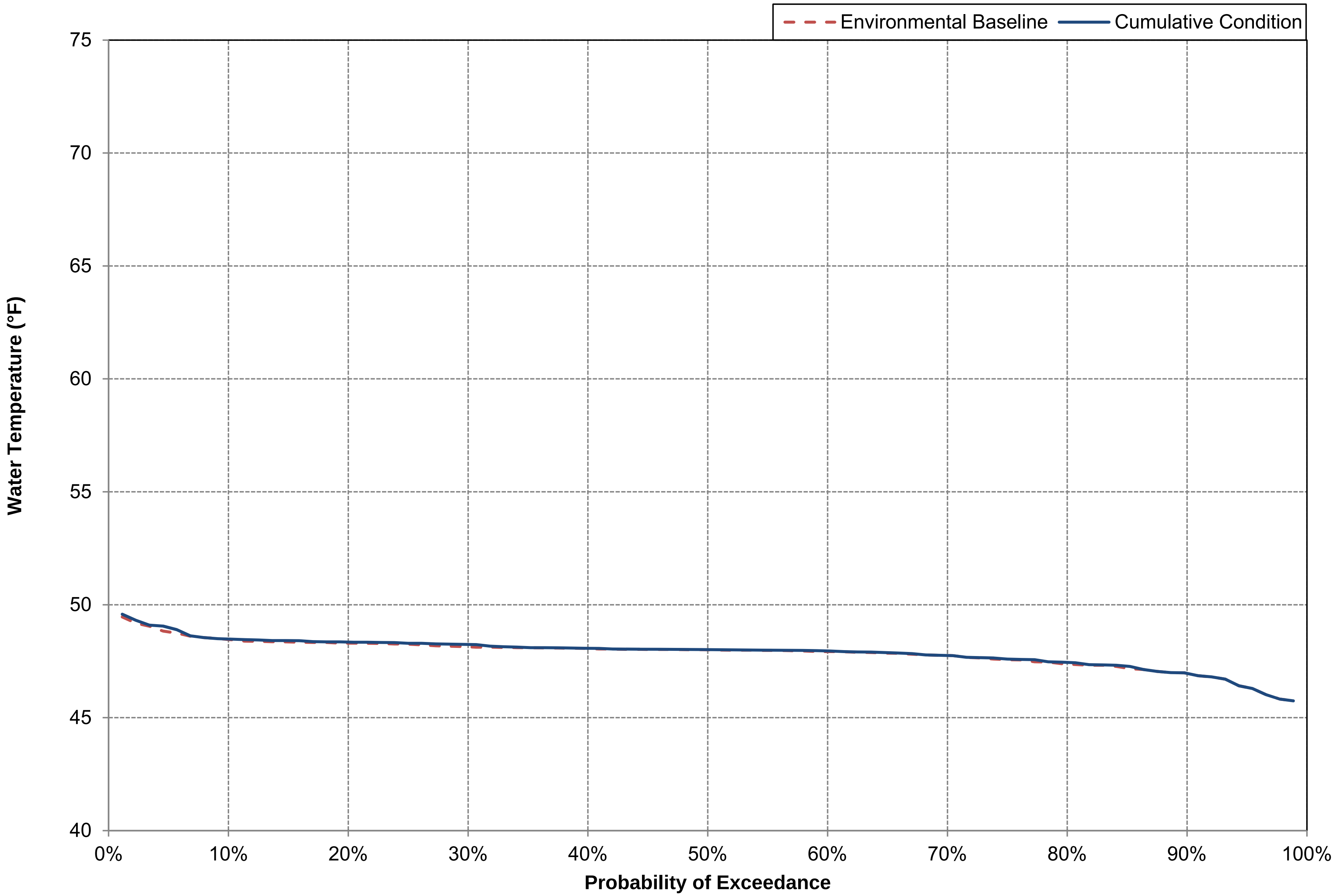
Water Temperature in the Lower Yuba River at Marysville During October Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

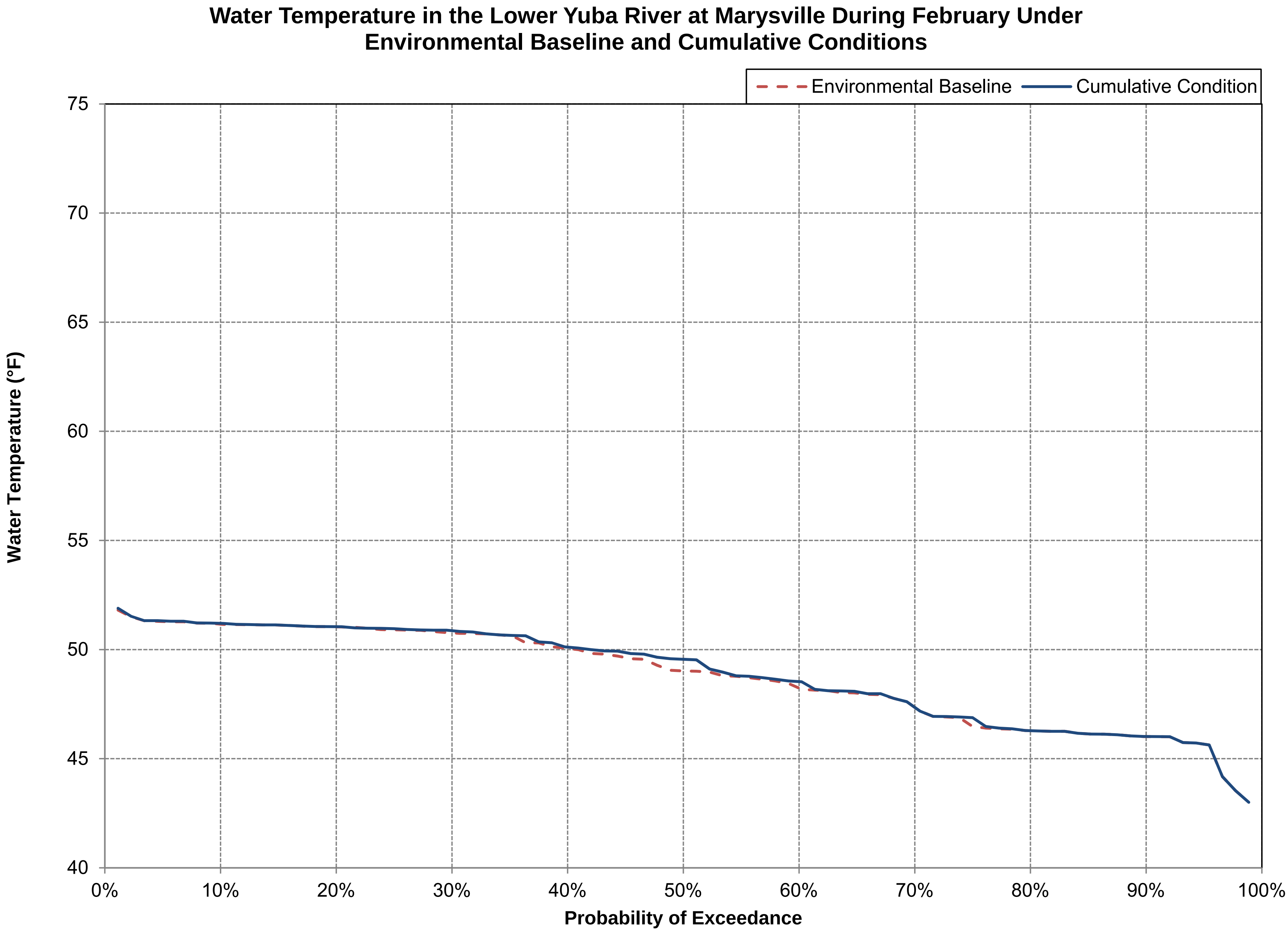


Water Temperature in the Lower Yuba River at Marysville During November Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

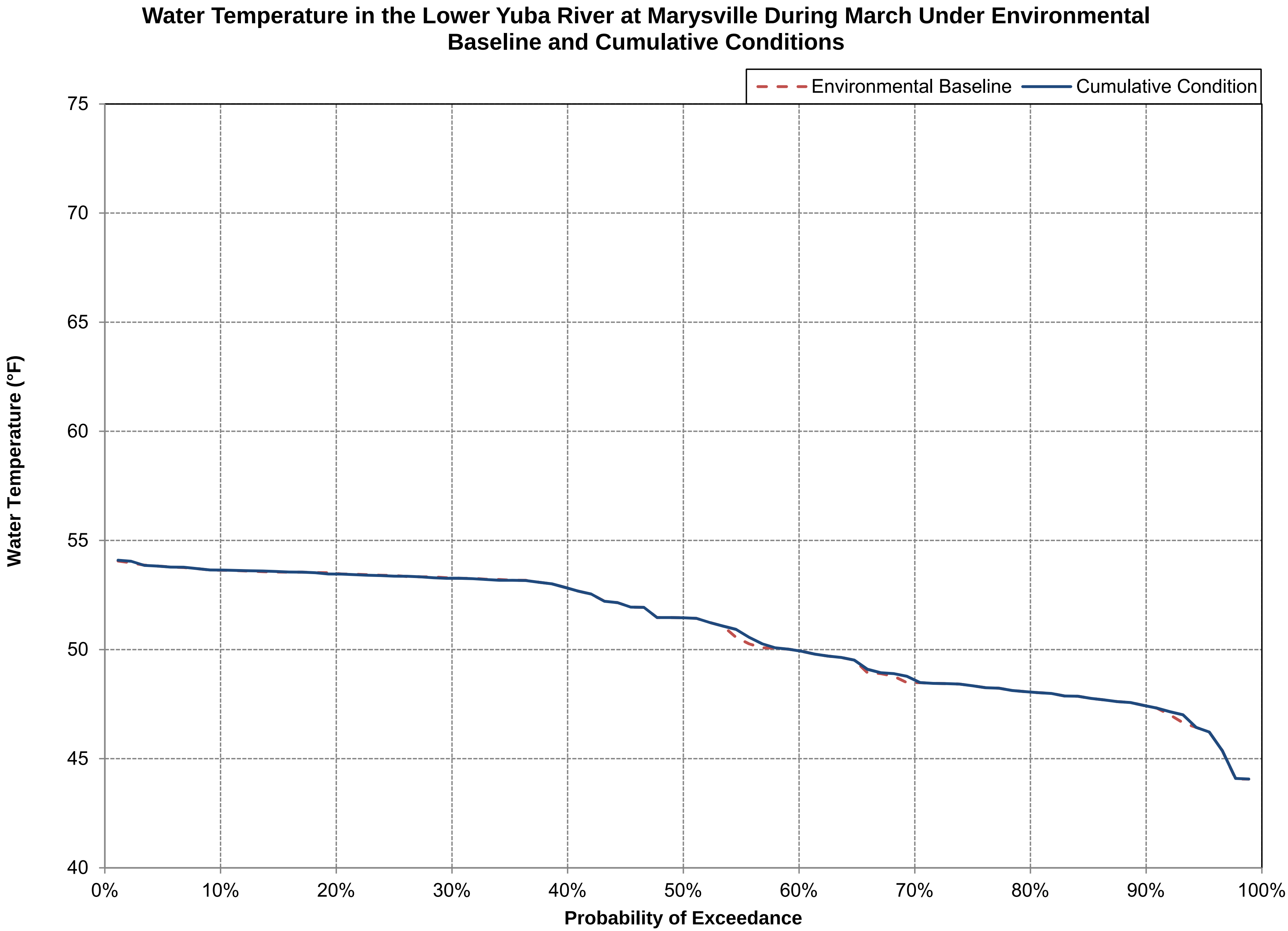

Water Temperature in the Lower Yuba River at Marysville During December Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

Water Temperature in the Lower Yuba River at Marysville During January Under Environmental Baseline and Cumulative Conditions

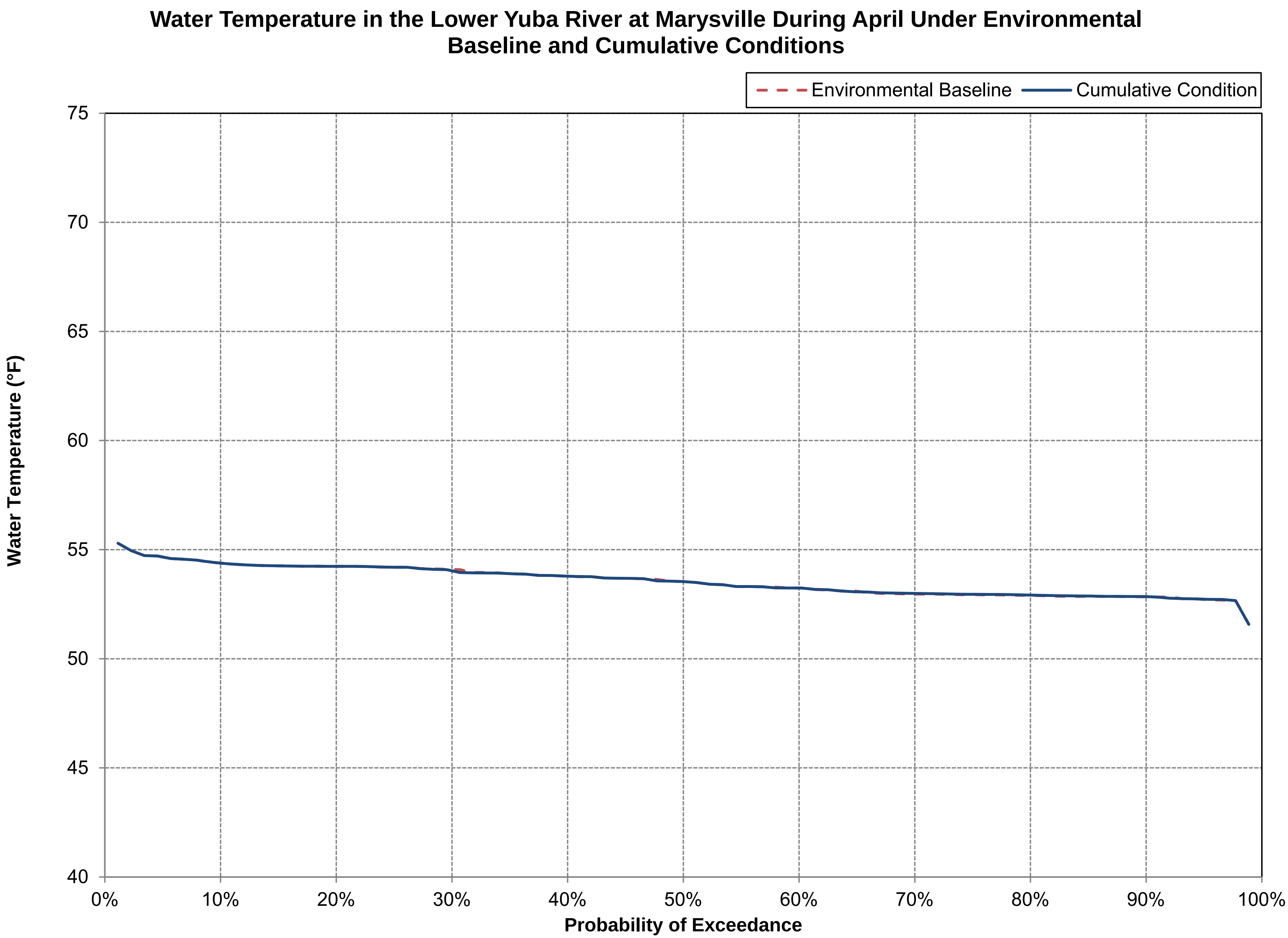




Water Temperature in the Lower Yuba River at Marysville During February Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

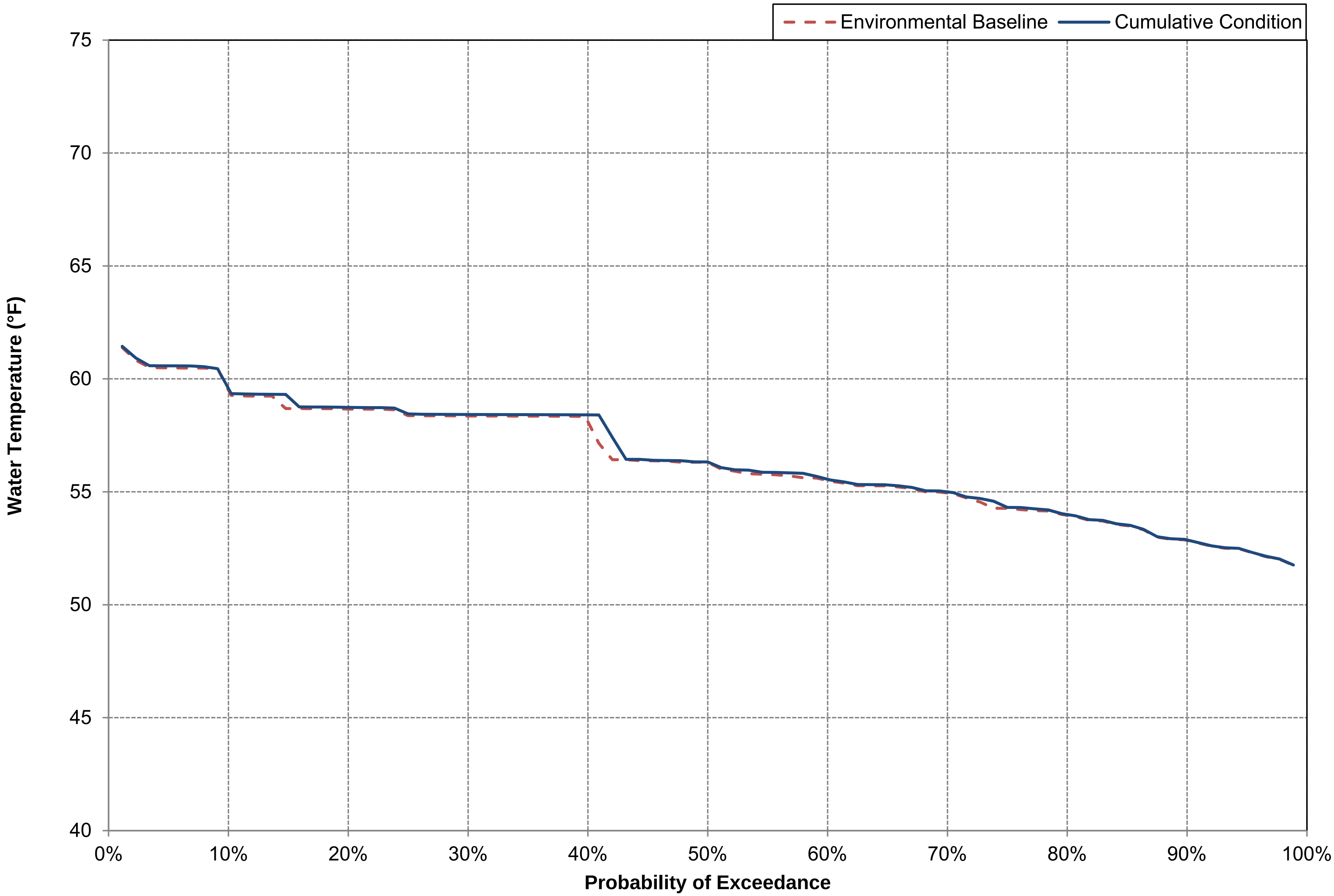


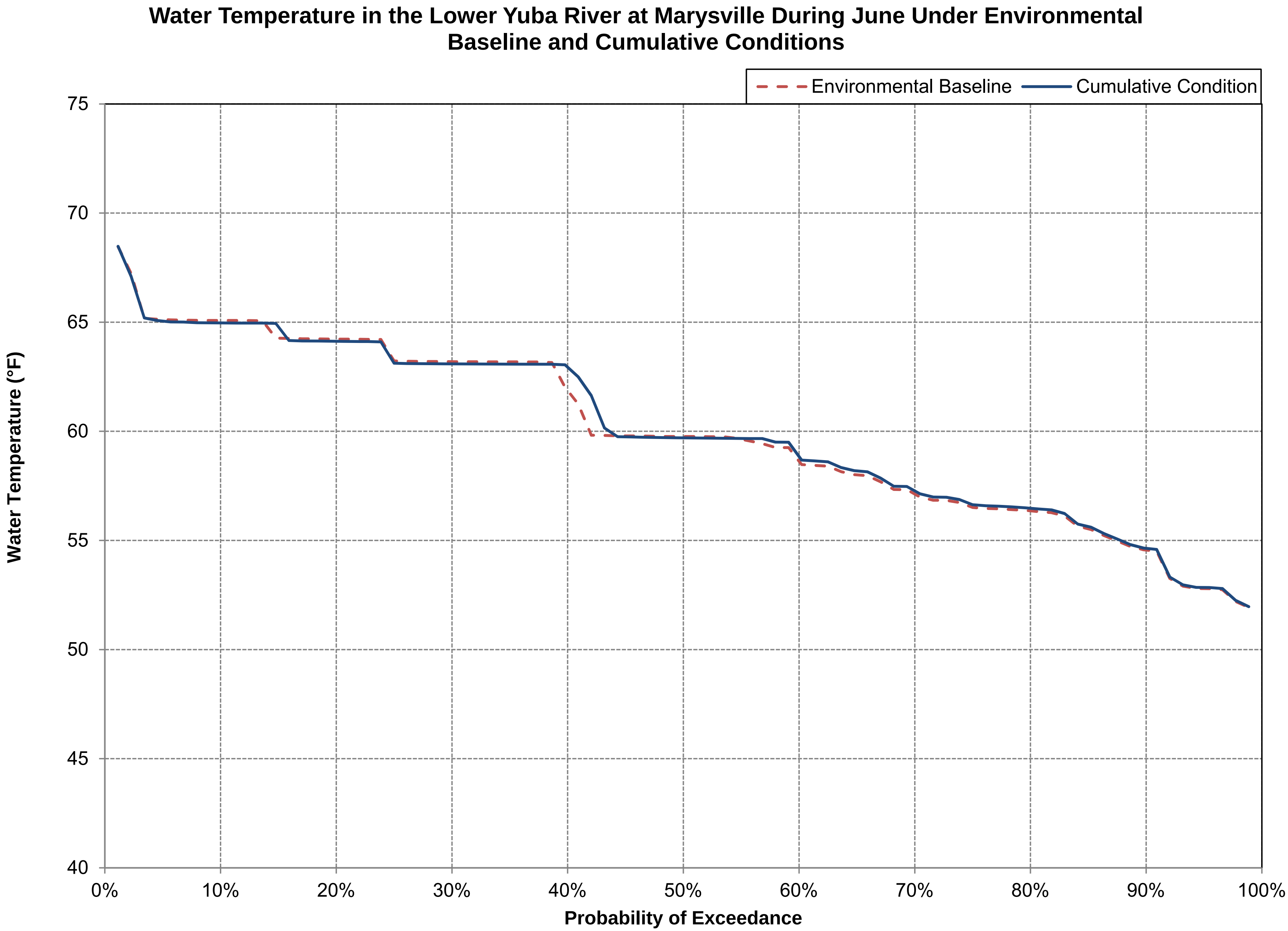
Water Temperature in the Lower Yuba River at Marysville During March Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

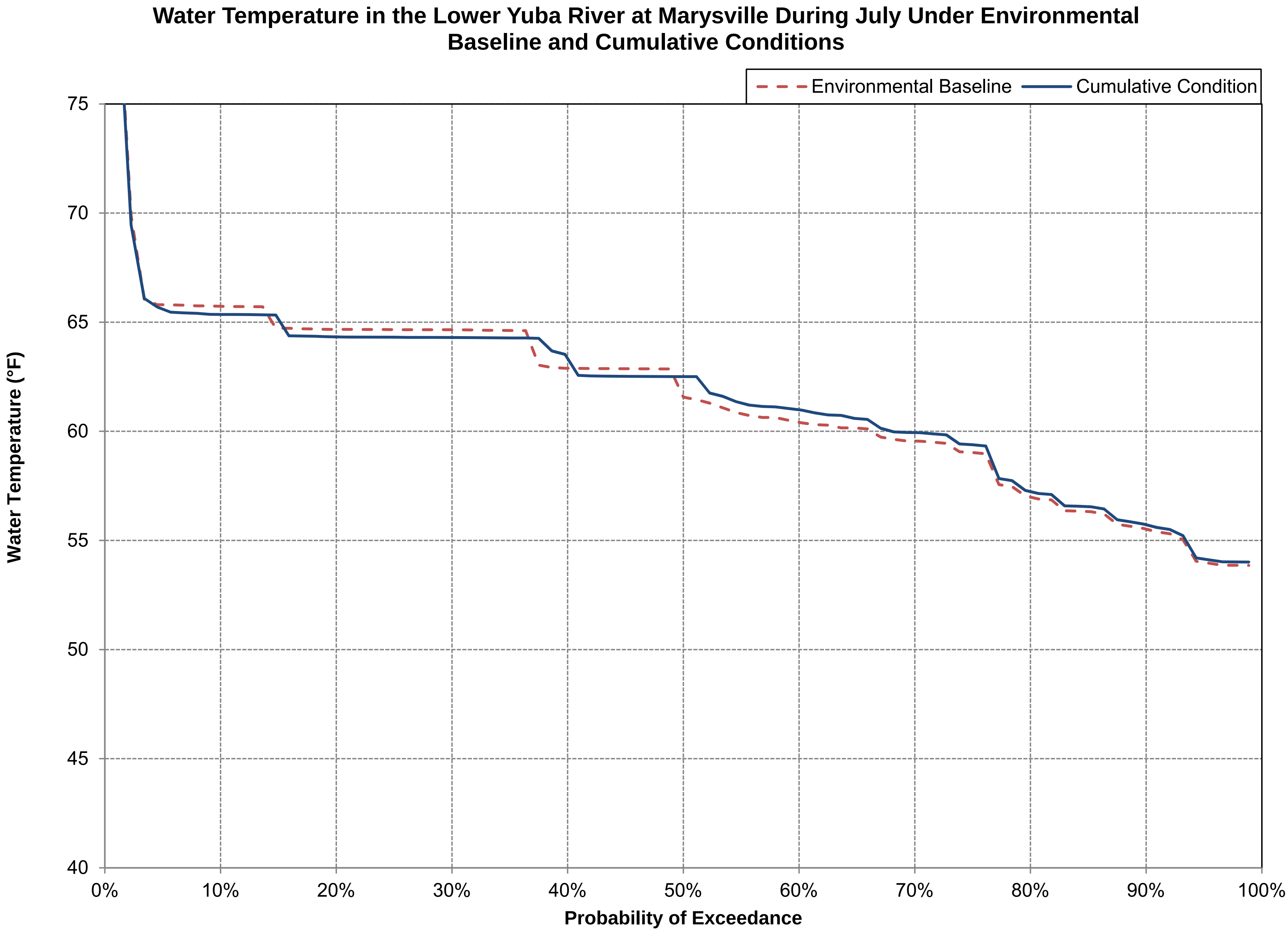


Water Temperature in the Lower Yuba River at Marysville During April Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

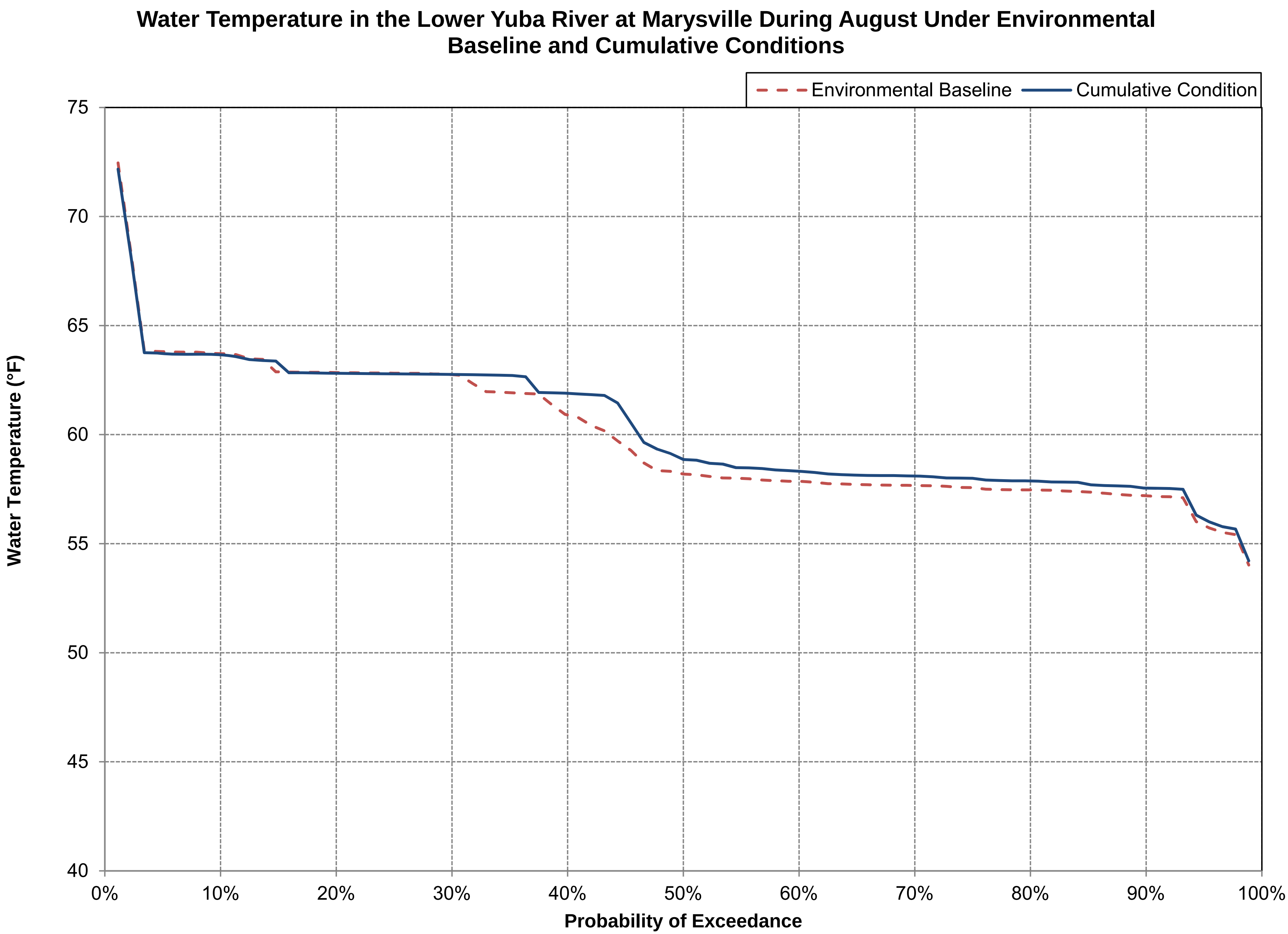
Water Temperature in the Lower Yuba River at Marysville During May Under Environmental Baseline and Cumulative Conditions




Water Temperature in the Lower Yuba River at Marysville During June Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

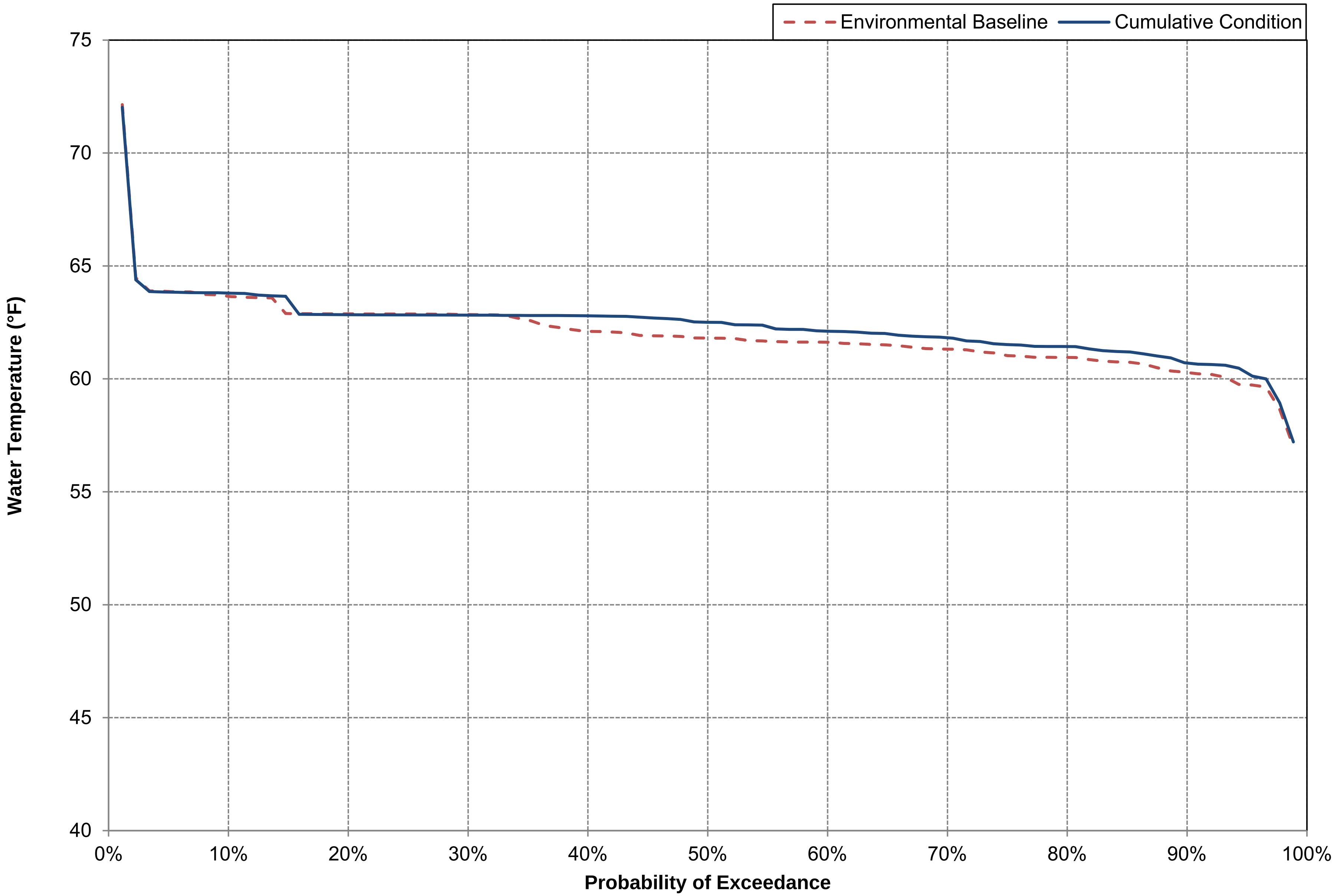


Water Temperature in the Lower Yuba River at Marysville During July Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance



Water Temperature in the Lower Yuba River at Marysville During August Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

Water Temperature in the Lower Yuba River at Marysville During September Under Environmental Baseline and Cumulative Conditions

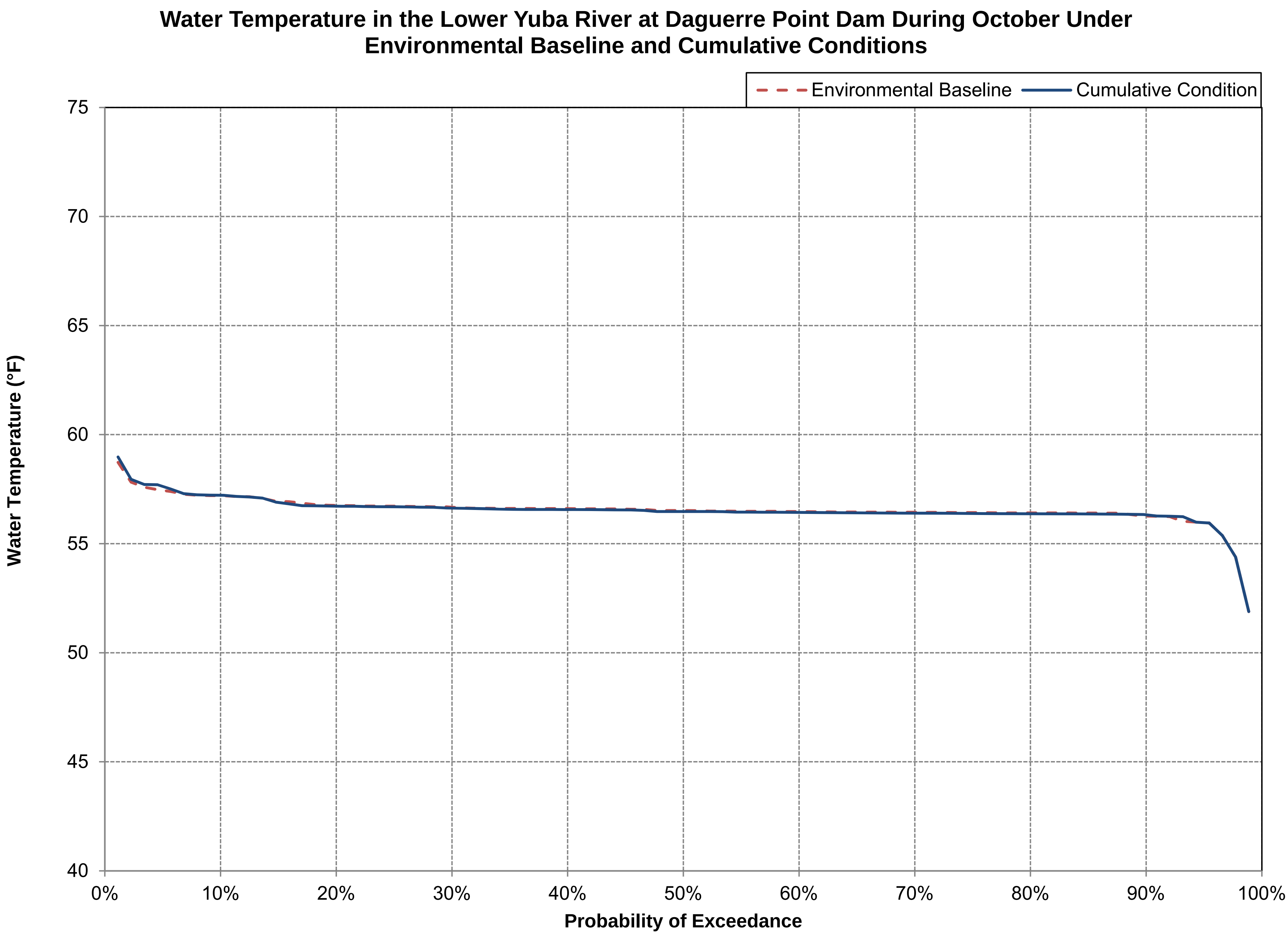


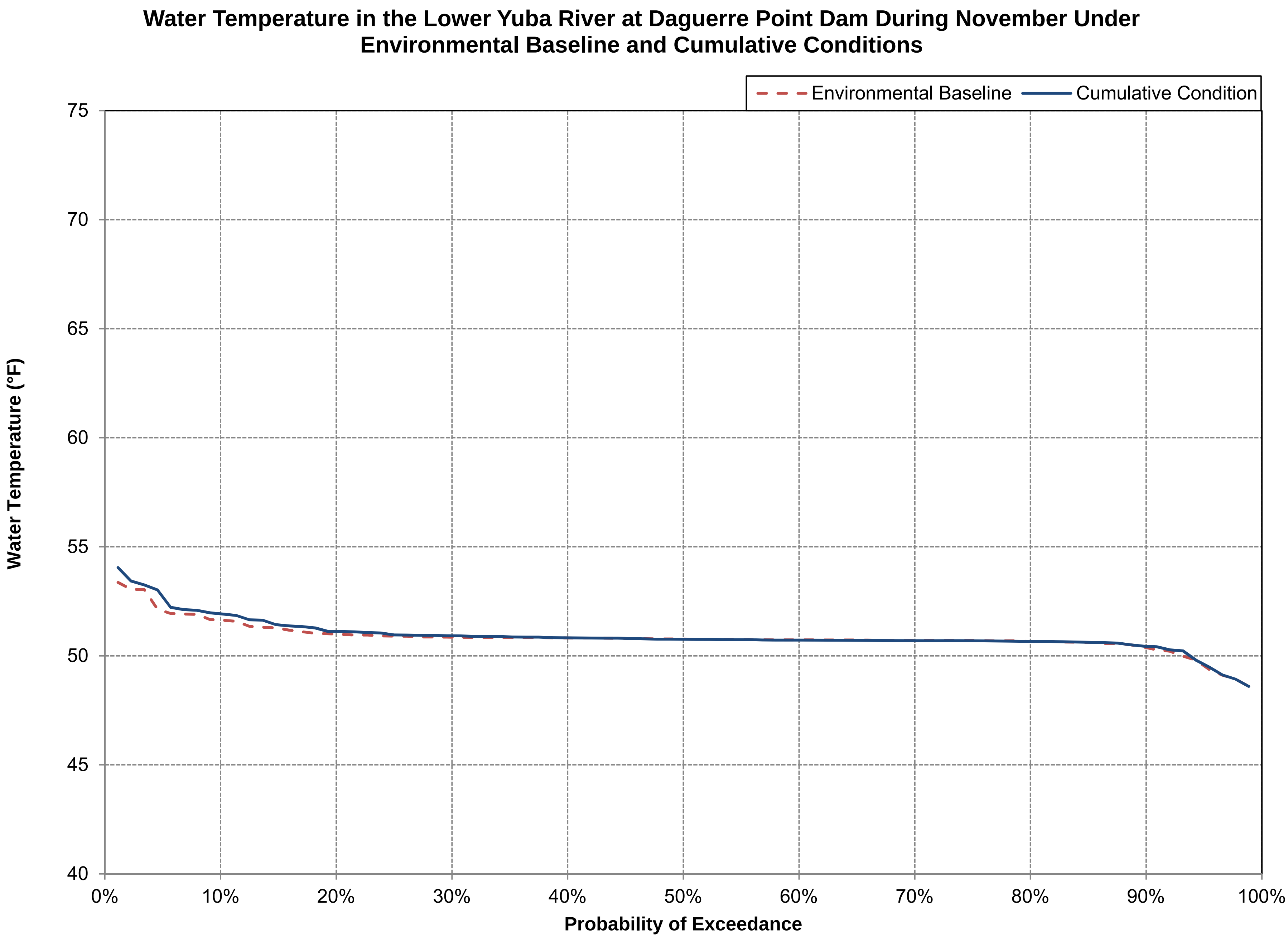
Long-term Average Water Temperature, and Average Water Temperature by Water Year Type in the Lower Yuba River at Daguerre Point Dam under the Environmental Baseline and Cumulative Conditions

Analysis Period	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
	Average Temperature (°F)											
Long-term												
Full Simulation Period[1]												
Environmental Baseline	56.6	50.8	48.2	47.3	48.3	50.4	53.1	54.9	57.5	57.8	57.6	59.0
Cumulative Conditions	56.5	50.9	48.2	47.3	48.3	50.4	53.1	54.9	57.4	57.6	57.5	58.9
Difference	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.1	-0.1
Water Year Types[2]												
Wet												
Environmental Baseline	56.3	50.5	47.9	47.1	47.5	48.7	52.0	53.3	55.7	55.9	56.0	58.3
Cumulative Conditions	56.3	50.5	47.9	47.1	47.5	48.7	52.0	53.3	55.7	55.9	56.0	58.3
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal												
Environmental Baseline	56.8	51.1	48.3	47.4	48.5	50.2	52.5	54.3	56.9	57.5	56.6	58.7
Cumulative Conditions	56.8	51.2	48.4	47.4	48.6	50.3	52.5	54.3	56.8	57.3	56.7	58.6
Difference	0.0	0.2	0.0	0.0	0.1	0.0	0.0	0.0	-0.1	-0.1	0.1	0.0
Below Normal												
Environmental Baseline	56.7	51.1	48.4	47.4	48.8	51.4	53.4	55.8	58.5	58.6	58.0	59.1
Cumulative Conditions	56.7	51.2	48.5	47.4	48.9	51.5	53.4	55.8	58.4	58.5	57.9	59.0
Difference	0.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	-0.1	-0.1	-0.1	0.0
Dry												
Environmental Baseline	56.6	50.8	48.4	47.4	48.8	52.0	54.3	56.4	59.3	59.3	59.4	59.6
Cumulative Conditions	56.5	50.9	48.4	47.4	48.8	52.0	54.3	56.2	59.1	58.9	59.1	59.4
Difference	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	-0.2	-0.4	-0.4	-0.2
Critical												
Environmental Baseline	56.7	51.0	48.4	47.4	48.9	52.2	54.7	57.1	59.9	60.4	60.6	60.7
Cumulative Conditions	56.7	51.1	48.5	47.4	49.0	52.3	54.7	57.0	59.7	60.0	60.2	60.4
Difference	0.0	0.1	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.3	-0.4	-0.2

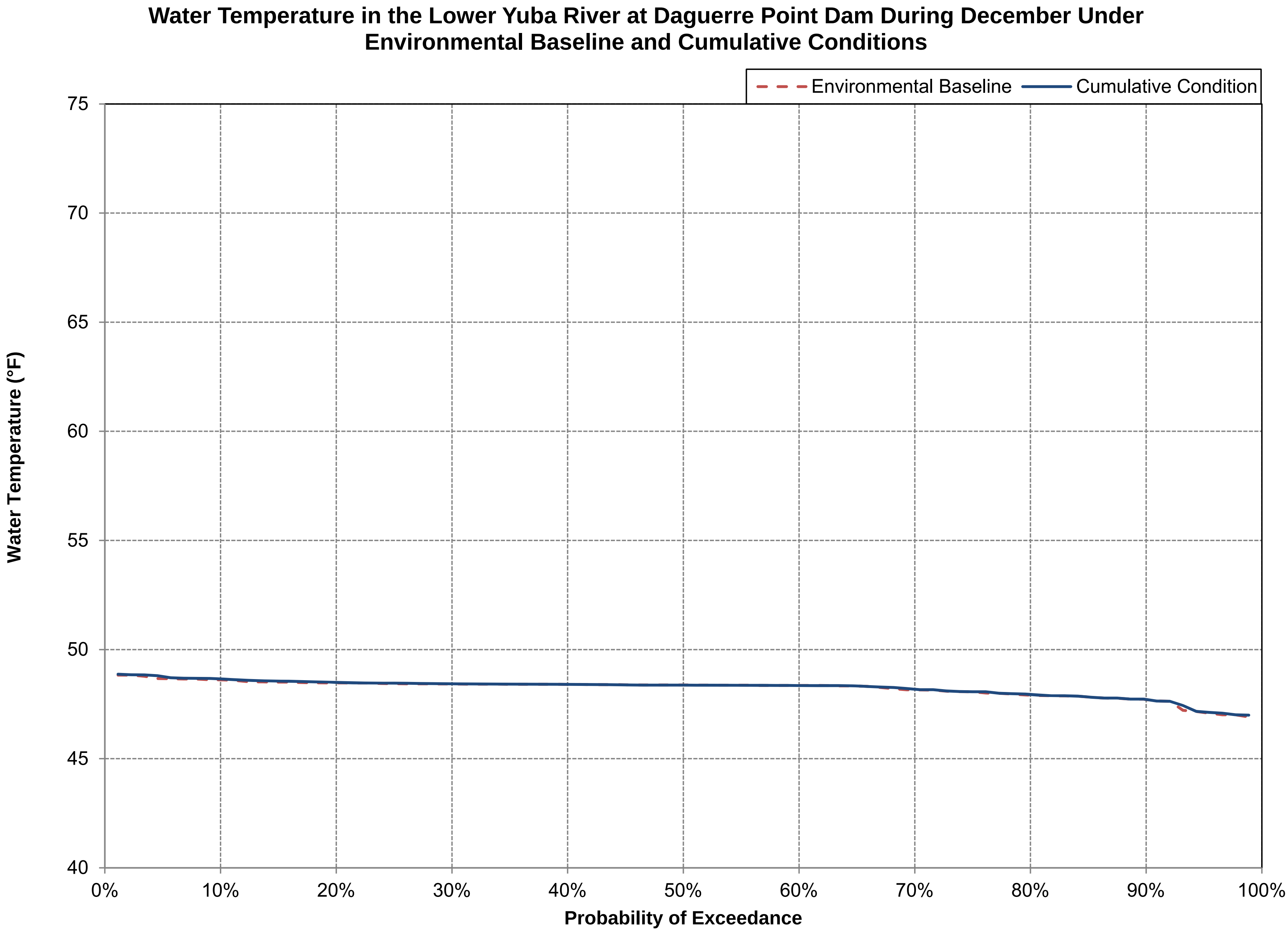
[1] Period of Record is Water Year 1922 - 2008

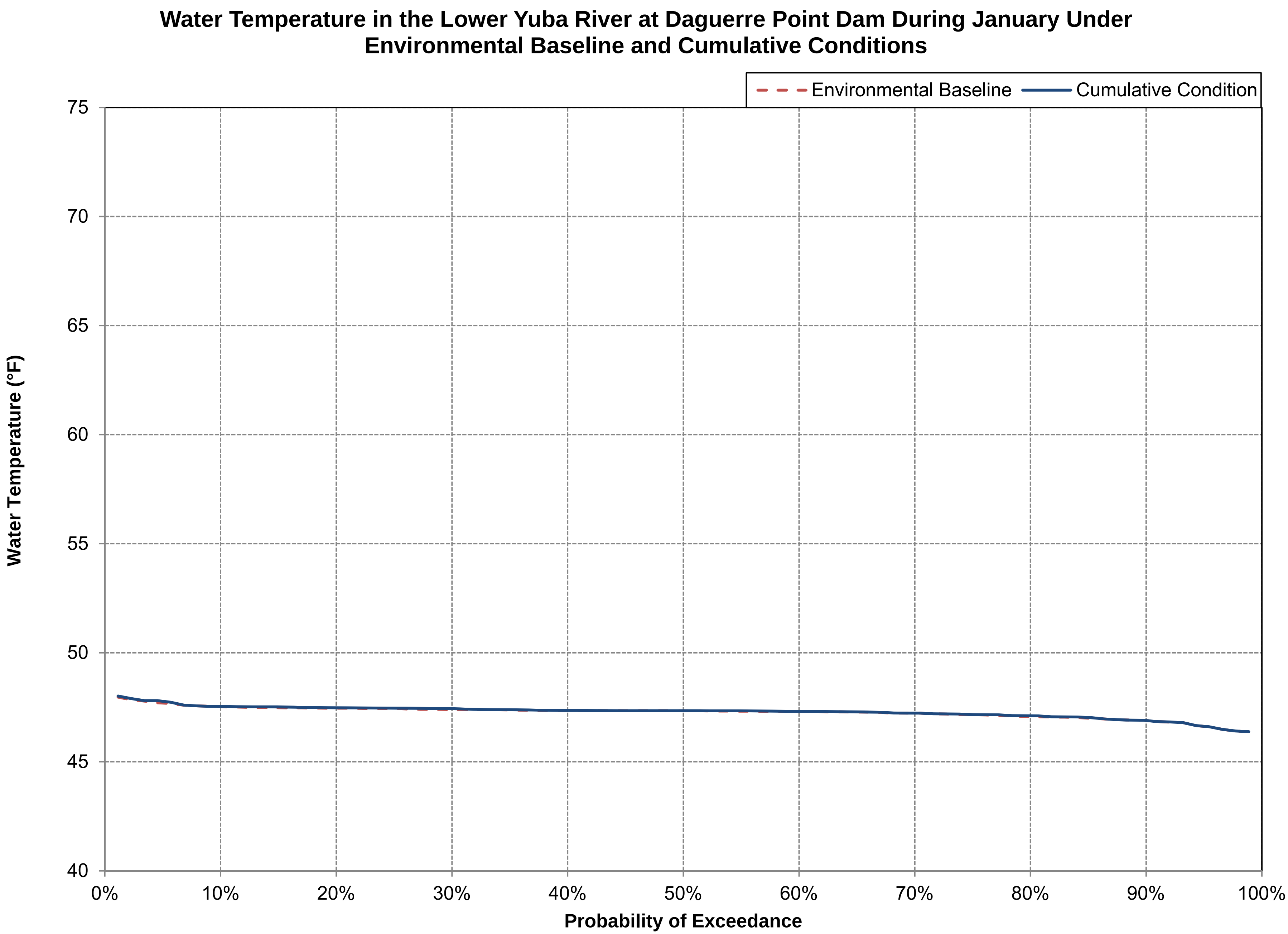
[2] As defined by the Yuba River Index described in SWRCB RD-1644

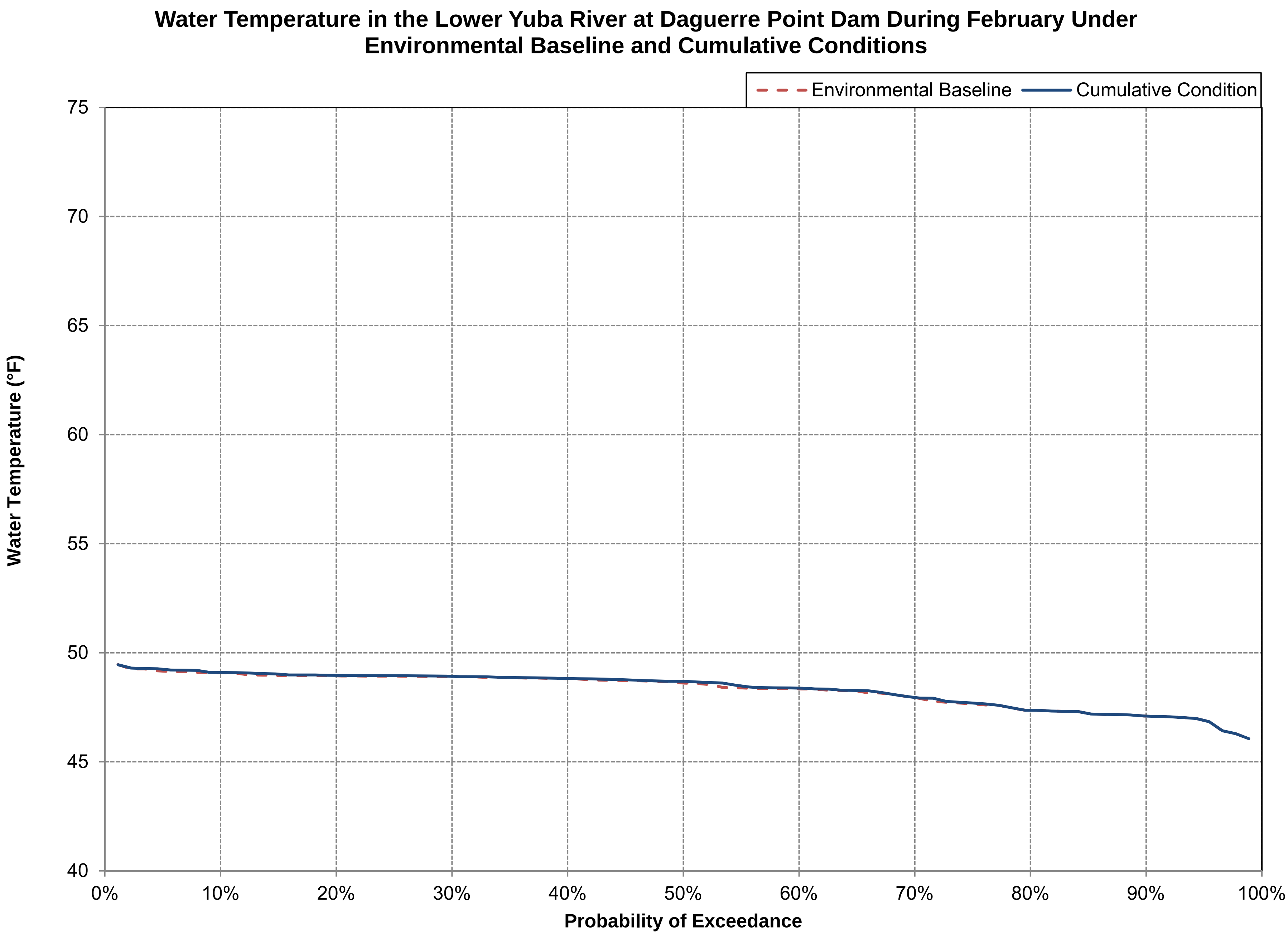

Water Temperature in the Lower Yuba River at Daguerre Point Dam During October Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance



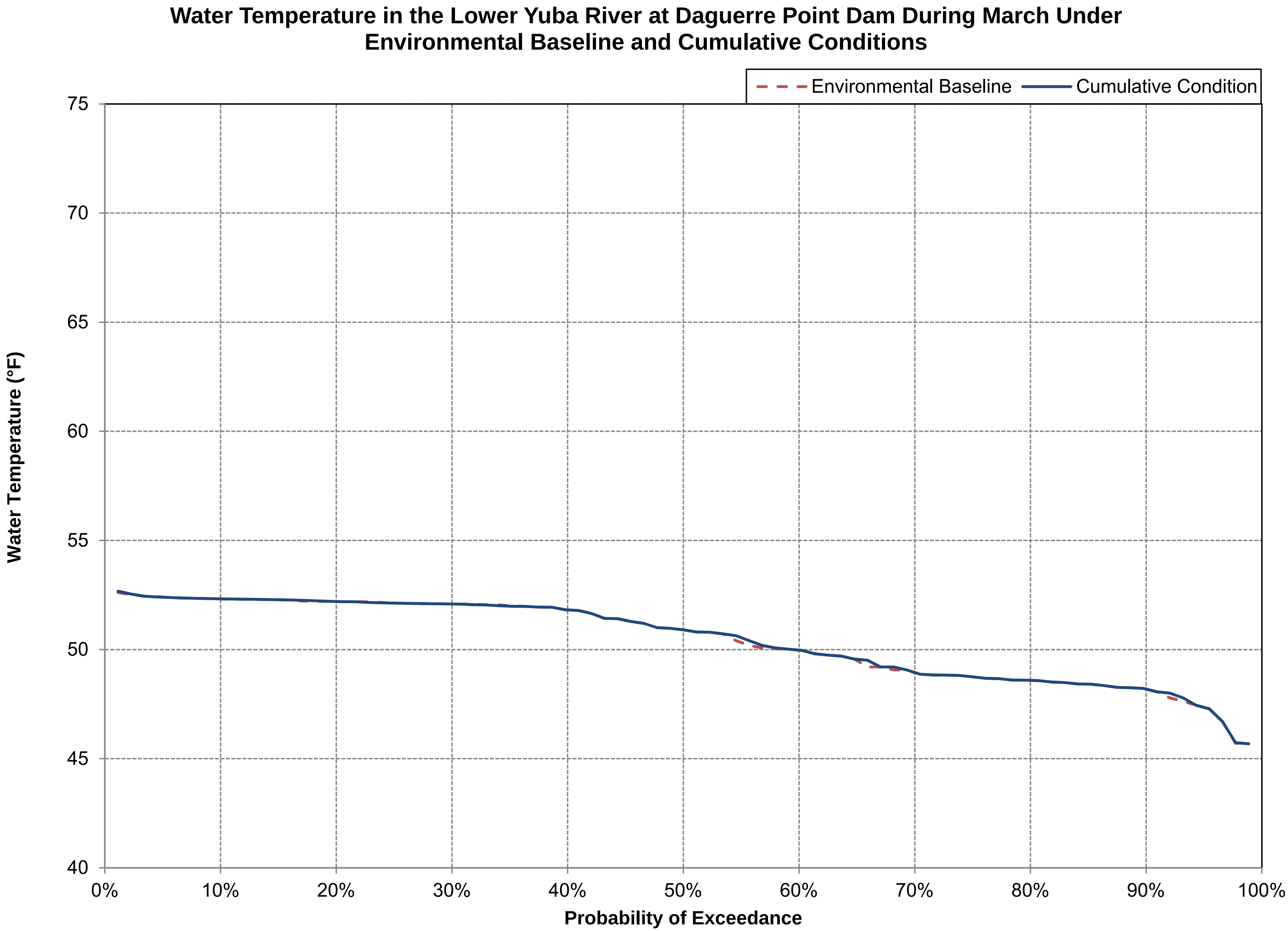
Water Temperature in the Lower Yuba River at Daguerre Point Dam During November Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance


Water Temperature in the Lower Yuba River at Daguerre Point Dam During December Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

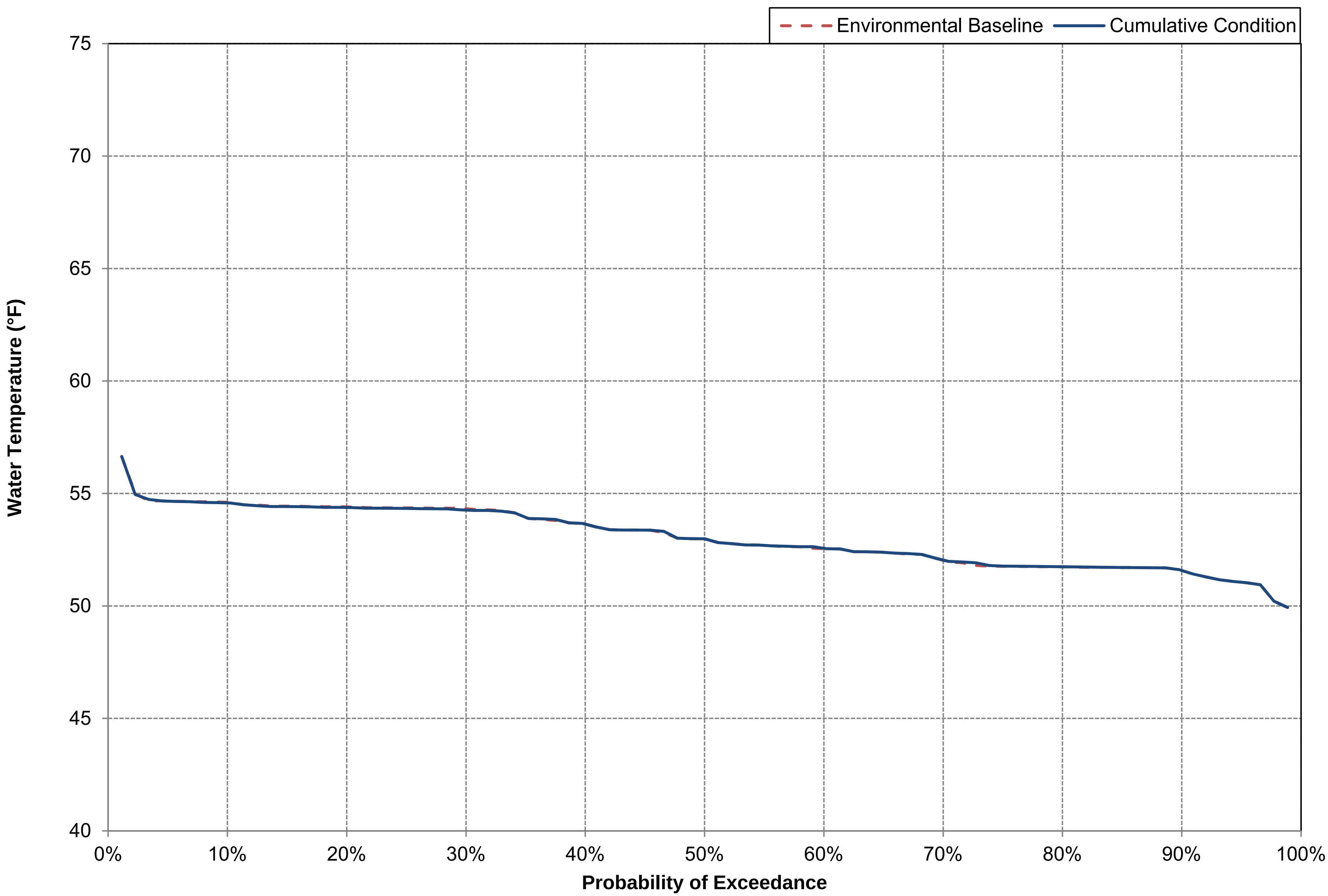

Water Temperature in the Lower Yuba River at Daguerre Point Dam During January Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

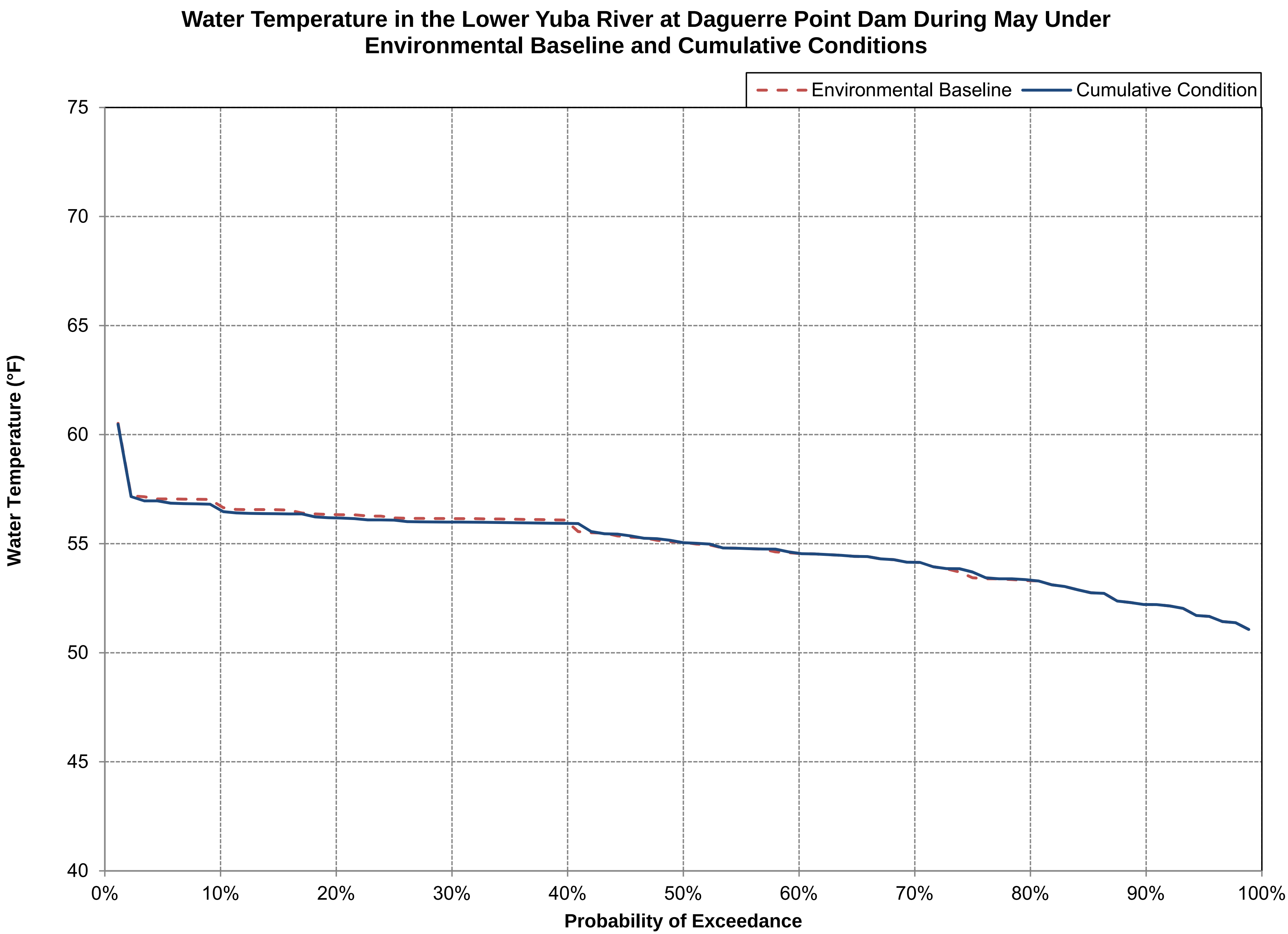


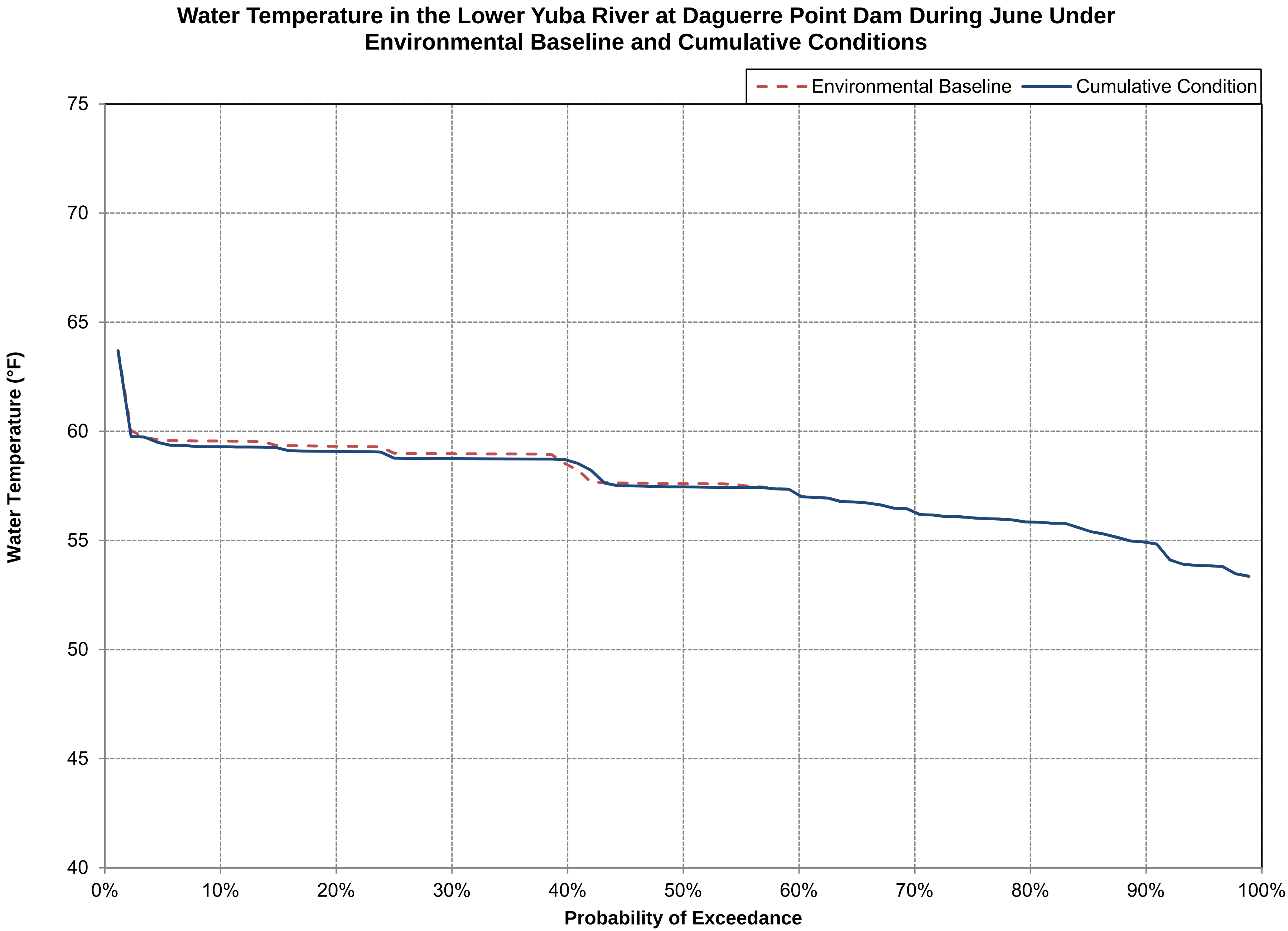
Water Temperature in the Lower Yuba River at Daguerre Point Dam During February Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance


Water Temperature in the Lower Yuba River at Daguerre Point Dam During March Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

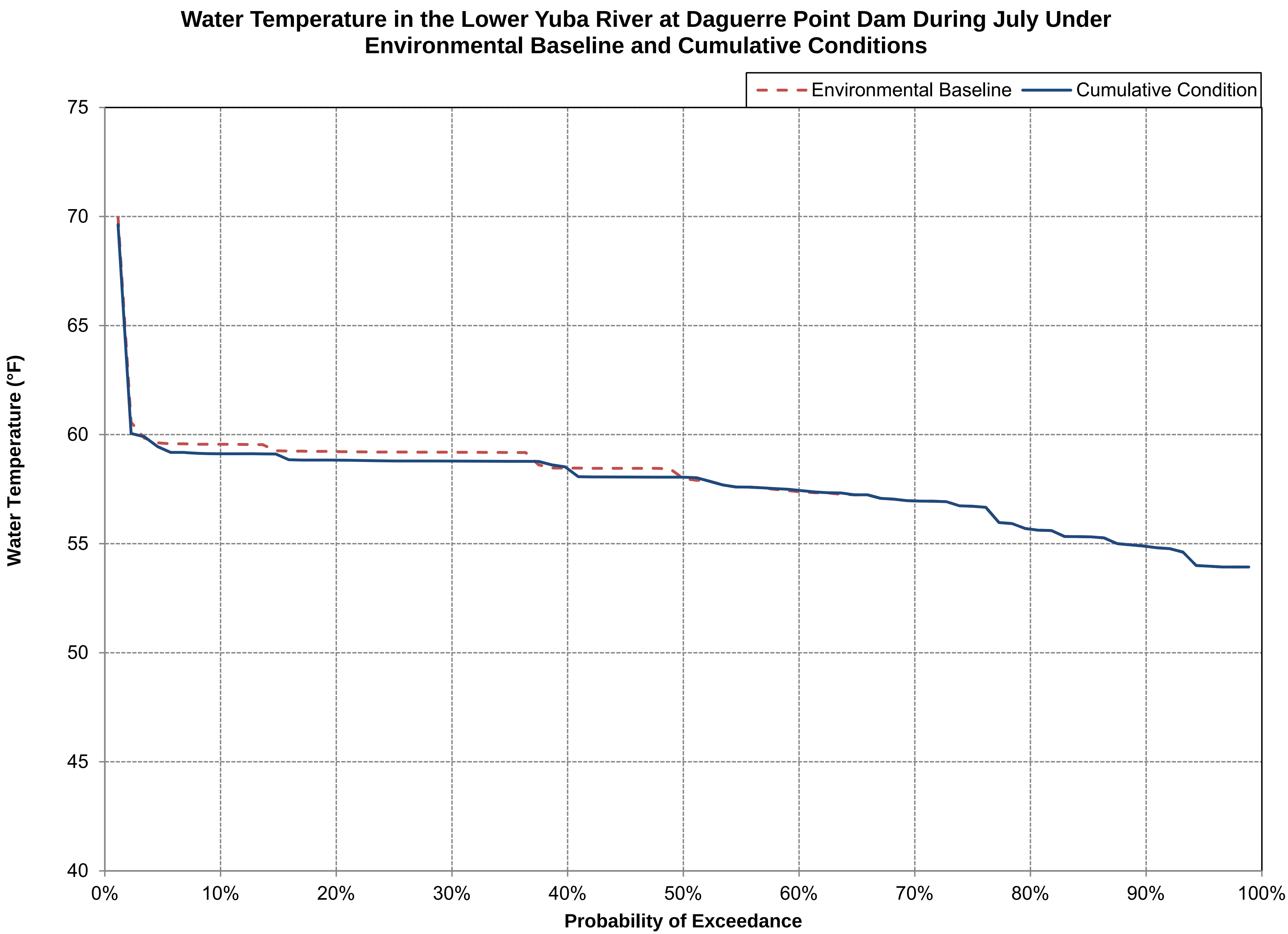
Water Temperature in the Lower Yuba River at Daguerre Point Dam During April Under Environmental Baseline and Cumulative Conditions



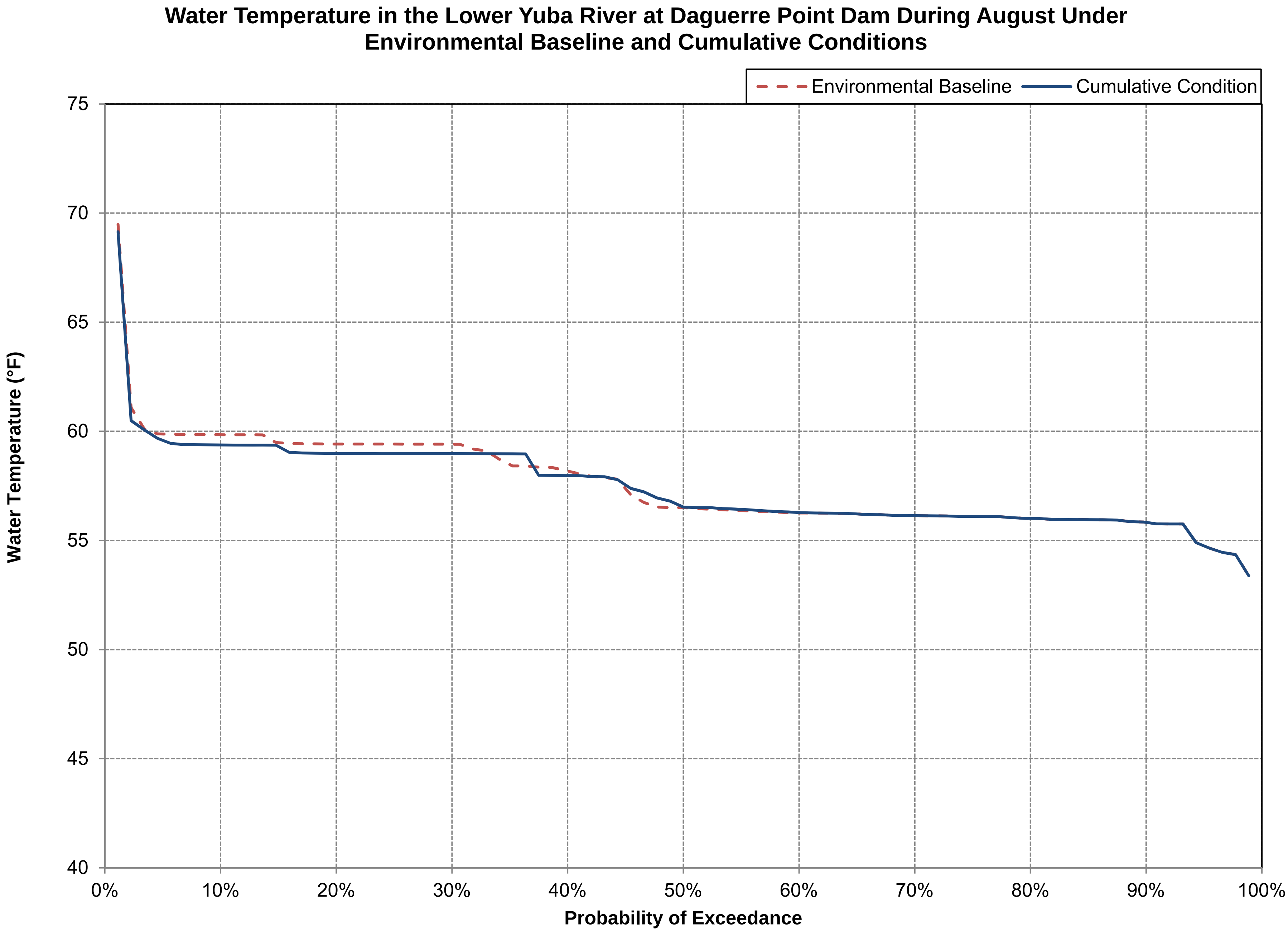

Water Temperature in the Lower Yuba River at Daguerre Point Dam During May Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

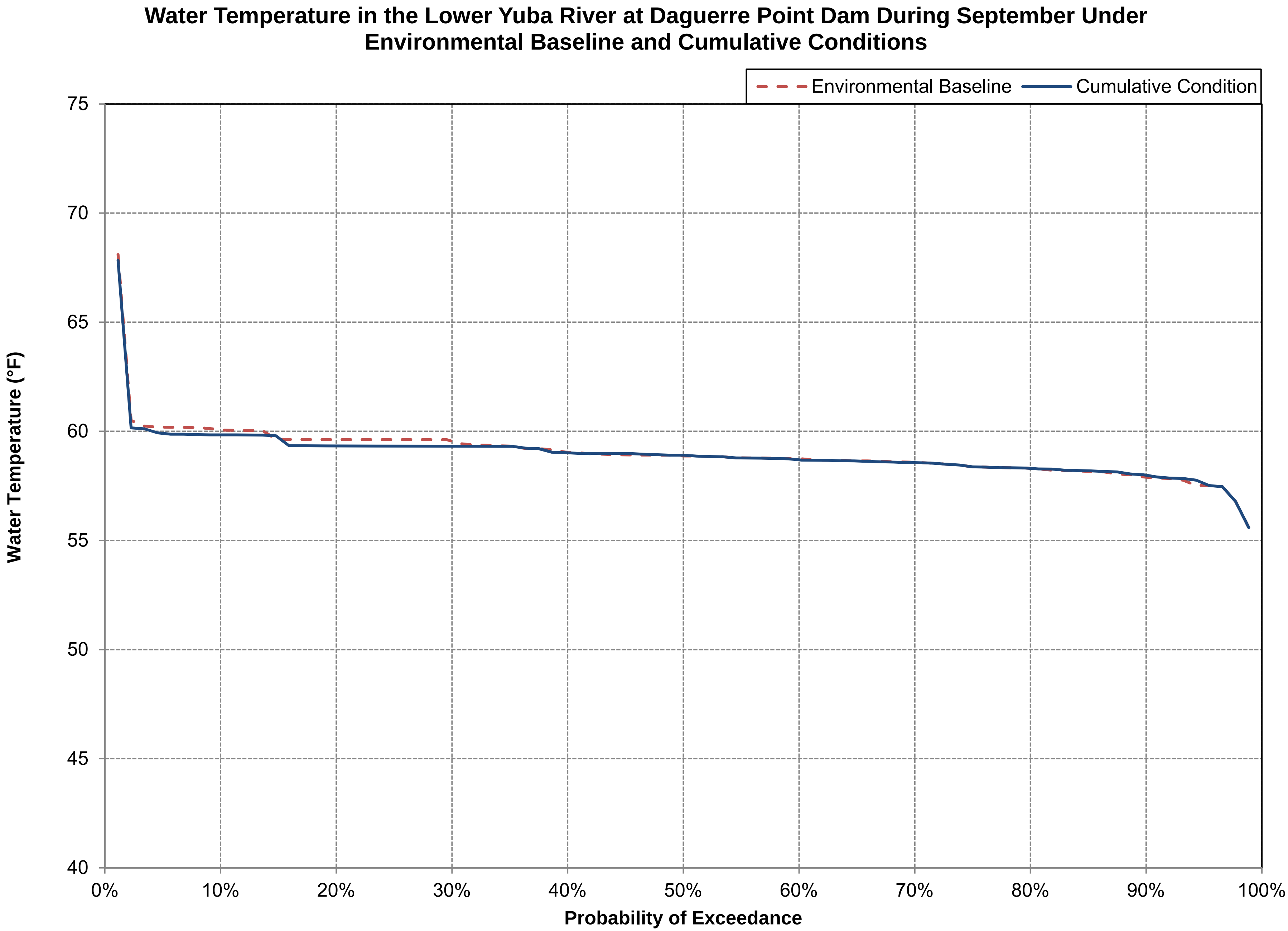


Water Temperature in the Lower Yuba River at Daguerre Point Dam During June Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance



Water Temperature in the Lower Yuba River at Daguerre Point Dam During July Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance


Water Temperature in the Lower Yuba River at Daguerre Point Dam During August Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance



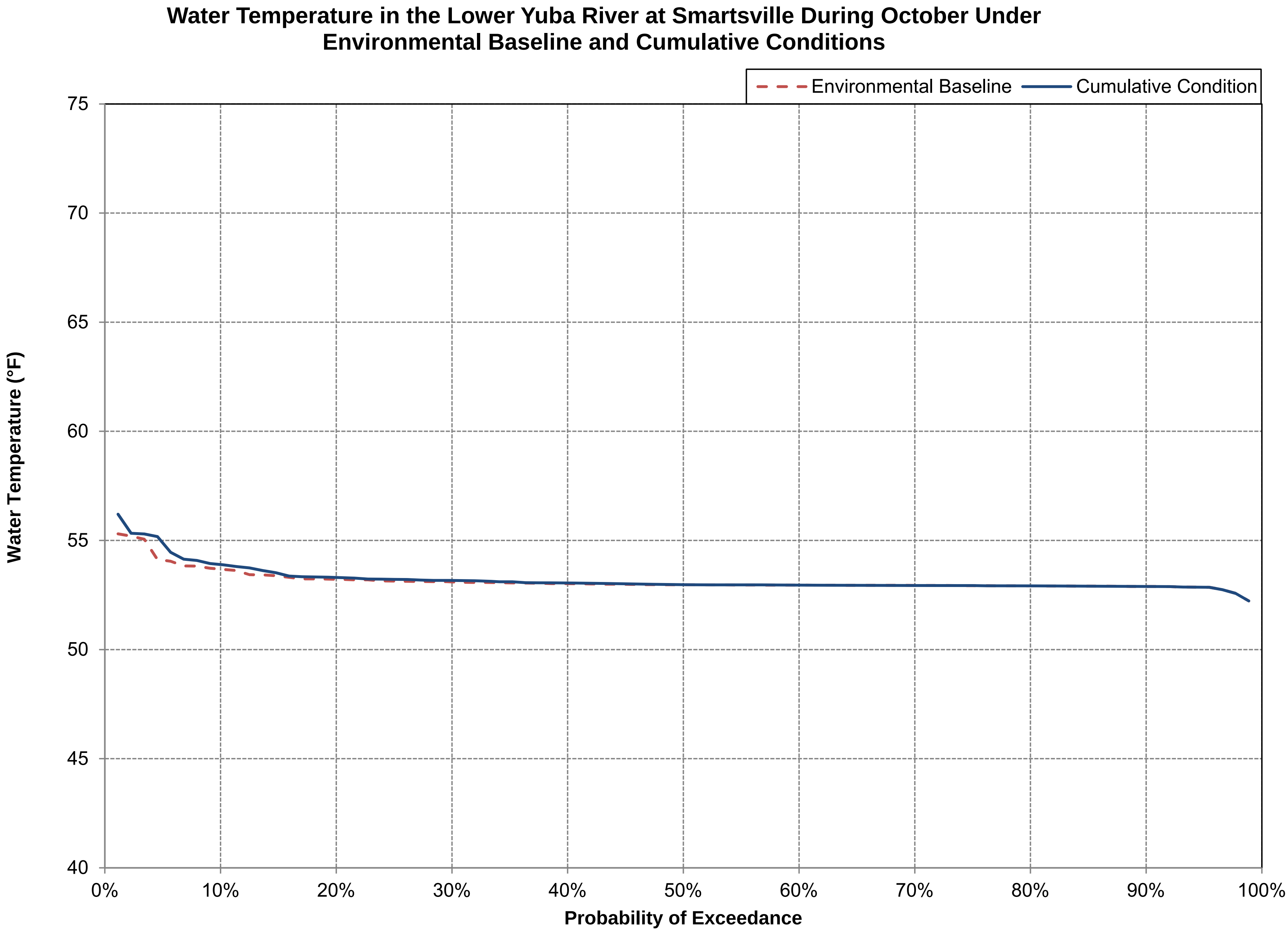
Water Temperature in the Lower Yuba River at Daguerre Point Dam During September Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

Long-term Average Water Temperature, and Average Water Temperature by Water Year Type in the Lower Yuba River at Smartsville under the Environmental Baseline and Cumulative Conditions

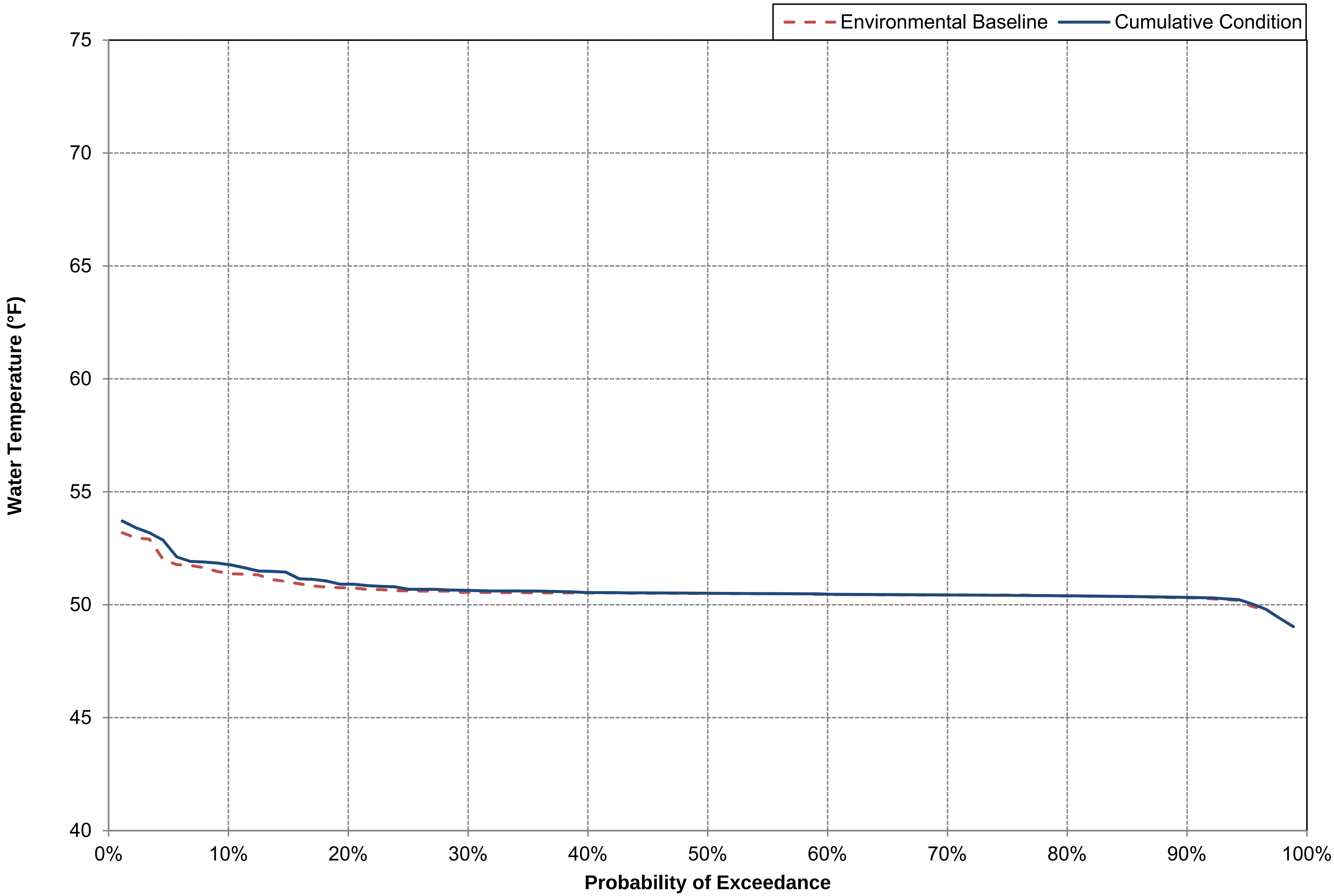
	Average Temperature (°F)											
Analysis Period	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Long-term												
Full Simulation Period[1]												
Environmental Baseline	53.1	50.6	48.7	47.6	48.6	49.3	50.6	52.0	53.5	54.8	54.7	54.8
Cumulative Conditions	53.2	50.7	48.8	47.7	48.6	49.3	50.6	52.0	53.5	54.7	54.7	54.9
Difference	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Water Year Types[2]												
Wet												
Environmental Baseline	53.0	50.4	48.0	46.5	47.4	48.0	50.0	51.6	53.1	54.1	54.2	54.6
Cumulative Conditions	53.0	50.4	48.1	46.6	47.4	48.0	50.0	51.6	53.1	54.1	54.2	54.6
Difference	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Above Normal												
Environmental Baseline	53.2	50.8	49.0	47.9	48.9	49.2	50.3	51.9	53.2	54.6	54.4	54.7
Cumulative Conditions	53.4	51.0	49.1	48.0	49.0	49.3	50.3	51.9	53.1	54.6	54.5	54.7
Difference	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Below Normal												
Environmental Baseline	53.3	50.9	49.2	48.2	49.3	50.1	50.9	52.1	53.7	55.0	54.8	54.8
Cumulative Conditions	53.4	51.0	49.3	48.3	49.4	50.1	50.9	52.1	53.7	55.0	54.8	54.8
Difference	0.1	0.1	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Dry												
Environmental Baseline	53.1	50.6	49.0	48.2	49.2	50.3	51.3	52.4	54.2	55.3	55.3	55.0
Cumulative Conditions	53.1	50.6	49.1	48.3	49.2	50.3	51.3	52.3	54.1	55.2	55.3	55.0
Difference	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.0	0.1
Critical												
Environmental Baseline	53.2	50.8	49.2	48.4	49.4	50.3	51.3	52.6	54.4	55.6	55.8	55.5
Cumulative Conditions	53.3	50.9	49.2	48.4	49.5	50.4	51.3	52.6	54.4	55.6	55.9	55.7
Difference	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2

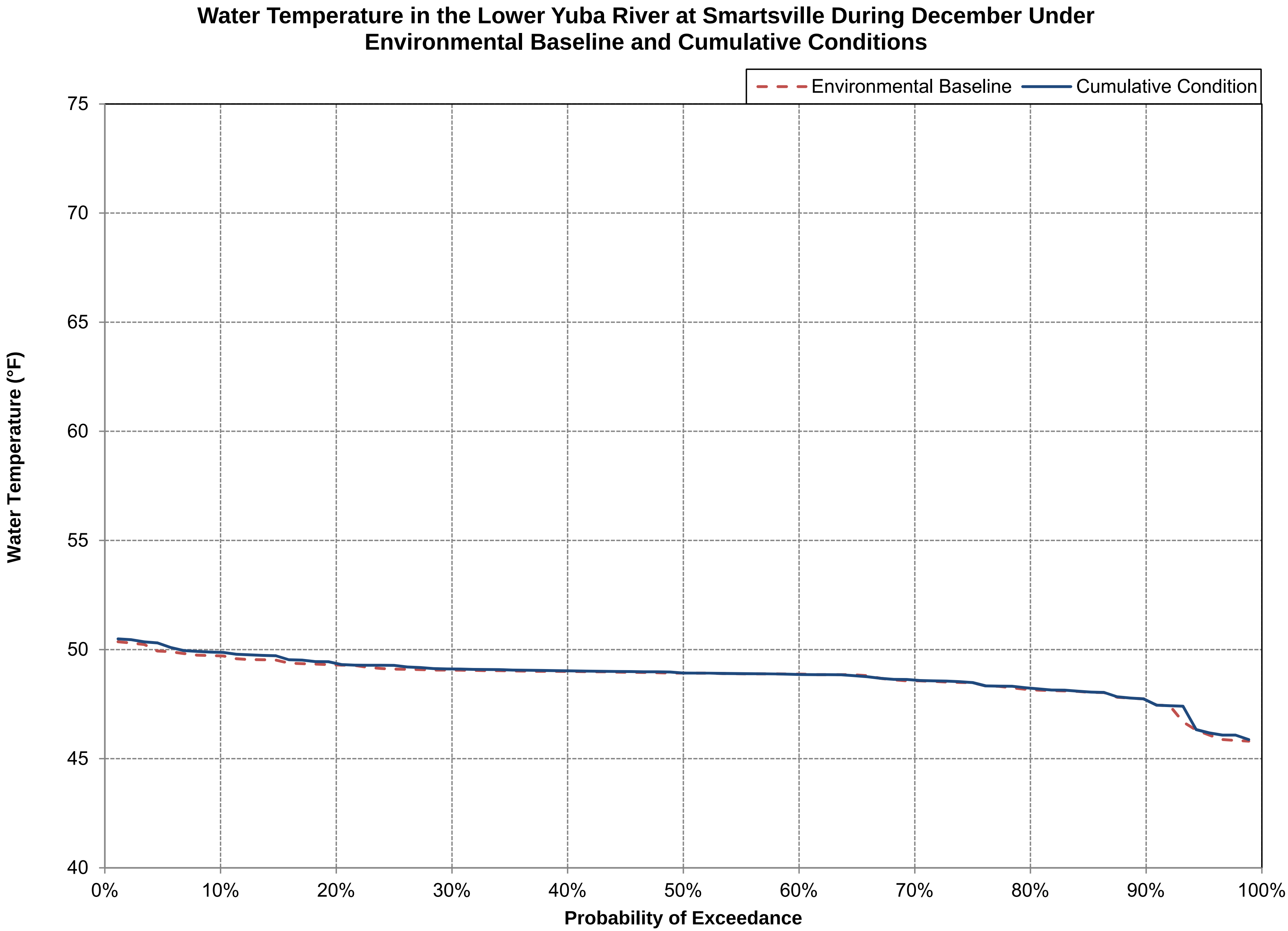
[1] Period of Record is Water Year 1922 - 2008

[2] As defined by the Yuba River Index described in SWRCB RD-1644

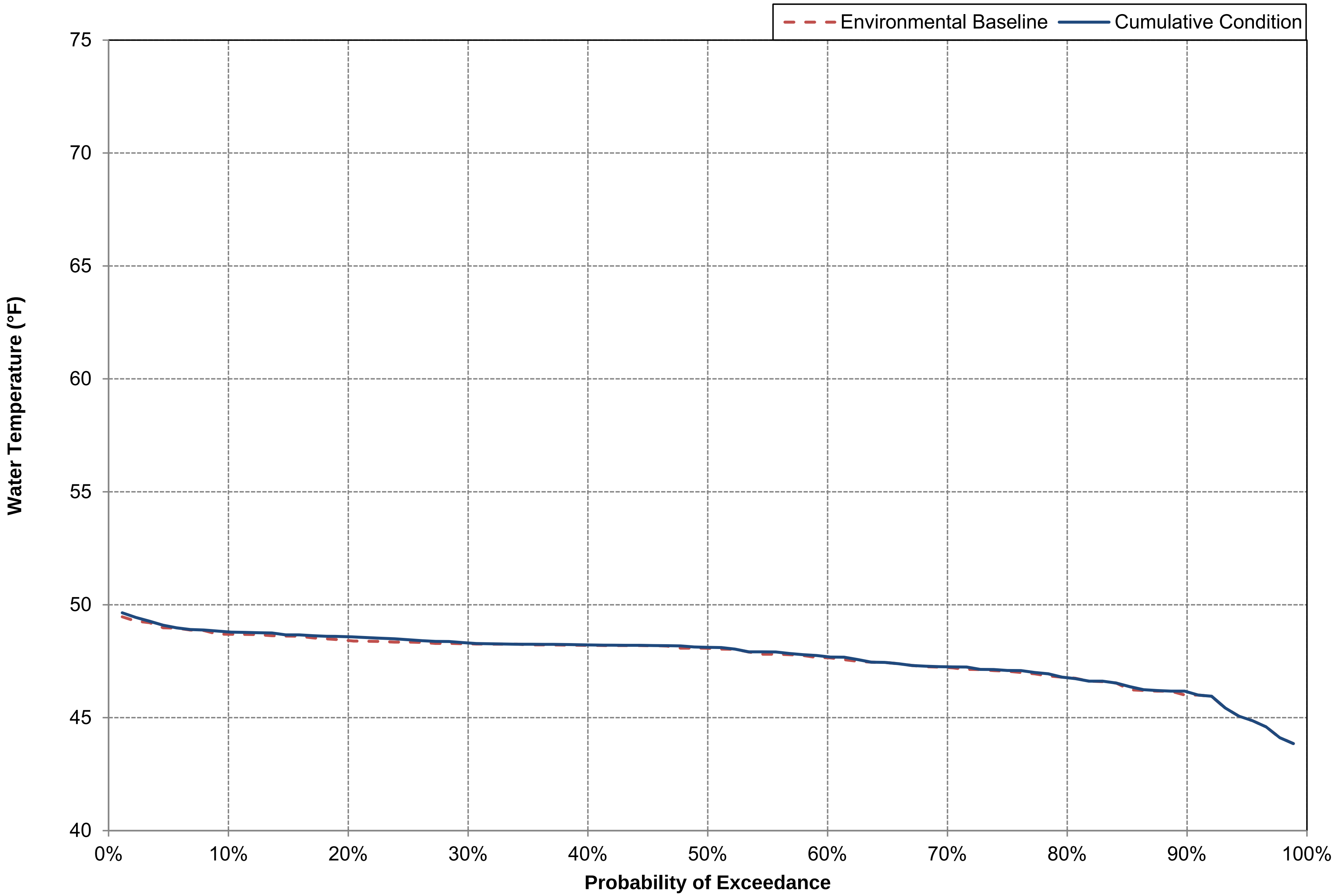

Water Temperature in the Lower Yuba River at Smartsville During October Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

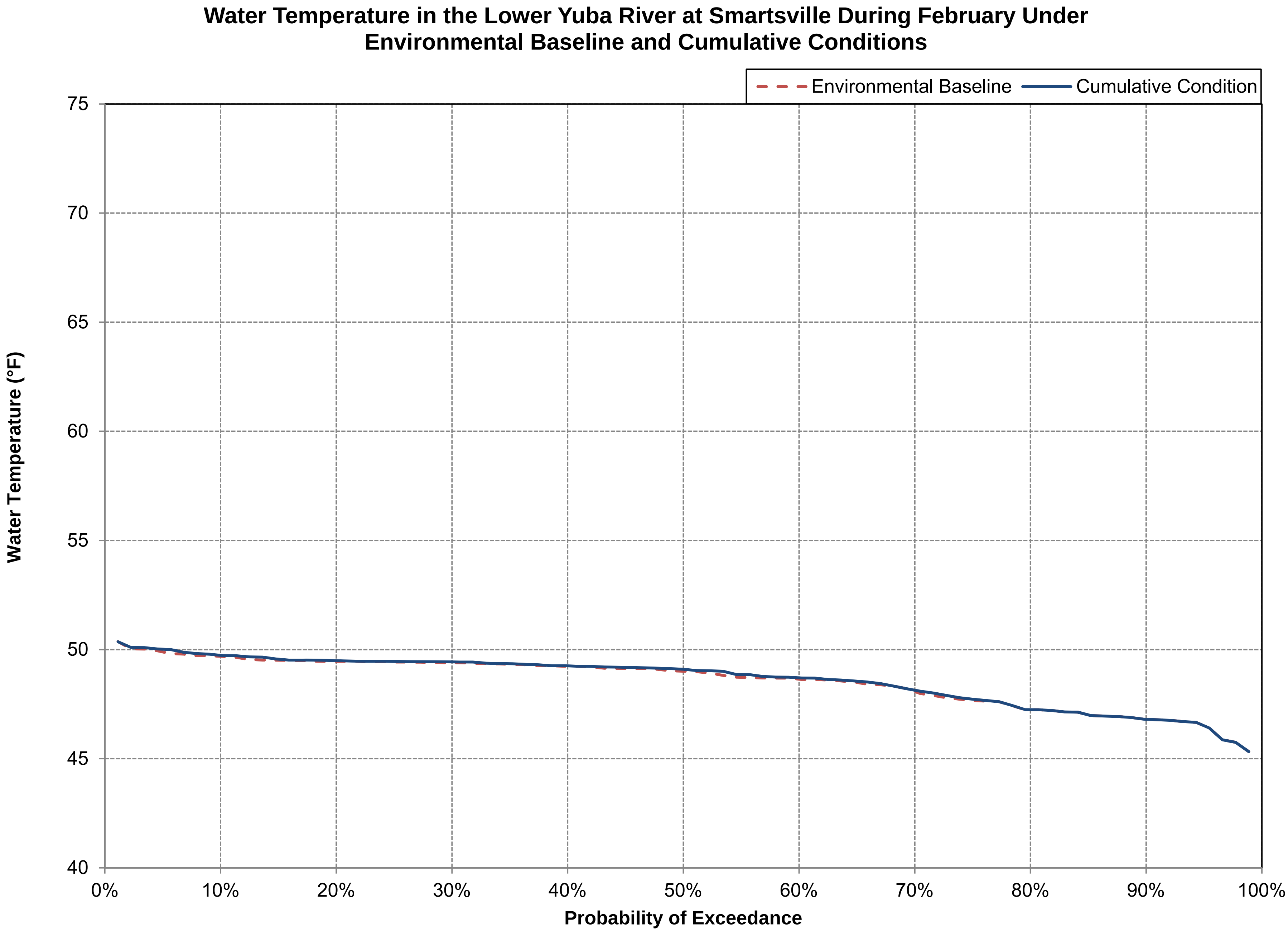
Water Temperature in the Lower Yuba River at Smartsville During November Under Environmental Baseline and Cumulative Conditions



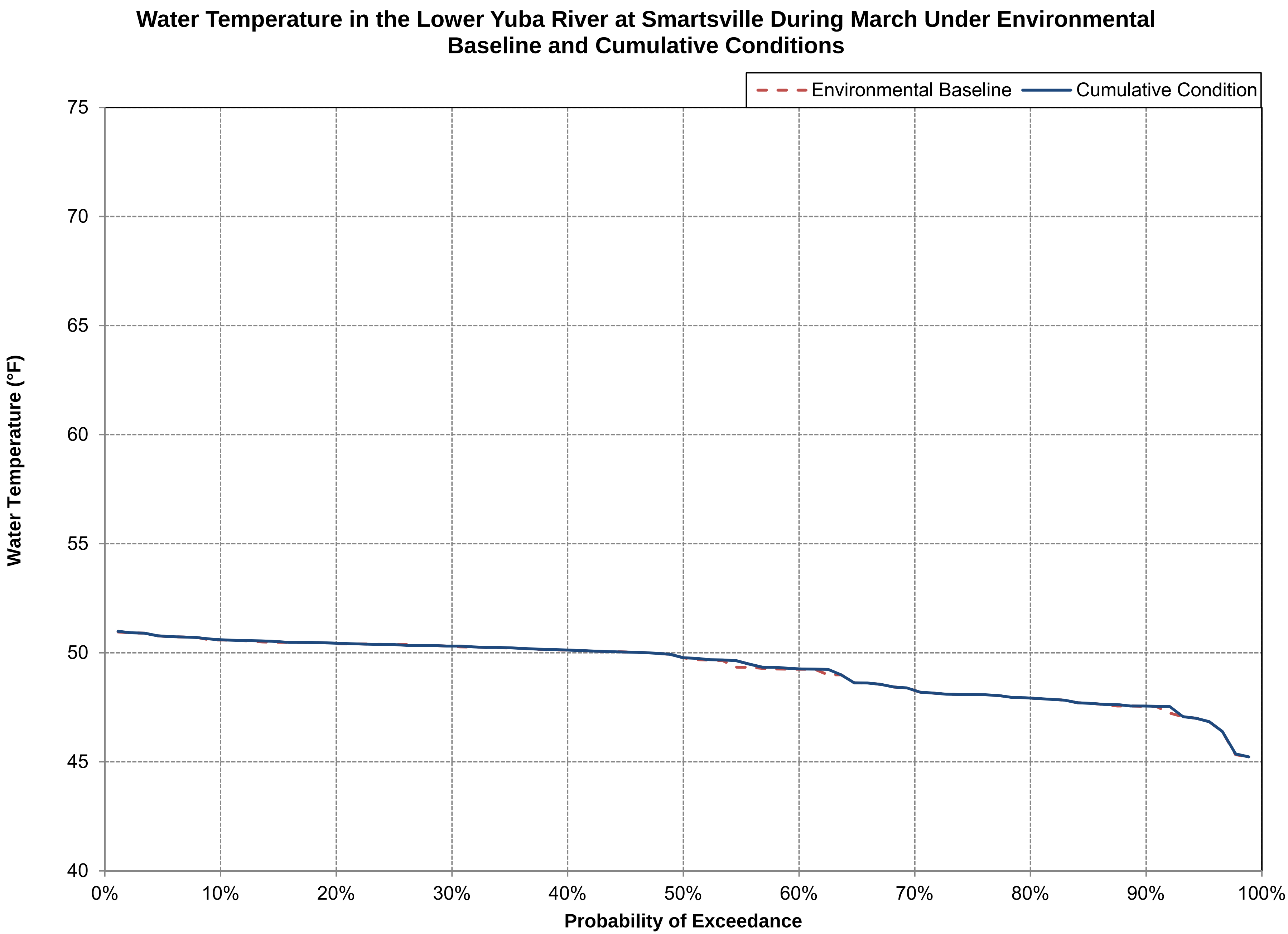

Water Temperature in the Lower Yuba River at Smartsville During December Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

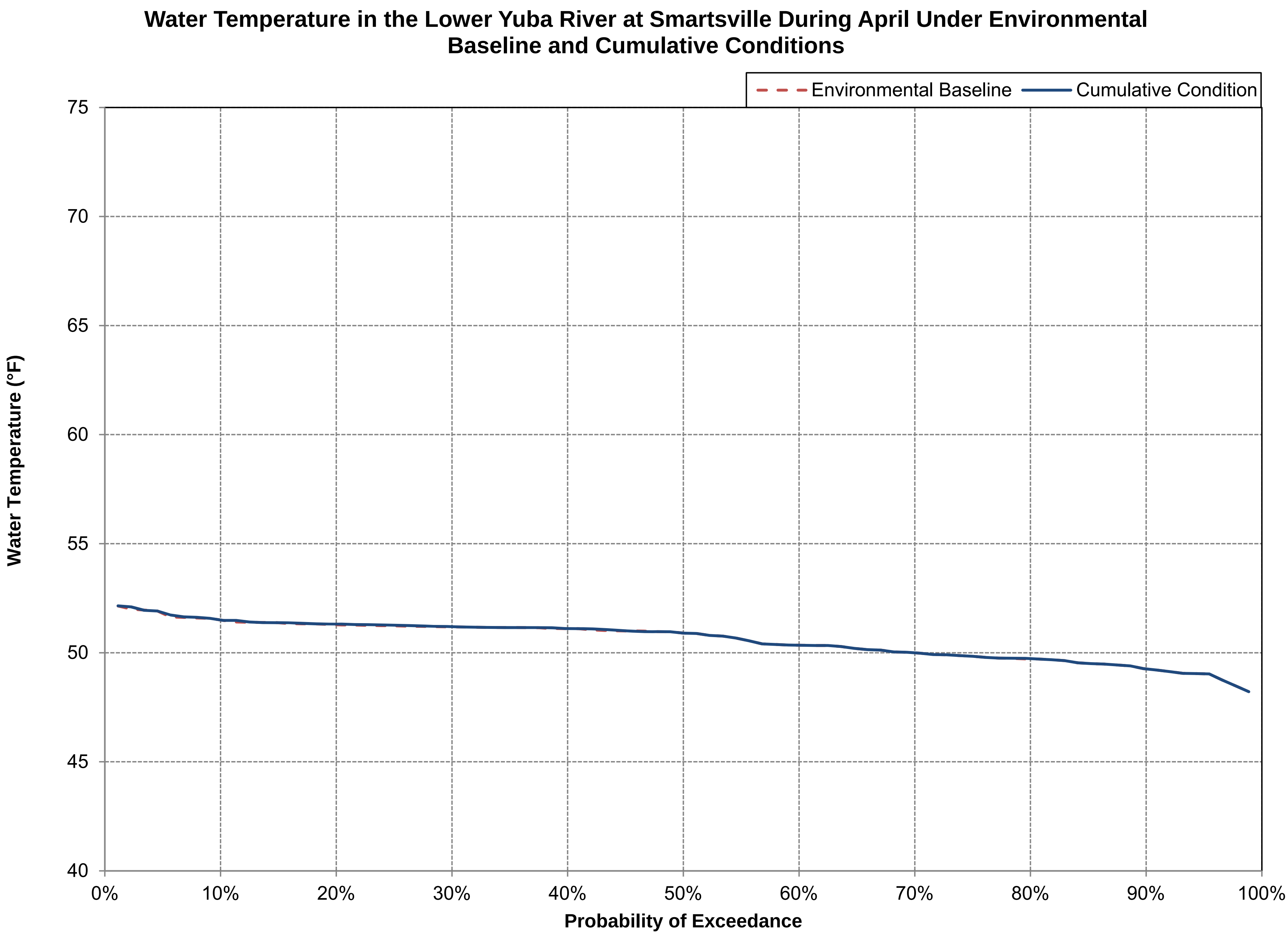
Water Temperature in the Lower Yuba River at Smartsville During January Under Environmental Baseline and Cumulative Conditions



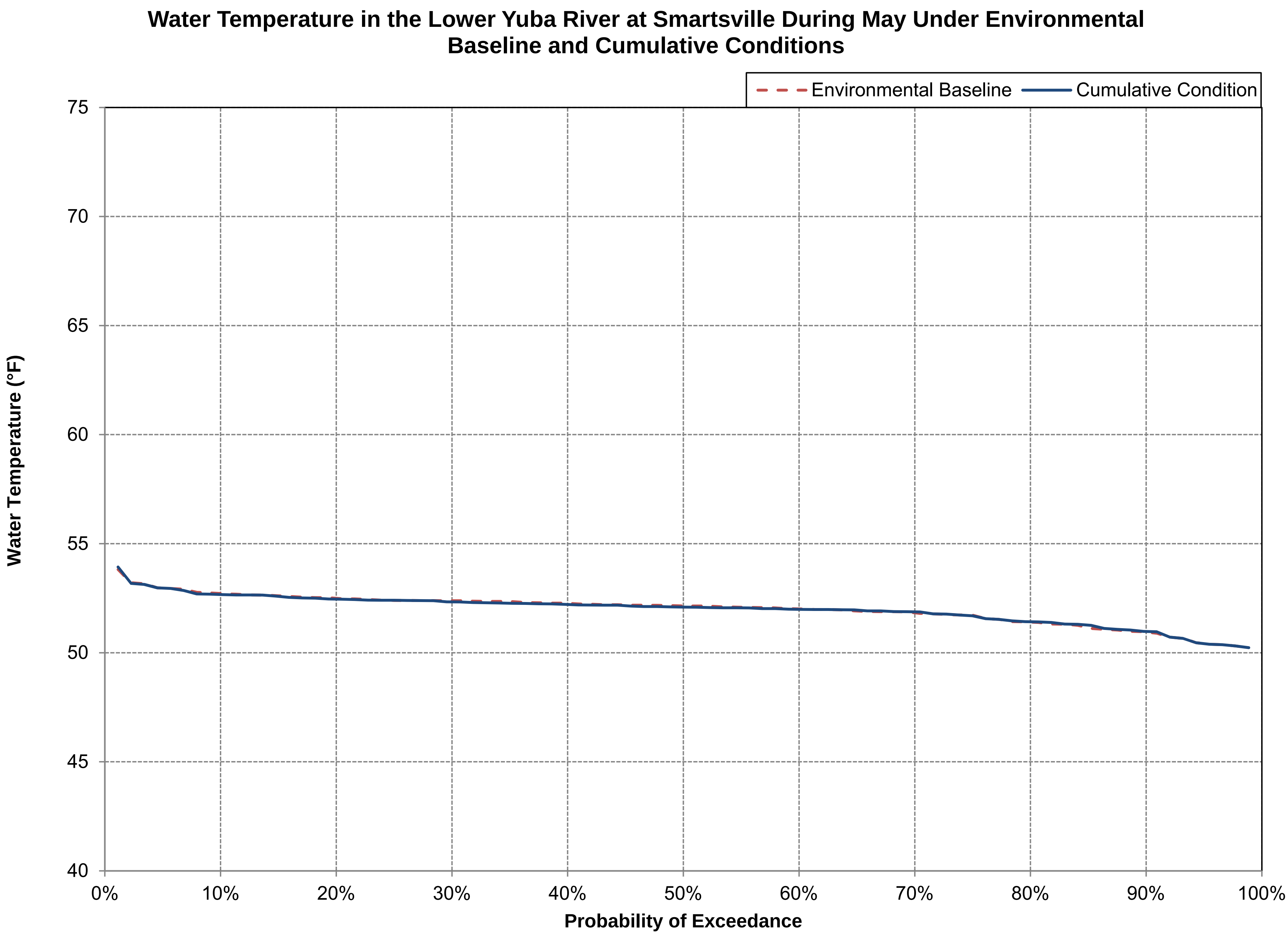


Water Temperature in the Lower Yuba River at Smartsville During February Under
Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance


Water Temperature in the Lower Yuba River at Smartsville During March Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

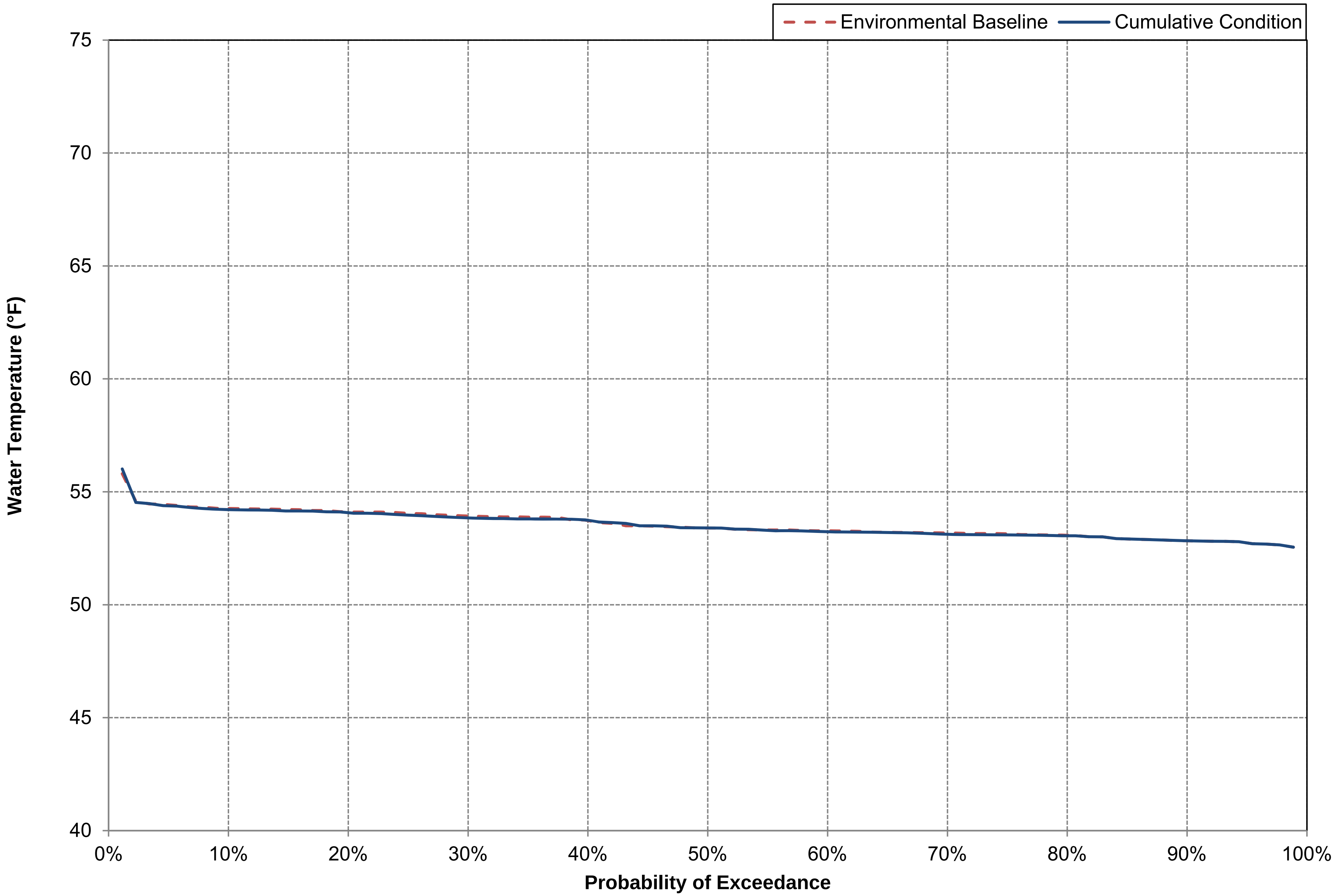


Water Temperature in the Lower Yuba River at Smartsville During April Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

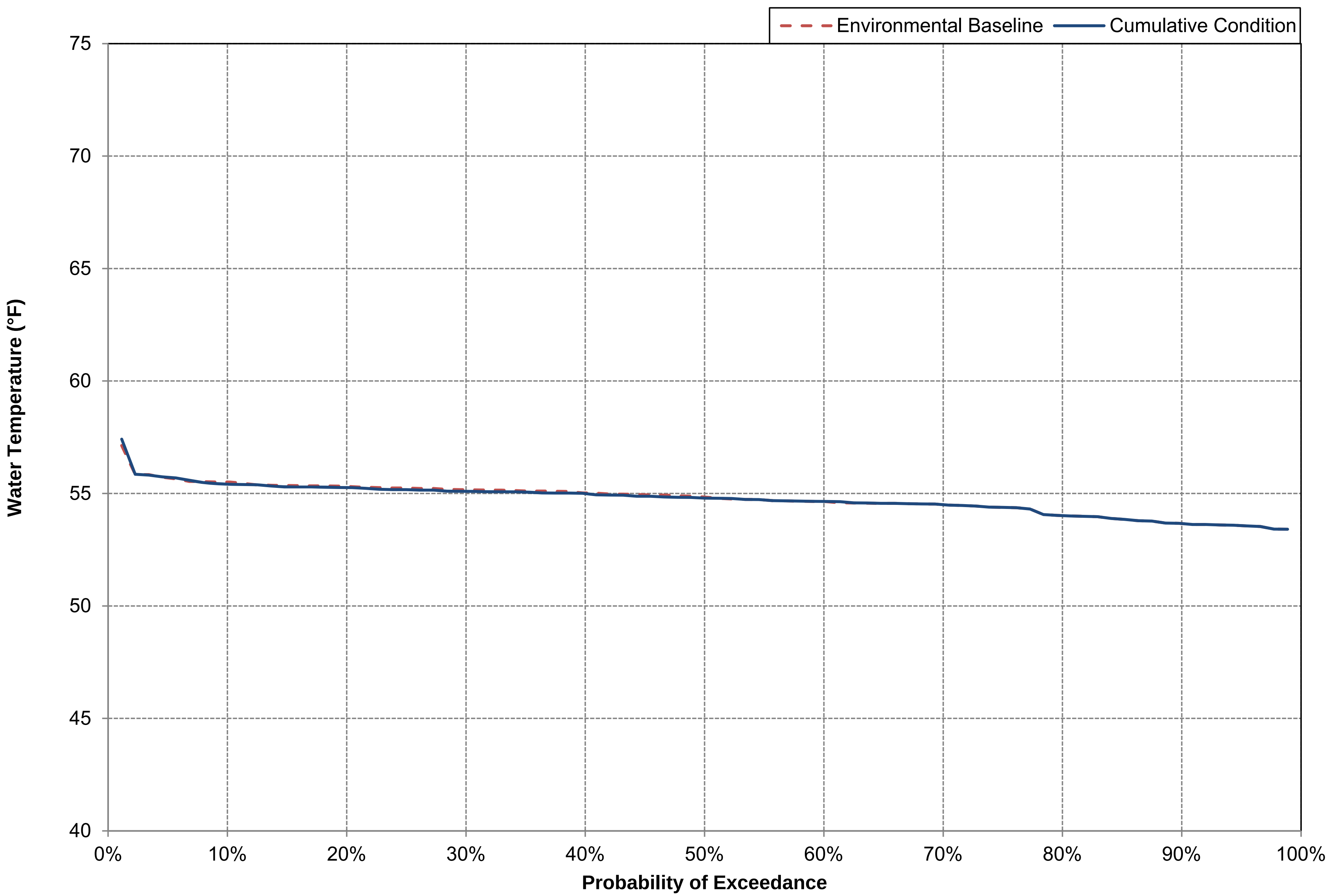


Water Temperature in the Lower Yuba River at Smartsville During May Under Environmental Baseline and Cumulative Conditions
Environmental Baseline
Cumulative Condition
Water Temperature (°F)
75
70
65
60
55
50
45
40
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Probability of Exceedance

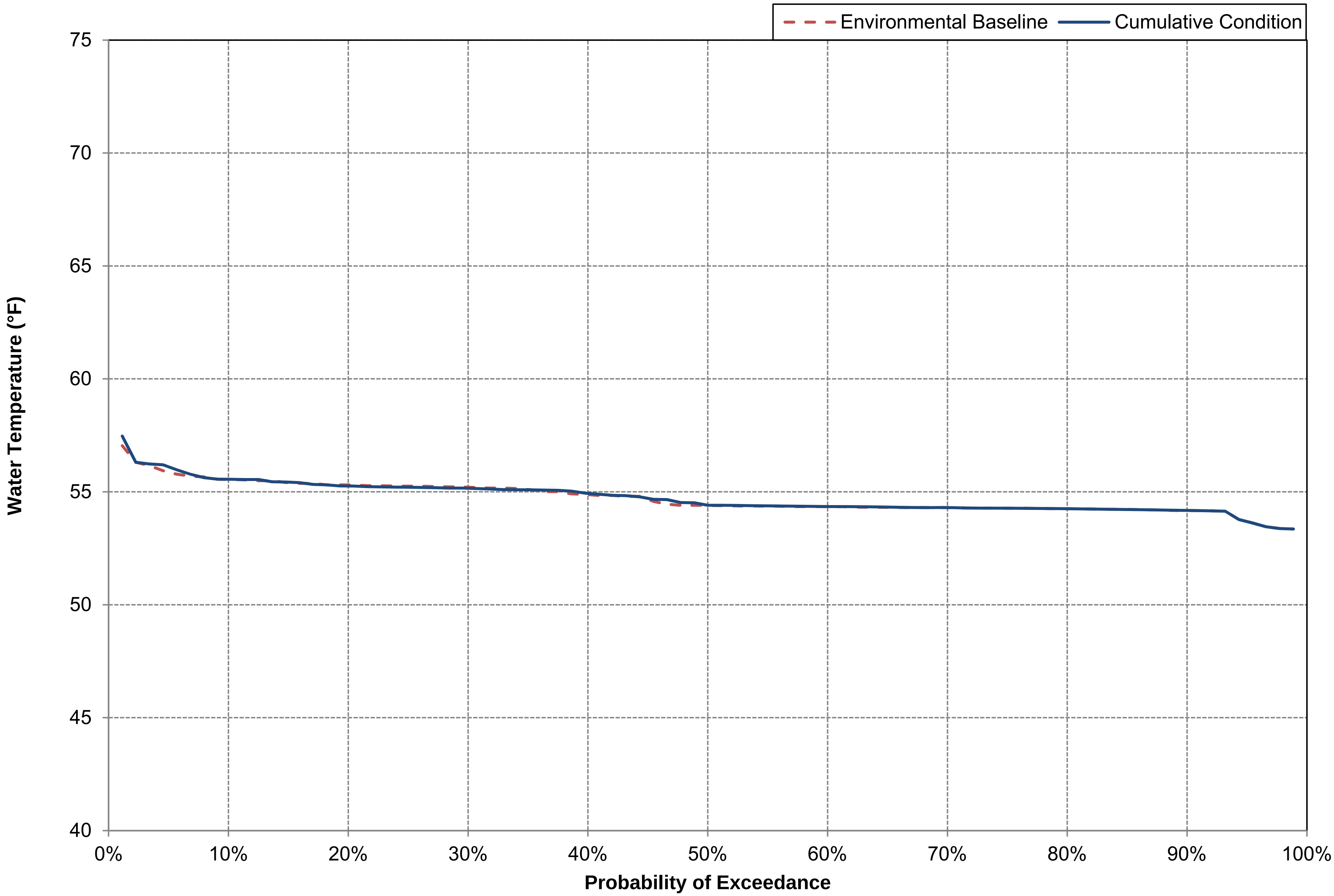
Water Temperature in the Lower Yuba River at Smartsville During June Under Environmental Baseline and Cumulative Conditions



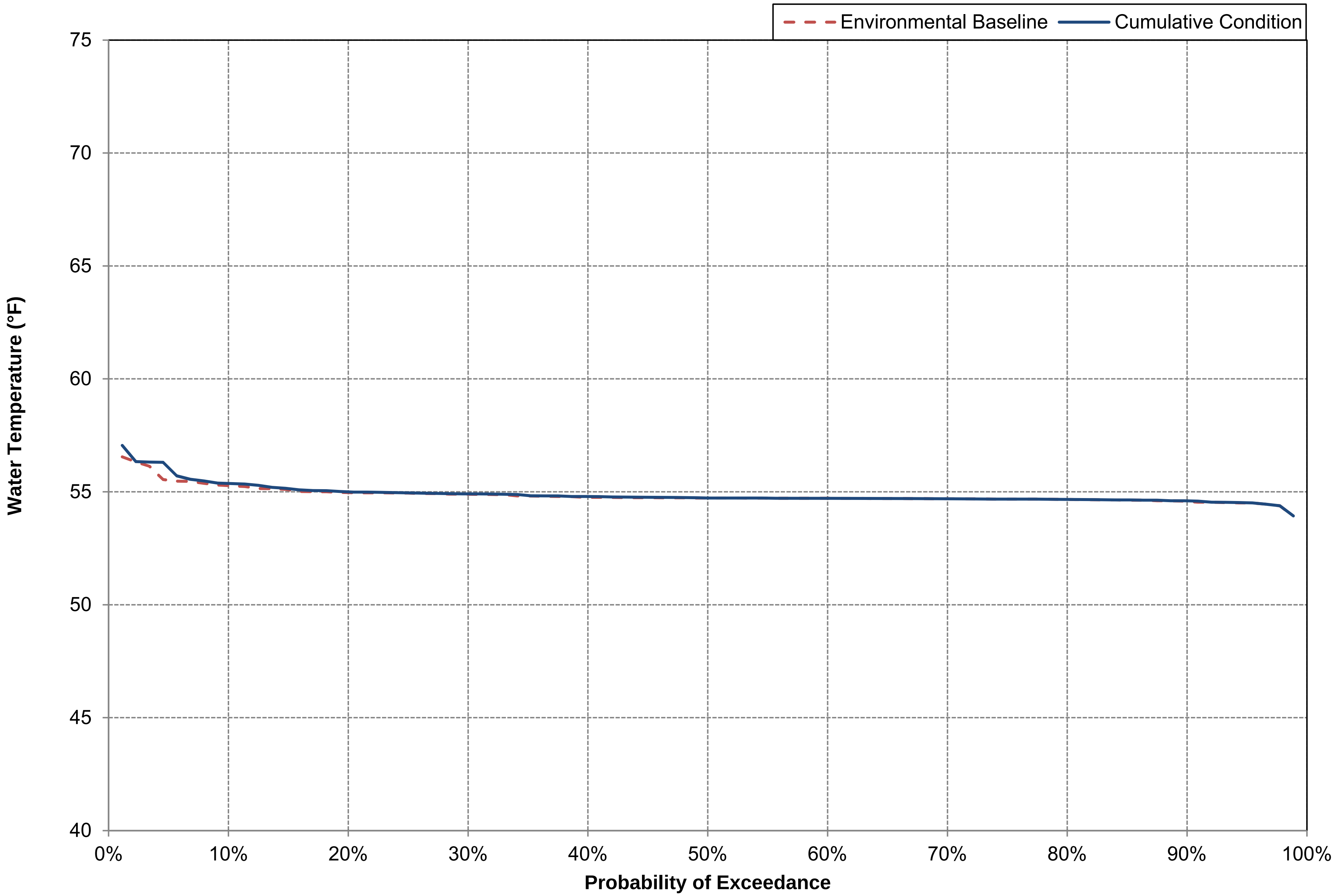
Water Temperature in the Lower Yuba River at Smartsville During July Under Environmental Baseline and Cumulative Conditions



Water Temperature in the Lower Yuba River at Smartsville During August Under Environmental Baseline and Cumulative Conditions



Water Temperature in the Lower Yuba River at Smartsville During September Under Environmental Baseline and Cumulative Conditions



Appendix B: lower Yuba River Accord EIR Modeling Technical Memoranda

Proposed Lower Yuba River Accord

Modeling Technical Memorandum

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Proposed Lower Yuba River Accord
Modeling Technical Memorandum

1.0 INTRODUCTION

This memorandum provides detailed information regarding the modeling tools, primary modeling assumptions, model inputs, and methodologies that are used to evaluate potential effects on reservoir operations, stream flow, water quality, water temperature, and salmon mortality under the various scenarios that are analyzed in the Proposed Yuba Accord EIR/EIS. Implementation of one of these scenarios would result in changes in operations of: (1) YCWA's Yuba Project; (2) YCWA Member Units' groundwater pumping within the Yuba Groundwater Basin; (3) the DWR Oroville-Thermalito complex of the SWP; (4) CVP/SWP Delta facilities; and (5) CVP/SWP San Luis Reservoir. This memorandum is included as Appendix D to the Draft EIR/EIS.

2.0 IMPACT ANALYSIS FRAMEWORK

This section describes the impact analysis framework to evaluate potential flow and water temperature related changes on surface water supplies, surface water quality, hydropower, and aquatic and riparian habitat utilized by listed species that would be expected to occur with implementation of the various alternatives analyzed in the Draft EIR/EIS.

Modeling scenarios were developed to represent existing and future hydrologic conditions with and without implementation of the alternatives considered for the Proposed Yuba Accord (i.e., Yuba Accord Alternative and Modified Flow Alternative) to enable an evaluation of potential environmental impacts for CEQA, NEPA and water rights purposes.

These scenarios include: (1) CEQA Existing Condition; (2) CEQA No Project Alternative; (3) CEQA Yuba Accord Alternative; (4) CEQA Modified Flow Alternative; (5) NEPA No Action Alternative; (6) NEPA Yuba Accord Alternative; and (7) NEPA Modified Flow Alternative. In addition to these scenarios, baseline conditions for the accounting of Released Transfer Water for the two characterizations (CEQA and NEPA) of the Yuba Accord Alternative are determined, but not directly used in any of the impact analyses. The hydrologic modeling and related post-processing of outputs is used to simulate the YCWA, Reclamation, and DWR water project operations associated with implementation of the alternatives.

Comparison of model results for the different scenarios is used in the discussions of environmental effects in the following resource chapters of the Draft EIR/EIS:

- Chapter 5 - Surface Water Supply and Management
- Chapter 6 - Groundwater Resources
- Chapter 7 – Power Production and Energy Consumption
- Chapter 8 - Flood Control
- Chapter 9 - Surface Water Quality
- Chapter 10 - Fisheries and Aquatic Resources
- Chapter 11 - Terrestrial Resources
- Chapter 12 – Recreation

- Chapter 13 - Visual Resources
- Chapter 14 - Cultural Resources
- Chapter 18 - Growth Inducement

2.1 IMPACT ANALYSIS APPROACH

The impact analysis compares modeling outputs from one modeling scenario with outputs from another scenario to determine the potential for changes in hydrologic and environmental conditions. Parameters represented by the modeling outputs include: reservoir storages and water surface elevations, river flows, reservoir and river water temperatures, early life stage Chinook salmon mortalities, and Delta water quality (EC).

The alternatives considered involve changes in surface water and groundwater management within the Yuba River and Yuba groundwater subbasins, changes in operations of the SWP Oroville-Thermalito complex, and modifications of CVP/SWP export operations in the Delta. Changes in San Luis Reservoir storage also are evaluated for certain resources, as appropriate.

The evaluation of environmental impacts is performed using the impact indicators and significance criteria developed for each resource topic (presented in resource chapters of the EIR/EIS). Simulation comparisons to be evaluated in the Draft EIR/EIS are presented in **Table 2-1**.

For purposes of addressing potential impact considerations of interest to the SWRCB and to satisfy CEQA requirements, modeling simulations for the alternatives evaluated in this EIR/EIS are compared to both the Existing Condition and the No Project Alternative. For CEQA impact assessment purposes, the alternatives (i.e., Yuba Accord, Modified Flow and No Project) are compared to the Existing Condition, which includes RD-1644 Interim instream flow requirements and current demands at Daguerre Point Dam (see Section 4.0, CEQA/NEPA Model Scenarios). To provide additional information to address SWRCB water rights issues, the action alternatives (i.e., Yuba Accord and Modified Flow) also are compared to the No Project Alternative, which includes RD-1644 Long-term instream flow requirements and additional demands at Daguerre Point Dam (see Section 4.0). Demands at Daguerre Point Dam are increase by an additional 40 TAF under the No Project Alternative, relative to the Existing Condition, due to the expected implementation of the Wheatland Project.

To satisfy NEPA requirements, modeling simulations for the Yuba Accord Alternative and the Modified Flow Alternative are compared to the No Action Alternative.

Cumulative impact analyses are required by both CEQA and NEPA regulations and are an important component of the environmental documentation and approval process. Model output for the Yuba Accord Alternative and the Modified Flow Alternative are used to provide an indication of the potential incremental contributions of the Yuba Accord Alternative and the Modified Flow Alternative to cumulative impacts.

Table 2-1. Summary of Required CEQA and NEPA Comparative Scenarios to be Evaluated

Statute	Base Scenarios		Compared Scenarios		Purpose of Comparison
CEQA	Scenario 1	CEQA Existing Condition	Scenario 3	CEQA Yuba Accord Alternative [a]	To evaluate potential impacts of the Proposed Project and Alternatives scenarios, relative to the Existing Condition
			Scenario 4	CEQA Modified Flow Alternative	
			Scenario 2	CEQA No Project Alternative	
NEPA	Scenario 5	NEPA No Action Alternative	Scenario 6	NEPA Yuba Accord Alternative [a]	To evaluate potential impacts of the Proposed Action and Alternatives, relative to the No Action Alternative
			Scenario 7	NEPA Modified Flow Alternative	
Water Rights	Scenario 2	CEQA No Project Alternative	Scenario 3	CEQA Yuba Accord Alternative	To evaluate potential impacts of the SWRCB action.
			Scenario 4	CEQA Modified Flow Alternative	

[a] The Yuba Accord Alternative is the CEQA Proposed Project Alternative and the NEPA Proposed Action Alternative.

2.2 PROJECT STUDY AREA

The project study area is described in four regions: (1) the Yuba Region; (2) the CVP/SWP Upstream of the Delta Region; (3) the Delta Region; and (4) the Export Service Area[1]. Operations of Trinity River, Clear Creek, Shasta Reservoir and the upper Sacramento River[2], Folsom Reservoir and the lower American River will not be affected by implementation of the alternatives considered, as discussed below. Simulation of these facilities is not included in the comparative impact analysis.

2.2.1 CHARACTERIZATION OF TRINITY RIVER AND CLEAR CREEK OPERATIONS

The CVP consists of seven divisions located within the Central Valley Basin and two out-of-basin divisions (i.e., the Trinity River Division and the San Felipe Division). The Trinity River Division is the only out-of-basin division that imports water into the Central Valley (i.e., the Sacramento River Basin). Water is transported from the Trinity River Basin via the Clear Creek Tunnel to Whiskeytown Reservoir. From Whiskeytown Reservoir, Trinity River water can be transported either via a second tunnel (i.e., Spring Creek Conduit) to Keswick Reservoir or released into Clear Creek, which flows into the Sacramento River. Reclamation conducts integrated operations between the CVP Trinity River and Shasta divisions.

The Trinity River does not naturally flow into the Sacramento River Basin but is connected by the Clear Creek Tunnel and the Spring Creek Conduit to the Sacramento River system and contributes to CVP water supply. Trinity River flows enter the Sacramento River below Keswick Dam via Clear Creek, however, Sacramento River flows below Keswick Dam do not influence or re-enter the Trinity River Basin. The Trinity River and Clear Creek systems are unlike other river systems (e.g., the Sacramento, Feather, and lower American) evaluated by CALSIM II modeling because project-related changes in flow, water temperature, or reservoir storage in those systems do not alter conditions affecting the availability, rate, timing, magnitude or duration of flows in the Trinity River Basin. The flow regime established in the Trinity River ROD is the only requirement for CVP water downstream of Lewiston Dam and is

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1 For modeling purposes, the Export Service Area includes San Luis Reservoir.

2 For analytical purposes of this EIR/EIS, the upper Sacramento River includes those reaches of the Sacramento River that are located between Keswick Dam and the Feather River confluence with the Sacramento River.

not altered by the Proposed Yuba Accord. Diversions from the Trinity River to the Sacramento River occur at Lewiston Lake and CVP operators have expressed their intent to maintain diversions consistent in magnitude and temporal distribution with those that have occurred historically.

Based on the CVP system configuration described above, and upon confirmation that the Proposed Yuba Accord would not directly or indirectly affect Trinity River resources through review of hydrologic and water temperature modeling results, the Trinity River system does not require detailed study in the Draft EIR/EIS. However, Trinity, Whiskeytown, and Folsom reservoirs are included in the water temperature modeling because including them is necessary to assess Sacramento River water temperatures.

2.2.2 CHARACTERIZATION OF FOLSOM RESERVOIR AND LOWER AMERICAN RIVER OPERATIONS

Reclamation does not anticipate modifying Folsom Reservoir, Folsom Dam, or lower American River operations as a result of the Proposed Yuba Accord for the following reasons: (1) average annual inflow to Folsom Reservoir is about 2.7 MAF, slightly more than 2.5 times the active storage in the reservoir; (2) the inflow to storage ratio is so large that Folsom Dam and Reservoir is operated as an annual reservoir with typically little or no opportunity to store water assets outside of naturally occurring inflow; (3) in a case when water assets might potentially be stored in Folsom Reservoir, the likelihood that assets would be spilled due to required flood control operations would be high; and (4) lower American River flow operations are highly sensitive to, and regulated by, fishery considerations such that changes to flow regimes are undesirable and unlikely if alternative operations can accomplish CVP objectives. For these reasons, CVP operators have expressed their intention to maintain lower American River releases below Nimbus Dam consistent in magnitude and temporal distribution with those that have occurred historically. Flow and water temperature output values for Folsom Reservoir and the lower American River are automatically calculated as part of the CALSIM II and post-processing modeling runs. As part of the modeling quality assurance and quality control process, a review of the preliminary model output for the scenarios presented in Table 2-1 was conducted to verify that project-related actions would not influence or change conditions in Folsom Reservoir and the lower American River.

Based on the known operational limitations to the American River system described above, and review of the model output, the American River system does not require detailed study in the Draft EIR/EIS. However, the American River is included in the water temperature modeling application because it is required to assess Sacramento River water temperatures.

2.2.3 CHARACTERIZATION OF SHASTA RESERVOIR AND THE SACRAMENTO RIVER UPSTREAM OF THE FEATHER RIVER CONFLUENCE

According to the modeling assumptions, flows on the Sacramento River upstream of the confluence with the Feather River would not change with the implementation of the Proposed Project/Action and alternatives. Due to institutional difficulties in implementing a program allowing increases in Yuba River flow at Marysville to offset a portion of Shasta Reservoir releases, thus increasing Shasta Reservoir storage, modeling of the Proposed Project/Action and alternatives did not include this option. According to modeling rules:

- Increases in Yuba River flow at Marysville can result in increased Oroville Reservoir storage, increased Delta exports, or increased Delta outflow.
- Decreases in Yuba River flow at Marysville in wet, above normal, or below normal years when the Delta is in balanced conditions, will be offset by an increase in releases from Oroville Reservoir.
- Decreases in Yuba River flow at Marysville in dry or critical years when the Delta is in balanced conditions, will be offset by a reduction in Banks pumping.
- Decreases in Yuba River flow at Marysville when the Delta is in excess conditions will be offset by a decrease in Delta outflow.

The only case in which Shasta Reservoir storage and Sacramento River flows upstream of the confluence with the Feather River could be affected by changes in Yuba River flow at Marysville is in the second case described above. Rather than by just increasing releases from Oroville Reservoir, a portion of the decrease could be offset by increases in Shasta Reservoir releases. But, an evaluation of the occurrence of these conditions indicates they are extremely unlikely (occurring in less than 2.5 percent of months during the 72-year simulation period for the Proposed Project/Action), and are relatively small compared to the total flow in the Sacramento River, particularly when divided according to the COA rules (55 percent CVP, 45 percent SWP). Accordingly, modeling assumed all operational changes would occur in the Feather River and Oroville Reservoir. In addition, conversations with SWP operations staff indicated that, with appropriate notice from YCWA to the SWP, changes in Yuba River flow could be accommodated by Oroville Reservoir releases, and included in the real-time COA accounting between the CVP and SWP.

3.0 MODELS USED FOR THE IMPACT ANALYSIS

Computer simulation models of water systems provide a means for evaluating changes in system characteristics such as reservoir storage, stream flow, and hydropower generation, as well as the effects of these changes on environmental parameters such as water temperature, water quality, and early life stage Chinook salmon survival. The models and post-processing tools used to simulate conditions with and without implementation of the Proposed Project/Action and alternatives include the following:

- Reclamation and DWR simulation model of the integrated CVP and SWP system operations (CALSIM II);
- Spreadsheet-based Yuba Project Model (YPM);
- Lower Yuba River Water Temperature Model (LYRWTM);
- Lower Yuba River Outflow Routing Tool;
- Reclamation Trinity, Shasta, Whiskeytown, Oroville, and Folsom reservoir water temperature models;
- Reclamation Feather, and Sacramento river water temperature models;
- Reclamation Feather, and Sacramento river early life stage Chinook salmon mortality models;
- Graphical and Tabular Analysis for Environmental Resources (GATAER) Tool
- DWR Delta hydrodynamic and water quality model (DSM 2);

- Sacramento-San Joaquin Delta Fish Salvage Analyses; and
- CVP and SWP (Project) Hydropower Production and Delta Export Pumping Power Demand Analysis

The CALSIM II model provides baseline monthly simulation of the CVP and SWP water operations (reservoir inflows, releases, and storage; river flow; and other operating parameters such as CVP/SWP pumping and Delta operations) without implementation of the Proposed Yuba Accord. The YPM provides the Yuba River outflow resulting from the Proposed Yuba Accord operations in the Yuba River Basin. Output from these two models is used as input to the Proposed Yuba Accord Routing Tool to develop the system-wide Yuba Accord operations and to produce a modified or "*virtual*" CALSIM II output database. This database contains the final Proposed Yuba Accord operations as if they had been computed in the CALSIM II model. This step allows the use of the current interface between the CALSIM II model and other models used in the simulation process.

The virtual CALSIM II output databases is used to generate the inputs required for the DSM2, water temperature, fish salvage, and power models. Output from LYRWTM is used as a boundary condition for the temperature models. The water temperature models output is subsequently used to generate the inputs to the early life stage Chinook salmon mortality models. The output or results, of all these models is used to generate a model simulation database. Finally, the GATAER tool is used to generate the information needed for the impact analysis in the form of tables and graphs of model results. These models and related post-processing tools are described in detail in the following sections.

A diagram of the modeling and post-processing applications is presented in **Figure 3-1**.

3.1 CALSIM II MODEL

CALSIM II was jointly developed by Reclamation and DWR for planning studies relating to CVP and SWP operations. The primary purpose of CALSIM II is to evaluate the water supply reliability of the CVP and SWP at current or future levels of development (e.g. 2001, 2020), with and without various assumed future facilities, and with different modes of facility operations.

Geographically, the model covers the drainage basin of the Delta, and SWP exports to the San Francisco Bay Area, Central Coast, and Southern California.

CALSIM II typically simulates system operations for a 73-year period using a monthly time-step. The model assumes that facilities, land use, water supply contracts, and regulatory requirements are constant over this period, representing a fixed level of development (e.g., 2001 or 2020). The historical flow record of October 1921 to September 1994, adjusted for the influence of land use change and upstream flow regulation, is used to represent the possible range of water supply conditions. It is assumed that past hydrologic conditions are a good indicator of future hydrologic conditions. Major Central Valley rivers, reservoirs, and CVP/SWP facilities are represented by a network of arcs and nodes. CALSIM II uses a mass balance approach to route water through this network.

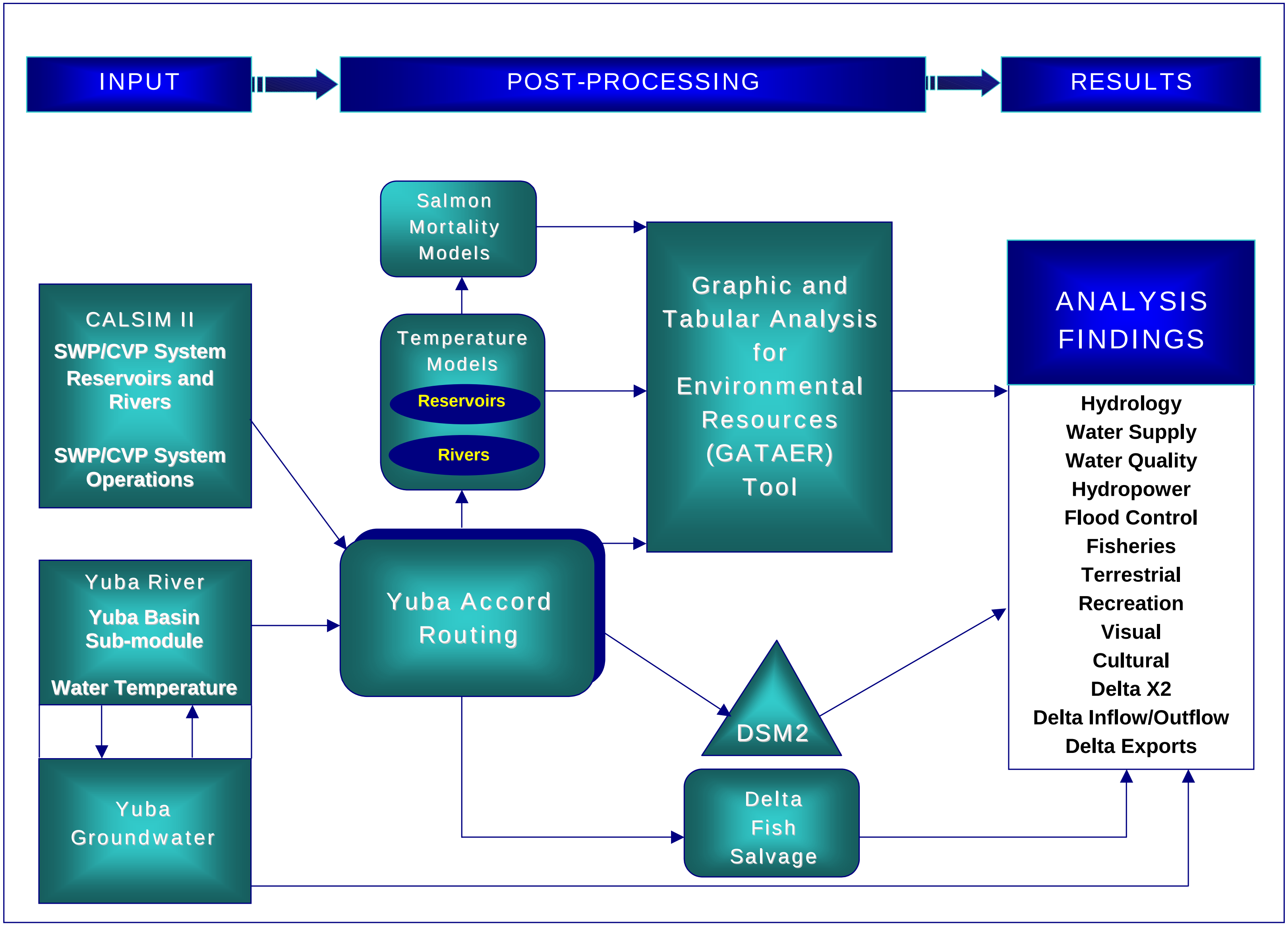

Figure 3-1. Modeling and Post-Processing Procedures

The model simulates one month of operation at a time, with the simulation passing sequentially from one month to the next, and from one year to the next. Each determination that the model makes regarding stream flow is the result of defined operational priorities (e.g. delivery priorities to water right holders, and water contractors), physical constraints (e.g., storage limitations, available pumping and channel capacities), and regulatory constraints (flood control, minimum instream flow requirements, Delta outflow requirements). Certain decisions, such as the definition of water year type, are triggered once a year, and affect water delivery allocations and specific stream flow requirements. Other decisions, such as specific Delta outflow requirements, vary from month to month. CALSIM II output contains estimated flows and storage conditions at each node for each month of the simulation period. Simulated flows are mean flows for the month, reservoir storage volumes correspond to end-of month storage.

CALSIM II models a complex and extensive set of regulatory standards and operations criteria. Descriptions of both are contained in Chapter 8 of the OCAP BA (Reclamation 2004b), and in the Benchmark Studies Assumptions Document (Reclamation and DWR 2002).

CALSIM II simulates monthly operations of the following water storage and conveyance facilities:

- Trinity, Lewiston, and Whiskeytown reservoirs (CVP);
- Spring Creek and Clear Creek tunnels (CVP);
- Shasta and Keswick reservoirs (CVP);
- Oroville Reservoir and the Thermalito Complex (SWP);
- Folsom Reservoir and Lake Natoma (CVP);
- New Melones Reservoir (CVP);
- Millerton Lake (CVP);
- Jones (CVP), Contra Costa (CVP) and Banks (SWP) pumping plants; and
- San Luis Reservoir (shared by CVP and SWP).

To varying degrees, nodes also define CVP/SWP conveyance facilities including the Tehama-Colusa, Corning, Folsom-South, and Delta-Mendota canals and the California Aqueduct. Other non-CVP/SWP reservoirs or rivers tributary to the Delta also are modeled in CALSIM II, including:

- New Don Pedro Reservoir;
- Lake McClure; and
- Eastman and Hensley lakes.

For this EIS/EIR, CALSIM II is used to establish baseline flow conditions in the Sacramento River, Feather River, and Delta, and the availability of pumping capacity at Banks and Jones pumping plants. CALSIM II output includes average monthly X2 (2 parts per thousand [ppt] near bottom salinity isohaline) location, Net Delta Outflow, and Delta export-to-inflow (E/I) ratio.

CALSIM II modeling undertaken for Reclamation's OCAP BA is used to provide the foundation for CVP/SWP system-wide baseline conditions (stream flow, storage, and diversions) used to represent the Existing Condition (CEQA basis of comparison) and the future No Action Alternative (NEPA basis of comparison). OCAP model simulations were rerun (OCAP Study 3 and OCAP Study 5) with updated inputs for lower Yuba River outflow to the Feather River, lower Yuba River diversions at Daguerre Point Dam, and Trinity River instream flow requirements downstream of Lewiston Dam.

3.2 YUBA PROJECT MODEL

The spreadsheet-based YPM simulates operations of New Bullards Bar and Englebright dams, diversions at Daguerre Point Dam, and flows in the lower Yuba River between Englebright Dam and its confluence with the Feather River. The model is a volumetric mass balance accounting tool, which simulates reservoir operations according to a set of pre-defined operating rules and to meet downstream water demands and instream flow requirements on the lower Yuba River.

A schematic of the model is presented in **Figure 3-2**. Additional details are presented in Attachment A.

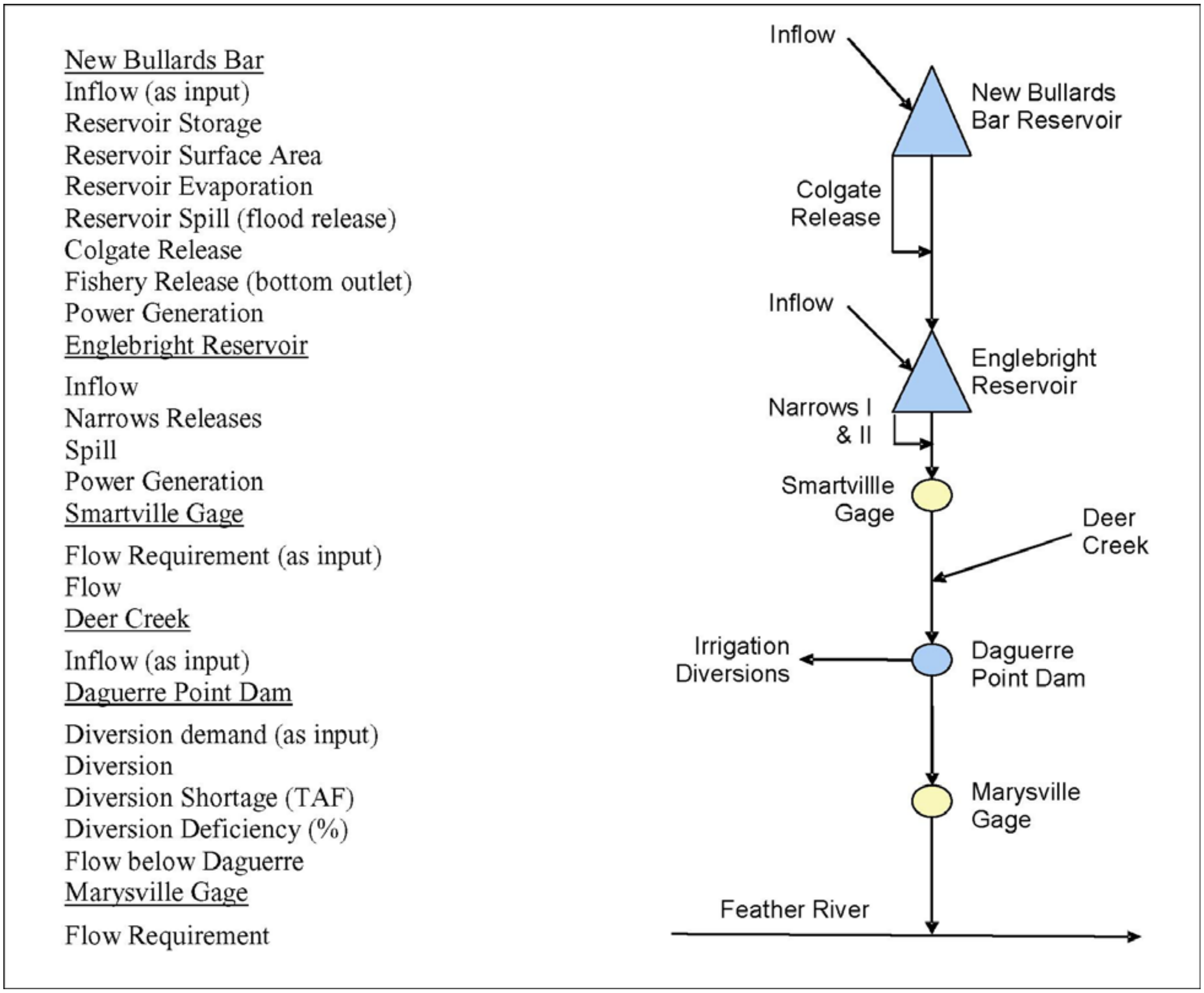

Figure 3-2. Lower Yuba River Model Network Schematic and Output

3.3 LOWER YUBA RIVER WATER TEMPERATURE MODEL

Due to limited available water temperature and meteorological data, a statistical rather than a physically based water temperature model was developed to evaluate the potential impacts of the alternatives considered in the Draft EIR/EIS. The statistical model is used to estimate the effects of various New Bullards Bar Reservoir storage regimes, flow releases, and diversions at

Daguerre Point Dam on water temperatures in the lower Yuba River. The statistical model is used to compare water temperatures between alternatives. The statistical model is not used to predict absolute water temperatures in the lower Yuba River.

The Proposed Yuba Accord modeling approach relies on further developing the statistical model utilized for the 2000 SWRCB Lower Yuba River Hearings. The statistical relationships previously developed for calculating predicted water temperatures were enhanced through extension of the historical data set used for model calibration. The statistical relationships used in the model developed for the 2000 SWRCB Lower Yuba River Hearings were based on historical data collected between 1990 and 1999. Now, five more years of data are available and have been incorporated into the revised model.

The statistical model consists of five sub-models that can be used to calculate water temperatures at the following locations:

- New Bullards Bar Dam low-level outlet
- New Colgate Powerhouse release
- Narrows I and II powerhouse release (assumed equal to water temperatures at the Smartville Gage)
- Daguerre Point Dam
- Marysville Gage

Additional information is provided in Attachment B**.**

3.4 LOWER YUBA RIVER OUTFLOW ROUTING TOOL

The lower Yuba River outflow routing tool is an Excel-based post-processing tool that uses output from CALSIM II and the YPM to simulate how changes in Yuba River flow at Marysville effect downstream flows in the Feather River, lower Sacramento River and Delta.

The starting point for the routing tool are CALSIM II simulations of CVP and SWP operations under the Yuba Accord accounting baseline, as defined in the Water Purchase Agreement. The Accord accounting baseline is used to determine Released Transfer Water under the Water Purchase Agreement, and includes RD-1644 interim instream flow requirements on the lower Yuba River, and FERC License 2246 instream flow requirements of 400 cfs at the Marysville Gage for the period October 1 to 14. Two CALSIM II simulations are performed, one for a present level of development based on OCAP Study 3 used for the CEQA analysis, one for a future level of development based on OCAP Study 5 used for the NEPA analysis. Input to the routing tool from a CALSIM II simulation includes Oroville reservoir storage, Feather River and lower Sacramento River flows, and Delta inflows, exports, and outflow.

The YPM is used to simulate flows in the lower Yuba River for each modeling scenario. Input to the routing tool from a YPM simulation is the lower Yuba River flow at the Marysville Gage.

The routing tool subsequently adjusts releases from Oroville Reservoir and CVP/SWP Delta exports to account for the changes in the lower Yuba River outflow under a specific scenario (e.g. CEQA Yuba River Accord) compared to the accounting baseline condition (RD-1644 Interim flows requirements). The modified reservoir storage, river flows, and Delta inflows, exports and outflow from the routing tool are stored in DSS so creating the virtual CALSIM II output database that is used by other post-processing tools.

The lower Yuba River outflow routing tool is a very efficient method of modeling the Proposed Project/Action and alternatives. The tool is necessary because the CALSIM II model is not presently configured to simulate the range of actions contemplated and evaluated in the Draft EIR/EIS. CVP and SWP operators have acknowledged their ability to limit the effects of the Yuba Accord to the Feather River, lower Sacramento River, and Delta through the use of forecasting, real-time accounting, and adjustment of the COA balance. CALSIM II is not set up to model this operational flexibility.

3.5 BUREAU OF RECLAMATION WATER TEMPERATURE MODELS

Reclamation has developed water temperature models for the Sacramento, Feather, and American rivers. The models have both reservoir and river components to simulate water temperatures in five major reservoirs (Trinity, Whiskeytown, Shasta, Oroville, and Folsom); four downstream regulating reservoirs (Lewiston, Keswick, Thermalito, and Natoma); and three main river systems (Sacramento, Feather, and American).

The following sections provide additional detail regarding the reservoir and river components of the water temperature models, respectively. Additional details regarding Reclamation's water temperature models are well documented in the CVPIA "*Draft Programmatic EIS (PEIS) Technical Appendix, Volume Nine*" (Reclamation 1997). These water temperature models also are documented in the report titled: "*U.S. Bureau of Reclamation Monthly Temperature Model Sacramento River Basin*" (Reclamation 1990).

3.5.1 BUREAU OF RECLAMATION'S RESERVOIR WATER TEMPERATURE MODELS

Reclamation's reservoir models simulate monthly water temperature profiles in five major reservoirs: Trinity, Whiskeytown, Shasta, Oroville, and Folsom. The vertical water temperature profile in each reservoir is simulated in one dimension using monthly storage, inflow and outflow water temperatures and flow rates, evaporation, precipitation, solar radiation, and average air temperature. The models also compute the water temperatures of dam releases. Release water temperature control measures in reservoirs, such as the penstock shutters in Folsom Reservoir and the temperature control device in Shasta Reservoir, are incorporated into the models.

Reservoir inflows, outflows, and end-of-month storage calculated by CALSIM II and post-processing applications are input into the reservoir water temperature models. Additional input data include meteorological information and monthly water temperature targets that are used by the model to select the level from which reservoir releases are drawn. Water temperature control devices, such as the outlet control device in Shasta Dam, the temperature curtains in Whiskeytown Dam, and the penstock shutters in Folsom Dam are incorporated into the simulation. Model output includes reservoir water temperature profiles and water temperatures of the reservoir releases. The reservoir release water temperatures are then used in the downstream river water temperature models, as described in the next section.

Trinity, Whiskeytown, and Folsom reservoirs are included in the modeling application because they are required to assess Sacramento River water temperatures; however, these reservoirs are not individually analyzed because there would be no change in CVP/SWP project operations due to implementation of the Proposed Project/Action or an alternative, relative to the bases of comparison (see Section 6.1).

3.5.2 BUREAU OF RECLAMATION'S RIVER WATER TEMPERATURE MODELS

Reclamation's river water temperature models utilize the calculated temperatures of reservoir releases, much of the same meteorological data used in the reservoir models, and CALSIM II and post-processing application outputs for river flow rates, gains and water diversions. Mean monthly water temperatures are calculated at multiple locations on the Sacramento, Feather, and American rivers.

Reservoir release rates and water temperatures are the boundary conditions for the river water temperature models. The river water temperature models compute water temperatures at 52 locations on the Sacramento River from Keswick Dam to Freeport, and at multiple locations on the Feather and American rivers. The river water temperature models also calculate water temperatures within Lewiston, Keswick, Thermalito, and Natoma reservoirs. The models are used to estimate water temperatures in these reservoirs because they are relatively small bodies of water with short residence times; thereby, on a monthly basis, the reservoirs act as if they have physical characteristics approximating those of riverine environments.

The American River is included in the modeling application because it is required to assess Sacramento River water temperatures. However, Folsom Reservoir and the lower American River are not included in post-processing modeling because of the annual high refill and spill potential at Folsom Reservoir; therefore, the modeling assumes no change in Folsom Reservoir storage/elevations or lower American River flows with implementation of the Proposed Project/Action or an alternative, relative to the bases of comparison (see Section 6.1).

3.6 BUREAU OF RECLAMATION'S EARLY LIFE STAGE CHINOOK SALMON MORTALITY MODELS

Water temperatures calculated for specific reaches of the Sacramento and Feather rivers are used as inputs to Reclamation's Early Life Stage Chinook Salmon Mortality Models (Salmon Mortality Models) to estimate annual mortality rates of Chinook salmon during specific early life stages. For the Sacramento River analyses, the model estimates mortality for each of the four Chinook salmon runs: fall, late fall, winter, and spring. For the Feather River analyses, the model[3] produces estimates of fall-run Chinook salmon mortality. Because hydrologic conditions in the Yuba River are not characterized in Reclamation's current Salmon Mortality Models, it is not possible to estimate changes in early life stage mortality for Chinook salmon in the lower Yuba River.

The Salmon Mortality Models produce a single estimate of early life stage Chinook salmon mortality in each river for each year of the simulation. The overall salmon mortality estimate consolidates estimates of mortality for three separate Chinook salmon early life stages: (1) pre-spawned (in utero) eggs; (2) fertilized eggs; and (3) pre-emergent fry. The mortality estimates

[3] For the purposes of improved technical accuracy and analytical rigor, simulated Chinook salmon early life stage survival estimates specific to the Feather River are derived from a revised version of Reclamation's Salmon Mortality Model (2004), which incorporates new data associated with: (1) temporal spawning and pre-spawning distributions; and (2) mean daily water temperature data in the Feather River. Although the updated Feather River information serving as input into the model deviates slightly from that which was used in Reclamation's OCAP BA, both versions of the model are intended for planning purposes only, and thus should not be used as an indication of actual real-time in-river conditions. Because a certain level of bias is inherently incorporated into these types of planning models, such bias is uniformly distributed across all modeled simulations, including both the Proposed Project/Action and alternatives and the bases of comparison, regardless of which version of the model is utilized.

are computed using output water temperatures from Reclamation's water temperature models as inputs to the Salmon Mortality Models. Thermal units (TUs), defined as the difference between river water temperatures and 32°F, are used by the Salmon Mortality Models to track life stage development, and are accounted for on a daily basis. For example, incubating eggs exposed to 42°F water for one day would experience 10 TUs. Fertilized eggs are assumed to hatch after exposure to 750 TUs. Fry are assumed to emerge from the gravel after being exposed to an additional 750 TUs following hatching.

Because the models are limited to calculating mortality during early life stages, they do not evaluate potential impacts to later life stages, such as recently emerged fry, juvenile out-migrants, smolts, or adults. Additionally, the models do not consider other factors that may affect early life stage mortality, such as adult pre-spawn mortality, instream flow fluctuations, redd superimposition, and predation. Because the Salmon Mortality Models operate on a daily time-step, a procedure is required to convert the monthly water temperature output from the water temperature models into daily water temperatures. The Salmon Mortality Models compute daily water temperatures based on the assumption that average monthly water temperature occurs on the 15th of each month, and interpolate daily values from mid-month to mid-month. Output from the Salmon Mortality Models provide estimates of annual (rather than monthly mean) losses of emergent fry from egg potential (i.e., all eggs brought to the river by spawning adults) (Reclamation 2003).

A similar water temperature based mortality model for steelhead in the Sacramento, Feather and Yuba rivers currently is not available. However, because the temporal and spatial spawning distributions of steelhead and late fall-run Chinook salmon are similar, it can be assumed that water temperature changes and resultant losses of steelhead eggs and fry would be similar to those estimated for late fall-run Chinook salmon using the Salmon Mortality Models, where available.

3.6.1 LOWER FEATHER RIVER EARLY LIFE STAGE CHINOOK SALMON MORTALITY MODEL REVISIONS

During March 2004, Reclamation's Salmon Mortality Model was revised to include updated information regarding the temporal distribution of Chinook salmon spawning activity in the lower Feather River. The revised Feather River Salmon Mortality Model estimates the water temperature-induced early life stage mortality using updated pre-spawning and spawning temporal distributions, which were derived from estimated daily carcass distributions. Estimated daily carcass distributions were derived from daily observations of Chinook salmon carcasses during the 2002 spawning period. Additional information regarding the use of carcass survey data as a basis for development of pre-spawning and spawning temporal distributions in the Feather River, is described in the Oroville Facilities Relicensing, FERC Project 2100, Study Plan F-10 – "*Task 2C: Evaluation of the Timing, Magnitude, and Frequency of Water Temperatures and Their Effects on Chinook Salmon Egg and Alevin Survival*" (DWR 2004).

While the revised Feather River Salmon Mortality Model utilizes updated pre-spawning and spawning temporal distributions as bases from which to calculate early life stage mortality, the remaining model assumptions, computations, and input variables remain unchanged from Reclamation's Feather River Early Life Stage Chinook Salmon Mortality Model.

3.6.2 OTHER SALMON MORTALITY MODEL CONSIDERATIONS

Three separate reviews of the NMFS October 2004 BO on the Long-term CVP and SWP OCAP (NMFS 2004) have been conducted to determine whether NMFS (2004) used the best available scientific and commercial information (2005).

McMahon (2006) acknowledged that a lack of information on how water operations related habitat alterations affect Central Valley salmonid populations exists. In this context, McMahon (2006) concluded that, "*…the Biological Opinion (BO) appears to be based on best available information with regards to temperature effects on survival of salmonid embryos and early fry in the upper Sacramento River and major tributaries…*".

Maguire (2006) reported two general concerns related to the salmon mortality model. First, Maguire (2006) stated, "*The mean monthly temperature may in fact be of little predictive value for mortality estimation without knowing (using) the variability and duration of variability.*" Second, Maguire (2006) suggested that the salmon mortality model is of limited usefulness because it does not evaluate potential impacts on emergent fry, smolts, juvenile emigrants, or adults, and the model only considers water temperature as a source of mortality.

With respect to the application of the salmon early life stage mortality model in NMFS (NMFS 2004), three concerns were reported within the California Bay-Delta Authority (CBDA) report (California Bay-Delta Authority 2005). First, CBDA (2005) questioned the use of water temperature predictions that were developed by linear interpolation between monthly means without accounting for variation. Second, water temperature at the time of spawning was taken as an index of pre-spawning water temperature exposure, which reportedly may be an unsatisfactory approach for spring-run Chinook salmon, which may hold in the river throughout the summer. Lastly, and reportedly the expert panel's most serious concern, "*…the data used to develop the relationships between temperature and mortality on eggs, alevins, and especially gametes was not the best available.*"

To address these three concerns, the expert panel recommended that NMFS should: (1) perform a thorough analysis of the data, relationships, and calculations of the salmon mortality model; (2) investigate how variation around monthly mean water temperatures would affect salmon mortality model results; and (3) suggest or make improvements to the model. It is uncertain whether NMFS will accept these recommendations and undertake these efforts to address the concerns raised with technical details of the salmon mortality model. At this time, this process has not been undertaken and salmon mortality model improvements have not been identified and incorporated into the model. Therefore, the existing salmon mortality model is the best available model for comparing the potential water temperature related effects of the Proposed Project/Action and alternatives on Chinook salmon early life stages to those of the basis of comparison.

3.7 GRAPHIC AND TABULAR ANALYSIS OF ENVIRONMENTAL RESOURCES TOOL

The GATAER Tool produces figures and tables for the analysis of output from CALSIM II, the water temperature models, salmon mortality models, and other post-processing applications. Data are loaded from these models into a DSS database, which is then used as input to a series of spreadsheets that generate the figures and tables for use in the environmental resource analyses. The figures and tables generated for the evaluation of specific resource topics and impacts is included in Appendix F4, *Graphical and Tabular Analysis of Environmental Resources – Summary and Technical Output*, of the Draft EIR/EIS.

3.8 DELTA SIMULATION MODEL 2

The Delta Simulation Model 2 (DSM2) is a branched one-dimensional model for simulation of hydrodynamics, water quality and particle tracking in a network of riverine or estuarine channels (DWR 2002). The hydrodynamic module can simulate channel stage, flow and water velocity. The water quality module can simulate the movement of both conservative and non-conservative constituents. The model is used by DWR to perform operational and planning studies of the Delta.

Impact analysis for planning studies of the Delta is typically performed for a 16-year period 1976 to 1991. In model simulations, EC is typically used as a surrogate for salinity. Results from CALSIM II and the post-processing analysis (i.e., Yuba River Outflow Routing Tool) are utilized to define Delta boundary inflows. CALSIM II derived boundary inflows include the Sacramento River flow at Hood, the San Joaquin River flow at Vernalis, inflow from the Yolo Bypass, and inflow from the Eastside streams. In addition, the Net Delta Outflow from CALSIM II is used to calculate the salinity boundary at Martinez.

Details of the model, including source codes and model performance, are available from the DWR, Bay-Delta Office, Modeling Support Branch Web site (http://modeling.water.ca.gov /delta/models/dsm2/index.html). Documentation on model development is discussed in the annual reports to the SWRCB, *Methodology for flow and salinity estimates in the Sacramento-San Joaquin Delta and Suisun Marsh* of the Delta Modeling Section of DWR.

3.9 SACRAMENTO-SAN JOAQUIN DELTA FISH SALVAGE EVALUATION

The CVP and SWP export facilities (including the Skinner Fish Facility and the Tracy Fish Collection Facility) that pump water from the Delta can directly affect fish mortality in the Delta through entrainment and associated stresses resulting from CVP/SWP export pumping operations. This section describes the methodology and assumptions that is used to evaluate these potential impacts. The evaluation uses historical fish salvage data from the CVP and SWP pumping plants to evaluate the overall effect of changes in Delta exports.

3.9.1 SALVAGE

Salvage operations at the CVP and SWP export facilities are performed to reduce the number of fish adversely affected by entrainment (direct loss). Salvage estimates are defined as the number of fish entering a salvage facility and subsequently returned to the Delta through a trucking and release operation. Because the survival of species that are sensitive to handling is believed to be low for most fish species, increased salvage is considered an adverse impact and decreased salvage is considered a beneficial impact on Delta fisheries resources.

Historical salvage records provide data for delta smelt, Chinook salmon, steelhead, and striped bass at both the CVP and SWP facilities. These data were used to develop estimates of salvage loss. During the historical period, 1993 to 2003, the CVP and SWP facilities were operated under Delta water quality, flow, and export constraint requirements that varied over the period and were different than the Delta requirements in place today. This suggests that the historical fish salvage was likely higher than it would be if the 1993 to 2003 period reoccurred with the CVP/SWP facilities operated under today's Delta requirements, as is assumed in this analysis.

Consistent with prior Reclamation assumptions (Reclamation 2004b), it is assumed that changes in salvage are directly proportional to changes in the amount of water pumped (i.e., doubling the amount of water exported doubles the number of fish salvaged). Salvage analyses are performed for winter-run Chinook salmon, spring-run Chinook salmon, steelhead, striped bass, and delta smelt to develop estimates of the relative impacts of CVP and SWP pumping operations under the various modeling scenarios. The evaluation uses historical fish salvage data from the CVP and SWP pumping plants to evaluate changes in Delta exports (increased pumping) and the resultant changes in salvage for various fish species in the Delta. The available historical salvage data extends from 1993 to 2003 for delta smelt, Chinook salmon, steelhead, and striped bass. The salvage data prior to 1993 does not sufficiently represent the current conditions in the Delta due to operational changes. Since 1993, the salvage data provides daily densities, in numbers of fish salvaged per thousand acre-feet pumped at the CVP Jones Pumping Plant and the SWP Banks Pumping Plant.

Populations of some of the listed species, such as winter-run Chinook salmon, are continuously variable and the geographical and temporal distribution of the population can be different today from what they were during the 1993 to 2003 period. Because of this, neither the timing, duration, nor the quantity of water needed for most export curtailments can be accurately estimated until shortly before an action is scheduled.

In response to NMFS issuance of a final rule (71 FR 17757 (2006)) listing the Southern DPS of North American green sturgeon as threatened under the ESA, Reclamation is in the process of developing a methodology for calculating green sturgeon salvage estimates at the CVP and SWP export pumping facilities in the Delta. If a methodology is developed prior to completion of the EIR/EIS for the Proposed Yuba Accord, it is anticipated that salvage estimates for green sturgeon also would be conducted.

3.9.2 MODELING

Salvage analyses is performed to develop an indication of the relative changes in CVP and SWP pumping operations under the various modeling scenarios evaluated in the Draft EIR/EIS. Salvage densities are developed for the purposes of evaluating the incremental effects of potential operations on the direct losses at the Delta export facilities. Calculations of salvage at the CVP and SWP facilities, as a function of changes in the seasonal volume of water diverted, have been used as an indicator of potential effects resulting from changes in water project operations. The magnitude of direct salvage resulting from export operations is a function of the magnitude of monthly water exports from each facility and the density (number per acre-foot) of fish susceptible to entrainment at the facilities.

Data selected for use in these analyses extended over a period from 1993 to 2003. The salvage densities are derived using historic records of species-specific salvage at the CVP and SWP facilities, which are used to calculate average monthly density (number of fish per thousand acre-feet), and then are multiplied by the calculated CVP and SWP monthly exports (in thousand acre-feet) obtained from the hydrologic modeling output to estimate direct salvage. The salvage estimates are calculated separately for the CVP and SWP export operations for all modeling scenarios.

Average monthly salvage densities for each species are calculated from daily salvage records over the period from 1993 to 2003 (pers. comm. M. Chotkowski, Reclamation *in* (Reclamation 2004a). Based on the daily salvage, expanded for sub-sampling effort, a daily density estimate is calculated using the actual water volume diverted at each of the two export facilities. The daily density estimates are averaged to calculate an average monthly density. For consistency, the average monthly density of each of the individual target species are used to calculate the estimated salvage using hydrologic modeling results for each modeling scenario. After calculating the monthly salvage estimates for each species, the baseline (or basis of comparison scenario) estimate are subtracted from the monthly salvage estimate for each species to determine the net difference in salvage estimates for the various scenarios.

Results of the hydrologic modeling provide estimates of the average monthly Delta export operations for both the CVP and SWP. Because hydrologic conditions may affect salvage densities, the average salvage densities are calculated separately for wet years (i.e., wet and above normal water years using the Sacramento Valley 40-30-30 Index) and dry years (i.e., below normal, dry, and critical water years using the Sacramento Valley 40-30-30 Index). Estimates of direct salvage from CVP and SWP facilities are calculated for Chinook salmon, steelhead, delta smelt, and striped bass, and then are used to determine the incremental benefits (reduced salvage) and impacts (increased salvage) calculated for each modeling scenario.

Despite the inaccuracies within the analyses caused by assuming historical fish salvage at the pumping plants, the evaluations are performed to provide an approximate quantification of the overall potential impacts with implementation of the alternatives, using the best available data. Without some quantification, the discussion and analyses of potential changes in fish salvage and the cost of exporting water would have to be qualitative and based solely on scientific opinion. Therefore, the results provided by the analyses must be considered as only part of the information (quantitative and qualitative) that are used to evaluate the potential effects in the Delta.

3.10 PROJECT HYDROPOWER PRODUCTION AND DELTA EXPORT PUMPING POWER DEMAND EVALUATION

CVP project hydropower impacts are assessed using the LongTermGen Model, which is a CVP power model developed to estimate the CVP power generation, capacity, and project use based on the operations defined by a CALSIM II simulation. Created using Microsoft's Excel spreadsheet with extensive Visual Basic programming, the LongTermGen Model computes monthly generation, capacity, and project use (pumping power demand) for each CVP power facility for each month of the CALSIM II simulation.

The LongTermGen model does not compute hydropower production for Oroville Reservoir or pumping power use for SWP pumping plants. To assess any changes in Oroville power production, equations were developed relating reservoir storage and release to generation and capacity, using historical data. These relationships were incorporated into an Excel 2000 spreadsheet that uses CALSIM II (or post-processing tool) output data as input.

Although the LongTermGen Model can calculate export pumping power demand for the CVP pumping plant at the Jones Pumping Plant, it does not calculate SWP export pumping power demand at the Banks Pumping Plant. Water pumped at Banks Pumping Plant can gravity flow to O'Neill Forebay, but water pumped at Jones Pumping Plant requires an additional lift at O'Neill Pumping Plant. The combined pumping power requirement at Jones and O'Neill is approximately equal to that of Banks Pumping Plant. For this reason, and because CVP or SWP water may be pumped at either Delta export facility, the Banks, and Jones plus O'Neill, pumping power demand was calculated using a plant requirement of 298 kilowatthours/acre-foot times the volume of water pumped at either facility. An Excel spreadsheet is used to calculate the resultant pumping power demand using input from the CALSIM II (or post-processing tool) simulations.

3.11 MODEL LIMITATIONS

Reclamation's OCAP BA outlines the limitations of three of the models that were used in the assessment conducted for the most recent Section 7 consultations on the OCAP, which led to NMFS and USFWS BOs for winter-run and spring-run Chinook salmon, steelhead, and delta smelt. These models (i.e., CALSIM II, water temperature, and salmon mortality) are the same models used to conduct the modeling analysis presented in the Draft EIR/EIS for the Proposed Yuba Accord. The following discussion regarding the model limitations used in the modeling analysis is taken directly from the CVP and SWP OCAP BA.

> "*The main limitation of CALSIM II and the temperature models used in the study is the time-step. Mean monthly flows and temperatures do not define daily variations that could occur in the rivers due to dynamic flow and climatic conditions. However, monthly results are still useful for general comparison of alternatives. The temperature models are also unable to accurately simulate certain aspects of the actual operations strategies used when attempting to meet temperature objectives, especially on the upper Sacramento River. To account for the short-term variability and the operational flexibility of the system to respond to changing conditions, cooler water than that indicated by the model is released in order to avoid exceeding the required downstream temperature target. There is also uncertainty regarding performance characteristics of the Shasta TCD [temperature control device]. Due to the hydraulic characteristics of the TCD, including leakage, overflow, and performance of the side intakes, the model releases are cooler than can be achieved in real-time operations; therefore, a more conservative approach is taken in real-time operations that is not fully represented by the models.*
>
> *The salmon model is limited to temperature effects on early life stages of Chinook salmon. It does not evaluate potential direct or indirect temperature impacts on later life stages, such as emergent fry, smolts, juvenile out-migrants, or adults. Also, it does not consider other factors that may affect salmon mortality, such as in-stream flows, gravel sedimentation, diversion structures, predation, ocean harvest, etc. Since the salmon mortality model operates on a daily time-step, a procedure is required to utilize the monthly temperature model output. The salmon model computes daily temperatures based on linear interpolation between the monthly temperatures, which are assumed to occur on the 15th day of the month.*
>
> *CALSIM II cannot completely capture the policy-oriented operation and coordination the 800,000 of dedicated CVPIA 3406 (B)(2) water and the CALFED EWA. Because the model is set up to run each step of the 3406(B)(2) on an annual basis and because the WQCP and ESA actions are set on a priority basis that can trigger actions using 3406(b)(2) water or EWA assets, the model will exceed the dedicated amount of 3406(b)(2) water that is available. Moreover, the 3406(b)(2) and EWA operations in CALSIM II are just one set of plausible actions aggregated to a monthly representation and modulated by year type. However, they do not fully account for the potential weighing of assets versus cost or the dynamic influence of biological factors on the timing of actions. The monthly time-step of CALSIM II also requires day-weighted monthly averaging to simulate minimum instream flow levels, VAMP actions, export reductions, and X2-based operations that occur within a month. This averaging can either under- or over-estimate the amount of water needed for these actions.*

> *Since CALSIM II uses fixed rules and guidelines results from extended drought periods might not reflect how the SWP and CVP would operate through these times. The allocation process in the modeling is weighted heavily on storage conditions and inflow to the reservoirs that are fed into the curves mentioned previously in the Hydrologic Modeling Methods section beginning on page 8-1 and does not project inflow from contributing streams when making an allocation. This curve based approach does cause some variation in results between studies that would be closer with a more robust approach to the allocation process*" (Reclamation 2004).

Because both the lower Yuba River outflow routing tool and DSM2 use output from CALSIM II planning studies, they share the same limitations as the CALSIM II model. The routing tool uses fixed operating rules to make decisions regarding CVP/SWP reservoir releases and changes to Delta exports. These rules were reviewed by Reclamation and DWR for consistency with CVP/SWP operator decisions. However, the fixed rules cannot capture the flexible and adaptive management of CVP/SWP operators.

Model assumptions and results are generally believed to be more reliable for comparative purposes than for absolute predictions of conditions. All of the assumptions are the same for both the with-project and without-project model runs, except assumptions associated with the action itself, and the focus of the analysis is the differences in the results. For example, model outputs for the Proposed Project/ Action can be compared to that of the CEQA No Project and NEPA No Action simulations. Results from a single simulation may not necessarily correspond to actual system operations for a specific month or year, but are representative of general water supply conditions. Model results are best interpreted using various statistical measures such as long-term and year-type average, and probability of exceedance.

4.0 CEQA/NEPA MODEL SCENARIOS

The full suite of CEQA and NEPA modeling scenarios developed to represent existing and future hydrologic conditions expected to occur with and without implementation of the alternatives considered for the Proposed Yuba Accord (i.e., Yuba Accord Alternative and Modified Flow Alternative) and evaluated in the Draft EIR/EIS are presented in **Table 4-1**. Because Reclamation's OCAP Study 3 and Study 5 are used as foundational studies, these studies also are presented in Table 4-1, so that the reader may compare specific assumptions that have been modified for each of the CEQA and NEPA modeling scenarios developed for the Proposed Yuba Accord. Details on the assumptions included in each of the scenarios are included in footnotes after the table. The assumptions for groundwater pumping and other aspects of Yuba Project operations are described in detail in Attachment A.

Yuba River operations must abide by the conditions that have been established in the Yuba County Water Agency Act, water rights permits and licenses administered by the SWRCB, FERC License #2246 for the Yuba River Development Project, FERC 1993 License to Pacific Gas and Electric Company (PG&E) for continued operation at the Narrows I Power House, Section 7 of the Flood Control Act of 1944 (at New Bullards Bar Dam and Reservoir), and the 1966 Power Purchase Contract between YCWA and PG&E (YCWA 2001).

Table 4-1. Yuba Accord CEQA AND NEPA Modeling Scenario Assumptions Matrix

Row			CEQA Scenarios					NEPA Scenarios		
1.	Scenario No.	-	1	2	3	4	-	5	6	7
2.	Description	Foundation Study OCAP Study 3 [p]	Existing Condition	No Project Alternative	Yuba Accord Alternative	Modified Flow Alternative	Foundation Study OCAP Study 5 [p]	No Action Alternative	Yuba Accord Alternative	Modified Flow Alternative
3.	Time Frame	2001	2005	2007-2025	2007-2025	2007-2025	2020	2007-2025	2007-2025	2007-2025
4.	**Lower Yuba River Basin**	**Assumption**	**Assumption**	**Assumption**	**Assumption**	**Assumption**	**Assumption**	**Assumption**	**Assumption**	**Assumption**
5.	**Lower Yuba River Operations**	Derived from DWR HEC-3 model	Updated using YPM [k]	Updated using YPM [k]	Updated using YPM [k]	Updated using YPM [k]	Derived from DWR HEC-3 model	Updated using YPM [k]	Updated using YPM [k]	Updated using YPM [k]
6.	**Maximum Demand at Daguerre Point Dam**	N/A [a]	298 TAF - wet, above normal years, 304 TAF below normal, dry, and critical years	338 TAF - wet, above normal years, 344 TAF below normal, dry, and critical years [b]	338 TAF - wet, above normal years, 344 TAF below normal, dry, and critical years [b]	338 TAF - wet, above normal years, 344 TAF below normal, dry, and critical years [b]	N/A [a]	338 TAF - wet, above normal years, 344 TAF below normal, dry, and critical years [b]	338 TAF - wet, above normal years, 344 TAF below normal, dry, and critical years [b]	338 TAF - wet, above normal years, 344 TAF below normal, dry, and critical years [b]
7.	**Carryover Storage Target for YCWA Deliveries to Member Units**	N/A [a]	Maximum 50% shortage for 1 in 100 year drought event in the following year	Maximum 50% shortage for 1 in 100 year drought event in the following year	Carryover storage targets inherent in flow schedules	Maximum 50% shortage for 1 in 100 year drought event in the following year	N/A [a]	Maximum 50% shortage for 1 in 100 year drought event in the following year	Carryover storage targets inherent in flow schedules	Maximum 50% shortage for 1 in 100 year drought event in the following year
8.	**Yuba Groundwater Basin Conjunctive Use**	N/A [a]	Groundwater use to compensate for surface water supply shortages at Daguerre Point Dam	Groundwater use to compensate for surface water supply shortages at Daguerre Point Dam	Groundwater use to compensate for surface water supply shortages at Daguerre Point Dam	Groundwater use to compensate for surface water supply shortages at Daguerre Point Dam	N/A [a]	Groundwater use to compensate for surface water supply shortages at Daguerre Point Dam	Groundwater use to compensate for surface water supply shortages at Daguerre Point Dam	Groundwater use to compensate for surface water supply shortages at Daguerre Point Dam
9.	**New Bullards Bar Reservoir End of September Maximum Target Storage**	N/A [a]	705 TAF [d]	705 TAF [d]	650 TAF [e]	705 TAF [d]	N/A [a]	705 TAF [d]	650 TAF [e]	705 TAF [d]
10.	**Carryover Storage Criteria for Stored Water Transfers for Use Outside of Yuba County**	N/A [a]	No shortages for 1 in 100 year drought event in the following year	No shortages for 1 in 100 year drought event in the following year	Stored water transfers inherent in flow schedules and New Bullards Bar Reservoir target operating line	No shortages for 1 in 100 year drought event in the following year	N/A [a]	No shortages for 1 in 100 year drought event in the following year	Stored water transfers inherent in flow schedules and New Bullards Bar Reservoir target operating line	No shortages for 1 in 100 year drought event in the following year
11.	**Stored Water Transfers to SWP, CVP and EWA**	N/A [a]	Stored water transfers. Transfers capped at recent maximum historical amounts [f]	No stored water transfers	Modeled per schedules 1-6, A-B, and New Bullards Bar Reservoir target operating line [n] [s]	Stored water transfers [f]	N/A [a]	No stored water transfers	Modeled per schedules 1-6, A-B, and New Bullards Bar Reservoir target operating line [n] [s]	Stored water transfers [f]
12.	**Groundwater Substitution Transfers to SWP, CVP and EWA**	N/A [a]	Groundwater substitution pumping. Transfers capped at recent maximum historical amounts [f] Total transfer limited to maximum of 164 TAF/year [r]. Groundwater substitution transfer limited to 85 TAF/year [l]	Groundwater substitution pumping [f]. Groundwater substitution pumping limited to 70 TAF/year, and 140 TAF/yr in any 3 consecutive years	Groundwater substitution pumping. 15 TAF groundwater pumping in Schedule 6 years. Groundwater substitution pumping limited to 90 TAF/year, and 180 TAF/yr in any 3 consecutive years	Groundwater substitution pumping. Groundwater substitution pumping limited to 70 TAF/year, and 140 TAF/yr in any 3 consecutive years [f]	N/A [a]	Groundwater substitution pumping. Groundwater substitution pumping limited to 70 TAF/year, and 140 TAF/yr in any 3 consecutive years [f]	Groundwater substitution pumping. 15 TAF groundwater pumping in Schedule 6 years. Groundwater substitution pumping limited to 90 TAF/year, and 180 TAF/yr in any 3 consecutive years	Groundwater substitution pumping. Groundwater substitution pumping limited to 70 TAF/year, and 140 TAF/yr in any 3 consecutive years [f]
13.	**Yuba River Development Project Power Generation**	N/A [a]	1966 PG&E Power Purchase Contract as modified by practice/agreement	1966 PG&E Power Purchase Contract as modified by practice/agreement	1966 PG&E Power Purchase Contract as modified by practice/agreement, as further modified for Proposed Yuba Accord	1966 PG&E Power Purchase Contract as modified by practice/agreement	N/A [a]	1966 PG&E Power Purchase Contract as modified by practice/agreement	1966 PG&E Power Purchase Contract as modified by practice/agreement, as further modified for Proposed Yuba Accord	1966 PG&E Power Purchase Contract as modified by practice/agreement

Row			CEQA Scenarios					NEPA Scenarios		
1.	Scenario No.	-	1	2	3	4	-	5	6	7
2.	Description	Foundation Study OCAP Study 3 [p]	Existing Condition	No Project Alternative	Yuba Accord Alternative	Modified Flow Alternative	Foundation Study OCAP Study 5 [p]	No Action Alternative	Yuba Accord Alternative	Modified Flow Alternative
14.	Lower Yuba River Instream Flow Requirements	1965 YCWA-DFG Agreement	SWRCB RD-1644 Interim	SWRCB RD-1644 Long-term	Proposed Yuba Accord flow schedules	SWRCB RD-1644 Interim with Conference Year provisions	1965 YCWA-DFG Agreement	SWRCB RD-1644 Long-term	Proposed Yuba Accord flow schedules	SWRCB RD-1644 Interim with Conference Year provisions
15.	Other Projects and Programs	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption	Assumption
16.	Trinity River Flows [g]	369 – 453 TAF	Trinity ROD flows	Trinity ROD flows	Trinity ROD flows	Trinity ROD flows	Trinity ROD flows	Trinity ROD flows	Trinity ROD flows	Trinity ROD flows
17.	Freeport Regional Water Project [h]	Not included	Not Included	Not Included	Not Included	Not Included	Included	Included	Included	Included
18.	CVP/SWP Intertie [i]	Not included	Not Included	Not Included	Not Included	Not Included	Included	Included	Included	Included
19.	CVPIA 3406 (b)(2)	Included	Included	Included	Included	Included	Included	Included	Included	Included
20.	EWA [m]	Included	As modeled in OCAP Study 3	As modeled in OCAP Study 3	As modeled in OCAP Study 3, except C1 water may exceed OCAP Upstream of Delta purchases for EWA in some years	As modeled in OCAP Study 3	Included [t]	As modeled in OCAP Study 5	As modeled in OCAP Study 5, except C1 water may exceed OCAP Upstream of Delta purchases for EWA in some years	As modeled in OCAP Study 5
21.	CVP/SWP Integration [j]	Not included	Not included	Not included	Not included	Not included	Not included	Included [j]	Includedd [j]	Included [j]
22.	South Delta Improvement Program	Not included	Not included	Not included	Not included	Not included	Included	Included	Included	Included

Matrix Footnotes

[a] CALSIM II modeling for OCAP represents the lower Yuba River as an inflow to the Feather River (arc C211) and a diversion at Daguerre Point Dam (arc D211). New Bullards Bar Dam and Englebright Dam are not modeled explicitly. Yuba River flows at Daguerre Point Dam are an input to CALSIM II. These inflows are derived from a DWR HEC-3 model of the Yuba Basin.

[b] Demands at Daguerre Point Dam increase by 40 TAF/year compared to existing conditions due to implementation of the Wheatland Project.

[d] Reservoir target operating line (TAF): Oct -705, Nov -680, Dec - 650, Jan - 610, Feb - 680, Mar - 750, Apr - 890, May - 960, Jun - 920, Jul – 840, Aug - 745, Sep – 705. The target end of September storage is 705 TAF, less stored water transfer amount.

[e] Reservoir target operating line (TAF): Oct -650, Nov -650, Dec - 650, Jan - 600, Feb - 650, Mar - 750, Apr - 850, May - 960, Jun - 920, Jul - 820, Aug - 695, Sep – 650. The target end of September storage is 650 TAF, less stored water transfer amount.

[f] Variable single-year transfer amount depending on water supply availability, transfer demand, and limited by E/I ratio, available conveyance capacity at Banks and Jones pumping plants and periods of Delta balanced conditions.

[g] The December 19, 2000, ROD on the Trinity River Main Stem Fishery Restoration EIS/EIR adopted a variable annual requirement of 369 TAF to 815 TAF.

[h] The Freeport Regional Water Project is a joint venture of the Sacramento County Water Agency and East Bay Municipal Utility District to supply water from the Sacramento River to customers in Sacramento County and the East Bay. Final EIR has been certified, The Final EIS has been released, and on January 4, 2005, Reclamation issued the ROD.

[i] The Delta-Mendota Canal to California Aqueduct Intertie is part of the CALFED conveyance program and consists of construction and operation of a 400 cfs pumping plant and pipeline connection between the DMC and the California Aqueduct. Reclamation and the San Luis & Delta-Mendota Water Authority completed a Finding of No Significant Impact/Negative Declaration and Draft Environmental Assessment/Initial Study in 2004.

[j] The CVP/SWP Integration is dependent on an increase in the permitted inflow to Clifton Court Forebay from 6,680 cfs to 8,500 cfs.

[k] YPM - Yuba Project Model

[l] The maximum historical YCWA groundwater substitution transfer of 85 TAF occurred in 1991.

[m] CALSIM II modeling for OCAP does not specify the source of water for EWA purchases upstream of the Delta

[n] Export of stored water transfers not limited by E/I ratio. When the E/I ratio is controlling, the incremental increase in exports resulting from Proposed Yuba Accord Released Transfer Water amount is the Delivered Transfer amount. It is assumed that YCWA will opt to pay carriage water cost if Released Transfer Water would otherwise be lost as surplus Delta outflow.

[p] Modeling foundations are in accordance with the relevant modeling studies conducted for the Long-term CVP OCAP Biological Assessment/Biological Opinions.

[r] The maximum YCWA annual water transfer, after inception of the EWA program in 2001, is 164 TAF and occurred in 2001. This transfer included 50 TAF sale to EWA, and 114 TAF sale to DWR's Dry Year Purchase Program.

[s] Water for EWA preferentially transferred from July to September using 500 cfs dedicated capacity. Transfer to EWA includes 60 TAF/year commitment of Component 1 water plus any previous year undelivered Component 1 water in wet, above normal, and below normal years. Additional delivery of Component 4 water to EWA using July – September dedicated capacity.

[t] The OCAP BA assumed that future operation of EWA would be similar to the Short-term EWA Program. The OCAP BA modeling assumptions regarding water purchases for the "*Future EWA*" are identical to those of the "*Today EWA*". These assumptions may differ from those being developed as part of the Long-term EWA Program EIR/EIS.

A description of YCWA's water supply management practices, including instream flow requirements related to protection of fishery benefits in the lower Yuba River, provision of surface water supplies to YCWA Member Units and related water demands, groundwater pumping practices, and other operational and regulatory considerations are presented in the Chapter 3, Proposed Project/Action and Alternatives, of the Draft EIR/EIS.

4.1 FOUNDATION STUDIES

The foundations studies are CALSIM II planning studies that have been developed by Reclamation in association with DWR for the OCAP BA. These studies are used as the basis for all hydrologic modeling.

4.1.1 OCAP STUDY 3

The environmental setting, or existing condition, represents the current conditions at the time a project is proposed. For CEQA purposes, the existing condition is defined as the time at which the notice of preparation is published (CEQA Guidelines Section 15125). The existing condition represents the current regulatory and physical conditions, which are used as a baseline to evaluate the significance of potential impacts associated with implementation of the alternatives considered in the Draft EIR/EIS.

OCAP Study 3, "*Today EWA*" was developed by Reclamation as part of the OCAP BA to evaluate the current EWA program (Reclamation 2004). OCAP Study 3 represents existing conditions, and therefore most correctly characterizes the modeling assumptions applied to the CEQA modeling scenarios evaluated in the Draft EIR/EIS.

No water transfers are modeled in OCAP Study 3, other than as part of the EWA program. Total North of Delta and South of Delta EWA purchases of water (referred to as assets) include fixed water purchases of 250 TAF per year in wet, above normal, and below normal water years, 230 TAF in dry water years, and 210 TAF in critical water years (Sacramento Valley 40-30-30 Index).

In OCAP Study 3, targets for upstream of Delta purchases varies from zero in a wet year, to approximately 47 TAF in above normal and below normal years, to 106 TAF in a dry year, and to 153 TAF in a critical year. Variable assets include use of 50 percent JPOD export capacity, acquisitions of 50 percent of any CVPIA 3406(b)(2) releases pumped by SWP, and dedicated 500 cfs pumping capacity at Banks from July through September, which is the preferred transfer period for EWA actions. EWA transfers are limited by Delta conditions and the availability of export capacity. Fixed assets are transferred during the July through September period. The OCAP BA does not identify the sellers of this water.

OCAP Study 3 assumptions associated with the EWA actions include: (1) reducing total exports by 50 TAF per month, relative to total exports without EWA, in December through February; (2) VAMP SWP export restrictions from April 15 through May 16; (3) Post VAMP SWP export restrictions from May 16 through May 31 (and potentially CVP export restrictions if b(2) post-VAMP action is not taken); and (4) export ramping in June.

CALSIM II does not simulate operations of the Yuba Project. Flow upstream of and diversions at Daguerre Point Dam are inputs to the model.

4.1.2 FOUNDATION STUDY OCAP STUDY 5

In contrast to the CEQA Guidelines, NEPA requirements focus on reasonable foreseeable actions that may occur at any time during the life of the project, rather than just near-term future actions. For NEPA purposes, the No Action Alternative is used as the basis of comparison for evaluating potential impacts due to implementation of the alternatives considered in the Draft EIR/EIS. The No Action Alternative is defined in the Reclamation NEPA Handbook (2000) as "*a projection of current conditions to the most reasonable future responses or conditions that could occur during the life of the project without any action alternatives being implemented.*"

OCAP Study 5, "*Future EWA*" was developed by Reclamation as part of the OCAP BA to evaluate a future EWA program, and was used to evaluate the effects of projects and actions included in the early consultation (Reclamation 2004). OCAP Study 5 accounts for future foreseeable projects/actions, and therefore most correctly characterizes the modeling assumptions applied to the NEPA modeling scenarios evaluated in the Draft EIR/EIS.

The hydrology and level of development used for NEPA modeling simulations is assumed to be the 2020 level of development, as forecasted by DWR in Bulletin 160-98. Assumptions under OCAP Study 5 are similar to OCAP Study 3. However, OCAP Study 5 includes the following additional projects or actions that are not included in OCAP Study 3:

- South Delta Improvements Program;
- CVP/SWP Integration;
- Freeport Regional Water Project; and
- California Aqueduct/Delta-Mendota Canal Intertie.

4.2 CEQA SCENARIOS

For CEQA purposes, model scenarios are based on OCAP Study 3, modified to account for (1) the Trinity River ROD flows; and (2) lower Yuba River operations under the Baseline Condition, as defined in Article 4, section 3 of the Water Purchase Agreement (RD-1644 Interim Yuba River flow requirements) and present level demands at Daguerre Point Dam as simulated by the YPM. Output from the resulting CALSIM II model simulation was subsequently modified using the lower Yuba River outflow routing tool to create simulations for the CEQA Existing Condition (Scenario 1), the CEQA No Project Alternative (Scenario 2), the CEQA Yuba Accord Alternative (Scenario 3) and the CEQA Modified Flow Alternative (Scenario 4).

4.2.1 CEQA EXISTING CONDITION (SCENARIO 1)

This simulation represents current hydrologic, operational and regulatory considerations within the Study Area as described in the Chapter 2, Description of Environmental Setting and Existing Condition, of the Draft EIR/EIS.

The Yuba River is subject to instream flow requirements according to SWRCB Decision 1644 (RD-1644), which came into effect on March 1, 2001. The intent of these requirements is to provide protection for fishery resources and other issues relating to water use and diversion activities in the lower Yuba River (the Yuba River below Englebright Dam). To characterize existing conditions, this scenario includes implementation of RD-1644 Interim flow requirements on the lower Yuba River. For the CEQA Existing Condition, two types of Yuba River water transfers are modeled: (1) stored water transfers from releases from New Bullards

Bar Reservoir, and (2) groundwater substitution transfers made by YCWA in cooperation with its Member Units. It is assumed that all transfers are sold to the CVP, SWP or EWA, and are used in the export service area south of the Delta. Assumptions regarding the magnitude and timing of these transfers are discussed in Attachment A. Stored water transfers are possible when the resulting end-of-September storage in New Bullards Bar Reservoir is at or greater than the required carryover storage to provide 100 percent deliveries in the following year for dry hydrologic conditions with a 1 in 100 year return period. Both stored water and groundwater substitution transfers are capped at their maximum historical amount since the inception of the EWA Program.

For modeling the CEQA Existing Condition, EWA actions are based on the OCAP Study 3 assumptions which include the purchase and conveyance of North of Delta water through Banks Pumping Plant during July to September for EWA purposes [4].

For modeling purposes, the portion of Yuba transfer water that is made available for EWA purchase is assumed to be part of the EWA North-of-Delta purchases included in OCAP Study 3. Therefore, these EWA transfers do not result in increased Delta exports beyond that already identified and simulated in OCAP Study 3. In some years, Yuba transfer water for EWA may exceed the volume of North-of-Delta purchases included in OCAP Study 3, and therefore represent an additional EWA transfer.

The portion of Yuba transfer water made available for EWA is determined as follows:

- ❑ If the SWP end-of-May Table A allocation, as determined in CALSIM II, is greater than 60 percent, all YCWA transfers are attributed to EWA.
- ❑ If the SWP end-of-May agricultural allocation from CALSIM II is between 40 percent and 60 percent, YCWA transfers are split evenly between EWA and DWR and Reclamation.
- ❑ If the SWP end-of-May agricultural allocation from CALSIM II is less than 40 percent, all YCWA transfers are attributed to DWR and Reclamation.

4.2.2 CEQA NO PROJECT ALTERNATIVE (SCENARIO 2)

The CEQA No Project Alternative represents current environmental conditions plus future operational and environmental conditions anticipated to occur in the foreseeable future pursuant to existing physical and regulatory environmental conditions in the absence of the Proposed Project or other action alternative.

This scenario includes implementation of RD-1644 Long-term flow requirements on the lower Yuba River. Additionally, the CEQA No Project Alternative differs from the CEQA Existing Condition because it assumes a future level of development, and additional irrigation demand at Daguerre Point Dam due to implementation of the Wheatland Project.

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[4] For the months of July, August, and September, the EWA Program has 500 cfs of dedicated conveyance capacity at the Banks Pumping Plant. EWA actions and CVPIA (b)(2) actions restrict pumping at Banks and Jones pumping plants in April, May and June, during which months the maximum allowable E/I ratio under D-1641 is 0.35. In April and May export at the Jones Pumping Plant is restricted to 3,000 cfs in accordance with D-1485 criteria to protect striped bass. EWA Transfer capacity under the JPOD also may be limited in October due to water quality impacts in the Delta. June EWA actions typically restrict pumping at Banks by ramping from post-VAMP May shoulder to June E/I ratio restrictions. Transfer capacity under the JPOD also may be limited in October due to water quality impacts in the Delta.

YCWA's ability to make stored water transfers under RD-1644 Long-term flow requirements is discussed in detail in Attachment C. No stored water transfers are possible. Groundwater substitution transfers are modeled in a similar manner to water transfers under the CEQA Existing Condition, except that YCWA water transfers are not capped at the maximum historical transfer amount. The maximum annual volume of groundwater substitution transfer is limited to 70 TAF. Additionally, it is assumed the maximum amount of groundwater pumping over any 3-year period is 140 TAF and over any 2-year period is 120 TAF. Also, because of institutional difficulties in implementing a groundwater substitution transfer, the modeling assumes that groundwater substitution transfers will be limited to critical and dry years, and below normal years when SWP Table A allocations less than 60 percent.

4.2.3 CEQA YUBA ACCORD ALTERNATIVE (SCENARIO 3)

The Yuba Accord Alternative includes three separate but interrelated agreements that would result in integrated operation of YCWA and Member Units water supply resources within Yuba County, as well as provide Reclamation and DWR with increased operational flexibility for the protection of Delta fisheries resources and the provision of supplemental water supplies to state and federal water contractors.

Under the Yuba Accord Alternative, YCWA, DWR, and Reclamation would be parties to the proposed Water Purchase Agreement. This agreement provides for the purchase and delivery of water to EWA, Reclamation, and DWR. Key elements of the Water Purchase Agreement include definition of water supply components, water accounting mechanism, and explanation of Conference Year principles. Under the Water Purchase Agreement, YCWA would have an obligation to provide specific quantities of transfer water (Component 1, Component 2, and Component 3) and would have the option to provide additional transfer water (Component 4) depending on supply availability and demand (see Attachment A). It also is assumed that 60 TAF of Component 1 water would be provided to the EWA Program regardless of water year type because of EWA Program demands and the availability of dedicated capacity at the CVP/SWP pumping facilities in the Delta, which have the ability to accommodate a minimum of 60 TAF of EWA asset acquisitions on an annual basis. The portion of Component 4 transfers allocated to EWA for the purpose of displacing a portion of the EWA North-of-Delta purchases as determined in CALSIM II is calculated using the same methodology as the CEQA Existing Condition and the CEQA No Project Alternative.

For modeling purposes, the preferred transfer period is July through September. In Reclamation's OCAP BA, the July through September period is identified as the primary transfer period for the EWA Program, and a large component of water from the Yuba Accord Alternative also would be transferred during these months. Because YCWA, Reclamation and DWR would like to maintain as much operational flexibility as possible, the modeling assumes that water could be transferred in all months, except for June, depending on: (1) available Delta export capacity; (2) compliance with the E/I ratio; and (3) the transfer would occur on a "*fish-friendly*" basis consistent with the provisions identified in Reclamation's OCAP BA (Reclamation 2004b).

The maximum annual volume of groundwater substitution transfer is limited to 90 TAF. Additionally, it is assumed the maximum amount of groundwater pumping over any 3-year period is 180 TAF and over any 2-year period is 150 TAF.

During some months, Yuba River flows at the Marysville Gage may be lower under the Yuba Accord Alternative compared to baseline conditions due to changes in instream flow requirements (e.g., RD-1644 Interim requirements compared to the Yuba Accord Alternative flow schedules), or due to New Bullards Bar Reservoir refill impacts. For modeling purposes, reductions in flow at the Marysville Gage that occur during Delta balanced water conditions are offset by either: (1) reduced CVP and/or SWP export pumping, or (2) increased releases from project storage (e.g., Oroville and Shasta reservoirs). Model assumptions regarding CVP/SWP operations are discussed in Section 5.

4.2.4 CEQA MODIFIED FLOW ALTERNATIVE (SCENARIO 4)

The Modified Flow Alternative includes implementation of flows characterized by SWRCB RD-1644 Interim flow requirements, and the conference year provisions that are proposed for the Yuba Accord Alternative. Stored water transfers are modeled in a similar manner to water transfers under the Existing Condition. However, transfers are not capped at their historical level. Groundwater substitution transfers are modeled in a similar manner to water transfers under the CEQA No Project Alternative.

For modeling purposes, the allocation of Yuba transfer water to EWA, DWR and Reclamation are as described for the CEQA Existing Condition.

4.3 NEPA SCENARIOS

For NEPA purposes, OCAP Study 5 is used to characterize the modeling scenarios representing the No Action Alternative, Yuba Accord Alternative, and the Modified Flow Alternative. Additionally, OCAP Study 5 characterizes the Cumulative Condition, which is used for both CEQA and NEPA cumulative impact analyses. For NEPA purposes, model scenarios are based on OCAP Study 5, modified to account for lower Yuba River operations under the Baseline Condition, as defined in Article 4, section 3 of the Water Purchase Agreement (RD-1644 Interim Yuba River flow requirements) and future level demands at Daguerre Point Dam as simulated by the YPM. Output from the resulting CALSIM II model simulation was subsequently modified using the lower Yuba River outflow routing tool to create simulations for the NEPA No Action Alternative (Scenario 5), the NEPA Yuba Accord Alternative (Scenario 6) and the NEPA Modified Flow Alternative (Scenario 7).

4.3.1 NEPA NO ACTION ALTERNATIVE (SCENARIO 5)

The principal elements of the NEPA No Action Alternative would generally be the same as those previously described for the CEQA No Project Alternative. The primary differences between the No Project and No Action alternatives are assumptions relating to land use development and the implementation of reasonably foreseeable programs and actions. The CEQA No Project Alternative considers conditions without the proposed project imposed upon an existing condition framework [current hydrologic operations, water demands, and level of land development, characterized by OCAP Study 3], while the NEPA No Action Alternative considers conditions without the proposed project in a future condition framework [future hydrologic operations, water demands, and level of land development, characterized by OCAP Study 5].

Because several of the conditions specific to RD-1644 are currently being contested and undergoing litigation, they may be subject to revision. Until those proceedings are finalized, the original conditions described in the SWRCB's decision apply and are incorporated as part of the hydrologic modeling assumptions. Therefore, this scenario includes implementation of RD-1644 Long-term flow requirements on the lower Yuba River. Lower Yuba River operations in OCAP

Study 5 have been modified to be consistent with operations under RD-1644 Long-term flow requirements.

No stored water transfers are possible under the No Action Alternative. Groundwater substitution transfers are modeled as for the No Project Alternative.

For the Draft EIR/EIS, OCAP Study 5 was modified to account for updated flows and diversions at Daguerre Point Dam, so as to provide consistency with the YPM. Similar to the approach used for the 2004 OCAP BA, EWA North-of-Delta purchases are considered to be part of the No Action Alternative, and are transferred to the export service area south of the Delta during the July through September period. However, the source water for these purchases is not represented explicitly in the modeling.

For modeling purposes, it is assumed a portion of the YCWA transfers are for EWA purchase. Accordingly, a portion of the EWA North-of-Delta purchases included in OCAP Study 5 are "displaced" by the corresponding Yuba River outflow. The portion of YCWA transfers made available for EWA for the purposes of determining the volume of EWA North-of-Delta purchases displaced by the YCWA transfers is as described for the CEQA Existing Condition.

The SVWMP is under development and in the process of completing separate environmental documentation for CEQA, NEPA and ESA regulatory compliance purposes. Under the proposed SVWMP Short-term Program, upstream water districts would make additional water available to the CVP and SWP in below normal, dry, and critical water years. Water in above normal years will be made available on request. Under the terms of the SVWMP, upstream water users would not be obligated to provide water to the CVP/SWP if providing water might have a negative impact on the upstream users' ability to meet their commitment in below normal, dry, or critical years.

The SVWMP is not included in OCAP Study 5, and in general is not included in the analyses for the Draft EIR/EIS that concern future conditions. However, for evaluation of impacts to the Yuba groundwater basin, YCWA's commitment to provide up to 15 TAF annually is considered.

4.3.2 NEPA Yuba Accord Alternative (Scenario 6)

The NEPA Proposed Action scenario includes implementation of the Yuba Accord Alternative, as previously discussed above, and presented in Chapter 3, Proposed Project/Action and Alternatives, of the Draft EIR/EIS. Modeling assumptions are as described for Scenario 3.

Yuba Project operations under the NEPA analysis differ from operations under the CEQA analysis due to changes in the available pumping capacity at Banks and Tracy pumping plants. The simulated available pumping capacity to support transfers is primarily affected by increased demands in the export service area, and the assumed implementation of the SDIP, and the associated increase in the permitted capacity at Clifton Court to 8,500 cfs.

4.3.3 NEPA Modified Flow Alternative (Scenario 7)

The NEPA Modified Flow Alternative includes implementation of flows characterized by SWRCB RD-1644 Interim flow requirements, and the conference year provisions that are proposed for the Yuba Accord Alternative. Modeling assumptions are as described for Scenario 4.

5.0 ASSUMPTIONS REGARDING CVP/SWP OPERATIONS

For modeling purposes, the following assumptions and operational constraints are applied to the CALSIM II post-processing applications used to simulate CVP/SWP reservoir and export operations. These assumptions were developed through an iterative process involving collaboration with Reclamation and DWR. The assumptions listed below are designed to address project considerations related to CVP/SWP exports and fisheries protections in the Delta.

5.1 Water Transfers

Cross-Delta water transfers are limited by Delta conditions[5], prevailing operational constraints, such as the E/I ratio, and available conveyance capacity.

Parties to the transfer are responsible for providing any incremental flows (i.e., carriage water) to protect Delta water quality standards. For modeling purposes, a carriage water cost of 20 percent of the released transfer water is assumed, so that a 75 TAF purchase of water upstream of the Delta would result in an export of 60 TAF, and an additional Delta outflow of 15 TAF.

The available conveyance capacity at Banks Pumping Plant for water transfers includes 500 cfs dedicated capacity for EWA at Banks Pumping Plant from July through September.

Stored water transfers are not possible when RD-1644 Long-term flow-requirements are governing Yuba River operations due to the associated carryover-storage requirement at New Bullards Bar Reservoir. A detailed description of this limitation is included in Attachment C. No such limit exists on groundwater substitution transfers.

5.2 No Transfer Period

For modeling purposes it is assumed that no Yuba transfer water will be pumped during the month of June. Typically CVP/SWP ability to pump transfer water in June is limited by fishery considerations. In addition, exports of Proposed Yuba Accord water are limited in April and May due to assumed (b)2 and EWA actions, and VAMP restrictions imbedded in the modeling logic: April 15 and June 15 due to VAMP[6], post-VAMP shoulder and June ramping[7].

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[5] Cross-Delta transfers can only occur during Delta balanced conditions, as defined by the Coordinated Operations Agreement (COA).

[6] As reported in Reclamation's OCAP BA (Reclamation 2004b), the VAMP program has two distinct components, including a flow objective and an export restriction. The export restriction involves a combined federal and state pumping limitation on the Delta pumps during April and May. Combined export targets for the 31-day pulse flow period of VAMP are specified in the San Joaquin River Agreement (U.S.Department of Interior *et al.* 1999).

[7] As reported in Reclamation's OCAP BA (Reclamation 2004b), additional export restrictions also occur during the post-VAMP shoulder and June ramping periods, which are extensions of VAMP-related export restrictions associated with the use of b(2) water.

Actual operations of the Delta pumping facilities are adjusted on a near real-time basis, using daily data, input and decisions by CVP and SWP operators in consultation with resource agency representatives from USFWS, NMFS and CDFG. CVP and SWP pumping rates may be adjusted on a weekly or daily basis in response to changing conditions, environmental actions and resource agency instructions. As a result, on some occasions CVP and SWP operations may increase to full authorized pumping rates during the month of June, and it may be possible to transfer some small amount of Yuba Accord water in the June of some years. Water transfers associated with the Yuba Accord would occur in June only when: (1) the Delta is in balance; (2) capacity exists at the CVP and SWP export facilities to pump the transfer water; (3) the E/I ratio and other potential delta constraints do not prevent the transfer; and (4) the ESA agencies allow pumping at Delta facilities that would include Yuba Accord transfer volumes. Because these occasions are expected to rarely occur, the modeling assumes that no export of Yuba Accord water would occur in June.

5.3 Proposed Yuba Accord Water for the Central Valley Project

For modeling purposes, it is assumed that all Proposed Yuba Accord water for the CVP would be exported to service areas south of the Delta.

5.4 Proposed Yuba Accord Water for the State Water Project

Full Table A amounts for the SWP total 4.173 MAF. Table A amounts for SWP long-term contractors upstream of the Delta (not including North Bay Aqueduct) total approximately 37.1 TAF (0.9 percent). Table A amounts for SWP long-term contractors served by the North Bay Aqueduct total 76.78 TAF (1.9 percent). Because these percentages are relatively small compared to the full Table A amounts, it is assumed for modeling purposes that all Yuba Accord water for the SWP would be exported to service areas south of the Delta.

5.5 Characterization of CVP/SWP Response to Decreases in Lower Yuba River Outflow

During some months flows in the lower Yuba River at the Marysville Gage may be lower under the Yuba Accord Alternative compared to the baseline conditions[8] due to changes in instream flow requirements (i.e., RD-1644 Interim requirements vs. Yuba Accord flow schedules), or due to New Bullards Bar Reservoir refill impacts.

For modeling purposes, reductions in flow at the Marysville gage that occur during Delta balanced water conditions are offset by either: (1) reduced export pumping; or (2) increased releases from project storage (Oroville Reservoir). When decreases in the lower Yuba River flow at the Marysville Gage occur in dry and critical water years during balanced water conditions, or when reductions in lower Yuba River flow at the Marysville Gage would result in balanced conditions in the Delta, CVP/SWP exports are reduced to offset the reduction in flows at the Marysville Gage. The reduction in export was assumed to occur at Banks Pumping Plant[9].

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[8] As defined in Exhibit 4, Section 2 of the Water Purchase Agreement

[9] Reduction in pumping at Banks can be expected to occur when the SWP is wheeling water for the CVP, or the SWP is pumping unused federal share. At other times a reduction in export based on COA sharing formula might be more appropriate (55:45 CVP:SWP split if there is unstored water for export, 75:25 CVP:SWP split if there is in-basin use), but not considered significant for modeling purposes.

- If the E/I ratio is controlling, then the reduction in export will be equal to the E/I ratio times the reduction in flow at Marysville. Delta outflow is reduced.
- If water quality standards are controlling, then the reduction in export is equal to the 0.8 times the reduction in flow at Marysville (i.e. an assumed carriage water cost of 20 percent). Delta outflow is reduced by 0.2 times the reduction in flow at Marysville.
- If Delta outflow standard is controlling, then the reduction in export is equal to the reduction in flow at Marysville. No change in Delta outflow.

For modeling purposes, when decreases in the lower Yuba River flow at the Marysville Gage occur in wet, above normal and below normal years during balanced conditions in the Delta, or when decreases in Yuba River flow at the Marysville Gage would result in balanced conditions in the Delta, exports are maintained and storage releases from Oroville and Shasta reservoirs are increased by an amount equal to the reduction in flow at the Marysville Gage.

For modeling purposes, when decreases in the lower Yuba River flow at the Marysville Gage occur during excess conditions in the Delta, or when decreases in Yuba River flow would not result in the Delta going into balanced conditions, neither additional releases nor decrease in exports are made. Instead, the amount of surplus Delta outflow is reduced.

For modeling purposes, when decreases in the lower Yuba River flow at the Marysville Gage would result in a violation of the Feather River flow requirement below the confluence with the Yuba River, storage releases from Oroville Reservoir are increased by an amount required to ensure compliance with applicable flow requirements.

5.6 PUMPING PRIORITIES: BANKS PUMPING PLANT VS. JONES PUMPING PLANT

Surplus pumping capacity available for transfers varies considerably. The CVP has little surplus capacity, except under drier hydrologic conditions. The SWP has greatest capacity in dry and critical years, less under average conditions, and some surplus in wetter years when demands may be lower because contractors have alternate supplies. Export of transfer water is divided between the Banks Pumping Plant and the Jones Pumping Plant according to the following rules:

- Water is transferred through the Banks Pumping Plant and the Jones Pumping Plant when the Delta is in balanced conditions. Transfers are constrained by the permitted pumping capacity, downstream channel capacity in the Delta-Mendota Canal, and the E/I ratio (unless YCWA elects to pay for carriage water costs).
- In practice, limited or no Jones pumping capacity is expected to be available. Accordingly, modeling assumes that in wet and above normal years, all transfers are exported through the Banks Pumping Plant until all capacity, including the dedicated EWA capacity, is used. Any remaining transfers are exported through available capacity at the Jones Pumping Plant.
- It is more likely that Jones pumping capacity is available during dry periods. Therefore, modeling assumes that during below normal, dry, and critical years, transfers are split evenly between the Banks Pumping Plant and the Jones Pumping Plant as long as export capacity is available. Once either plant reaches capacity, any remaining transfers are exported through the remaining capacity at the other pumping plant.

5.7 REREGULATION OF YUBA RIVER WATER IN OROVILLE RESERVOIR

When Delta conditions constrain the export of increased Yuba River flow at the Marysville Gage, it may be possible for the SWP to reduce releases from Oroville Reservoir, resulting in an increase of storage for later release and export. Oroville Reservoir releases from storage can be reduced if:

- Feather River flows are greater than the flow requirement below the Thermalito Afterbay Outlet, but upstream of the Yuba River confluence. If Oroville Reservoir is operating to meet a minimum instream flow requirement, no reductions in releases are possible.
- An increase in Oroville Reservoir storage would not result in an encroachment into reserved flood control space.

Increased storage in Oroville Reservoir resulting from increases in Yuba River flow at the Marysville Gage is subsequently released from storage:

- During flood control operations.
- When the Delta is in balanced conditions, and there is export capacity at either the Banks or Jones pumping plant.
- To meet instream flow requirements on the Feather River downstream of the confluence with the Yuba River due to a decrease in Yuba River flow at the Marysville Gage.

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Attachment A

Yuba Project Model

Attachment A
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Yuba Project Model

A.1 INTRODUCTION

The surface water resources of the Yuba Region are described in Chapter 5, Surface Water Supply and Management, of the Draft EIR/EIS. This attachment describes how these resources are modeled to determine possible environmental impacts and environmental consequences of the Proposed Project and alternatives. In particular, this attachment describes reservoir operations modeling for the Yuba Project and modeling of flows in the lower Yuba River downstream of Englebright Reservoir.

This attachment is divided into four sections. This Section briefly describes the Yuba Project and facilities and operations on the lower Yuba River. Section A.2 describes the structure of the YPM and elements of the model that are common to all modeling scenarios considered in this EIR/EIS. Section A.3 describes elements of the YPM that differ between scenarios (e.g., instream flow requirements for the lower Yuba River). Finally, Section A.4 discusses modeling of water transfers that require the use of other models to characterize conditions in the Delta.

A.1.1 THE YUBA RIVER BASIN

The Yuba River Basin encompasses an area of about 1,339 square miles and rises from an elevation of about 88 feet above msl at the Marysville Gage, near the Yuba River's confluence with the Feather River, to about 8,590 feet above msl in the upper basin. The estimated annual unimpaired runoff of the Yuba River at Smartville has ranged from a low of 0.4 MAF in 1977 to a high of 4.9 MAF in 1982, with an average of about 2.4 MAF per year (1901-2005)[1]. In general, the runoff is nearly equally divided between runoff from rainfall during October through March and runoff from snowmelt during April through September.

The Yuba Region is one of four regions that make-up the project study area. It encompasses storage and hydropower facilities of the Yuba Project, the Yuba River downstream from New Bullards Bar Reservoir, the lower Yuba River downstream from Englebright Reservoir to the confluence with the Feather River, the YCWA Member Unit water service areas, the local groundwater basins, and lands overlying the groundwater basins.

Figure A-1 shows the principal streams and facilities of the Yuba Region. Daguerre Point Dam and Englebright Dam were originally constructed by the California Debris Commission, a unit of the Corps for debris control, and now are operated and maintained by the Corps. The Yuba Project, operated by YCWA, is a multiple-use project that provides flood control, power generation, irrigation, recreation, and protection and enhancement of fish and wildlife. It includes New Bullards Bar Dam and Reservoir, New Colgate Powerhouse and Narrows II Powerhouse. Englebright Dam and Reservoir and Daguerre Point Dam are not part of the Yuba Project. However, Englebright Dam and Reservoir are used to regulate the power peaking releases from the New Colgate Powerhouse and Daguerre Point Dam is used by YCWA to

[1] The forecasted seasonal unimpaired flow at Smartville is estimated each year by DWR and reported monthly in Bulletin 120, *Water Conditions in California*.

divert water to its Member Units[2]. The elements of the Yuba Project are described in more detail in the following subsections.

A.1.2 NEW BULLARDS BAR DAM, RESERVOIR AND NEW COLGATE POWERHOUSE

New Bullards Bar Reservoir, located on the North Yuba River, is the major storage facility of the Yuba Project. The reservoir has a total storage capacity of 966 TAF with a required minimum pool of 234 TAF (as required by YCWA's FERC Project License), thus leaving 732 TAF of capacity that can be regulated. A portion of this regulated capacity, 170 TAF, normally must be held empty from September through April for flood control.

The North Yuba River inflow to New Bullards Bar Reservoir is augmented by diversions from the Middle Yuba River to Oregon Creek via the Lohmann Ridge Tunnel, and by diversions from Oregon Creek into the reservoir via the Camptonville Tunnel. The average combined inflow to New Bullards Bar Reservoir from the North Yuba River and the diversions from the Middle Yuba River and Oregon Creek is about 1.2 MAF per year[3]. Releases from New Bullards Bar Reservoir are made through the New Colgate Powerhouse, which has a capacity of 3,700 cfs, the dam's bottom outlet, the Fish Release Powerhouse, or a gated spillway.

The Fish Release Powerhouse is so named because it generates power from the water released at the base of the New Bullards Bar Dam for fishery maintenance on the river. This facility was added by YCWA in 1986. If there is a power outage at the dam, this tiny powerhouse can be used to operate the massive spillway gates of New Bullards Bar Dam.

A.1.2.1 ENGLEBRIGHT RESERVOIR AND NARROW I AND II POWERHOUSES

Englebright Reservoir is situated downstream of New Bullards Bar Reservoir, at the confluence of the Middle and South Yuba rivers. The average annual inflow to Englebright Reservoir, excluding releases from New Bullards Bar Dam, is approximately 400 TAF. Englebright Reservoir has a total storage capacity of 70 TAF, but provides limited conservation storage as the reservoir is used to attenuate power peaking releases from the New Colgate Powerhouse and tributary inflows.

Water from Englebright Reservoir is released for generation at the Narrows I (owned by PG&E) and Narrows II powerhouses. The Narrows I Powerhouse has limited capacity and typically is used for low flow reservoir releases (less than 700 cfs), or to supplement the Narrows II Powerhouse capacity for high flow reservoir releases. The combined release capacity of the Narrows I and II powerhouses is 4,190 cfs. Narrows II Powerhouse is typically shut-down for annual maintenance at the beginning of September for a 2 to 3 week period.

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[2] YCWA provides surface water to its Member Units: Brophy Water District, Browns Valley Irrigation District, Cordua Irrigation District, Dry Creek Mutual Water Company, Hallwood Irrigation Company, Ramirez Water District, and the South Yuba Water District. YCWA also provides surface water to the city of Marysville for Lake Ellis, and YCWA will provide surface water in the future to the Wheatland Water District.

[3] Based on model simulations of current facilities for the 1922 to 1994 period, and estimated historical inflows for the 1995 to 2005 period.

Figure A-1. Lower Yuba River Basin

Under existing water rights and agreements, PG&E may release up to 45 TAF from Englebright Reservoir storage, although only about 10 TAF of storage normally are used. Fluctuations in Englebright Reservoir storage principally occur for daily or weekly regulation of winter inflows and New Colgate Powerhouse releases. Because of recreational and power generation needs, the storage level within the reservoir seldom drops below 50 TAF.

A.1.2.2 LOWER YUBA RIVER

The lower Yuba River refers to the 24-mile section of the river between Englebright Dam and the confluence with the Feather River south of Marysville. This stretch of the Yuba River is shown in **Figure A-2**. Instream flow requirements are specified for the lower Yuba River at the Smartville Gage (RM 23.6), approximately 2,000 feet downstream from Englebright Dam, and at the Marysville Gage (RM 6.2). Below the Smartville Gage, accretions, local inflow, and runoff contribute, on average, approximately 200 TAF per year to the lower Yuba River. Deer Creek flows into the Yuba River at approximately RM 22.7. Dry Creek flows into the Yuba River at RM 13.6, approximately two miles upstream of Daguerre Point Dam. The flow in Dry Creek is regulated by BVID's operation of Merle Collins Reservoir, located on Dry Creek about eight miles upstream of its confluence with the Yuba River.

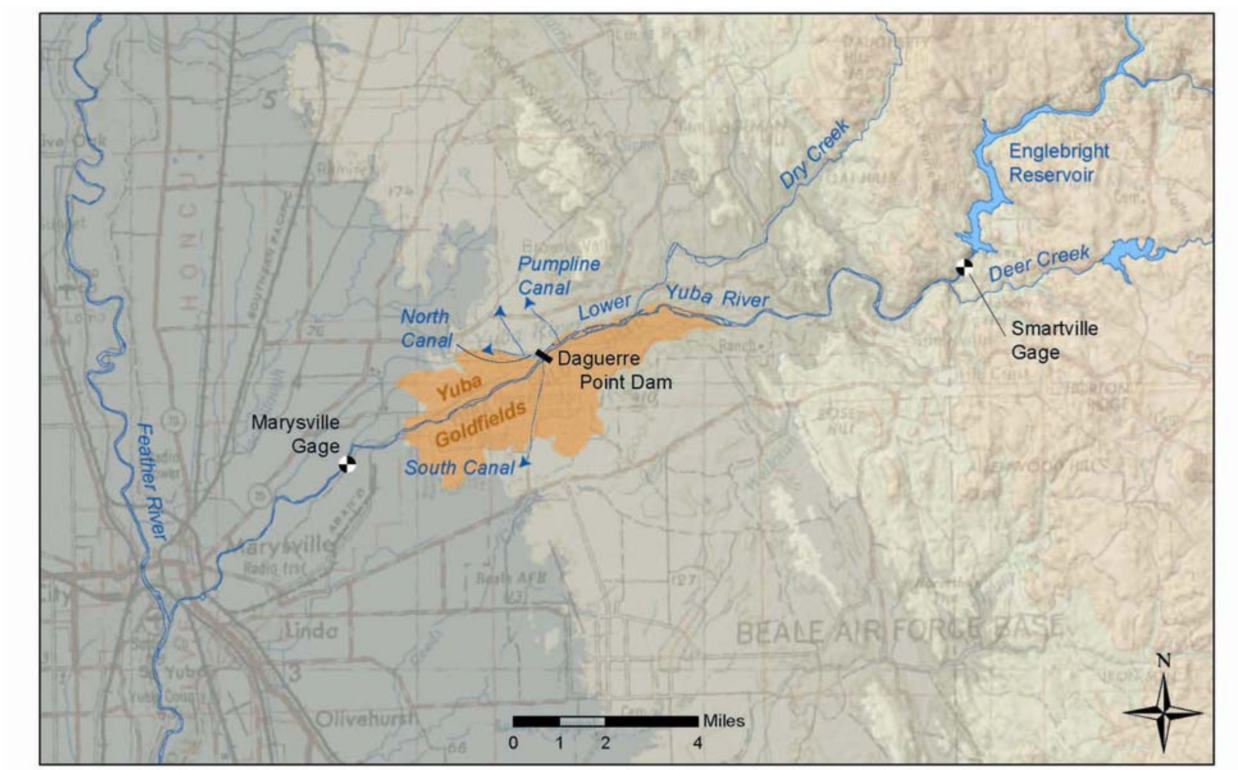

Figure A-2. Lower Yuba River

BVID diverts water at its Pumpline Diversion Facility, approximately one mile upstream from Daguerre Point Dam. Daguerre Point Dam, located at RM 11.6, controls water elevations for irrigation diversions. CID, HIC, and RWD receive water via the Hallwood-Cordua Canal (North Canal) from the north side of the Yuba River just upstream from the north abutment of the dam. BWD, SYWD, and DCMWC receive water via the South Yuba Canal (South Canal) from the south side of the Yuba River just upstream from the south abutment of the dam.

A.2 MODELING THE LOWER YUBA RIVER

This section presents an overview of the YPM, and describes elements of the model that are common to all modeling scenarios considered in this Draft EIR/EIS.

The first model of the Yuba Basin was developed by DWR's Division of Planning (now named the Bay-Delta Office) using the HEC-3 program to generate inflows for DWR's planning model DWRSIM for the SWP (Yuba River Watershed Model, DWR 1985). Between 1988 and 2002, Bookman-Edmonston Engineering, Inc. (B-E), on behalf of YCWA, collaborated with DWR to further refine and develop this model. B-E moved the model from the HEC-3 to the HEC-5 software platform, and modified operational parameters and criteria to better characterize YCWA operations. The HEC-5-based Yuba River Basin Model simulates the entire Yuba River watershed, including facilities outside of YCWA's operational control. Detailed information regarding the HEC-5 model is presented in the Yuba River Basin Model: Operations and Simulation Procedures Report prepared for the SWRCB 2000 Lower Yuba River Hearings.

In 2002, MWH developed the YPM, a spreadsheet model of the Yuba Project and lower Yuba River. Inflows to New Bullards Bar and Englebright reservoirs, and flows from Deer Creek to the lower Yuba River were obtained from the output of the HEC-5 Yuba River Basin Model. The YPM was subsequently used to determine operations of New Bullards Bar Reservoir to meet instream flow requirements, diversion demands, and reservoir operational requirements for the 2006 and 2007 Yuba Accord Pilot Program. Figure 3-2 of Appendix D, Modeling Technical Memorandum, shows the YPM network schematic and lists model output.

A.2.1 YUBA PROJECT MODEL

The YPM simulates system operations for a multi-year period using a monthly time-step. The model assumes that facilities, land use, water supply contracts, and regulatory requirements are constant over the simulation period, representing a fixed level of development (e.g., 2001 or 2020). The historical flow record from October 1921 to September 1994[4], adjusted for the influence of land use changes and upstream flow regulation, is used to represent the possible range of water supply conditions (this approach is standard practice for planning models, though projects with a long planning horizon are considering climate change scenarios). For example, model results for 1976 to 1977 do not try to represent the historical flow conditions that actually occurred in 1976 to 1977, but rather represent the flow conditions that would occur with operation of the current (or future) facilities under current (or future) regulatory conditions during a repeat of the 1976 to 1977 two-year drought.

[4] Hydrologic inputs for the Yuba Project Model have been developed for the period October 1921 to September 2005. However, the shorter period October 1921 to September 1994 was used for modeling for this Draft EIR/EIS to conform to the simulation period used by the CALSIM II model.

A.2.1.1 INFLOWS

In general, inflow data for the YPM are derived from the HEC-5 based Yuba River Basin Model (model run YRBMS 18-99). The HEC-5 Yuba River Basin Model yields a time series of monthly simulated system flows for a 73-year period with a repeat of the 1922 to 1994 historical hydrologic conditions. Inflows for the 1922 to 1994 period account for upstream impairments at Jackson Meadows Reservoir, Bowman Reservoir, Fordyce Lake, and Lake Spaulding. These inflows also account for exports from the South Yuba River to Deer Creek, the American River Basin, and Bear River Basin, and exports from Slate Creek to the Feather River Basin.

For modeling purposes, inflows to New Bullards Bar Reservoir are aggregated into a single time series. This inflow incorporates flows from the North Yuba River, Oregon Creek, and the Middle Yuba River via the Camptonville and Lohman Ridge tunnels. Similarly, inflows to Englebright Reservoir are aggregated into a single time series representing combined inflow from the South Yuba River, Middle Yuba River, Canyon Creek, and Oregon Creek.

Deer Creek flows into the Yuba River below the Smartville Gage. Deer Creek has upstream impairments, with diversions into the Bear River and American River watersheds. Modeled inflows from 1922 through 1994 account for these upstream impairments, and calculated inflows to the lower Yuba River are corrected for accretions and depletions along Deer Creek.

In the YPM, inflows from Dry Creek into the lower Yuba River are not considered in reservoir release decisions to meet downstream flow and diversion requirements. Flows in Dry Creek are regulated by Merle Collins Reservoir, which is outside of YCWA's operational control. Inflows from Dry Creek are not included in the model's flow balance at the Marysville Gage for meeting regulatory requirements. However, Dry Creek flows are included in the lower Yuba River outflow to the Feather River that is input into the CALSIM II model.

A.2.1.2 RESERVOIR EVAPORATION

Reservoir storage is adjusted for evaporation for each month in the period of simulation using an area-capacity curve and monthly evaporation factors. The monthly evaporation factors for New Bullards Bar and Englebright reservoirs are presented in **Table A-1**.

Table A-1. Monthly New Bullards Bar and Englebright Reservoir Evaporation Factors

Reservoir	Evaporation Rate (ft/month)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
New Bullards Bar	0.36	0.16	0.11	0.09	0.13	0.19	0.28	0.35	0.53	0.64	0.60	0.44
Englebright	0.42	0.16	0.10	0.09	0.16	0.24	0.31	0.40	0.63	0.76	0.71	0.50

A.2.2 NEW BULLARDS BAR RESERVOIR OPERATIONS

New Bullards Bar Reservoir operations are primarily driven by downstream demands (instream flow requirements and diversion requirements), power generation considerations, and requirements for annual carryover storage.

A.2.2.1 RESERVOIR RULE CURVES

Reservoir rule curves, or target operating lines, define reservoir target storage for each month. These different rule curves are discussed below.

The New Bullards Bar Reservoir critical line is based on the terms of the 1966 PG&E Power Purchase Contract, as described in Chapter 5 of the Draft EIR/EIS. Under the Power Purchase Contract, PG&E has a right to require YCWA to release up to 3,700 cfs through New Colgate Powerhouse to bring the end-of-month storage in New Bullards Bar to the critical line each month. Storage is allowed to exceed the monthly power storage critical line when releases from New Bullards Bar Reservoir would result in Englebright Reservoir releases exceeding the combined capacity of Narrows I and Narrows II powerhouses, causing reductions in total system power generation. The New Bullards Bar Reservoir critical line is not used in the YPM, and is discussed here for reference only.

For modeling purposes, the FERC-required minimum pool for New Bullards Bar Reservoir of 234 TAF line establishes the minimum reservoir storage. Similarly, the target operating line establishes the maximum reservoir storage for a given month, except under two conditions:

- New Bullards Bar Reservoir releases to achieve the target storage line would exceed the release capacity of the New Colgate Powerhouse

- New Bullards Bar Reservoir releases to achieve the target storage line would cause releases at Englebright Dam to bypass Narrows I and Narrows II due to the combination of large releases from New Bullards Bar Reservoir and high inflows from the South Yuba and Middle Yuba rivers.

A target operating line is established for each based on the carryover storage requirements described in Section A.3.2.3.

A.2.2.2 FLOOD CONTROL

New Bullards Bar Dam must be operated from September 16 to May 31 to comply with flood control regulations. Under the contract between the United States and YCWA entered into on May 9, 1966, YCWA agreed to reserve up to 170 TAF of storage space for flood control. The YPM specifies an end-of month flood control space, as presented in **Table A-2**. This flood control space does not vary from year to year. The YPM makes controlled releases through New Colgate Powerhouse and New Bullards Bar Dam bottom outlet, and uncontrolled releases through the spillway to maintain the flood control space.

Table A-2. New Bullards Bar Reservoir Flood Storage Space Allocation

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Storage (TAF)	170	170 170	170 170	170			70	0	0	0	0	56

A.2.2.3 POWER GENERATION

In the YPM, power generation from New Colgate Powerhouse is calculated each month based on reservoir surface water elevation, flow-dependent tailwater elevation, and an assumed efficiency of 90 percent. The maximum capacity of the powerhouse is assumed to be 3,700 cfs. The minimum power generation per month from New Colgate Powerhouse is assumed to be 18,500 MWh, as stated in the 1966 PG&E Power Purchase Contract. The Fish Release Powerhouse is not included in the YPM power generation calculation.

A.2.2.4 ANNUAL CARRYOVER STORAGE TARGET

New Bullards Bar Reservoir is operated to meet minimum carryover storage requirements (end-of-September storage) designed to ensure that instream flow requirements and anticipated surface water deliveries to YCWA member units will be met during the next year. The carryover storage requirement is a drought protection measure. Reservoir carryover storage is used to make up the difference between the available surface water supply and system demands (diversion demands, instream flow requirements, and system operational losses) under dry conditions. For modeling purposes, the determination of the yearly carryover storage requirement is based on several factors: the drought protection level (return period); Member Unit water demands; instream flow requirements; minimum percentage delivery during the next year; and forecasted unimpaired flows. The drought protection level is designed to provide full instream flow requirements and 50 percent of diversion requirements during the following water year, if that water year were to have the specified return period (assumed for this modeling to be 1 in 100 years, that is, if the next year is a 1-in-100 driest year). The 50 percent delivery corresponds approximately to no deliveries of supplemental water, a 50 percent cut in deliveries of base project water, and full deliveries of all pre-1914 water rights settlement water.

For modeling purposes, the delivery carryover storage requirement is calculated as:

Carryover storage requirement

= Annual diversion requirement for member units (with 50 percent deficiency)

\+ Annual instream flow requirement

\+ Annual system operational loss

\+ Annual evaporation (27 TAF)

\+ Operation buffer (50 TAF)

\+ Minimum pool (234 TAF)

\- Available water for the lower Yuba River during the following year, if it were to have a specified hydrological condition (assumed to be 1-in-100 driest year)

System operational losses are present because the lower Yuba River is not completely controlled by the existing facilities (e.g., inflows from Deer Creek and Dry Creek). The following two relationships have been developed based on model simulations. The development of system loss is focused on the simulation results for drier water years, when the carryover storage requirements affect the water supply available for deliveries.

Water Available Annually for the Lower Yuba River

$$= 0.00005045\,(\text{Annual total unimpaired flow of Yuba River Basin})^2$$

$$+\ 0.6446\,(\text{Annual total unimpaired flow of Yuba River Basin})$$

System Operational Loss

$$= 6.2619\,(\text{Annual total unimpaired flow of Yuba River Basin})^{3.04736}$$

To simplify the demand and instream flow requirements in the calculation of the annual carryover storage requirement, the diversion and instream fishery flow requirements for the period from October to March used for the above calculation are the requirements for above normal water years, which results in smaller diversion requirements and higher instream fishery flow requirements. Before the new year type classification is determined, the operation should follow the year type defined in the previous year; however, this refinement is not considered necessary for the precision of modeling.

The carryover storage requirement is relaxed when it would result in a delivery shortage of more than 50 percent in the current year. This is because YCWA would not operate the Yuba Project so as to impose deficiencies of 50 percent or greater in the current year to protect against the risk of a 50 percent curtailment in the following year.

The annual and multi-year inflows and associated exceedance probabilities, and the minimum observed inflow during the historical period 1922 to 1994 are presented in **Table A-3.** Exceedance probabilities are based on an assumed log-Pearson distribution of flows. The 1977 unimpaired flow corresponds approximately to a 1 in 167 year drought event. The 1976 to 1977 2-year unimpaired flow corresponds to a 1 in 300 year drought event. The 1987 to 1992 6-year unimpaired flow corresponds approximately to a 1 in 100 year drought event.

Table A-3. Exceedance Probability and Historical Minimum River Unimpaired Flow

Exceedance Probability	1-Year Flow	2-Year Flow	3-Year Flow	4-Year Flow	5-Year Flow	6-Year Flow	7-Year Flow
Historical Flow (TAF)							
Historical Minimum	370 [a]	1,174 [b]	3,323	4,821	6,430	7,341 [c]	9,891
Corresponding Exceedance	99.40%	99.67%	97.96%	98.07%	97.89%	98.98%	97.91%
Calculated Flow For a Given Exceedance (TAF)							
99.5%	350	1,277	2,745	4,082	5,407	6,754	8,461
99.0%	432	1,482	3,005	4,435	5,863	7,325	9,108
98.5%	490	1,621	3,179	4,667	6,160	7,694	9,525
98.0%	537	1,730	3,313	4,845	6,387	7,975	9,840

[a] 1977
[b] 1976 to 1977
[c] 1987 to 1992

Carryover storage requirements for water transfers are calculated in the same manner as carryover storage requirements for delivery drought protection, except that the requirement for water transfers is calculated so there is sufficient water to provide 100 percent deliveries to Member Units in the following year for a 1-in-100 year drought event. This difference is necessary because YCWA may transfer only water that is surplus to that needed for local uses. Attachment C describes these carryover storage requirements in more detail.

A.2.2.5 FLOW REQUIREMENTS BELOW NEW BULLARDS BAR DAM

The 1963 FERC license, as amended in 1966, contains reservoir release and instream flow requirements. YCWA is obligated to operate the Yuba Project to meet minimum instream flows throughout the year below New Bullards Bar Dam, Englebright Dam and Daguerre Point Dam. The minimum release to the North Yuba River from New Bullards Bar Reservoir is 5 cfs year-round. The YPM specifies a minimum 5 cfs release from the bottom outlet of New Bullards Bar Dam through the Fish Release Powerhouse.

A.2.3 ENGLEBRIGHT RESERVOIR OPERATIONS

The YPM does not simulate storage operations at Englebright Reservoir. Within the model, storage is held constant from month to month. Each month's release equals reservoir inflow less reservoir evaporation. The maximum controlled release from Englebright Reservoir is 4,190 cfs through the Narrows I and Narrows II powerhouses. The release capacities of the Narrows I and Narrows II powerhouses are used as part of the release criteria for New Bullards Bar Reservoir to avoid spilling at Englebright Reservoir. However, because Englebright Reservoir also receives uncontrolled inflows from the South Yuba and Middle Yuba rivers, spilling of Englebright Reservoir at some times is unavoidable.

A.2.3.1 POWER GENERATION

In the YPM, power generation at Narrows I and II is not an operational constraint. However, it is calculated to estimate the total system power generation. There are no considerations for maximizing power generation other than through avoiding spills at Englebright Reservoir. Power generation from the Narrows I and II powerhouses is calculated each month based on an assumed reservoir surface water elevation of 530 feet, flow-dependent tailwater elevation, and an assumed efficiency of 90 percent.

A.2.3.2 FLOW REQUIREMENTS BELOW ENGLEBRIGHT DAM

YCWA's FERC license specifies minimum release schedules to be met, except for flood control operations and release of uncontrolled inflows from tributary streams. Stream flow fluctuation and ramping criteria specified in the 1966 FERC license have since been superseded by a more restrictive set of requirements established on November 22, 2005.

Flow requirements in the 1993 Narrows I Powerhouse FERC license are not modeled in the YPM for the following reasons: (1) the 1993 FERC license flow requirements have only a limited impact on the operation of New Bullards Bar and Englebright reservoirs because flow requirements usually are satisfied by operations for Daguerre Point Dam diversion requirements and instream flow requirements below Daguerre Point Dam under YCWA's 1966 FERC license, (2) the 1993 FERC license flow requirements have been shown to be constantly met under the Yuba Accord Alternative, and (3) YPM cannot explicitly incorporate the conditions specifying when the 1993 Narrows I licensee will maintain the schedule of daily average flows. The volume accounting procedure required in the FERC license could be implemented through iterative YPM simulations. However, a preliminary study showed that the limited impact of these requirements does not warrant such an elaborate effort; rather, a post-processing spreadsheet analysis provides a satisfactory check that these requirements are met.

Flow Stability Criteria below Englebright Dam have been established to avoid dewatering Chinook salmon redds and causing other fishery related impacts. For modeling purposes, the flow in October is established as an additional modified flow requirement for November through January.

Because the ramping criteria are characterized by 5-day averages, and the YPM uses a monthly time step, literal application of the ramping criteria in modeling would unrealistically restrict operations of New Bullards Bar Reservoir. Accordingly, the modeling uses a simplified ramping criterion, where changes in monthly releases from Englebright Dam under non-spill conditions are not allowed to exceed 200 cfs between October and January.

A.2.4 DIVERSION REQUIREMENTS

All diversions on the lower Yuba River are modeled using an aggregate diversion at Daguerre Point Dam. The aggregate diversion includes diversions to serve areas north and south of the lower Yuba River, riparian diversions to the Dantoni Area downstream of Daguerre Point Dam, diversions to the City of Marysville and seepage losses.

Agricultural diversion requirements for the YCWA service area have been estimated for present and projected full level of development conditions in Yuba County (SWRCB Lower Yuba River Hearings 2000, Exhibit S-YCWA-15: Lower Yuba River diversion requirements: Present and full development). The 12-month schedules of diversion requirements are based on crop acreages and applied crop water rates within the service area (as limited by contract allocations). The diversion requirements also account for fall flooding of rice fields for waterfowl habitat and rice straw decomposition. The present level of demands presented in **Table A-4** are for water purveyors that have existing contracts with YCWA and developed or developing distribution systems to convey Yuba River water to the purveyor's service area. The table also includes 400 AF per month for seepage losses from the lower Yuba River upstream of the Marysville Gage. The post-2007 agricultural demands on the lower Yuba River (after implementation of the Wheatland Project) are presented in **Table A-5**. The service area for the post-2007 demands includes the present YCWA service area and the Wheatland Water District[5].

Table A-4. Irrigation Demand at Daguerre Point Dam, Present Level Development

Water Year Type (YRI)	Irrigation Demand (AF)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Wet	18,692	10,441	5,210	400	400	1,226	13,055	59,187	54,170	63,869	53,743	17,705	298,098
Above Normal	18,692	10,441	5,210	400	400	1,226	13,055	59,187	54,170	63,869	53,743	17,705	298,098
Below Normal	18,692	10,441	5,210	400	400	2,753	17,311	59,187	54,170	63,869	53,743	17,705	303,881
Dry	18,692	10,441	5,210	400	400	2,753	17,311	59,187	54,170	63,869	53,743	17,705	303,881
Critical	18,692	10,441	5,210	400	400	2,753	17,311	59,187	54,170	63,869	53,743	17,705	303,881

Table A-5. Irrigation Demand at Daguerre Point Dam, Projected Full Development

Water Year Type (YRI)	Irrigation Demand (AF)												
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
Wet	20,543	10,717	5,338	400	400	2,191	17,625	65,600	62,174	72,780	60,519	20,201	338,488
Above Normal	20,543	10,717	5,338	400	400	2,191	17,625	65,600	62,174	72,780	60,519	20,201	338,488
Below Normal	20,543	10,717	5,338	400	400	3,835	22,230	65,600	62,174	72,780	60,519	20,201	344,736
Dry	20,543	10,717	5,338	400	400	3,835	22,230	65,600	62,174	72,780	60,519	20,201	344,736
Critical	20,543	10,717	5,338	400	400	3,835	22,230	65,600	62,174	72,780	60,519	20,201	344,736

[5] The first phase of the Wheatland Project is estimated to have a total annual demand at Daguerre Point Dam of 29 TAF. This demand will not all come online in 2008; a reasonable estimate is that 60 percent of this demand will be served in 2008, 80 percent in 2009 and 100 percent in 2010. After the completion of the second phase of the project, it is estimated that the total annual demand of the Wheatland Water District will be 40 TAF.

The estimated demands have been refined to adjust for water year type classifications based on the Yuba River Index. This refinement reflects an estimated reduction of demand in wet and above normal years resulting from higher than normal soil moisture at the start of the irrigation season and reduced pre-irrigation water requirements. Water demands for grains, pastures, and orchards are reduced by 0.4 feet during March and April in these water year types.

Figure A-3 compares the estimated annual present level development demands used for modeling purposes with historical deliveries by YCWA to its Member Units. The present level development demands shown in Figure A-3 do not include estimated demands for riparian diverters within the Dantoni Area, or demands for the City of Marysville, or the estimated seepage losses. The figure shows that since 1998 surface water deliveries have been consistent with the assumed present level of demand presented in **Table A-4**.

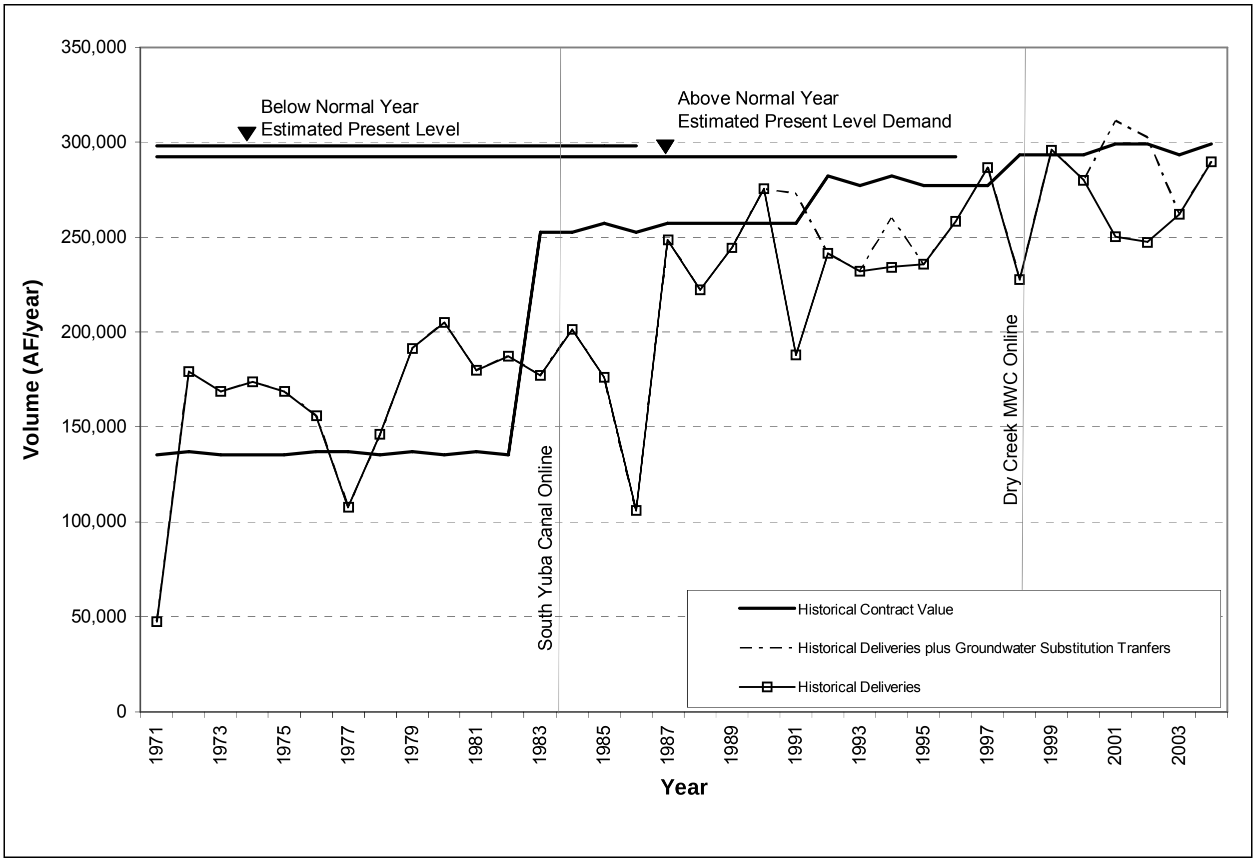

Figure A-3. Historical Deliveries to YCWA Member Units Compared to Estimated Present Level of Demands

A.2.5 DELIVERY SHORTAGE CALCULATIONS

The YPM meets the full diversion demand at Daguerre Point Dam, if the resulting end-of-September carryover storage in New Bullards Bar Reservoir is above the delivery carryover storage required for the specified level of drought protection (1 in 100 years). Delivery deficiencies of up to 50 percent are allowed by the model to maintain delivery carryover storage requirements. Delivery shortages, when required, are applied uniformly (as a fixed percent of demand) from April through to the following March. If a 50 percent deficiency is reached, then

New Bullards Bar Reservoir is drawn down below the carryover storage requirement, as necessary to prevent deficiencies from exceeding 50 percent during that year.

A.2.6 WATER TRANSFERS

Two types of water transfers are modeled using the YPM: (1) stored water transfers, and (2) groundwater substitution transfers. For a stored water transfer, the monthly transfer volume is added to the system demands downstream of Daguerre Point Dam. The diversions at Daguerre Point Dam are maintained and the additional water (transfer volume) flows into the Feather River. Stored water transfers for the Yuba Accord Alternative are implicit in the Accord flow schedules and New Bullards Bar Reservoir target operating line so do not require this adjustment.

Modeling groundwater substitution transfers requires two modifications to the YPM: (1) the diversion demand at Daguerre Point Dam is proportionally uniformly decreased over the irrigation season, typically April to September by the amount of the groundwater substitution transfer, and (2) the system demand downstream from Daguerre Point Dam is increased. The seasonal volume of increased demands downstream of Daguerre Point Dam is equal to the decrease in irrigation deliveries. However, the temporal mismatch from month to month is balanced through regulation of New Bullards Bar Reservoir releases. Reduced releases from New Bullards Bar Reservoir prior to the transfer result in additional storage, or backing-up water, in New Bullards Bar Reservoir. The start of groundwater substitution operations requires that New Bullards Bar Dam is under water management operations and is not operating to meet flow requirements at the Smartville Gage.

In an iterative modeling procedure, the annual volume of groundwater substitution transfer is determined by considering the available pumping capacity at Banks and Jones pumping plants, and rules developed to protect the Yuba groundwater basin from excessive drawdown. Subsequently, the YPM is rerun, and surface water deliveries in any year are reduced by the amounts of any groundwater substitution pumping to achieve the transfer volume.

A.2.7 GROUNDWATER MODELING

The YPM includes a simple routine for simulating combined storage in the North Yuba and South Yuba groundwater subbasins. Groundwater modeling is limited to simple mass balance accounting of changes in annual storage from existing conditions. The two subbasins are treated as a single basin. Changes in storage from existing conditions are based on: (1) the net observed historical rate of groundwater recharge, (2) deficiency groundwater pumping to make-up for any surface water delivery shortages, and (3) groundwater substitution pumping. The net observed historical rate of groundwater recharge is the average annual historical change in groundwater storage after removing the effects of historical groundwater substitution transfers. A detailed analysis of historical groundwater conditions is presented in Chapter 6, Groundwater Resources, of the Draft EIR/EIS. The average annual recharge rate for the North Yuba Subbasin is estimated to be about 10 TAF per year. The average annual recharge rate for the South Yuba Subbasin is estimated to be about 20 TAF per year. The change in storage is calculated as the net observed historical rate of groundwater recharge, minus simulated deficiency pumping, minus simulated groundwater substitution pumping. Changes in induced groundwater recharge due to changes in groundwater levels are ignored in this approach.

With implementation of the Wheatland Project, additional groundwater pumping capacity will be available in the South Yuba Subbasin. Water users in the Wheatland Water District have historically pumped groundwater to meet all their agricultural water demands. After 2007, YCWA will deliver surface water from the Yuba River to the Wheatland Water District to meet a total future projected annual agricultural water demand of approximately 40 TAF. As a result, the Wheatland Project will have a positive effect on the South Yuba Subbasin groundwater storage. So as to achieve a conservative analysis, the beneficial effect of the Wheatland Project on groundwater storage and recharge has not been accounted for.

A.3 MODELING SCENARIOS

The Existing Condition and four alternatives are considered in detail for this Draft EIR/EIS. The alternatives considered are as follows:

- No Project Alternative (as defined by CEQA)
- No Action Alternative (as defined by NEPA)
- Yuba Accord Alternative (Proposed Project/Action)
- Modified Flow Alternative

These alternatives are described in detail in Chapter 3 of the Draft EIR/EIS. A total of seven model scenarios are considered:

- Scenario 1: CEQA Existing Condition
- Scenario 2: CEQA No Project Alternative
- Scenario 3: CEQA Yuba Accord Alternative
- Scenario 4: CEQA Modified Flow Alternative
- Scenario 5: NEPA No Action Alternative
- Scenario 6: NEPA Yuba Accord Alternative
- Scenario 7: NEPA Modified Flow Alternative

These modeling scenarios are discussed in Section 4 and Section 5 of the Modeling Technical Memorandum. The assumptions for the different modeling scenarios are summarized in Table 3-1 of the Modeling Technical Memorandum. This section describes how the different scenarios are modeled with respect to New Bullards Bar Reservoir target operating line, New Bullards Bar Reservoir carryover storage target, and Yuba River instream flow requirements. Section A.4 discusses the water transfer assumptions for each scenario.

A.3.1 NEW BULLARDS BAR RESERVOIR OPERATING LINE

Simulated New Bullards Bar Reservoir target operating lines are presented in **Figure A-4** and **Table A-6** for the various model scenarios. Reservoir storage levels presented in Table A-6 are maximum amounts; actual reservoir storage may be significantly less in some years due to dry hydrological conditions.

The critical line, described in Section A.2.2.1, is the maximum target storage defined under the 1966 Power Purchase Contract. It is included here for reference only. Target Operating Line 1 represents current practice, agreed to by YCWA and PG&E on a year-to-year basis. Under Target Operating Line 1, YCWA can hold more water in storage than under the critical line. However, both Target Operating Line 1 and the PG&E critical line designate 705 TAF as the end-of-September maximum reservoir surface water elevation. Target Operating Line 1 is the

New Bullards Bar Reservoir target storage for the Existing Condition, the CEQA No Project Alternative, the NEPA No Action Alternative and the Modified Flow Alternative. Target Operating Line 2 is the target storage for the Yuba Accord Alternative.

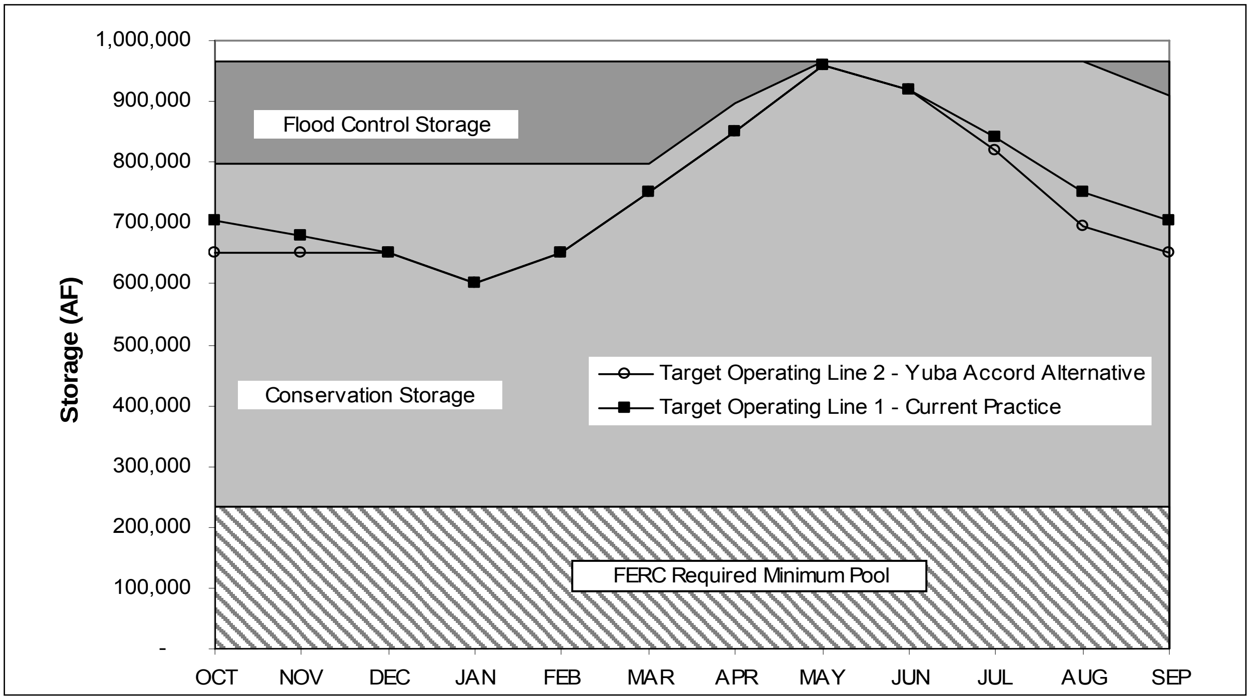

Figure A-4. New Bullards Bar Reservoir Target Operating Lines

Table A-6. New Bullards Bar Reservoir Operational Storage Targets

Target	End-of-Month Storage Target (TAF)											
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Inactive Storage	234	234	234	234	234	234	234	234	234	234	234	234
Critical Line	660	645	645	600	600	685	825	930	890	830	755	705
Target Operating Line 1 [a]	705	680	650	600	650	750	850	960	920	840	750	705
Target Operating Line 2 [b]	650	650	650	600	650	750	850	960	920	820	695	650
Flood Control	796	796	796	796	796	796	896	966	966	966	966	910

[a] Target Storage Line 1 represents current operational practice, and proposed operations under the Modified Flow Alternative.
[b] Target Storage Line 2 represents proposed operations under the Yuba Accord Alternative.

A.3.2 LOWER YUBA RIVER INSTREAM FLOW REQUIREMENTS

Instream flow requirements on the lower Yuba River were originally specified in the September 2, 1965 agreement between YCWA and CDFG. These requirements were incorporated into the 1966 FERC license which specified minimum releases from Englebright Dam. In 1993, FERC issued a new license to PG&E for the continued operation of the Narrows I Powerhouse. Contained within this license is a new set of instream flow requirements for fisheries resources downstream of Englebright Dam as measured at the Smartville Gage. SWRCB in Revised Decision-1644 (RD-1644), adopted July 16, 2003, specified both interim and long-term instream flow requirements for the lower Yuba River at the Smartville and Marysville gages. The Yuba Accord Alternative would implement three agreements relating to operation of the Yuba Project. Changes in facility operations under the Yuba Accord Alternative would primarily be triggered by proposed new instream flow schedules at the Smartville and Marysville gages. The proposed instream flows are described in Exhibit 1 of the Lower Yuba River Fisheries Agreement.

The 1966 FERC flow requirements, RD-1644 flow requirements and the proposed Yuba Accord flow schedules are described in Chapter 5 of the Draft EIR/EIS. This section describes how these instream flow requirements are modeled in the YPM. Regulatory flow requirements at the Smartville and Marysville gages are sometimes specified for parts of some months. These flow requirements must be approximated for use in a model that uses a monthly timestep.

Several water supply indices have been developed for the Yuba Basin. These indices are used to specify minimum instream flow requirements and water supply contract obligations. Flow requirements under RD-1644 are defined by the Yuba River Index. Flow requirements for the Yuba Accord Alternative are defined by the North Yuba Index.

The Yuba River Index was developed in 2000 for the SWRCB Lower Yuba River Hearings to describe the hydrology of the lower Yuba River. This index is a measure of the unimpaired river flows at Smartville. The Yuba River Index is used to determine the water year types and the corresponding instream flow requirements under RD-1644.

The North Yuba Index was developed in conjunction with the Proposed Yuba Accord. This index provides a measure of available water in the North Yuba River that can be used to meet instream flow requirements and delivery requirements to Member Units on the lower Yuba River. The Yuba River Index is based on unimpaired flows at Smartville, and thus does not accurately represent the water available for storage by YCWA. The North Yuba Index comprises two components: (1) active storage in New Bullards Bar Reservoir at the start of the current water year (October 1), and (2) total actual and forecasted inflow into New Bullards Bar Reservoir for the current water year, including diversions from the Middle Yuba River and Oregon Creek to New Bullards Bar Reservoir. The definition and calculation of the North Yuba Index is presented in Exhibits 4 and 5 of the Proposed Yuba Accord Lower Yuba River Fisheries Agreement.

In the YPM instream flow requirements are applied based on the water year type from April through March. The Yuba River Index was reconstructed from 1922 to 1994 using results from the HEC-5 based Yuba River Basin Model. The North Yuba Index is calculated dynamically in the YPM based on New Bullards Bar Reservoir storage and forecasted inflow. The YPM assumes perfect knowledge of future inflows to forecast the North Yuba Index in April.

A.3.2.1 SMARTVILLE GAGE

The Smartville Gage is located approximately 2,000 feet downstream from Englebright Dam, and upstream from the Deer Creek inflow. In the YPM, flow at this gage is simulated as the total outflow from Englebright Dam. The various instream flow requirements for the Smartville Gage, as modeled, are presented in **Table A-7**.

Table A-7. Modeled Yuba River Instream Flow Requirements at the Smartville Gage

1966 YCWA FERC License												
All Water Year Types [e]	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
	527 [a]	620	620	818 [a]	620	620	0	0	0	0	0	0
SWRCB RD-1644 Interim (cfs)												
Water Year Type (Yuba River Index)	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Wet	700	700	700	700	700	700	800 [b]	0	0	0	0	490 [b]
Above Normal	700	700	700	700	700	700	800 [b]	0	0	0	0	490 [b]
Below Normal	632 [a]	700	700	700	700	700	767 [b]	0	0	0	0	410 [b]
Dry	555 [a]	600	600	600	600	600	533 [b]	0	0	0	0	383 [b]
Critical	510 [a]	600	600	600	600	600	490 [b]	0	0	0	0	260 [b]
SWRCB RD-1644 Long-term (cfs)												
Water Year Type (Yuba River Index)	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Wet	700	700	700	700	700	700	800 [b]	0	0	0	0	490 [b]
Above Normal	700	700	700	700	700	700	800 [b]	0	0	0	0	490 [b]
Below Normal	700	700	700	700	700	700	800 [b]	0	0	0	0	490 [b]
Dry	555 [a]	600	600	600	600	600	733 [b]	0	0	0	0	383 [b]
Critical	510 [a]	600	600	600	600	600	733 [b]	0	0	0	0	330 [b]
Extremely Critical	510 [a]	600	600	600	600	600	567 [b]	0	0	0	0	330 [b]
Yuba Accord Alternative (cfs)												
Water Year Type (North Yuba Index) [c]	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
1	700	700	700	700	700	700	850 [b]	0	0	0	0	700
2	700	700	700	700	700	700	750 [b]	0	0	0	0	700
3	700	700	700	700	700	700	700 [b]	0	0	0	0	700
4	700	700	700	700	700	700	800 [b]	0	0	0	0	700
5	600	600	550	550	550	550	600 [b]	0	0	0	0	500
6	600	600	550	550	550	550	550 [b]	0	0	0	0	500
Conference [d]	527	620	620	818	620	620	0	0	0	0	0	0

[a] Indicated flow represents average flow rate for the month. Actual flow requirements vary during the month.
[b] Indicated flow represents average flow rate for the month. Actual flow requirements vary during the month. Where the actual flow requirement is zero for part of the month, the flow requirement for modeling purposes is based on the flow requirement at the Marysville Gage.
[c] For the Yuba Accord Alternative, Schedule 1 years are years with the NYI > 1,400 TAF, Schedule 2 are years with NYI > 1,040 TAF, Schedule 3 are years with NYI > 920 TAF, Schedule 4 are years with NYI > 820 TAF, Schedule 5 are years with NYI > 693 TAF, Schedule 6 are years with NYI > 500 TAF, and Conference Years are years with NYI < 500 TAF.
[d] In Conference Years under the Yuba Accord Alternative, YCWA would operate the Yuba Project so that flows in the lower Yuba River comply with the instream flow requirements of YCWA's 1966 FERC license, except that YCWA would not pursue any of the flow reductions authorized by Article 33(c) of that license.
[e] Flow schedules include a buffer of 2.5 percent + 5 cfs. The buffer is required because the minimum instream flow specified in the 1966 FERC license is a daily required flow.

In April and September, flow requirements under RD-1644 and the Yuba Accord Alternative at the Smartville Gage are specified only for part of the month. For modeling purposes, the instream flow requirement for Marysville, for the part of the month for which no Smartville requirement is specified, is used to calculate the monthly average flow requirement at the Smartville Gage. This step has been taken to so that the Smartville flow requirement controls New Bullards Bar Reservoir operations when appropriate. For example, the required flow at the Smartville Gage under the Yuba Accord Alternative under Schedule A is 700 cfs for April 1 to 15, and is not specified for April 16 to 30. For Schedule 2 years, the required flow at Marysville is 700 cfs Apr 1 to 15 and 800 cfs for April 16 to 30. For modeling purposes, the required flow at the Smartville Gage for Schedule 2 years is calculated as 700 cfs for 15 days and 800 cfs for 15 days, resulting in a monthly average flow of 750 cfs.

A.3.2.2 MARYSVILLE GAGE

The Marysville Gage is the lower of the two flow requirement compliance points. For modeling purposes, the Marysville Gage flow is calculated as the flow over Daguerre Point Dam; no accretions or depletions are simulated below the dam. The flow over Daguerre Point Dam is calculated as the flow at Smartville, plus the inflow from Deer Creek, minus the Daguerre Point Dam diversion. The various instream flow requirements for the Marysville Gage are presented in **Table A-8**.

Several months (April, June, July, and September) have different flow requirements for different parts of the month. Because the YPM operates on a monthly timestep, the weighted average monthly flow for each month is used. For example, if the minimum instream flow requirement for April requires 20 days at 500 cfs and 10 days at 1,000 cfs, the modeled monthly requirement is (500 cfs * 20 days + 1,000 cfs * 10 days)/(20 days + 10 days) = 667 cfs.

A.4 WATER TRANSFERS

This section presents the water transfer assumptions for the different modeling scenarios, relating to operation of the Yuba Project and the export of transfer water from the south Delta through Banks and Jones pumping plants. Since 1987 water transfers have been an important element in YCWA's operation of the Yuba Project. For modeling purposes, it is assumed that YCWA transfers are cross-Delta transfers and all transfer water, less carriage water, is moved through Banks or Jones pumping plants. Simulated transfers are limited to periods of Delta balanced water conditions, by the availability of surface water and groundwater water from the Yuba Region, and the availability of conveyance at Banks and Jones pumping plants.

For modeling purposes, the preferred transfer period is from July 1 to September 30. For the months of July, August, and September, EWA has 500 cfs dedicated conveyance capacity at Banks Pumping Plant. EWA actions and the Central Valley Project Improvement Act (CVPIA) (b)(2) actions typically restrict pumping at Banks and Jones pumping plants in April, May, and June, during which months the maximum allowable E/I ratio under D-1641 is 0.35. Transfer capacity under the JPOD may be limited in October due to water quality impacts in the Delta. Release of transfer water is also limited by the scheduled maintenance of Narrow II power plant during the beginning of September.

It is assumed that water transfers, whether derived from storage releases or groundwater substitution pumping, are scheduled so as to achieve maximum fish benefit even if some supplemental instream flows cannot be transferred. Released transfer water that cannot be exported, is not backed-up into CVP/SWP storage, but contributes to Delta outflow.

Table A-8. Modeled Yuba River Instream Flow Requirements at the Marysville Gage

1966 YCWA FERC License [a]												
Water Year Type	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
f>50%	415	415	415	256	256	256	256	256	256	77	77	70
f < 50%	353	353	353	218	218	218	218	218	218	65	65	65
f < 45%	332	332	332	205	205	205	205	218	218	65	65	65
f < 40%	291	291	291	179	179	179	179	218	218	65	65	65
SWRCB RD-1644 Interim Flows (cfs)												
Water Year Type (Yuba River Index)	**Oct** [b]	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Wet	387[c]	500	500	500	500	500	667[c]	1,500	808[c]	265[c]	250	250
Above Normal	387[c]	500	500	500	500	500	667[c]	1,500	808[c]	265[c]	250	250
Below Normal	387[c]	500	500	500	500	500	633[c]	1,500	808[c]	265[c]	250	250
Dry	332[c]	400	400	400	400	400	400[c]	500	400[c]	251[c]	250	250
Critical	332[c]	400	400	400	400	400	357[c]	270	245[c]	103[c]	100	127[c]
SWRCB RD-1644 Long-Term Flows (cfs)												
Water Year Type (Yuba River Index)	**Oct** [c]	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
Wet	387[c]	500	500	500	500	500	667[c]	1,500	808[c]	265[c]	250	250
Above Normal	387[c]	500	500	500	500	500	667[c]	1,500	808[c]	265[c]	250	250
Below Normal	387[c]	500	500	500	500	500	667[c]	1,500	808[c]	265[c]	250	250
Dry	332[c]	400	400	400	400	400	600[c]	1,500	808[c]	265[c]	250	250
Critical	332[c]	400	400	400	400	400	600[c]	1,100	800	265[c]	250	250
Extremely Critical	332[c]	400	400	400	400	400	433[c]	500	500	263[c]	250	250
Yuba Accord Alternative (cfs)												
Water Year Type (North Yuba Index) [d]	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**
1	500	500	500	500	500	700	1,000	2,000	1,500	700	600	500
2	500	500	500	500	500	700	750[c]	1,000	650[c]	500	500	500
3	500	500	500	500	500	500	700	900	500	500	500	500
4	400	500	500	500	500	500	750[c]	745[c]	400	400	400	400
5[e]	400	500	500	500	500	500	550[c]	497[c]	400	400	400	400
6	350	350	350	350	350	350	425[c]	448[c]	225[c]	350[f]	350[f]	450[f]
Conference [g]	400	400	400	245	245	245	245	245	245	70	70	70

[a] Flow schedules include a buffer of 2.5 percent + 5 cfs. The buffer is required because the minimum instream flow specified in the 1966 FERC license is a daily required flow.

[b] The FERC License 2246 instream flow requirement of 400 cfs applies to the period October 1 to October 14.

[c] Indicated flow represents average flow rate for the month. Actual flow requirements vary during the month.

[d] For the Yuba Accord Alternative, Schedule 1 years are years with the NYI > 1,400 TAF, Schedule 2 are years with NYI > 1,040 TAF, Schedule 3 are years with NYI > 920 TAF, Schedule 4 are years with NYI > 820 TAF, Schedule 5 are years with NYI > 693 TAF, Schedule 6 are years with NYI > 500 TAF, and Conference Years are years with NYI < 500 TAF.

[e] For the Yuba Accord Alternative in Schedule 5 years, the instream flow requirement is adjusted when carryover storage in New Bullards Bar Reservoir is below 400 TAF. If the September 30 New Bullards Bar Reservoir storage is below 400 TAF, the Marysville Gage instream flow requirement is 400 cfs from October 1 until the next February Bulletin 120 forecast is available. For modeling purposes, the adjustment is made for the months of October to January. If the September 30 New Bullards Bar Reservoir storage is below 450 TAF, but above 400 TAF the River Management Team may decide to adjust the Marysville Gage instream flow requirement of 400 cfs from October 1 until the next February Bulletin 120 forecast is available. For modeling purposes, this second adjustment is not made.

[f] Includes 30 TAF Schedule 6 year groundwater pumping commitment – modeled as 200 cfs in July and August and 100 cfs in September. The actual flow schedule for the 30 TAF would be determined by the River Management Team according to when the water is transferable to the Transfer Agreement transferees, and to achieve maximum fish benefits.

[g] In Conference Years, YCWA would operate the Yuba Project so that flows in the lower Yuba River comply with the instream flow requirements in YCWA's 1966 FERC license, except that YCWA would not pursue any of the flow reductions authorized by Article 33(c) of that license.

A.4.1 MODELING PROCEDURE

The modeling procedure is broken down into a series of steps. Step 1 and Step 2, described below, are required to establish a set of baseline flows from which the flow and storage conditions subsequently are determined for each of the modeling scenarios. Steps 3 to 6 describe an iterative modeling process using the YPM and the lower Yuba River outflow routing tool (described in Section 3.4 of Appendix D) to simulate YCWA water transfers.

1. The YPM is run to simulate Yuba Project operations for the Yuba Accord accounting baseline (i.e., RD-1644 Interim instream flow requirements, no stored water or groundwater transfers)

2. The CALSIM II model is run to establish a set of baseline conditions for: (a) the CEQA analysis; and (b) the NEPA analysis[6], which are consistent with the lower Yuba River outflow and Daguerre Point Dam diversions established in Step 1.

3. The YPM is run to simulate Yuba Project operations under the Existing Condition and for each alternative in the absence of stored water transfers (except for the Yuba Accord Alternative for which transfers are implicit in the Accord flow schedules and New Bullards Bar Reservoir target operating line), and in the absence of groundwater substitution transfers.

4. Based on CALSIM II output from Step 2, the lower Yuba outflow routing tool is used to adjust flow and storage conditions for all model scenarios due to changes in the lower Yuba River outflow from Step 3 compared to Step 1. Subsequently, for each scenario, Delta conditions are determined (excess or balanced water conditions), and the available pumping capacity at Banks and Jones pumping plants for water transfers calculated.

5. The YPM is rerun to simulate any stored water transfers and/or groundwater substitution transfers.

6. Using the lower Yuba outflow routing tool, the additional outflow from the lower Yuba River from Step 5, is used to adjust Feather and lower Sacramento river flows, Delta inflow, Delta exports, and Delta outflow.

A.4.2 STORED WATER TRANSFERS

In the 18 years between 1987 and 2004, YCWA transferred water in 12 years, averaging about 120 TAF in each transfer year. The details of the individual transfers are presented in Table 5-5 in Chapter 5. Stored water transfers were made by YCWA from storage releases from New Bullards Bar Reservoir in all of the transfer years except for 1994. The majority of transferred water has been exported at Banks and Jones pumping plants for use in service areas south of the Delta.

Single-year stored water transfers may occur when the projected end-of-September carryover storage in New Bullards Bar Reservoir, without the transfer, is greater than the storage required to ensure 100 percent deliveries to Member Units in the following year under a drought event with a 1 in 100 year return period. Carryover storage requirements for local deliveries and carryover storage requirements for stored-water transfers for the various modeling scenarios are presented in **Table A-9**. Values given in the table, except for the Yuba Accord Alternative, are based on a 1-in-100 year level of protection against critically dry conditions in the following year. The reduced carryover storage requirement under the Yuba Accord Alternative is made possible by inclusion of carryover storage in the North Yuba Index which is used to specify the

[6] The CALSIM II model run for the CEQA analysis is based on OCAP Study 3. The CALSIM II model run for the NEPA analysis is based on OCAP Study 5.

following year Yuba Accord flow schedules. Dry hydrologic conditions may result in New Bullards Bar Reservoir carryover storage, before any transfer, below the end of September maximum target storage of 705 TAF. Except under these conditions, the volume of stored water transfer is measured as the differences between 705 TAF and the carryover storage required to ensure full deliveries to YCWA Member Units in the following year.

Table A-9. Carryover Storage Requirements for New Bullards Bar Reservoir

Scenario			Demand (TAF)		Lower Yuba River Flow Requirements	Carryover Storage Requirement (TAF)	
No.	Act	Description	Above Normal Years	Below Normal Years		For Local Deliveries	Stored Water Transfers
1	CEQA	Existing Condition	298	304	RD-1644 Interim	477	610
2/5	CEQA/NEPA	No Project/No Action Alternative	338	344	RD-1644 Long-Term	558	710 [a]
3/6/8	CEQA/NEPA	Yuba Accord Alternative	338	344	Accord Flow Schedules	540 [b]	[c]
4/7/9	CEQA/NEPA	Modified Flow Alternative	338	344	RD-1644 Interim	497 [d]	648 [d]

[a] No stored water transfers are possible because the carryover storage requirement exceeds the Target Operating Line 1 value of 705 TAF for September 30 (see Table A-7).

[b] Value given is based on Schedule 6 instream flow requirements in the following year (April-March). Carryover storage requirement for local deliveries for a conference year (~1:100 year exceedance) is 495 TAF for deliveries.

[c] Because stored-water transfers are inherent in the Yuba Accord Alternative flow schedules and operational parameters, carryover storage requirements for stored water transfers are not used in modeling of Scenarios 3, 6, and 8. The calculated carryover storage requirements for stored water transfers for the Yuba Accord Alternative are 647 TAF for a 1-in-100 Conference Year and 692 TAF for a 1-in-100 Schedule 6 Year.

[d] Values given are based on critical year instream flow requirements in the following year (April-March). Carryover storage requirements for a conference year (~1:100 year exceedance) are 486 TAF for deliveries and 638 TAF for water transfers.

For modeling of the CEQA Existing Condition, the maximum single-year YCWA transfer is capped at 164 TAF, which is the historical maximum YCWA water transfer since inception of the EWA. This transfer occurred in 2002, and included sales to DWR and EWA.

Implementation of RD-1644 Long-term flow requirements and additional irrigation demand at Daguerre Point Dam due to implementation of the Wheatland Project would reduce available storage in New Bullards Bar Reservoir. Carryover storage requirements for water transfers under RD-1644 Long-term exceed the September target operating storage of 705 TAF. Therefore, no stored water transfers are possible for the No Project Alternative and the No Action Alternative.

For the Yuba Accord, stored water is made available through the Yuba Accord flow schedules and through the New Bullards Bar Reservoir Target Operating Line that specifies a target end-of-September storage of 650 TAF (compared to 705 TAF for the Existing Condition, the No Project Alternative, the No Action Alternative, and the Modified Flow Alternative). No additional stored water transfers are modeled.

Attachment C of the Modeling Technical Appendix describes carryover storage requirements for water transfers in greater detail.

A.4.3 GROUNDWATER SUBSTITUTION TRANSFERS

Groundwater substitution transfers were made by YCWA in coordination with its Member Units in 1991, 1994, 2001, and 2002, and are included in all scenarios. For modeling purposes, it is assumed that groundwater substitution pumping occurs in dry and critical years (Sacramento Valley 40-30-30 Index), and in below normal years when the allocations to the SWP are less than 60 percent.

Under the Existing Condition, single-year transfer amounts are capped at 61 TAF, which is the historical maximum YCWA groundwater substitution transfer since inception of the EWA. Similarly, under the Existing Condition, back-to-back groundwater substitution transfers are limited to two successive years and to a maximum total transfer of 116 TAF, which corresponds to the combined 2001 and 2002 transfer.

Analysis of the 2001 and 2002 water transfer data and estimates of historical changes in groundwater storage suggests a third year of transfer of a similar volume could have been conducted without inducing any detrimental decline in groundwater levels in the Yuba Basin and without drawing groundwater levels to the historical low levels seen in 1991. Recent surveys conducted by YCWA with potential participants in the groundwater substitution program indicated a maximum groundwater substitution pumping volume of approximately 90 TAF per year could be implemented.

For the Yuba Accord Alternative, groundwater substitution transfer modeling assumes a maximum 3-year total groundwater pumping volume of 180 TAF. An additional constraint of a maximum 2-year groundwater substitution transfer pumping volume of 120 TAF is applied to prevent transfers of 90 TAF in two consecutive years, followed by a year without any groundwater substitution pumping. The resulting 3-year pattern for maximum annual groundwater substitution pumping is 90 TAF for the first year, 60 TAF for the second year, and 30 TAF for the third year. With implementation of the Wheatland Project, the maximum available groundwater pumping capacity for groundwater substitution transfers and groundwater pumping to make-up for deficiencies in surface water deliveries is assumed to be 120 TAF.

While these constraints establish reasonable maximum groundwater pumping levels for the Yuba Accord Alternative, institutional difficulties in implementing a single-year groundwater substitution transfer program require that additional restrictions on pumping be used to simulate operations for the No Project Alternative, No Action Alternative and the Modified Flow Alternative. Accordingly, groundwater substitution pumping in the absence of a long-term water purchase agreement is limited to a maximum volume of 140 TAF over 3 years. The resulting 3-year pattern for the maximum annual groundwater substitution pumping is 70 TAF in the first year, 50 TAF in the second year, and 20 TAF in the third year.

For the NEPA analysis, groundwater substitution transfers have been further limited by consideration of the volumes of groundwater pumping that may occur in support of the Sacramento Valley Water Management Program.

Limits on the maximum annual volume of groundwater substitution pumping are distributed monthly assuming the following percentages for May through September: 20 percent, 20 percent, 25 percent, 25 percent, and 10 percent respectively. These percentages are based upon experiences from the 2001 and 2002 groundwater substitution transfers. The start of groundwater substitution pumping is dictated by New Bullards Bar Reservoir operations as simulated by the YPM. Water can be backed up in storage when releases from New Bullards Bar Dam are controlled by irrigation requirements at Daguerre Point Dam or instream flow requirements at the Marysville Gage. No groundwater substitution pumping was modeled after the end of September.

For modeling purposes, groundwater pumping is limited so that the long-term average annual groundwater pumping, including deficiency pumping, is at or less than 30 TAF, which is the net observed historical rate of groundwater recharge. Groundwater substitution pumping is also limited so that the simulated groundwater storage remains above the 1991 level.

A.4.4 YUBA ACCORD ALTERNATIVE

Under the Yuba Accord Alternative, YCWA, Reclamation and DWR would be parties to the proposed Water Purchase Agreement. This agreement provides for the purchase and delivery of water to EWA, Reclamation and DWR. Key elements of the Water Purchase Agreement include definition of water supply components, water accounting mechanism, and explanation of Conference Year principles.

Under the Water Purchase Agreement, YCWA would have an obligation to provide specific quantities of transfer water (Component 1, Component 2, and Component 3) and would have the option to provide additional transfer water (Component 4) depending on supply availability and demand. **Table A-11** summarizes YCWA's water transfer commitments under the Water Purchase Agreement. In the first 8 years of the agreement (2007 through December 31, 2015), Reclamation and DWR would purchase 60 TAF per year of Component 1 water, for a total of 480 TAF. YCWA's obligation to supply Component 2 water is year-type dependent. YCWA's obligation to supply Component 3 water would be dependent on CVP/SWP contract allocations and CVP/SWP requests for the water. Component 1 water would be surface water made available through the Yuba Accord flow schedules and New Bullards Bar Reservoir target operating line. Component 2, 3, and 4 water would be made available through a mix of the Accord flow schedules and groundwater substitution pumping.

Table A-10. Summary of Proposed Yuba Accord Water Purchase Agreement

CVP Allocation	SWP Allocation	Water Year Type	Transfer Type	Transfer Amount (TAF)	Source
N/A	N/A	All	Component 1	60	Stored water only [e]
N/A	N/A	Dry	Component 2	15	Stored water and groundwater substitution pumping
N/A	N/A	Critical	Component 2	30	Stored water and groundwater substitution pumping
< 35%	< 40%	N/A	Component 3a	40	Stored water and groundwater substitution pumping
35% - 45%	40% - 60%	N/A	Component 3b	40 [a]	Stored water and groundwater substitution pumping
N/A	N/A	All	Component 4 [c]	Supply Limited [b]	Stored water and groundwater substitution pumping [d]

[a] For modeling purposes, it is assumed that the CVP/SWP will request 40 TAF of Component 3b water when allocations for the CVP or SWP are within the percentages shown. Under the Draft Water Purchase Agreement, there is no commitment by either the CVP or SWP to request this water.

[b] For modeling purposes, it is assumed that YCWA transfer amount is limited only by supply, by Delta conditions, and by conveyance capacity at Banks and Jones pumping plants during the transfer period.

[c] For modeling purposes, it is assumed that, except in dry and critical years, YCWA will delivered previous years undelivered Component 1 water prior to making Component 4 water available to the CVP/SWP.

[d] For modeling purposes it is assumed that that the price of water would not support groundwater substitution transfers in wet and above normal years.

[e] Stored water refers to water made available through the Yuba Accord flow schedules and New Bullards Bar Reservoir target operating line that has an end-of-September target of 650 TAF.

A.4.4.1 SCHEDULE 6 YEAR PUMPING COMMITMENT

As part of the Yuba Accord Alternative, YCWA would enter into agreements with its Member Units (Conjunctive Use Agreements) to implement a program for the conjunctive use of surface water and groundwater. Under these agreements, participating Member Units would agree to pump specified percentages of 30 TAF of groundwater in Schedule 6 years. Through exchanges with surface water deliveries, these agreements would provide 30 TAF to supplement flows at Marysville, over and above the Accord flow schedules for Schedule 6 years.

Schedule 6 year groundwater substitution transfers are modeled through a uniform percentage reduction in the Daguerre Point Dam diversion demand, typically from April to September. The water that would have been diverted at Daguerre Point Dam is backed up in New Bullards Bar Reservoir, and then later released to the Delta on a pattern that allows the CVP/SWP to export the released transfer water. New Bullards Bar Reservoir storage is not affected by Schedule 6 groundwater pumping, after the transfer is complete, because no net storage withdrawal occurs to support the groundwater substitution transfer.

For modeling purposes, storage releases to support the groundwater substitution transfers in Schedule 6 years are assumed to normally provide an increase in flow at Marysville of 200 cfs in July and August, and 100 cfs in September. The release schedule is modified in some years based on CALSIM II model results to account for Delta conditions and available Delta export capacity.

A.4.4.2 GROUNDWATER SUBSTITUTION PUMPING

Accounting rules for water transfers under the Yuba Accord Alternative are presented in *Exhibit 4 – Accounting, and Exhibit 5 – Refill Accounting of the proposed agreement for the Long-term purchase of water from YCWA* of Appendix B. Released Transfer Water is calculated based on baseline flow conditions and flow conditions under the Yuba Accord Alternative, as measured at the Marysville Gage. Delivered Transfer Water is defined as the Released Transfer Water that is accounted as being exported by the Buyers. Transfer accounting determines YCWA need to implement groundwater substitution transfers to provide Component 2 and Component 3 water. Baseline conditions for Released Transfer Water are calculated using the YPM, and are based on RD-1644 interim instream flow requirements and FERC License 2246 instream flow requirements of 400 cfs at the Marysville Gage for the period October 1 to 14.

For modeling purposes, groundwater substitution transfers under the Yuba Accord Alternative are determined based on the following factors:

- Groundwater pumping constraints, described in Section A4.3, formulated to protect the Yuba groundwater basin from overdraft
- Delta conditions and the availability of export capacity at Banks and Jones pumping plants
- YCWA commitment to provide Reclamation and DWR with 15 TAF of Component 2 water in dry years and 30 TAF of Component 2 water in critical years (Sacramento Valley 40-30-30 Index)
- YCWA commitment to provide Reclamation and DWR up to 40 TAF of Component 3 water depending on CVP and SWP contract allocations.

The schedule for the release of groundwater substitution water is determined through post-processing of CALSIM II output. Transfer water is released during periods of Delta balanced water conditions, when there exists: (1) CVP/SWP pumping capacity to export the transfer water, and (2) the E/I ratio is not controlling Delta exports. However, in Schedule 2 and 3 years, 10 percent of the transfer water is dedicated to mitigating instream flows, even if this water is not transferable. In Schedule 4 and 5 years this percentage is 20 percent.

Attachment B

Lower Yuba River Water Temperature Evaluation

Attachment B

Lower Yuba River Water Temperature Evaluation

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Attachment B
Lower Yuba River Water Temperature Evaluation

B.1 INTRODUCTION

The Yuba River has been developed for water supply, hydropower generation, flood control, sedimentation control, and recreation over a period extending back to the Gold Rush in the mid-1800s. These developments have varied and have resulted in complex impacts to the water temperature regime of the Yuba River.

The lower Yuba River is the 24-mile reach stretching from Englebright Dam to the confluence with the Feather River, south of Marysville. The construction of the Yuba River Development Project, and specifically New Bullards Bar Reservoir in 1970, has played a significant role in reducing the lower Yuba River water temperature in the spring, summer, and fall. Inflows from tributaries intermix with releases from reservoirs to develop the water temperature profile within the river channel. The flows emanating from Englebright Reservoir and Narrows I and II powerhouses provide the base flow of cold water in the upper reaches of the lower Yuba River. During certain periods of the year, inflows from Deer Creek (RM 22.7) near Smartville, and Dry Creek (RM 13.6) have significant effects on the heat gain of the river. During the irrigation season, a portion of the river flow is diverted at Daguerre Point Dam (RM 11.6).

Example of the average temperature regime of the lower Yuba River, from New Bullards Bar Reservoir to Marysville for May and August, is shown in **Figure B-1**.

B.1.1 COLDWATER POOL SYSTEM

Other than weather, the greatest factor that affects water temperatures in the lower Yuba River is the temperature of water released from the Narrows I and II powerhouses, which are located immediately downstream of Englebright Dam. Because Englebright Reservoir has a relatively small capacity (70 TAF), the temperature of water released from the Narrows I and Narrows II powerhouses are primarily governed by:

- Temperature of releases from New Bullards Bar Dam through New Colgate Powerhouse
- Air temperature
- Middle Yuba and South Yuba rivers' inflow rates and water temperatures

B.1.1.1 NEW BULLARDS BAR RESERVOIR

New Bullards Bar Reservoir is a 966,000 acre-foot capacity reservoir, which in most years has a significant coldwater pool supply. A cross-section of the dam is shown in **Figure B-2**. The reservoir outlet control gates provide the ability to release water from different levels at the dam, from a high elevation of 1,956 feet above msl to a low elevation of 1,638 feet above msl (at the low-level outlet). The upper intake is fitted with slide gates, so that flows from the upper 150 feet of the reservoir can be regulated.