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7.8 RIPARIAN RESOURCES AFFECTED ENVIRONMENT

This section describes riparian resources around Project reservoirs and diversion pools and along bypass and peaking reaches associated with the Middle Fork American River Project (MFP or Project).

Hydrology and geomorphology information pertinent to the discussion of riparian resources associated with the MFP are summarized in this section. Detailed information on hydrology and geomorphology are discussed in Sections 7.3 – Water Use Affected Environment and 7.7 – Geomorphology Affected Environment, respectively. Special-status plants and wildlife that may occur in riparian areas are discussed in Section 7.6 – Botanical and Wildlife Resources Affected Environment.

7.8.1 Information Sources

Existing information regarding riparian resources in the vicinity of the MFP was collected, reviewed, and evaluated. Relevant information used to prepare this section includes the following reports:

- Final 2005 Physical Habitat Characterization Study Report (PCWA 2006; Supporting Document [SD] G) provides a landscape-level characterization of riparian vegetation distribution and abundance along the river channels upstream and downstream of the MFP dams and diversions.

- Final 2006 Physical Habitat Characterization Study Report (PCWA 2007a; SD G) provides a quantified assessment of riparian resources upstream and downstream of the MFP dams and diversions.

- Pre-Application Document (PAD) for the Middle Fork American River Project (PCWA 2007b) includes a general description of the existing riparian vegetation in the MFP.

- AQ 10 – Riparian Resources Technical Study Report (TSR) (AQ 10 – TSR) (PCWA 2010a; SD B) provides detailed information on riparian vegetation around reservoirs and evaluations of riparian vegetation and hydrologic relationships along the bypass and peaking reaches.

- AQ 1 – Instream Flow TSR (AQ 1 – TSR) (PCWA 2010b; SD B) includes water surface elevation modeling that was used in evaluating the relationships between riparian vegetation and hydrologic regimes along the bypass and peaking reaches.

- AQ 9 – Geomorphology TSR (AQ 9 – TSR) (PCWA 2010c; SD B) includes information on channel geomorphology of bypass and peaking reaches in the vicinity of the MFP, including channel classifications and adjustability.

- TERR 1 – Vegetation Communities and Wildlife TSR – 2007 (TERR 1 – TSR) (PCWA 2010d; SD B) includes maps of riparian vegetation and supplements mapping data collected for the Physical Habitat Characterization reports (PCWA 2006 and 2007a).

7.8.2 Riparian Vegetation around Project Reservoirs and Diversion Pools

Riparian vegetation around the MFP reservoirs and diversion pools was mapped from helicopter and/or ground surveys (PCWA 2006 and AQ 10 – TSR [PCWA 2010a; SD B]). Information on the distribution, composition, and age classes of existing woody riparian vegetation was collected as part of the mapping. Dominant species (woody and herbaceous) were also identified. Specific survey methods used for each reservoir are described in detail in the Physical Habitat Characterization reports (PCWA 2006 and 2007a) and the AQ 10 – TSR (PCWA 2010a; SD B). Riparian mapping data included in TERR 1 – TSR (PCWA 2010d; SD B) supplemented the data collected as part of the riparian studies.

Riparian vegetation was generally sparse along all the reservoirs and diversion pools, with a total of 16.9 acres and 5.0 miles mapped along the shorelines of all the reservoirs and diversion pools (Table 7.8-1). The distribution and composition of the riparian vegetation in the vicinity of the MFP, including around the reservoirs and diversion pools are shown on Map 7.8-1. Additional maps that show the age structure of the riparian vegetation (i.e., young, medium-aged, and mature woody individuals) are available in 2006 Physical Habitat Characterization Report (PCWA 2007a) and the AQ 10 – TSR (PCWA 2010a; SD B).

7.8.2.1 Large and Medium Reservoirs

The large and medium MFP reservoirs (Hell Hole and French Meadows reservoirs, Middle Fork Interbay, and Ralston Afterbay) are generally surrounded by rock outcrops and steep slopes, and the shorelines are primarily composed of bedrock or coarse substrates that are not suitable for riparian vegetation establishment. The majority of the Hell Hole Reservoir (83%) and French Meadows Reservoir (94%) shorelines were sparsely vegetated (Table 7.8-1). Most of the riparian vegetation that was present was established at the upper ends of the reservoirs where gradients are lower and alluvium accumulates (AQ 9 – TSR [PCWA 2010c; SD B]). Small patches of vegetation (typically willows) were also established at other locations around the reservoirs near tributary or drainage inflows. Around Hell Hole Reservoir, a total of 6.1 acres (2.3 miles) of primarily willows, with a few alders and black cottonwoods, were mapped, primarily in the upper portion of the reservoir near the confluences of Five Lake Creek and the Rubicon River. Around French Meadows Reservoir, a total of 2.5 acres (0.6 mile) of riparian vegetation (alders and willows) was mapped along the shoreline, mostly near the Middle Fork American River confluence. Sedges and other herbaceous species were also present along the shorelines (AQ 10 – TSR [PCWA 2010a; SD B]).

At Ralston Afterbay, riparian vegetation was primarily present in a few locations (e.g., near the confluence with the Middle Fork American River and just upstream of the dam) and was relatively sparse along most of the shoreline (Table 7.8-1) (6.1 acres total along 1.3 miles of shoreline). The communities were comprised of mature alders and willows, with cottonwoods interspersed. At Middle Fork Interbay, 1.7 acres of riparian vegetation was present along 0.6 mile of shoreline, primarily along the north side of the reservoir. The communities were comprised of alders, with some willows interspersed (Table 7.8-1).

7.8.2.2 Diversion Pools

Around Duncan Creek Diversion Pool, a total of 0.2 acre of alders and willows were present, primarily scattered along the western side and upper end of the diversion pool (along 0.1 mile of shoreline). A narrow riparian corridor comprised of alders, including seedlings, and willow shrubs line the banks of the South Fork Long Canyon Creek Diversion Pool, for a total of approximately 0.3 acre (along 0.07 mile of shoreline). Little riparian vegetation was mapped around the perimeter of the North Fork Long Canyon Diversion Pool, and only a few woody riparian individuals were established within the first approximately 0.5 mile upstream of the diversion (Table 7.8-1).

7.8.3 Riparian Vegetation along Bypass and Peaking Reaches

The distribution and abundance of riparian resources along the bypass and peaking reaches associated with MFP were mapped from helicopter at a landscape-scale during 2005 studies (PCWA 2006). As part of the surveys, information on community composition and the distribution of dominant species was also collected. The distribution pattern of vegetation was mapped as polygons (wide corridors), continuous (long, narrow corridors), discontinuous (sporadic vegetation with a long reach), or sparse (no or only one or two individuals within a long reach). The community composition data collected during the 2006 studies occurred at a finer scale and focused on species distributions across the riparian zone and along the stream banks at selected representative study sites on the bypass and peaking reaches. Community composition across the riparian zone was surveyed using line-intercept survey methods, and the greenline method (Winward 2000) was utilized to survey vegetation along the stream banks.

The general age classes of riparian trees and shrubs were also mapped during the 2005 helicopter surveys. Specifically, the presence of seedlings, young, medium-aged, or mature individuals[1] was mapped within each of the communities along the river and stream reaches. More detailed information on the ages of the riparian vegetation was collected during the 2006–2008 field surveys at representative study sites (PCWA 2007a; 2007b; and AQ 10 – TSR [PCWA 2010a; SD B]).

[1] Age class structure was based on categories of shrub stem densities per individual and tree diameters, as follows: Seedlings (S); Young (Y): shrubs with less than 10 stems per individual or trees with diameters (diameter at breast height [dbh]) less than 3 inches; Medium-aged (M): shrubs with between 10 and 60 stems per individual or trees with DBHs between 3 and 9 inches; and Old/Mature (O): shrubs with more than 60 stems per individual or trees with DBHs greater than 9 inches.

A summary of riparian resources along each of the bypass and peaking reaches, including the distribution pattern of the dominant riparian species along the reaches; riparian corridor width and substrate; vegetation distribution and community composition; age class structure and regeneration; canopy structure; riparian health; and riparian and inundation relationships is provided in Table 7.8-2. A list of all species encountered during the riparian studies is available in the AQ 10 – TSR (PCWA 2010a; SD B).

7.8.3.1 Distribution and Abundance

Riparian habitat occurred along approximately 93 linear miles[2] or 42% of the total river miles along the bypass and peaking reaches associated with the MFP. Riparian habitat was discontinuously distributed along another 30 linear miles of stream (14% of total river miles). Meadow habitat was not observed in the survey area. The distribution and abundance of the riparian vegetation are shown on Map 7.8-1. More detailed maps depicting the riparian vegetation along the MFP rivers and streams are available in the 2005 Physical Habitat Characterization Report (PCWA 2006).

The confined valley walls and bedrock and/or coarse substrate that are characteristic of large sections of the bypass reaches considerably influence the riparian abundance and distribution. The width of the riparian corridor is limited by the narrow valley bottoms, steep side slopes, and prevalence of bedrock and coarse substrate along long sections of the bypass reaches. Alluvial bar and colluvial deposits along the streams are potential locations for colonization, establishment, and development. Sparse or discontinuous narrow corridors of riparian vegetation were generally present within these reaches (AQ 10 – TSR [PCWA 2010a; SD B]). Wide corridors of riparian vegetation were relatively uncommon except in the peaking reach and in the Rubicon River immediately downstream from Hell Hole Dam. The peaking reach is entirely alluvial and the section of the Rubicon River immediately downstream of Hell Hole Reservoir is an alluviated valley flat.

The riparian communities along the bypass and peaking reaches were comprised of riparian trees and shrubs, including willows, alders, cottonwoods, and dogwood. Alder was the dominant species within all the riparian communities. The common co-dominant or sub-dominant species included various species of willows and dogwoods and Indian rhubarb. Cottonwoods were a sub-dominant species in certain locations on the Middle Fork American River in the peaking reach, Long Canyon Creek, and the Rubicon River downstream of the South Fork Rubicon River confluence. Black locust was also a component of the community in the peaking reach. The distribution and abundance patterns of the dominant species along the bypass and peaking reaches are summarized in Table 7.8-2. The majority of species encountered in the surveys were native species, and typically, the majority were riparian and wetland species (AQ 10 – TSR) [PCWA 2010a; SD B]).

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[2] Total linear miles includes vegetation established along both stream banks.

The distribution patterns of riparian vegetation within the peaking reach has also been influenced by historical land use activities, in particular mining, which changed the substrate characteristics and elevations of the bars. Almost all the bars in the peaking reach reportedly were dredged. Hillsides and bars were completely denuded to supply lumber to build flumes and other structures needed to support the mining activities. Entire towns were built on the bars for the miners.

7.8.3.2 Age Structure

A diversity of age classes, including seedlings and young individuals, was present within the majority of the riparian communities along the bypass and peaking reaches. Based on the landscape-level mapping, the communities along the bypass reaches were predominantly comprised of young and medium-aged individuals or mixed age classes (young, medium-aged, and mature individuals). In the peaking reach, a little more than 50% of the communities were comprised of primarily older individuals (medium and mature aged trees and shrubs). Regeneration (hundreds of seedlings) was observed in the peaking reach during field surveys on bars with suitable sized substrates for seedling establishment. Many of the bars in the peaking reach are comprised of large coarse material that is not suitable for riparian establishment. Age class structure along the bypass and peaking reaches is summarized in Table 7.8-2.

7.8.3.3 Comparison Rivers

Riparian vegetation distribution and abundance and community composition and age structure on the bypass and peaking reaches were compared to the riparian vegetation on comparison unimpaired river reaches (North Fork American and North Fork of the Middle Fork American rivers) and upstream of MFP diversions (South Fork Long Canyon and Duncan creeks). Additional results of the comparison analyses are available in AQ 10 – TSR (PCWA 2010a; SD B). The position of riparian vegetation adjacent to the channel in the bypass, peaking, and comparison (unimpaired) reaches is discussed in Section 7.8.4.2. In general, riparian vegetation distribution and abundance along the channel, community composition, age structure, canopy structure, and health were similar between the bypass and peaking reaches and the appropriate comparison unimpaired reach, with a few exceptions. Along the peaking reach, the distribution and abundance of riparian vegetation was greater with more mature patches compared to the North Fork American River comparison reach. On the Rubicon River, riparian vegetation abundance along the margins of bars was typically greater than that observed along the comparison unimpaired river reach on the North Fork American River. On Duncan Creek, the abundance of riparian vegetation was a little greater and occurred in larger patches upstream of the diversion compared to downstream.

7.8.4 Riparian Resources and Hydrologic Regime Relationships

The patterns of riparian vegetation establishment and distribution along a river are created by the interaction of physical processes (e.g., flows of varying magnitudes) and the different life history characteristics of the dominant species.

Common woody riparian species have many life history adaptations that promote their success under dynamic and episodic, yet seasonally predictable, hydrologic conditions. A summary of the life history strategies of the dominant woody riparian species (Fremont and black cottonwoods, white and mountain alders, and willows) present along the bypass and peaking is provided in Table 7.8-3. The timing of seed dispersal of these common species is summarized in Table 7.8-4.

The life history strategies for alders (including seed release timing and viability period) are quite different for willows and cottonwoods. Alders release seeds in the fall. The seeds are viable for long periods of time and can establish once suitable moisture conditions are present. Cottonwoods and willows release seeds in the spring, timed with the recession of spring flows. The seeds are only viable for a short period of time (weeks), requiring suitable moisture and soil conditions to be present at the time of seed release. However, for all the species to survive the first summer, recession rates from the spring flows cannot exceed the root growth rates of the seedlings and water needs to be available to the seedlings after the spring flow recession is complete (e.g., throughout the dry summer months).

Results from studies from the literature indicate that seedlings typically survive down ramping rates that range from 0.4 to 1.6 inches per day. Seedlings can survive down ramping rates up to 3.9 inches per day, depending on various factors such as species, substrate characteristics, and other sources of water (e.g., seeps, hillslope runoff, precipitation) (Table 7.8-3). Seedling mortality is often naturally high and seedlings that establish too close to the channel where late summer and fall water is available are more susceptible to scouring and uprooting by subsequent high winter or spring flows. As a result, riparian vegetation often establishes in elevation zones where water is available during the drier months, but not too close to the base flow (summer and fall) channel where they are susceptible to damage by higher flows.

All three species readily reproduce vegetatively (i.e., from downed limbs and trunks, root sprouts), which enables these species to rapidly re-establish following scouring flood disturbances. New individuals establish from abraded trunks, fallen or downed branches, or twigs or root pieces deposited during a high flow event.

The hydrology associated with successful recruitment events (scouring and recruitment flows and recession rates) and the position of vegetation along the channel (frequency, duration, and width and depth of inundation) were evaluated during studies conducted for the MFP relicensing (AQ 10 – TSR [PCWA 2010a; SD B]). In addition, tree cores from the bypass and peaking reaches and comparison reaches from nearby unimpaired rivers (North Fork American and North Fork of the Middle Fork American rivers) were analyzed to identify the hydrologic characteristics (e.g., magnitude, duration, recession rates) of successful recruitment events using the ages of dated trees established at different elevations along the stream banks. As discussed earlier, riparian trees and shrubs of various ages (young, medium-aged, mature) were present along all the bypass and peaking reaches, indicating the flows that promote successful establishment have occurred in the MFP.

7.8.4.1 Riparian Recruitment

Results of the AQ 10 – TSR (PCWA 2010a; SD B) indicate that successful recruitment events were often preceded by large magnitude scouring flows in the bypass and peaking reaches (AQ 10 – TSR, Appendix G, [PCWA 2010a; SD B]). For successful recruitment to occur after a large scouring flow, spring flows with suitable recession rates (recruitment flows) are necessary to provide sufficient moisture to the seedlings and sprouts. This hydrology may occur in the same year as the scouring flow or may occur several years later (Mahoney and Rood 1998; Dixon 2003, Karrenberg 2002; Merritt et al. 2009). Once established, the riparian vegetation generally persists until the next scouring flow. Scouring flows, recruitment flows, and recession rates under existing conditions in the bypass and peaking reaches are described below.

Scouring Flows

High magnitude, infrequent flow events (scouring flows) maintain the channel by scouring banks and the channel bed, and are important for maintaining channel complexity. Flows of this magnitude also scour existing riparian vegetation and supply new alluvial material by initiating bank erosion or slope failures. In the absence of these flows (either by flow regulation or a sequence of drier water years), vegetation can encroach into the low flow stream channel. This encroachment could result in sediment deposition within the vegetation and a narrowing of the channel with new bank or ”berm” formation.

The results of the geomorphology and riparian studies (AQ 10 – TSR [PCWA 2010a; SD B]) and (AQ 1 – TSR [PCWA 2010b; SD B] indicated that sediment/channel conditions in the bypass and peaking reaches were being maintained by the current flow regime and berm development was not observed. The total number of days that scouring flows (based on impaired five-year recurrence interval)[3] occurred during the period of record (1975–2007) by water year type is summarized in Table 7.7-10. Scouring flows generally occurred during the wetter water years in the bypass and peaking reaches (six years) for a total of 14 to 22 days (depending on the reach) during the period of record.

The majority of trees in the bypass, peaking, and unimpaired comparison river reaches established during years with low to moderate magnitude spills following particularly high magnitude winter events (e.g., 1986 and 1996–1997) that scoured banks and bars, and prepared seed beds (AQ 10 – TSR, Appendix G [PCWA 2010a; SD B]). It is possible that other recruitment events occurred during or prior to the period of record

[3] The 5-year recurrence interval flow (Q5) was selected to represent a flow that would scour the channel. Based on the results of the relicensing studies (AQ 1 – TSR [PCWA 2010b; SD B]); AQ 9 –TSR [PCWA 2010c; SD B]); and AQ 10 –TSR [PCWA 2010a; SD B]), the Q5 flow for each reach is estimated to be able to mobilize the channel bed (McBain and Trush 1997; Schmidt and Potyondy 1994) and exceed bankfull elevations. The Q5 flow is also within the range of high flows that are typically associated with large-scale cottonwood and willow regeneration in the literature (i.e., Mahoney and Rood 1998).

evaluated (1975–2007), but the trees were removed (scoured) during more recent events.

Recruitment Flows

Recruitment flows were evaluated for the spring/early summer (May-June) time period. For this analysis, the recruitment flow for each reach was defined as the flow that is approximately the flow at which additional increases in flow provide very little additional width and depth of inundation of the channel (AQ 10 – TSR, Appendix B [PCWA 2010a; SD B]). This is also the flow that was equal to or greater than the magnitude of the flow required to initiate gravel motion (AQ 9 – TSR [PCWA 2010c; SD B]). Table 7.8-5 identifies the number of days that the recruitment flows occurred in the bypass and peaking reaches in May and June (seed dispersal and setting period) by water year type. Riparian recruitment may occur with lower magnitude flows, but this would result in vegetation establishing closer to the low flow channel.

In general, riparian recruitment flows in the larger bypass reaches occurred during wet and above normal water years, with an average duration of 7 to 28 days in wet water years and 3 to 14 days in above normal water years. On the smaller bypass reaches, recruitment events also typically occurred in wetter wet and above normal water years, with an average duration of 3 to 22 days in wet water years and 0 to 6 days in above normal water years. In the peaking reach, recruitment flows were less frequent and of shorter duration compared to the bypass reaches (2 days on average). However, hundreds of seedlings and young individuals were observed on bars with suitable substrates during field surveys.

RECESSION RATES

Recession rates of spring/early summer flows during the time of spring seed release and seed setting (during the receding limb of the hydrograph) were evaluated for selected years at instream flow study sites (AQ 10 – TSR [PCWA 2010a] and AQ 1 – TSR [PCWA 2010b; SD B]). Recession rates were determined for years that were identified as successful recruitment events based on tree core aging information in the bypass and peaking reaches. Details describing this analysis, including graphs showing the recession rates for each event, are available in AQ 10 – TSR (PCWA 2010a; SD B).

On the larger bypass reaches, particularly immediately below the large dams, and in Duncan Creek, recession rates of the spring high flow (early May to late June), were typically faster than those identified in the literature (2–3+ inches per day). Recession rates typically decreased with distance downstream as a result of accretion and tributary inflows. Recession rates were typically faster in wet water years than those associated with spills that occurred during above normal water years. On the Long Canyon Creek bypass streams, recession rates associated with spring high flows were generally relatively slow and within the range for high seedling survival success identified in the literature (Tables 7.8-2 and 7.8-3).

7.8.4.2 Riparian Vegetation Position Adjacent to the Channel (Encroachment)

The lateral distribution (position) of riparian trees adjacent to the channel was evaluated along surveyed transects at representative study sites. Specifically, the elevation at which mature woody riparian vegetation was established and the rooted elevations of trees dated with tree cores were related to inundation width, frequency, and duration along the channel. The position of the riparian vegetation on the bypass and peaking reaches was compared to that on the comparison unimpaired river reaches (North Fork American and North Fork of the Middle Fork American rivers) and upstream of the Project diversions. Additional information, including graphs of each transect showing the species composition in relation to flow stage (water depth) and inundation frequency, is available in Appendix B, AQ 10 – TSR (PCWA 2010a; SD B).

On the larger bypass and peaking reaches, the lateral distribution of vegetation adjacent to the channel was influenced by the availability of suitable substrate, summer water availability, and magnitude and frequency of scouring flows. Bedrock and large boulders along the channel margins and high, coarse bars limited riparian establishment in many locations. The trees that established following the large, scouring events (i.e., 1986 and 1997) were rooted at elevations that corresponded to the stages of the spring flows that occurred during subsequent years.

On the Middle Fork American River bypass reaches, the riparian vegetation was established at similar positions relative to the low flow channel as that observed along the comparison river reach (North Fork of the Middle Fork American River). On the peaking reach, the amount of vegetation was greater and typically occurred in larger corridors and closer to the channel compared to the comparison reach on the North Fork American River. Vegetation in the peaking reach was typically established within the elevational range influenced by summer flows (up to approximately 1,000 cubic feet per second (cfs), depending on the water year type). In comparison, summer flows are substantially lower on the North Fork American River (40–100 cfs). On the North Fork American River, particularly in drier years, seedlings would need to be rooted low in the channel to reach water during the late summer and fall, and therefore, would be susceptible to erosion during winter flows. In comparison, on the peaking reach, seedlings can survive through the summer farther away from the channel even during drier years due to the higher summer/ fall flows and would not be as susceptible to erosion by winter flows (AQ 10 – TSR [PCWA 2010a; SD B]).

In the narrower, confined reaches of the Rubicon River, riparian vegetation was established at similar locations along the channel as that observed along the comparison reach on the North Fork American River. Where large bars were present, however, the position of the vegetation differed. On the Rubicon River, vegetation was established along the perimeters of large, coarse bars. On the comparison reach, the bars were not as high and the substrate was finer than the bars on the Rubicon River and the majority of the larger trees and shrubs were located towards the back of the bars at the base of the hillslopes. Primarily young shrubs were established along the bar perimeters, where frequent scour by winter and spring flow occurs.

Along the small bypass streams (Duncan, South Fork Long Canyon, and North Fork Long Canyon creeks) and the comparison reaches upstream of the diversions, the stream valleys are very confined, with a very narrow "floodplain" zone between the low flow channel and the hillslope (i.e., limited floodplain development). As a result, riparian vegetation, where present, was typically distributed in this narrow zone between the stream margins to the edge of the hillslopes (AQ 10 – TSR [PCWA 2010a; SD B]).

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TABLES

Table 7.8-1. Summary of Riparian Vegetation around Project Reservoirs and Diversion Pools.

Location	Total Acreage Riparian Vegetation[1]	Total Miles of Vegetated Shoreline	Total Miles of Shoreline
Large Reservoirs			
Hell Hole Reservoir	6.1		11
French Meadows Reservoir	2.5		9
Medium Reservoirs			
Middle Fork Interbay	1.7		1
Ralston Afterbay	6.1		4
Diversion Pools			
Duncan Creek Diversion Pool	0.2		
South Fork Long Canyon Diversion Pool	0.3		
North Fork Long Canyon Diversion Pool	None mapped		
Total	16.9		

[1]Total acreages are based on riparian mapping information from the 2005 Physical Characterization Report (PCWA 2006), TERR 1 - TSR (PCWA 2010d; SD B), and AQ 10 - TSR (PCWA 2010a).

Table 7.8-2. Summary of Riparian Vegetation Community Characteristics in the Bypass and Peaking Reaches.

Riparian Corridor Width[1]	Riparian Corridor Substrate[1]	Vegetation Distribution and Community Composition[1,2]	Age Class Structure and Regeneration[1,2]	Canopy Structure[1]	Riparian Health[1,3]	Vegetation Position Adjacent to Channel and Recession Rates[3]
Duncan Creek						
20 to 24 feet on average; ranging from 7 to 40 feet	Stream banks and adjacent areas: Combination of bedrock, boulder, and/or cobble particle sizes	Total Acreage[6]: Approximately 7.3 acres along 8.6 miles of river. Distribution: Sparse or not present throughout most of the bypass reach (76%), with continuous (16%) or discontinuous (5%) narrow riparian corridors along some reach reaches. Wide corridors were not common (3% of reach). Dominant Species: Alders and/or willows, with cottonwoods (24%) present in some reaches. Indian rhubarb was common within the stream channel. Other dominant species included white redosier dogwood, large boykinia, stream bank trefoil, arrowlead grounsel, thimbleberry, and bracken fern. Community Composition: 55 plant species identified Percent native plant species: 98% Special-status plants: None Noxious weeds: None Percent wetland/riparian species:[1] 65%	Age Class Structure: Majority of vegetation was young or medium-aged vegetation (70%). Medium and mature aged communities were observed along about 22% of the channel; and mixed age classes occurred along 8% of the bypass reach. Trees: Most trees were between 1 to 6 inches in diameter. Large trees up to approximately 24 inches in diameter were also present with tin the riparian corridor. Shrubs: Most shrubs had 30–60 stems per individual that were <1-inch in diameter. Many smaller individuals with <10 stems per individual and a few larger individuals were also present. Regeneration: Riparian seedlings and sprouts were observed within all the study sites.	Tree Density: <1 tree per 10 square meters (108 square feet)). Shrub stem densities were variable, depending on species and elevation above the channel. Canopy Structure: Total canopy cover: 43%; up to 100% in localized areas Trees: 21–56% Shrubs: <16% Ground layer: 30%	Decadence: Low. Insect herbivory damage of alder leaves was observed at a number of locations and resulted in high leaf mortality on particular individuals.	At the study sites, alders and willows were typically established over a range of elevations from the water's edge to the base of the hillslopes. Cottonwoods were also established on the stream banks. Recession rates near the diversion were typically 2–3 inches per day and decreased with downstream distance due to accretion inflows (1–2 inches per day near the Middle Fork American River confluence).
North Fork Long Canyon Creek						
17 feet on average; ranging from 12 to 25 feet	Stream banks: Mix of cobble and boulder particle sizes, interspersed with local areas of sand, silt, and gravel	Total Acreage[6]: Approximately 9.7 acres along 3.1 miles of river. Distribution: Primarily narrow continuous corridors (48%). Sparse or minimal along approximately 41% of the bypass reach. Wide corridors were present along approximately 11% of the reach. Dominant Species: Alders and willows (79% of communities), with cottonwoods interspersed in some reaches (21%). Indian rhubarb also common within the stream channel. Other dominant species included incense cedar, Douglas fir, Indian rhubarb, large boykinia, western columbine, common bedstraw, stream bank trefoil, bracken fern, Sierra hare sedge, and California spikenard. The overstory was dominated by incense cedar and Douglas fir. Community Composition: 55 identified plant species Percent native plant species: 96% Noxious weed species: bull thistle and sheep sorrel Special-status plants: None Percent wetland/riparian species: 47%	Age Class Structure: Seedlings and young individuals were present within the majority of the riparian corridors (69%). Remaining communities dominated by mature/medium-aged trees and shrubs. Trees: Majority of white alders were 1 to 6 inches in diameter. Shrubs: Almost all shrub stems were <1/2 inches in diameter and most individuals had <10 stems each. Regeneration: Alder seedlings were observed along the stream banks at the study site,	Tree Density: About 4 trees per 10 square meters (108 square feet). White alders were the densest compared to other species. Canopy Structure: Total canopy cover: >90% Trees: 94% Shrubs: 13% Ground layer: 34%	Decadence: Low. Only a few dead or individual shrubs that were damaged from floods were observed along the stream banks.	At the study sites, there was a relatively narrow transition zone between the areas that were infrequently and frequently inundated along the stream channel. Alders were fairly evenly distributed across the riparian zone from the stream margins to the hillslopes. Recession rates were typically 1.6 inches per day or less, as larger spring flows were not captured by the diversion.

Table 7.8-2. Summary of Riparian Vegetation Community Characteristics in the Bypass and Peaking Reaches (continued).

Riparian Corridor Width[1]	Riparian Corridor Substrate[1]	Vegetation Distribution and Community Composition[1,2]	Age Class Structure and Regeneration[1,2]	Canopy Structure[1]	Riparian Health[1,3]	Vegetation Position Adjacent to Channel and Recession Rates[3]
South Fork Long Canyon Creek						
20 feet on average; ranging from 7 to 33 feet	Stream banks: Mix of sand, silt, cobble, and gravel, with occasional bedrock and boulder outcrops	Total Acreage[6]: Approximately 2.9 acres along 3.3 miles of river. Distribution: Sparsely or discontinuously distributed vegetation along approximately 2/3 of the bypass reach (64%). Where present, the riparian vegetation occurred as a narrow continuous (34%). Wide corridors of vegetation were uncommon (2% of the total length). Dominant Species: Alders and/or willows (66% of the communities), with cottonwoods also prominent within the community (approximately 34%). Dominant shrubs included redosier dogwood, willows, and snowberry. Dominant ground layer species included white clover, Colorado rush, large boykinia, willow herb, selfheal, lady fern, bracken fern, and sheep sorrel. Incense cedar was the dominant overstory species. Community Composition: 43 plant species identified Percent native plant species: 93% Noxious weeds: bull thistle, sheep sorrel, and Himalayan blackberry Special-status plants: None Percent wetland/riparian species: 60%	Age Class Structure: Seedlings and young vegetation were present within almost all the communities (98%), except near the confluence with North Fork Long Canyon Creek. Trees: White alder trees were a range of size classes (seedlings to trees greater than 24 inches in diameter). Shrubs: Willows generally had <10 stems, which were all <1 inch in diameter. Regeneration: Seedlings and young of several riparian species, including white alder, red willow, and shining willow, were observed along the greenline.	Tree Density: 8 trees per 10 square meters (108 square feet), with relatively high densities of white alder trees (4.5 individuals per 10 square meters). Canopy Structure: Total canopy cover: 87% Trees: 86% Shrubs: 10% Ground layer: 33%	Decadence: Low.	At the study sites, there was a relatively narrow transition zone between the areas that were infrequently and frequently inundated along the stream channel. Alders and willows were laterally distributed from the stream banks to the edge of the hillslopes. Recession rates were typically 1.6 inches per day or less, as larger spring flows were not captured by the diversion.
Long Canyon Creek						
22 to 31 feet on average; ranging from 0 to 50 feet	Stream bank and areas adjacent to the channel: Combination of bedrock, boulder and/or cobble particle sizes	Total Acreage[6]: Approximately 9.1 acres along 11.3 miles of river. Distribution: Sparse or not present along most of the Long Canyon Creek bypass reach (73%). Where present, it was primarily distributed as a narrow continuous corridor (23%). Dominant Species: Willows and alders (96% of the communities). Less than 5% of the communities included cottonwoods. Indian rhubarb was common within the stream channel. Other dominant species included white alder, red willow, western brookfoam, seep monkeyflower, sticky monkeyflower, lady fern, bracken fern, and California wild grape. Community Composition: 72 plant species identified Percent native plant species: 97% Special-status plants: None Noxious weeds: None Percent wetland/riparian species: 71%	Age Class Structure: Seedlings or young vegetation was present in >80% of the bypass reach. Communities along some sections were comprised primarily of medium-aged and mature vegetation (approximately 19%). Trees: All the white alders and willow trees were < 6 inches in diameter, with the majority between 1 and 3 inches in diameter. Shrubs: Willow shrubs also were fairly small – < 30 stems per individual with stems <1/2 inch in diameter. Regeneration: White alder and willow seedlings and saplings were observed at both study sites.	Tree Density: <1 tree per 10 square meters (108 square feet)) near the confluence with the Rubicon River and higher at the upper study site (2.1 individuals per 10 square meters). Canopy Structure: Total canopy cover: 60% at the upstream site and approximately 35% near the Rubicon River confluence Trees: 30–60% Shrubs: 7–18% Ground layer: Typically <5%, up to 100% in some areas.	Decadence: Low.	Similar to the North and South Forks of Long Canyon Creek, the inundated zone and transition zone between riparian and upland species was very narrow. Alders and willows were typically established along the channel margins. Recession rates were typically 1.6 inches per day or less, as larger spring flows were not captured by the diversion.

Table 7.8-2. Summary of Riparian Vegetation Community Characteristics in the Bypass and Peaking Reaches (continued).

Riparian Corridor Width[1]	Riparian Corridor Substrate[1]	Vegetation Distribution and Community Composition[1,2]	Age Class Structure and Regeneration[1,2]	Canopy Structure[1]	Riparian Health[1,3]	Vegetation Position Adjacent to Channel and Recession Rates[3]
Rubicon River – Hell Hole Dam to Ralston Afterbay						
60 to 71 feet on average, ranging from 21 to 146 feet The stream valley floor within the sub-reach upstream of Ellicott Bridge and in the upper section of the sub-reach between Ellicott Bridge and the Long Canyon Creek confluence was over-widened by the flood associated with the 1964 Hell Hole Dam failure. Flood also deposited extremely course boulder bars, particularly in the upper sub-reach downstream of Ellicott Bridge.	Upstream of Ellicott Bridge: Bars: Large boulder material Stream banks: Smaller boulders, cobbles, gravels, and silts Ellicott Bridge to Long Canyon Creek Confluence: Bars: Very coarse boulders Stream banks: Bedrock, boulder, and cobble, with infrequent pockets of sand and gravel Long Canyon Creek Confluence to Ralston Afterbay: Bars and Stream banks: Bedrock, boulder, and cobble, with sand and gravel present in localized areas	Total Acreage[6]: Approximately 59.7 acres along 28.9 miles of river (does not include river miles where flow is sub-surface). Distribution: Minimal riparian vegetation (sparse or discontinuous distribution) (approximately 60% of reach). Narrow (32%) and wide (8%) corridors lined the remaining channel. Dominant Species: Cottonwoods were a component of approximately 73% of the communities. Alders and/or willows were dominant species in the remaining communities. Common herbaceous species included hairy willow herb, Douglas's sagewort, Indian rhubarb, crimson monkeyflower, seep monkeyflower western brookfoam, streambank trefoil, pearly everlasting, California spikenard, western panicum, tinker's penny, Durango root, and several sedge species. Community Composition: 49 identified plant species upstream of Ellicott Bridge; 81 plant species identified from Ellicott Bridge to Long Canyon Creek confluence; and 56 species identified from Long Canyon Creek confluence to Ralston Afterbay Percent native plant species: 79–94% Special-status plants: None Noxious weeds: Bermuda grass, bristly dogstail grass, black locust, hogbite, hairy crabweed, yellow bristle grass, everlasting cudweed, lady's thumb, Mexican tea Jerusalem oak, rat-tail fescue, shortpod mustard, hogbite, Himalayan blackberry, and common woolly mullein. Percent wetland/riparian species: 57–71%	Age Class Structure: Majority of communities comprised of mixed age classes (22%) or medium/ young vegetation (60%). Remaining communities comprised primarily of mature/ medium-aged individuals. Trees: White alders ranged in size from seedlings to 24 inches in diameter. Majority were between 1–3 inches in diameter, with quite a few larger trees (diameters between 3–6 inches and 9–11 inches). Shrubs: Typically medium-sized with 11–30 stems per individual; although many had more than 60 stems per individual. Most stems were small (<1/2 inch in diameter, but many were between 3–5 inches in diameter). A few individuals were quite large (61 to 100 stems per individual). Regeneration: White alder and willow regeneration was observed at the study sites. Majority of dated trees established between 1995 and 2000. Some trees also established in the early 1970's.	Tree densities: 2.5 to 4.3 trees per 10 square meters (108 square feet). Almost all trees present were white alders. Canopy Structure: Total canopy cover: 35% on average downstream of Ellicott Bridge; 93% upstream of Ellicott Bridge Trees: 30% on average downstream of Ellicott Bridge; 85% upstream of Ellicott Bridge Shrubs: 21% on average Ground layer: 12% on average; up to 100% in localized areas	Decadence: Typically low. Leaf damage from insects was observed on some white alder trees.	At the study sites, alders and willows were established in two main elevational bands – immediately adjacent to the low flow channel along the large bar deposits or a little higher up on the bar surfaces. Willows were more typically established along or within the stream margins than the willows. At the lower study sites, the alders were established a little farther up on the bars compared to the other sites; potentially reflecting individuals that survived 2006 high flows. Based on tree core dating, alder trees were established at elevations that corresponded to spring flows that followed large scouring events. Recession rates were typically fast (3+ inches per day) during wet water years. During above normal water years, recession rates were generally slower (1–1.6 inches per day), largely influenced by accretion and tributary inflows.
Middle Fork American River – Bypass Reach – French Meadows Dam to Middle Fork Interbay						
20 to 25 feet on average, ranging from 0 to 50 feet	Stream banks and areas adjacent to the channel: Bedrock or coarse particle sizes, including boulders and cobbles, with small pockets of gravels and sands	Total Acreage[6]: Approximately 1.8 acres along 12.6 miles of river. Distribution: Sparse through most of the reach (89%). Where present, the riparian corridor was a narrow continuous (3%) or discontinuous (8%) corridor. Dominant Species: Alders and/or willows (57% of the communities), with cottonwoods co-dominant in some sections (43% of the communities). Other dominant species present included redosier dogwood, large boykinia, western brookfoam, crimson monkeyflower, Douglas's sagewort, streambank trefoil, California skullcap, curvepod yellowcress, California fuchsia, lady fern, bracken fern, common horsetail, and several grasses, rushes, and sedges. Community Composition: 51 plant species identified Percent native plant species: 86% Noxious weeds: creeping bent grass and bull thistle Special-status plants: None Percent wetland/riparian species: 73%	Age Class Structure: Majority was comprised of young and medium-aged or mixed size classes (>89%). Mature/ medium-aged vegetation comprised approximately 7% of the communities. Trees: A range of size classes of white alders were present at the study sites, from seedlings to mature trees (>11 inches in diameter). Shrubs: Willows and dogwoods tended to be relatively small (<10 stems per individual), with stems ranging in size from ½ inch to 5 inches in diameter. Regeneration: Regeneration (seedlings and saplings) of white alders and willows were observed at both study sites.	Tree Density: 2.5 trees per 10 square meters (108 square feet)). Canopy Structure: Total canopy cover: 55% on average Trees: 65% on average Shrubs: <10% Ground layer: <10%	Decadence: Low. Some white alders near the channel were lying horizontally due to recent high flows.	At the study sites, white alders were typically distributed laterally from the water's edge to the base of the hillslopes. Seeps were observed to support riparian vegetation near the hillslopes at some locations. Willows were typically established along the stream margins. Spring recession rates below French Meadows Dam were fast (at least 3 inches per day) in wet and above normal water years. Recession rates typically decreased downstream due to accretion inflows in above normal water years (1–2 inches per day).

Table 7.8-2. Summary of Riparian Vegetation Community Characteristics in the Bypass and Peaking Reaches (continued).

Riparian Corridor Width[1]	Riparian Corridor Substrate[1]	Vegetation Distribution and Community Composition[1,2]	Age Class Structure and Regeneration[1,2]	Canopy Structure[1]	Riparian Health[1,3]	Vegetation Position Adjacent to Channel and Recession Rates[3]
Middle Fork American River – Bypass Reach – Middle Fork Interbay to Ralston Afterbay						
28 to 48 feet on average, ranging from 21 to 95 feet	Stream banks and bars: Boulder, cobble, gravel, and sand-sized particles, with short bedrock sections	Total Acreage[6]: Approximately 20.5 acres along 9.9 miles of river. Distribution: Continuous narrow or wide corridors (62%). The remaining portion of the reach was minimally vegetated with narrow discontinuous (28%) corridors or sparse vegetation (10%). Dominant Species: White alders, with blackberry and willows common shrubs along the stream margins. Cottonwoods were co-dominant within approximately 25% of the communities. Overstory dominated by California bay and Douglas fir. Common herbaceous species included giant chain fern, large boykinia, Indian rhubarb, seep monkeyflower, common scouring rush, Douglas's sagewort, western panicum, California wild grape, and western brookfoam. Community Composition: 67 plant species identified Percent native plant species: 87% Noxious weeds: ripgut grass, skeletonwood, and hedgehog dog-tail grass Special-status plants: None Percent wetland/riparian species: 57%	Age Class Structure: Majority of riparian communities was comprised of young and medium-aged individuals or mixed size classes (>92%). Remaining communities were primarily mature/ medium-aged vegetation. Trees: Broad range of white alder size classes present within the study sites – from seedlings to mature trees >11 inches in diameter. Shrubs: Willows tended to be relatively young with <10 stems per shrub, and most stems <3 inches in diameter. Regeneration: Both seedlings and young white alders and willows were observed along the stream banks. Hundreds of willows seedlings were observed at some study sites. Majority of dated trees established during three recruitment events—1986; 1996–1997; and prior to 1975.	Tree Density: 2 trees per 10 square meters (108 square feet)). Canopy Structure: Total canopy cover: 62–66% Trees: Typically 55–60% Shrubs: 25–32% Ground layer: <20%	Decadence: The Ralston Ridge Fire burned portions of the riparian corridor at a couple of the study sites. At the study site that was unaffected by the fire, decadence was negligible.	At the study sites, willows were established near or within the low flow channel. White alders were typically distributed laterally from the water's edge to the base of the hillslopes. Based on tree core dating, many of the alders established at elevations that corresponded to spring flows that followed large scouring events. Below Middle Fork Interbay, recession rates were variable (<1.6 inches per day to > 3 inches per day).
Peaking Reach						
44 to 159 feet on average; ranging from 90 (Ruck-a-Chucky rapids reach) to 253 feet	Stream banks and bars: Boulder, cobble, sand, and silt particle sizes Stream banks in Ruck-a-Chucky Reach: Bedrock, with shorter segments comprised of boulder-sized substrate	Total Acreage[6]: Approximately 152.1 acres along 29.7 miles of river. Distribution: Narrow and wide corridors along wide bars within the peaking reach (almost 70%). Riparian vegetation was either sparse or discontinuously distributed within the other sections of the reach (30%). Dominant Species: Alders and/or willows (26%), and Fremont cottonwoods (component of approximately 29% of communities). Black locust was also co-dominant in localized reaches (45%). Shrub layer dominated by numerous species of willows, blackberries, and California wild grape. Most common herbaceous species observed included Spanish clover, cocklebur, Jerusalem oak (a non-native species), Douglas's sagewort, mountain aster, tall flatsedge, Oregon false goldenaster, and western panicum. Community Composition: 72 plant species were identified Percent native plant species: 72% Noxious weeds: ripgut grass, yellow star-thistle, skeletonwood, Bermuda grass, hedgehog dog-tail grass, scotch broom, orchard grass, edible fig, shortpod mustard, Italian ryegrass, English plantain, black locust, Himalayan blackberry, and woolly mullein Special-status species: None Percent wetland/riparian species: 56%	Age Class Structure: Majority of the communities comprised of mature and medium-aged vegetation (56%). Remaining communities comprised of individuals of various size classes. Where seedlings were observed, they were often abundant. Hundreds of willow seedlings and young willows were observed at the study sites. Trees: White alders within the study sites ranged from seedlings to large trees (24 inches in diameter). Most alders were between 3 and 6 inches in diameter. Shrubs: Willows were of variable sizes. Large, mature individuals with many stems were often present. However, smaller individuals, with <30 stems per individual were also common. Regeneration: Hundreds of seedlings were present in some areas. Young white alders, cottonwoods and seedlings of both species present along the stream channel. Black locust seedlings were also observed. Majority of cored trees were established with two main recruitment events—1986–1987 and 1996–2000.	Tree Density: <1.6 trees per 10 square meters (108 square feet)). Canopy Structure: The majority of the bars were sparsely vegetated only with herbaceous vegetation, and woody riparian trees and shrubs were found nearer to the perimeters of the bars, along high flow channels, or sometimes along the base of the hillslopes. Total canopy cover: 45%. Trees: 5–29% Shrubs: 32% Ground cover: <15%	Decadence: Low. Leaf damage caused by insects was observed on some willows.	In the peaking reach study sites, the bars were not inundated until flows exceeded at least 6,000 cfs. Back channel areas were inundated at lower flows (e.g., 1,000–3,000 cfs) and riparian species were often established along these features. Most of the vegetation within the study sites was established at elevations where the vegetation is supported by the summer flows (80 and 1,000 cfs). The species at the lower elevations were typically alders and willows, with some black locust interspersed. Cottonwoods tended to be at slightly higher elevations and along the narrower reaches.

Table 7.8-2. Summary of Riparian Vegetation Community Characteristics in the Bypass and Peaking Reaches (continued).

Riparian Corridor Width[1]	Riparian Corridor Substrate[1]	Vegetation Distribution and Community Composition[1,2]	Age Class Structure and Regeneration[1,2]	Canopy Structure[1]	Riparian Health[1,3]	Vegetation Position Adjacent to Channel and Recession Rates[3]

[1]PCWA (2007a)
[2]PCWA (2006)
[3]AQ 10 – TSR (PCWA 2010a; SD B)
[4]Age class structure was based on categories of shrub stem densities per individual and tree diameters, as follows: Seedlings (S); Young (Y): shrubs with less than 10 stems per individual or trees with diameters (diameter at breast height [DBH]) less than 3 inches; Medium-aged (M): shrubs with between 10 and 60 stems per individual or trees with DBHs between 3 and 9 inches; and Old/ Mature (O): shrubs with more than 60 stems per individual or trees with DBHs greater than 9 inches.
[5]Wetland and riparian species include: OBL: (Obligate): Almost always occur in wetlands (99%). FACW (Facultative Wetland): Usually occur in wetlands (67–99%). FAC (Facultative): Equally likely to occur in wetlands and non-wetlands (34–66%).
[6]Total acreage is an estimate. Most of the riparian vegetation was present as a linear feature along the stream channels. Areas were calculated for riparian vegetation mapped as polygons. For the riparian vegetation mapped as continuous line features, acreages were estimated using an approximately riparian corridor width of 6 meters. Riparian vegetation that was mapped as sparse or discontinuously distributed were not included in the estimate.

Table 7.8-3. Life History Strategies of Dominant Woody Riparian Species Found in the Vicinity of the MFP.

ATTRIBUTE		SPECIES				
		Cottonwood		Willow	Alder	
		Fremont	Black		White	Mountain
Initiation[1]						
Reproduction	Flowering Timing	Mar to June (Stella et al. 2006)	Apr to May (as cited in Braatne et al. 1996)	Apr to May; depends on location/ elevation and species (USDA-FS 2009; Zasada et al. 2009)	Mar (Harrington et al. 2009)	Early spring. Mar/ Apr (USDA-NRCS 2009; Uchytil 1989b)
	Seed Dispersal Timing	Seed Dispersal Timing is provided in Table C-2.				
	Seed Dispersal Agent2	Hydrochoric and anemochoric				Hydrochoric and zoochoric
	Asexual Traits	Crown breakage and flood-related disturbance (e.g. tree fall) (Braatne et al. 1996)	Root suckering and crown breakage (Braatne et al. 1996)	Root sprouts and sprouting of broken stem and root pieces transported during high flows, and layering of stems (Zasada et al. 2009)	Root or trunk resprouting; layering (Uchytil 1989a)	Rhizomes and root sprouts (Uchytil 1989b)
Germination and Establishment[3]	Seed Viability (in natural conditions)	1 to 3 weeks (as cited in Braatne et al. 1996)	1 to 2 weeks (as cited in Braatne et al. 1996)	A few days to a week, no more than 3 weeks (Anderson 2006)	Not a limiting factor (e.g. many months) (Harrington et al. 2009)	
	Germination	24 hours in moist, bare soil (Braatne et al. 1996)	24 hours in moist, bare soil (Braatne et al. 1996)	12 to 24 hours (USDA-FS 2009; Karrenberg et al. 2002)	Can germinate immediately in favorable conditions (Uchytil 1989a and 1989b)	
	Seedling Root Growth Rate (and Recession Rate Associated with Establishment)	Seedling root growth rate: 4 to 12 mm/day (as cited in Braatne et al. 1996); can reach 40 cm length in 30 days (Braatne et al. 1996) Recession rate: 2.5 to 4 cm/day (up to 10 cm/day) (Mahoney and Rood 1998; Amlin and Rood 2002; Roberts et al. 2002; Stella et al. 2006)	Seedling root growth rate: 6 to 12 mm/day (as cited in Braatne et al. 1996; USDA-FS 2009); can reach 40 cm length in 30 days (Braatne et al. 1996)	Recession rate: 1 to 2.5 cm/day (Amlin and Rood 2002)	Rapid (similar to cottonwoods with water table declining rates of 1 to 3 cm/day); require continuously moist substrates to successfully establish (Uchytil 1989a and 1989b; USDA-NRCS 2009; as cited in Braatne et al. 1996)	

Table 7.8-3. Life History Strategies of Dominant Woody Riparian Species Found in the Study Area (continued).

ATTRIBUTE		SPECIES				
		Cottonwood		Willow	Alder	
		Fremont	Black		White	Mountain
Initiation[1] (continued)						
Dormant Season	Rooting Depth of Sapling, first growing season	75 to 150 cm (Braatne et al. 1996)		40 to 60 cm (Karrenberg et al. 2002)	Root growth rates similar to cottonwoods	
Maturation[4]						
	Age at Reproductive Maturity	5 to 10 years (as cited in Braatne et al. 1996)	8 to 10 years (as cited in Braatne et al. 1996)	5 to 10 years (Zasada et al. 2009)	10 years, can be earlier (Harrington et al. 2009)	3 to 4 years
	Rooting Depth of Mature Stands/ Depth to Groundwater	3 to 5+ m (as cited in Braatne et al. 1996)	3 to 5+ m (Braatne et al. 1996)	Less than 3 m	1 m (Uchytil 1989b)	
	Lifespan	130+ years (as cited in Braatne et al. 1996)	100 to 200 years (as cited in Braatne et al. 1996)	Varies depending on species. Stems survive 10 to 20 years (USDA-FS 2009)	100 years	60 to 100 years
	Tree Height (mature tree)	12 to 35 m (USDA-NRCS 2008)	8 to 13.5 m (as cited in Braatne et al. 1996)	Variable, depends on species	15 to 24 m (Uchytil 1989a)	1 to 9 m (Harrington et al. 2009)
	Diameter at Breast Height (mature tree)	30 to 150 cm USDA-NRCS 2008)	8 to 11.7 cm (as cited in Braatne et al. 1996)	Variable, depends on species	28 to 60 cm (Uchytil 1989a)	Typically 10 to 20 cm (Uchytil 1989b)

Table 7.8-3. Life History Strategies of Dominant Woody Riparian Species Found in the Study Area (continued).

ATTRIBUTE		SPECIES				
		Cottonwood		Willow	Alder	
		Fremont	Black		White	Mountain
Germination/Recruitment Microsite Characteristics						
	Depth to Water Table or Elevation above Baseflow	Elevation above baseflow: 1 to 3 m (Mahoney and Rood 1998; Roberts et al. 2002)	Elevation above water table: 0.7 to 3 m (Law et al. 2000; Jamison and Braatne 2001)	Elevation above baseflow: 0.6 to 3 m (Mahoney and Rood 1998; Jamison and Braatne 2001)	Elevation above baseflow: 0.4 m above baseflow (Lisle 1989)	Depth to water table: 1 m (Uchytil 1989b)
	Substrate	Bare, moist sandy, humous, or gravelly soils -with silts and clays.	Bare, moist sandy, humous, or gravelly soils - with silts and clays.	Bare, moist sandy, humous, or gravelly soils - with silts and clays.	Sunny, wet mineral sites exposed from receding flood waters; cobbles, gravels and sands (Uchytil 1989a and 1989b)	
	Location on Floodplain	Point bars, cut off channels, lower terraces	Gravel bars, floodplains, and terraces	Point bars and cut off channels; water's edge	Sandbars or other fresh alluvium exposed by receding flood waters (Uchytil 1989a and 1989b)	

[1]Initiation refers to seed dispersal, germination, and initial seedling growth.
[2]Hydrochroic: water-dispersed; Anemochoric: wind-dispersed; Zoochoric: animal-dispersed.
[3]Establishment refers to the continued survival and growth of seedlings and saplings over several years until the tree reaches maturity.
[4]Maturity (sexual) occurs once a tree begins to flower and produce seed.

Table 7.8-4. Timing of Seed Dispersal for Common Woody Riparian Species in the Vicinity of the MFP.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Seed Dispersal[1]												
COTTONWOODS												
Fremont Cottonwood (*Populus fremontii)*												
Sacramento												
Sacramento River												
San Joaquin and Tuolumne Rivers												
Trinity River												
Black Cottonwood (*Populus balsamifera)*												
Trinity River												
ALDERS												
White Alder (*Alnus rhombifolia)*												
San Joaquin and Tuolumne Rivers												
Trinity River										peak		
Mountain Alder (*Alnus incana* ssp. *tenuifolia)*												
WILLOWS												
Arroyo Willow (*Salix lasiolepis)*												
San Joaquin and Tuolumne Rivers												
Trinity River												
Gooding's Willow (*Salix gooddingii)*												
San Joaquin and Tuolumne Rivers												
San Joaquin and Tuolumne Rivers												
Shining Willow (*Salix lucida)*												
Trinity River												
Narrowleaf Willow (*Salix exigua)*												
Trinity River												
San Joaquin and Tuolumne Rivers												
San Joaquin and Tuolumne Rivers												

[1]References and elevation data for the different studies are:

San Joaquin River and Tuolumne River (< 650 feet elevation) (Stella et al 2006)

Sacramento River (< 300 feet elevation) (CALFED 1999)

San Joaquin River (< 600 feet elevation) (as reported in McBain and Trush 2002)

Sacramento River (< 300 feet elevation) (Roberts et al 2002 [TNC])

Trinity River (< ~1500 feet elevation) (McBain and Trush 1997)

General Source (Uchytil 1989b and as cited in Braatne et al 1996 for POBA)

Table 7.8-5. Average Number of Riparian Recruitment Days (May and June Only) by Water Year Type and Total Number of Riparian Recruitment Days by Water Year Type under Existing Flows (Impaired) (1975-2007).

Site/Release Location	Flow Threshold[1] (cfs)	WYT	Existing Conditions			
			Total # of Days	Average # of Days[2]	Event Year Average # of Days[3]	Number of Years[4]
Small Streams						
Duncan D6.3	149	Wet	42	4	7	6 / 10
		Abv Normal	12	2	6	2 / 6
		Blw Normal	0	0	0	0 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**54**	**---**	**---**	**8 / 33**
Duncan D0.0	383	Wet	13	1	3	4 / 10
		Abv Normal	4	1	4	1 / 6
		Blw Normal	0	0	0	0 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**17**	**---**	**---**	**5 / 33**
North Fork Long Canyon Creek	29	Wet	91	9	18	5 / 10
		Abv Normal	0	0	0	0 / 6
		Blw Normal	0	0	0	0 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**91**	**---**	**---**	**5 / 33**
South Fork Long Canyon Creek	40	Wet	112	11	22	5 / 10
		Abv Normal	0	0	0	0 / 6
		Blw Normal	0	0	0	0 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**112**	**---**	**---**	**5 / 33**
Long Canyon Creek LC9.0	197	Wet	38	4	8	5 / 10
		Abv Normal	4	1	4	1 / 6
		Blw Normal	0	0	0	0 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**42**	**---**	**---**	**6 / 33**
Long Canyon LC0.0	652	Wet	9	1	5	2 / 10
		Abv Normal	2	0	2	1 / 6
		Blw Normal	0	0	0	0 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**11**	**---**	**---**	**3 / 33**

Table 7.8-5. Average Number of Riparian Recruitment Days (May and June Only) by Water Year Type and Total Number of Riparian Recruitment Days by Year for Existing Flow Conditions (Impaired) (1975-2007) (continued).

Site/Release Location	Flow Threshold[1] (cfs)	WYT	Existing Conditions			
			Total # of Days	Average # of Days[2]	Event Year Average # of Days[3]	Number of Years[4]
Middle Fork American River below French Meadows Dam						
MF44.7	343	Wet	77	8	11	7 / 10
		Abv Normal	24	4	12	2 / 6
		Blw Normal	0	0	0	0 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**101**	**---**	**---**	**9 / 33**
MF36.2	702	Wet	53	5	9	6 / 10
		Abv Normal	3	1	3	1 / 6
		Blw Normal	0	0	0	0 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**56**	**---**	**---**	**7 / 33**
Middle Fork American River below Middle Fork Interbay Dam						
MF35.5	322	Wet	197	20	28	7 / 10
		Abv Normal	17	3	17	1 / 6
		Blw Normal	0	0	0	0 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**214**	**---**	**---**	**8 / 33**
MF26.2	532	Wet	125	13	21	6 / 10
		Abv Normal	7	1	7	1 / 6
		Blw Normal	0	0	0	0 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**132**	**---**	**---**	**7 / 33**
Rubicon River below Hell Hole Dam						
R25.7	500	Wet	120	12	17	7 / 10
		Abv Normal	14	2	14	1 / 6
		Blw Normal	2	0	2	1 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**136**	**---**	**---**	**9 / 33**
R20.9	678	Wet	124	12	21	6 / 10
		Abv Normal	13	2	13	1 / 6
		Blw Normal	1	0	1	1 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**138**	**---**	**---**	**8 / 33**
R3.5	2,198	Wet	37	4	7	5 / 10
		Abv Normal	3	1	3	1 / 6
		Blw Normal	0	0	0	0 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**40**	**---**	**---**	**6 / 33**

Table 7.8-5. Average Number of Riparian Recruitment Days (May and June Only) by Water Year Type and Total Number of Riparian Recruitment Days by Year for Existing Flow Conditions (Impaired) (1975-2007) (continued).

Site/Release Location	Flow Threshold[1] (cfs)	WYT	Existing Conditions			
			Total # of Days	Average # of Days[2]	Event Year Average # of Days[3]	Number of Years[4]
Middle Fork American River below Ralston Afterbay						
MF24.2	6,581	Wet	7	1	2	3 / 10
		Abv Normal	1	0	1	1 / 6
		Blw Normal	0	0	0	0 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**8**	**---**	**---**	**4 / 33**
MF14.1	6,674	Wet	7	1	2	3 / 10
		Abv Normal	1	0	1	1 / 6
		Blw Normal	0	0	0	0 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**8**	**---**	**---**	**4 / 33**
MF4.8	6,797	Wet	7	1	2	3 / 10
		Abv Normal	1	0	1	1 / 6
		Blw Normal	0	0	0	0 / 6
		Dry	0	0	0	0 / 5
		Critical	0	0	0	0 / 6
		Total	**8**	**---**	**---**	**4 / 33**

[1] For the purposes of this analysis, the magnitude of the recruitment flow was at least equal to or greater than the magnitude of the flow required to initiate gravel motion (AQ 9 – TSR [PCWA 2010c]) and approximately the flow at which increases in the width and depth of inundation with increased flow changed very little (Appendix B, AQ 10 – TSR [PCWA 2010a; SD B]).

[2] Total number of event days / number of years in water year type.

[3] Total number of event days / number of years with events in water year type.

[4] Number of years with events / total number of years in water year type.

MAPS