3.7 Vegetation, Wildlife, and Wetlands

Operation of the TRD has directly affected vegetation, wildlife, and wetland resources within and adjacent to the Trinity River and in reservoir environments within the Trinity River Basin and Central Valley. As described in Geomorphic Environment (Section 3.2), impacts to vegetation, wildlife, and wetland resources are in large part a by-product of geomorphic processes including the amount and timing of flows and the transport and deposition of sediment. Vegetation, Wildlife, and Wetland Resources Technical Appendix C provides more detail to the discussions that follow.

Operation of the TRD has directly affected vegetation, wildlife, and wetland resources within and adjacent to the Trinity River.

3.7.1 Vegetation

Affected Environment.

Trinity River Basin. Prior to dam construction the natural hydrograph of the Trinity River was characterized by high winter and spring flows followed by greatly reduced summer flows (with great inter-year variability). Large winter and spring floods maintained multi-age woody riparian vegetation via channel scouring, periodic channel migration, and varying seed distribution during flow recession. The result was a mosaic of early-successional willow-scrub vegetation combined with patches of more mature willow-alder and alder-dominated associations. Pre-dam aerial photographs indicate that approximately 300 acres of diverse riparian vegetation occurred between Lewiston Dam and the North Fork.

Construction of the TRD greatly reduced the magnitude of peak flows, obstructed coarse sediment input from above the dam, and allowed fine sediment to accumulate on channel features that had previously been regularly scoured by flood flows. The result is a more static system that is susceptible to expansion and maturation of woody riparian vegetation. Riparian vegetation has now increased in area by almost 300 percent (to approximately 900 acres; Figure 3-39) by encroaching into areas that had previously been scoured by flood flows. The expansion and maturation of woody riparian vegetation has had detrimental effects, including the formation of a riparian berm that effectively armors and anchors the river banks, thereby preventing the river from meandering within the channel. The establishment of these berms further exacerbates the encroachment and maturation of woody vegetation.

Riparian vegetation has now increased in area by almost 300 percent…by encroaching into areas that had previously been scoured by flood flows.

Existing riparian vegetation is most prevalent from the Lewiston Dam to the confluence with the North Fork. This reach includes approximately 330 acres of early-successional willow-dominated vegetation, 170 acres of more mature later-successional alder-dominated vegetation, and 380 acres of willow-alder mix. Between the North Fork and the South Fork, the Trinity River channel is

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restricted by canyon walls that limit riparian vegetation to a narrow band. Peak flows in this reach have been impacted only modestly by dam operations. Between the South Fork and the Klamath River, the Trinity River alternates between confined reaches with little riparian vegetation to alluvial reaches with vegetation similar to pre-dam conditions in the reach between Lewiston Dam and the North Fork.

At Trinity and Lewiston Reservoirs plant species consist of those typically found in standing water and include floating species, rooted aquatic species, and emergent wetland species. Emergent wetland and riparian vegetation is constrained by fluctuating water levels and steep banks.

Nine ***special-status*** plant species in the Trinity River Basin were identified from the California Native Plant Society (CNPS) Electronic Inventory database and through communications with agency biologists. All of these species potentially occur in the project area in association with streambank habitats (Table 3-24). None of the species are protected by federal or state endangered species acts.

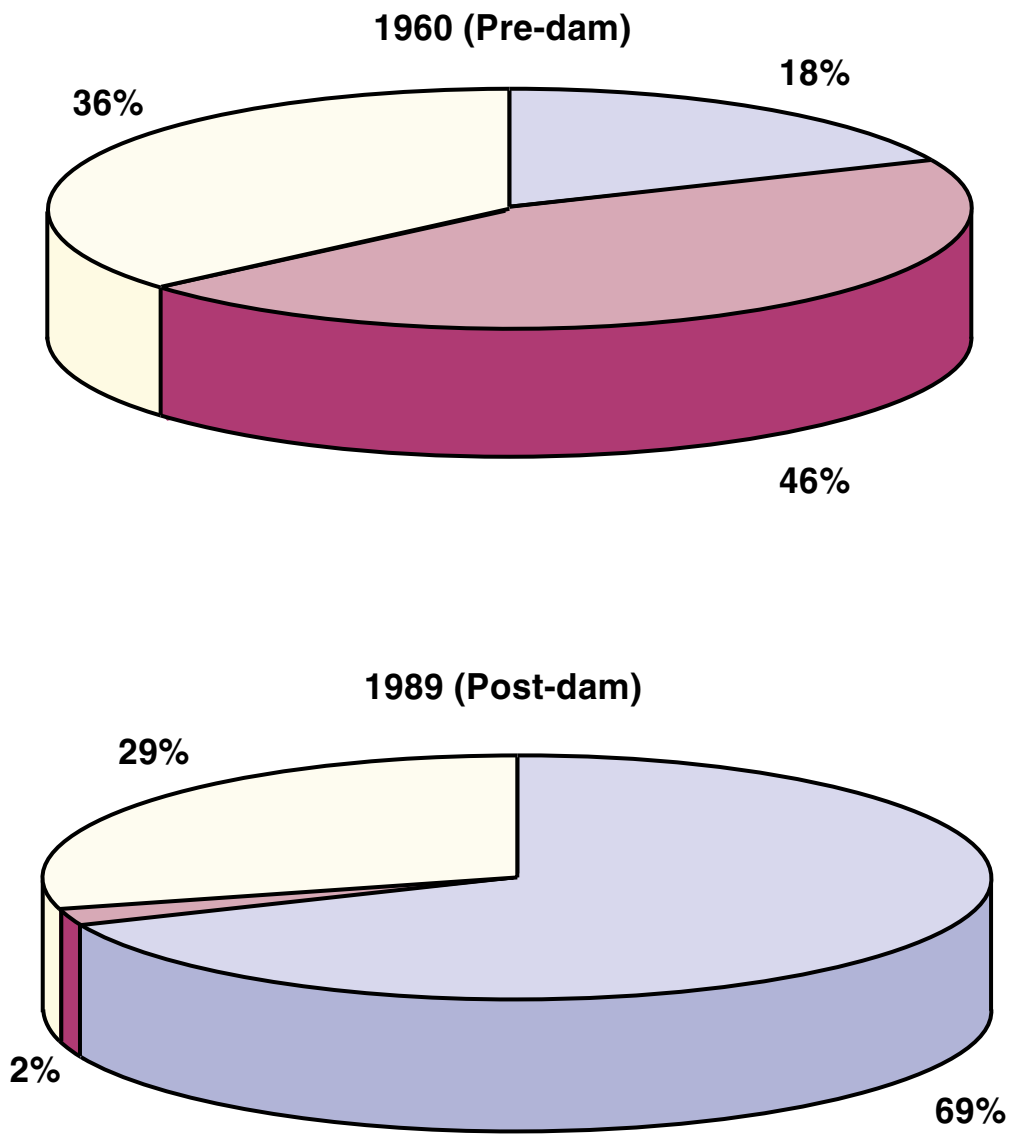
TABLE 3-24
Special-status Plant Species Occurring or Potentially Occurring in Riparian, Wetland, and Riverine Habitat along the Trinity and Lower Klamath Rivers

		Status		
Common Name	**Scientific Name**	**CNPS**	**CA**	**Federal**
Rattan's milk-vetch[a]	*Astragalus rattanii* var. *rattanii*	4	—	—
Bottlebrush sedge[a]	*Carex histricina*	2	—	—
Fox sedge	*Carex vulpinoidea*	2	—	—
California lady's-slipper[a]	*Cypripedium californicum*	4	—	—
Clustered lady's-slipper[a]	*Cypripedium fasciculatum*	4	—	FSC
Heckner's lewisia[a]	*Lewisia cotyledon* var. *heckneri*	1B	—	FSC
Showy raillardella[a]	*Raillardella pringlei*	1B	—	FSC
Great burnet[a]	*Sanguisorba officinalis*	2	—	—
English peak greenbriar[a]	*Smilax jamesii*	1B	—	—

[a]Known to occur in the general area of the project.

Status Definitions:
CNPS California Native Plant Society
1B Plants considered rare, threatened, or endangered throughout their range
2 Plants considered rate, threatened, or endangered in California
4 Plants of limited distribution
FSC ***Federal Species of Concern***

Lower Klamath River Basin / Coastal Area. Vegetation on the lower Klamath River is largely determined by a more natural hydrograph than it is on the Trinity. Partly as a result, a greater diversity of riparian and riverine habitats occur. Plant species composition also changes with proximity to the ocean as the river slows, water temperatures increase, and tidal influence affects salinity.



Comparison of riparian vegetation, gravel bar, and open water habitat between 1960 (pre-dam) and 1989 (post-dam) in the upper (upstream of the confluence with the North Fork) Trinity River (Wilson, 1993).

FIGURE 3-39
HABITAT CHANGE PRE-DAM vs. POST-DAM
TRINITY RIVER MAINSTEM FISHERY RESTORATION EIS/EIR

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Nine special-status plant species occur or potentially occur in river, riparian, and wetland environments in the Lower Klamath River Basin / Coastal Area (Table 3-24).

Central Valley. Reservoirs usually support vegetation above the high watermark that is typical of the vegetation that occurred prior to creation of the reservoir. Common vegetation types found above reservoir watermarks in the Central Valley include valley foothill hardwood and chaparral, and to a much lesser degree, freshwater emergent wetland vegetation. Sacramento River riparian vegetation is represented by willow scrub, willow-cottonwood stands, mature cottonwood forest, mixed riparian herb / scrub, alder-willow forest, riparian forest, and valley oak riparian forest. Wildlife refuges served by the CVP include typical wetland vegetation.

Eleven special-status plant species occur or potentially occur in river, riparian, and wetland environments in the Central Valley (Table 3-25).

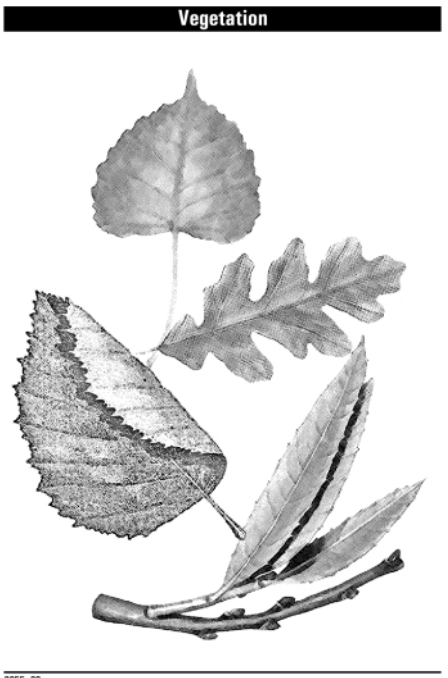

TABLE 3-25
Special-status Plant Species Potentially Occurring in the Central Valley

Common Name	Scientific Name	Status		
		CNPS	CA	Federal
Suisun marsh aster	*Aster lentus*	1B	—	FSC
Fox sedge	*Carex vulpinoidea*	2	—	—
Suisun thistle	*Cirsium hydrophilum* var. *hydrophilum*	1B	—	FE
Soft bird's beak	*Cordylanthus mollis* ssp. *mollis*	1B	CR	FE
Silky cryptantha	*Crypthantha crinita*	1B	—	FE
Rose-mallow	*Hibiscus lasiocarpus*	2	—	—
Northern California black walnut	*Juglans californica* var. *hindsi*	1B	—	FSC
Mason's lilaeopsis	*Lilaeopsis masoni*	1B	CR	FSC
Delta mudwort	*Limosella subulata*	2	—	—
Eel-grass pondweed	*Potamogeton zosteriformes*	2	—	—
Sandford's arrowhead	*Sagittaria sanfordii*	1B	—	FSC

Status Definitions:
FE Listed and endangered under federal Endangered Species Act
FSC Federal Species of Concern
CR Considered as rare by the State of California
CNPS California Native Plant Society
1B List 1B species: rare, threatened, or endangered in California throughout their range
2 List 2 species: rare, threatened, or endangered in California, but more common elsewhere

Environmental Consequences.

Methodology. The analysis of project impacts to Trinity River vegetation focused on the ability of each alternative to restore "healthy" river attributes, as defined in the Geomorphic Environment section (3.2). As noted in that section, most attributes are assessed according to a threshold flow magnitude and frequency. Many of these frequencies are based on periodic flows every few

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years, as would occur in a natural flood-drought cycle. For this reason alternatives are not assessed by wet- or dry-year class. Instead, they are assessed across year classes in terms of long-term frequencies. The vegetation analysis focuses on those attributes and characteristics necessary to restore pre-dam riparian plant communities (Table 3-26). Departure from pre-dam conditions is termed "degradation" for purposes of this analysis.

TABLE 3-26
Healthy River Attributes and Associated Riparian Characteristics

	Attribute	Characteristic
1.	Spatially complex channel geomorphology	Riparian community with all stages of successional development
		No net loss of riparian habitat following channel migration
2.	Flows and water quality are predictably unpredictable	Discourage riparian plant germination on alternate bars by inundation during seed dispersion
3.	Frequently mobilized channelbed surface	Lower rates of riparian encroachment by scouring shallow-rooted 1- to 2-year old seedlings
4.	Periodic channelbed scour and fill	Re-establishment of dynamic riparian plant stands in various stages of succession on higher elevations of alternate bars
		Mortality of 3- to 4-year old saplings on alternate bar surfaces to discourage riparian plant encroachment and berm formation
5.	Balance fine and coarse sediment budgets	Reduce riparian berm fossilization to improve channel dynamics and salmonid habitat
		Maintain physical complexity by sustaining alternate bar geomorphology
6.	Periodic channel migration	Multi-age class structure in stands of cottonwood and other species dependent on channel migration
7.	A functional floodplain	None used
8.	Infrequent channel resetting floods	Create dynamic riparian stands in various stages of succession on higher elevation of alternate bars
		Control populations of 3- to 4-year old saplings on alternate bar surfaces close to channel center, and scour stands of mature riparian vegetation
		Convert mature, less productive riparian habitats to highly productive, early-successional stages
9.	Self-sustaining diverse riparian plant communities	Increase woody riparian age diversity
		Promote rehabilitation of channel dynamics
10.	Naturally fluctuating groundwater table	High diversity of habitat types within the entire river corridor

Alternatives were qualitatively compared to the No Action Alternative based on their ability to create riparian characteristics through combinations of flow and/or mechanical rehabilitation (Table 3-27). Scheduled releases from Lewiston Dam, and the frequency of releases, were used as the basis of comparison for each alternative against the healthy river attributes. Individual characteristics were compiled into a composite ranking comparing the alternative's overall ability to restore riparian vegetation to pre-dam conditions.

TABLE 3-27
Vegetation Impacts Compared to the No Action Alternative

Attribute	No Action	Maximum Flow	Flow Evaluation	Percent Inflow	Mechanical Restoration	State Permit
Overall ranking of the ability of the alternative to restore plant communities to pre-dam conditions	5	1 (Best)	2	3	4	6 (Worst)
Riparian community with all stages of successional development	Continued degradation compared to pre-dam condition	Substantial improvement	Improvement	Slight improvement	Same as No Action	Additional degradation
No loss of riparian habitat following channel migration	No channel migration	Substantial improvement	Improvement	Slight improvement	Same as No Action	Additional degradation
Discourage riparian plant germination on alternate bars by inundation during seed dispersion	Some inundation of alternate bars during seed dispersion	Improvement	Improvement	Substantial improvement	Slight improvement	Additional degradation
Lower rates of riparian encroachment by scouring shallow-rooted 1- to 2-year old seedlings	Continued degradation compared to pre-dam condition	Substantial improvement	Substantial improvement	Improvement	Slight improvement	Additional degradation
Re-establishment of dynamic riparian plant stands in various stages of succession on higher elevations of alternate bars	Continued degradation compared to pre-dam condition	Improvement	Substantial improvement	Slight improvement	Same as No Action	Additional degradation
Mortality of 3- to 4-year old saplings on alternate bar surfaces to discourage riparian plant encroachment and berm formation	Continued degradation compared to pre-dam condition	Improvement	Substantial improvement	Slight improvement	Same as No Action	Additional degradation
Reduce riparian berm establishment to improve channel dynamics	Continued degradation compared to pre-dam condition	Substantial improvement	Improvement	Slight improvement	Same as No Action	Additional degradation
Multi-age class structure in stands of cottonwood and other species dependent on channel migration	Continued degradation compared to pre-dam condition	Substantial improvement	Improvement	Slight improvement	Same as No Action	Additional degradation
Periodic elimination of mature vegetation along channel	Continued degradation compared to pre-dam condition	Substantial improvement	Improvement	Slight improvement	Same as No Action	Additional degradation

TABLE 3-27
Vegetation Impacts Compared to the No Action Alternative

Attribute	No Action	Maximum Flow	Flow Evaluation	Percent Inflow	Mechanical Restoration	State Permit
Control populations of 3- to 4-year old saplings on alternate bar surfaces close to channel center, and scour stands of mature riparian vegetation	Continued degradation compared to pre-dam condition	Substantial improvement	Improvement	Slight improvement	Slight improvement	Additional degradation
Convert mature, less productive riparian habitats to highly productive, early-successional stages	Continued degradation compared to pre-dam condition	Substantial improvement	Improvement	Slight improvement	Slight improvement	Additional degradation
Increase woody riparian overstory and understory species diversity	Continued degradation compared to pre-dam condition	Substantial improvement	Improvement	Slight improvement	Slight improvement	Additional degradation
Promote rehabilitation of channel dynamics	Continued degradation compared to pre-dam condition	Substantial improvement	Improvement	Slight improvement	Slight improvement	Additional degradation
High diversity of habitat types within the entire river corridor	Some inundation of wetland areas on floodplain	Substantial improvement	Improvement	Improvement	Slight improvement	Additional degradation

Flow reductions in the Sacramento River predicted for each of the project alternatives are not expected to have a significant adverse impact on riparian vegetation in the Central Valley for the following reasons:

- In the Sacramento River downstream of Red Bluff, inflow from tributary streams increases and has an increasingly greater influence on flows in the Sacramento River than Keswick releases. Thus, changes in Keswick releases predicted for the project alternatives would not be expected to substantially change the hydrologic dynamics that shape and support riparian communities in the Sacramento River downstream from Red Bluff. This conclusion is supported by modeled changes in stage (i.e., water-surface elevation) predicted at the Verona gage for the project alternatives. The Maximum Flow Alternative showed the greatest decrease in water-surface elevation relative to the No Action Alternative of any of the alternatives. The greatest predicted decrease in stage is 1.5 feet and occurs in November of a wet year. All other months, water-year classes, and alternatives show a smaller decrease in stage relative to the No Action Alternative. The project alternatives show the smallest change in stage relative to the No Action Alternative over the dry period. The greatest predicted decrease in stage in the dry period is 0.6 feet in July under the Maximum Flow Alternative. Predicted differences in water-surface elevations between the project alternatives and existing conditions are similar. The small change in water-surface elevation, particularly in dry years, would not be expected to substantially change water availability for riparian vegetation and, therefore, would not be expected to result in changes in the riparian community.
- Flow levels in the section of the Sacramento River between Keswick Dam and Red Bluff are largely determined by Keswick releases. This section of the river has a bedrock geomorphology (The Resources Agency, 1989) that acts to restrict riparian vegetation to higher terraces that are only inundated at very high flow levels. Depth to the water table is a strong determinant of the composition, growth, and survival of riparian communities (Stromberg, 1995). As distance from the water channel increases, the importance of groundwater to sustaining riparian vegetation increases (Stromberg and Patten, 1996). Many streams in the Sacramento Valley have historically been gaining streams, a condition where groundwater is discharged into the stream. Even during drought periods, groundwater levels in the Sacramento Valley basin have historically declined only moderately, recovering to pre-drought levels in subsequent wetter periods. These observations suggest that groundwater plays a substantial role in sustaining riparian vegetation between

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Keswick and Red Bluff, with flow levels in the river having a lesser role.

- Although groundwater is likely to have a greater influence on the persistence of riparian vegetation in the Sacramento River above Red Bluff, river flows may also contribute. The elevation of the water-surface is more important in determining the availability of water to riparian vegetation than river flows. Under the project alternatives, predicted water-surface elevations at Keswick would not change substantially relative to the No Action Alternative. The Maximum Flow Alternative shows the greatest change in stage of all alternatives. The maximum decrease in stage under this alternative relative to the No Action Alternative predicted at Keswick is 2.6 feet in November of a wet year. Predicted differences in dry years when water availability would be more limited for riparian vegetation are less than 0.9 feet in all months relative to the No Action Alternative for all project alternatives. Predicted differences between water-surface elevations under all alternatives and existing conditions are similar. These small changes in water-surface elevations would not be expected to substantially change water availability for riparian vegetation and, therefore, would not be expected to result in changes in the composition, distribution, or extent of riparian vegetation in the Sacramento River above Red Bluff.
- In the Delta, riparian vegetation persists as narrow strands along waterways and also as isolated stands in interior portions behind berms. Much of the Delta is 10-20 feet below msl and the water table is at or near ground level (Dennis et al., 1984). As a result of this high water table, riparian vegetation can persist in areas isolated from the river channel (Dennis et al., 1984). With the high water table and reduced direct influence of Keswick releases on river stages in the Delta, the project alternatives would not be expected to result in a substantial change in the composition or extent of riparian vegetation.

Similarly, vegetation along the Klamath River would not be appreciably affected by any of the alternatives as the confluence with the Trinity is approximately 100 miles downstream of Lewiston Dam and Trinity flows into the Klamath are greatly influenced by tributary flows downstream of Lewiston.

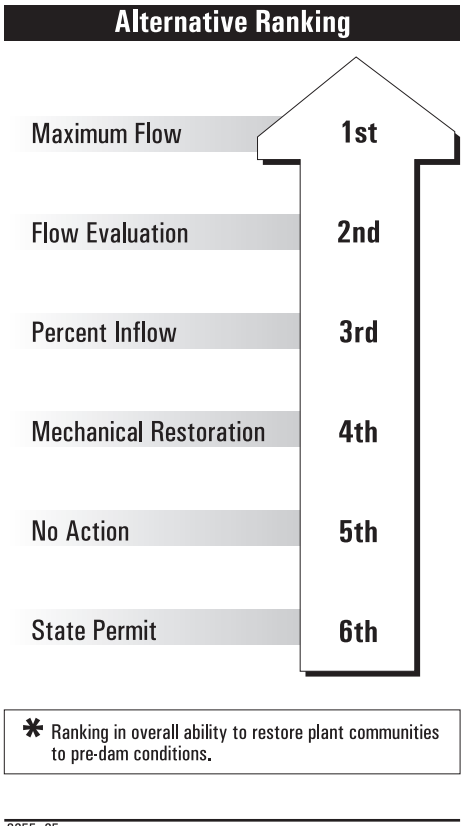
Significance Criteria. Impacts on vegetation would be significant if project implementation would result in any of the following:

- Potential for reductions in the number, or restrictions of the range, of an endangered or threatened plant species or a plant species that is a candidate for state listing or proposed for federal listing as endangered or threatened

- Potential for substantial reductions in the habitat of any native plant species including those that are listed as endangered or threatened or are candidates (CESA) or proposed (ESA) for endangered or threatened status
- Potential for causing a native plant population to drop below self-sustaining levels
- Potential to eliminate a native plant community
- Substantial adverse effect, either directly or through habitat modifications, on any plant identified as a sensitive or special-status species in local or regional plans, policies, or regulations
- Substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations
- Substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means
- A conflict with any local policies or ordinances protecting vegetation resources
- A conflict with, or violation of, the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, state, or federal habitat conservation plan relating to the protection of plant resources

No Action. The No Action Alternative would continue the current flow regime. The flows are insufficient to counteract the riparian vegetation encroachment and maturation that commenced immediately following dam construction. Overall, this alternative is expected to continue the transformation of riparian vegetation away from pre-dam conditions. This alternative ranked fifth relative to other alternatives in its ability to restore healthy river attributes and associated riparian characteristics to the pre-dam condition (Table 3-27).

Maximum Flow. This alternative was designed to use flow as the primary tool for restoration. The major flow event is a scheduled release of 30,000 cfs in extremely wet years that would move the channel and scour riparian berms and associated mature vegetation. The high flows are expected to result in an increase in early-successional vegetation similar to that found in pre-dam conditions. However, loss of berms and riparian vegetation could result in the loss of special-status plant populations that may have established in these discrete areas. Because flows are the primary restoration tool, restoration would occur along the entire upper river continuum, rather than just at specific rehabilitation sites (as under some of the other alternatives). This alternative ranks first overall in its ability to



restore healthy river attributes and associated riparian vegetation characteristics to the pre-dam condition.

Flow Evaluation. This alternative would use mechanical as well as hydraulic means to remove mature riparian vegetation; flows would then be used to maintain the sites. Removal of mature riparian vegetation could result in the loss of special-status plant populations that have established in these areas. This alternative ranked second overall in its ability to restore healthy river attributes and associated riparian vegetation characteristics to pre-dam conditions.

Percent Inflow. This alternative is unique in that timing of flows mimics real conditions. Peak flow would tend to be higher than under the No Action Alternative, but summer flows would tend to be lower. Yearly volumes could be higher or lower, depending on inflows to Trinity Reservoir. The mechanical removal of berms and associated riparian vegetation could result in the loss of special-status plant populations. Overall, this alternative ranked third in its ability to restore healthy river attributes and associated riparian vegetation characteristics to pre-dam conditions.

Mechanical Restoration. This alternative uses mechanical means to accomplish restoration. This alternative would not restore conditions along the river continuum, but rather, would restore conditions only at discrete sites. The mechanical removal of berms and associated mature riparian vegetation could result in loss of special-status plant populations. The Mechanical Restoration Alternative would do little to restore healthy river attributes and associated riparian vegetation characteristics because it does not restore the processes associated with flows (e.g., varying seed distribution). It ranked fourth overall in its ability to restore healthy river attributes and associated riparian vegetation characteristics to pre-dam conditions.

State Permit. The State Permit Alternative would reduce annual flows to 120,500 af, the level at which much of the current degradation occurred. This alternative would result in further degradation of riparian vegetation conditions in terms of greater riparian encroachment and maturation. This alternative ranked last among the alternatives in its ability to restore healthy river attributes and associated riparian vegetation characteristics to pre-dam conditions.

Existing Conditions versus Preferred Alternative. The Preferred Alternative would substantially improve vegetation along the Trinity River compared to existing conditions (in terms of restoring to pre-dam conditions). The degree and nature of the change would be similar to the difference between the Flow Evaluation and No Action Alternatives; however, existing conditions may not be as severe as conditions under the No Action Alternative (i.e., year 2020) because of the continuing degradation of the river.

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Mitigation. No mitigation is required in regard to flow-related actions. The following mitigation should be implemented to ensure potential significant adverse impacts as a result of mechanical ground-disturbing activities are reduced to a less than significant level:

- Conduct site-specific environmental reviews prior to channel rehabilitation projects, spawning gravel placement, watershed protection work, and other activities not specifically covered by this document (i.e., the non-flow activities). Such reviews would, when appropriate, include surveys for federal and state endangered, threatened, and proposed species, or for other species if required by permitting agencies (e.g., USFS). If such species are present, actions would be taken to avoid or mitigate impacts.
- Develop and implement a revegetation plan for all ground-disturbing activities (excluding channel rehabilitation sites). Revegetation shall use plant species found either adjacent to the area to be impacted or along a similar area (e.g., tributary), subject to landowner and / or agency concurrence. Replacement ratios and monitoring plans, if determined necessary, would be developed in cooperation with the Corps, Service, and CDFG.

3.7.2 Wildlife

Affected Environment.

Trinity River Basin. Many wildlife species that inhabited river and riparian habitats prior to dam construction still occur along the Trinity River, although species that prefer early-successional stages or require greater riverine structural diversity likely occurred in greater abundance prior to the dam. Common species prior to dam construction likely include rough-skinned newt, Pacific coast aquatic garter snake, foothill yellow-legged frog, western pond turtle, and American dipper. Wildlife species that foraged on the abundant salmon and steelhead runs (e.g., black bear, bald eagle, and other scavengers) were also common along the pre-dam Trinity.

The current flow regime has established conditions favoring upland habitat at the expense of wetland and aquatic habitat. The shift in habitat types is a causative factor in the current depressed populations of aquatic, semi-aquatic, and wetland wildlife species compared to terrestrial species. Species such as the western pond turtle, an example of a semi-aquatic species, have declined since completion of the dams in response to diminishing instream habitat. In contrast, species that favor mature, late-successional riparian habitats, such as northern goshawk and black salamander, prefer the current mature conditions.

The shift in habitat types is a causative factor in the current depressed populations of aquatic, semi-aquatic, and wetland wildlife species compared to terrestrial species.

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Impounded water in reservoirs attracts resting and foraging waterfowl and other species that favor standing or slow-moving water. Reservoirs also provide important foraging habitat for eagles and other raptors that prey on fish and waterfowl.

Special-status species that are known to be present, or potentially present, in areas affected by the project are listed in Table 3-28. Agency concerns, expert opinion, available data, and impact analyses identified four special-status wildlife species that could be affected by project implementation—the foothill yellow-legged frog, western pond turtle, bald eagle, and willow flycatcher. The frog, turtle, and flycatcher serve as indicator species for impacts to Trinity River wildlife. Impacts to the eagle were assessed because it is a federally listed species and of substantial interest to the public.

Agency concerns, expert opinion, available data, and impact analyses identified four special-status wildlife species that could be affected by project implementation—the foothill yellow-legged frog, western pond turtle, bald eagle, and willow flycatcher.

TABLE 3-28
Special-status Wildlife Species Occurring or Potentially Occurring in Riparian and Riverine Habitat in the Trinity River Basin

		Status	
Common Name	**Scientific Name**	**CA**	**Federal**
Amphibians			
Southern torrent salamander[a]	*Rhyacotriton variegatus*	CFP, CSSC	FSC
Tailed frog[a]	*Ascaphus truei*	CFP, CSSC	
California red-legged frog[a,b]	*Rana aurora draytonii*	CSSC	FT
Cascades frog	*Rana cascadae*	CFP, CSSC	FSC, FSS
Foothill yellow-legged frog[a]	*Rana boylii*	CFP, CSSC	FSC, FSS
Reptiles			
Western pond turtle[a]	*Clemmys marmorata*	CSSC	FSS
Birds			
Barrow's goldeneye[a]	*Bucephala islandica*	CSSC	
Osprey[a]	*Pandion haliaetus*	CSSC	
Bald eagle[a]	*Haliaeetus leucocephalus*	CE, CFP	FT
Northern Harrier	*Circus cyaneus*	CSSC	
Sharp-shinned hawk[a]	*Accipiter striatus*	CSSC	
Cooper's hawk[a]	*Accipiter cooperii*	CSSC	
Northern goshawk[a]	*Accipiter gentilis*	CSSC	FSC,FSS
Golden eagle[a]	*Aquila chrysaetos*	CFP, CSSC	BLMS
Merlin[a]	*Falco columbarius*	CSSC	
Peregrine falcon[a]	*Falco peregrinus anatum*	CE, CFP	NONE, delisted 8/25/99
Prairie falcon[a]	*Falco mexicanus*	CSSC	
Ruffed grouse[a]	*Bonasa umbellus*	CSSC	
California gull[a]	*Larus californicus*	CSSC	
Northern spotted owl[a]	*Strix occidentalis caurina*	CSSC	FT
Long-eared owl[a]	*Asio otus*	CSSC	
Short-eared owl	*Asio flammeus*	CSSC	
Black swift[a]	*Cypoeseloides niger*	CSSC	
Vaux's swift[a]	*Chaetura vauxi*	CSSC	
Willow flycatcher[a]	*Empidonax traillii*	CE	FSS
Purple Martin	*Progne subis*	CSSC	
Black-capped chickadee[a]	*Parus atricapillus*	CSSC	
Loggerhead shrike	*Lanius ludovicianus*	CSSC	FSC

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TABLE 3-28
Special-status Wildlife Species Occurring or Potentially Occurring in Riparian and Riverine Habitat in the Trinity River Basin

		Status	
Common Name	**Scientific Name**	**CA**	**Federal**
Yellow warbler[a]	*Dendroica petechia brewsteri*	CSSC	
Yellow-breasted chat[a]	*Icteria virens*	CSSC	
Mammals			
Little brown myotis	*Myotis lucifugus occultus*	CSSC	FSC
Townsend's Western big-eared bat	*Plecotus townsendii townsendii*	CSSC	FSC
Pallid bat	*Antrozous pallidus*	CSSC	
Snowshoe hare	*Lepus americanus*	CSSC	
Mountain beaver	*Aplodontia rufa*	CSSC	
Northern flying squirrel[a]	*Glaucomys sabrinus californicus*	CSSC	FSC
Ringtail[a]	*Bassariscus astutus*	CFP	FSC
Marten[a]	*Martes americana*	CSSC	FSC, FSS
Pacific fisher[a]	*Martes pennanti pacifica*	CSSC	FSC, FSS
Wolverine[a]	*Gulo gulo letus*	CT, CFP	FSC
Badger	*Taxidea taxus*	CSSC	

[a] Known to occur in the general area of the project
[b] In this part of its range, the California red-legged frog is a Federal Species of Concern

Status Definitions:

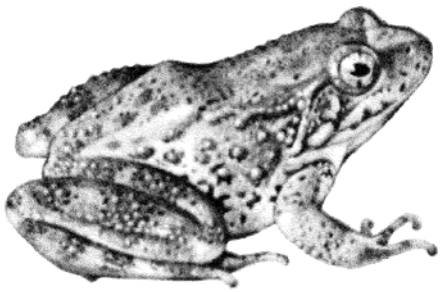
BLMS	Bureau of Land Management Sensitive
FC	Federal Candidate for listing
CE	Listed as endangered under the California Endangered Species Act
CT	Listed as threatened under the California Endangered Species Act
CSSC	California Species of Special Concern
FE	Listed and endangered under federal Endangered Species Act
FT	Listed as threatened under federal Endangered Species Act
FSC	Federal Species of Concern
FSS	Forest Service Sensitive
CFP	***California Fully Protected***

The foothill yellow-legged frog breeds in low-velocity, shallow water near sparsely vegetated gravel bars. These areas have been reduced 95 percent compared to pre-dam conditions.

The foothill yellow-legged frog breeds in low-velocity, shallow water near sparsely vegetated gravel bars (Figure 3-40). These areas have been reduced 95 percent compared to pre-dam conditions. Almost no frogs have been found in the 12 RMs below Lewiston Dam, probably because of the lack of breeding habitat. Escape habitat, in the form of nearby pools, has also been reduced by low flows, fine sediment accumulation, and riparian encroachment.

The natural recession in flows following peak snowmelt runoff is believed to be a cue for egg deposition for the foothill yellow-legged frog. Prior to dam construction, snowmelt flows peaked sometime in the spring and gradually tailed off towards summer. However, dam releases have not always included a spring recession, or the recession has been greatly weakened and/or out of sync with tributary flows, thereby negating an important breeding cue for frogs. Release schedules that do not match the natural snowmelt recession may

Foothill Yellow-legged Frog



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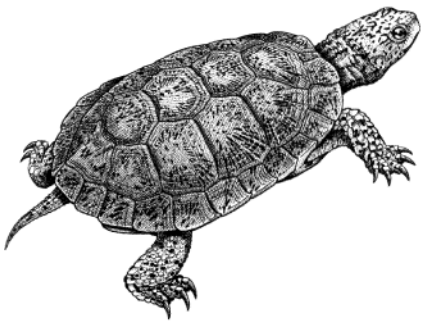
result in reduced reproductive success for the foothill yellow-legged frog. For example, a scheduled peak release may wash away eggs that were deposited in response to earlier tributary recessions. Conversely, a late snowmelt peak from the tributaries may harm eggs deposited because of the artificial recession of dam releases.

Although the western pond turtle still occupies some locations in the Trinity River, "the alterations of channel morphology and flow regimes associated with damming (have decreased the) habitat suitability" for the species.

Although the western pond turtle still occupies some locations in the Trinity River, "the alterations of channel morphology and flow regimes associated with damming (have decreased the) habitat suitability" for the species (Reese and Welsh, 1998). For example, instream pools, used by turtles for cover and protection from predators, have largely been lost because of channelization (Figure 3-40). (This habitat has been replaced to some extent by undercut banks with slow-moving water.) Areas that historically provided low water velocities during high flows (e.g., side channels and gravel bars) have also been reduced, resulting in increased mortality to hatchlings and juveniles. Furthermore, because current summer releases from the dam are colder than pre-dam conditions, development in early life stages could be affected, as well as behavior in all life stages. The harmful effects of the coldwater releases are compounded by a reduction in thermal stratification compared to pre-dam conditions, a consequence of the decreased structural diversity. In other words, the turtle (and many other species) no longer has the temperature choices it had in pre-dam conditions.

Western Pond Turtle



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The bald eagle has experienced a reduction in Trinity River forage because of the declining salmon escapements, a result of the construction and operation of Trinity and Lewiston Dams. However, the eagle adapts well to reservoirs where it forages on fish and waterfowl. Eight bald eagle pairs are known to exist in the areas surrounding Trinity and Lewiston Reservoirs, and 15 nests were active around Shasta Reservoir in 1997. One study demonstrated a positive correlation between the number of bald eagle chicks per occupied nest versus Shasta Reservoir water levels (U.S. Bureau of Reclamation, 1992). However, a subsequent study suggested that the presence of boats caused decreased reproduction, whereas lower water levels did not (Kristan and Golightly, 1995). The Reclamation study did not find a correlation between reproduction and water levels for bald eagles nesting near Trinity and Lewiston Reservoirs.

Reproductive success of eagles near Trinity and Lewiston Reservoirs has generally exceeded the recovery goal of 1.0 young per occupied nest (as established in the Pacific Region recovery plan: U.S. Fish and Wildlife Service, 1986); however, success near Shasta Reservoir has failed to meet the goal in recent years. Bald eagle use of the reservoirs increases dramatically in some winters.

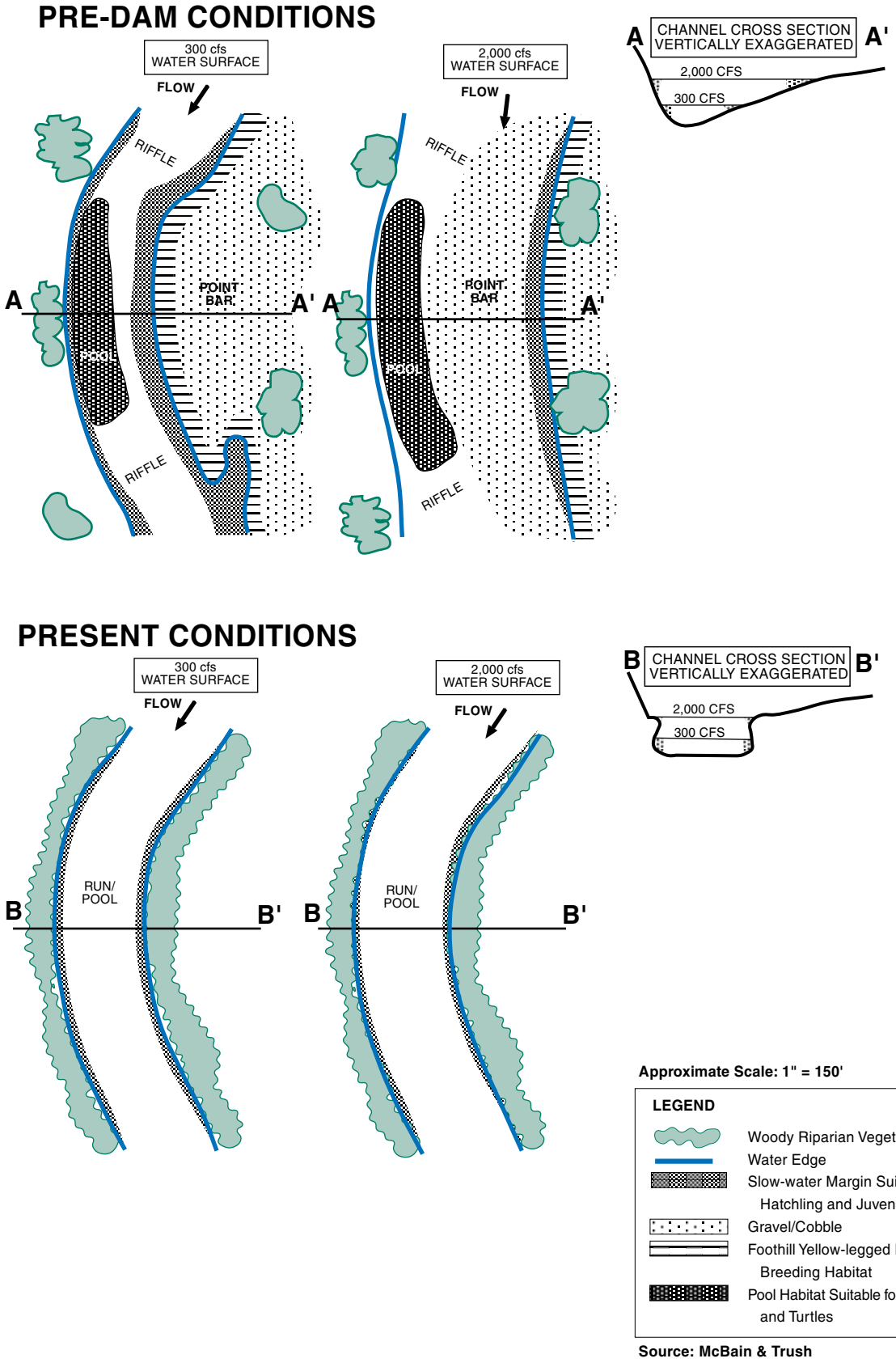

FIGURE 3-40
HABITAT FOR RIVERVINE WILDLIFE SPECIES, PRE-DAM AND PRESENT CONDITIONS
TRINITY RIVER MAINSTEM FISHERY RESTORATION EIS/EIR

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The willow flycatcher is a summer resident in California, breeding in riparian willow thickets, often in association with wetlands. This habitat type is considered early-successional and was more abundant in the pre-dam floodplain than it is currently. Approximately a dozen willow flycatchers were recorded annually from the Trinity River in 1990-92; however, no breeding birds were detected (Wilson, 1995). The lack of standing water and flying insects—a result of channelization of the river—was speculated as a possible factor limiting willow flycatcher breeding. The survey detected birds repeatedly at the site of a newly constructed side-channel rehabilitation project.

Willow Flycatcher

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Lower Klamath River Basin / Coastal Area. Lower Klamath River wildlife species are expected to be similar to those found in the Trinity River Basin.

Central Valley. Migratory waterfowl and shorebirds comprise a large portion of the vertebrate wildlife species occupying riverine riparian and reservoir habitats along the Sacramento River and in the Bay-Delta. Habitats surrounding reservoirs generally support wildlife species that would occupy these habitats in the absence of the reservoir. Reservoirs themselves provide only marginal habitat for many wildlife species because fluctuating water levels prevent establishment of riparian, wetland, and submergent vegetation used by wildlife for foraging, resting, breeding, and nesting. Wildlife refuges served by the CVP provide wetland and associated habitat for waterfowl and some terrestrial species including the giant garter snake.

Special-status wildlife species occurring or potentially occurring in riverine, riparian, and reservoir habitats in the Central Valley are shown in Table 3-29.

Environmental Consequences.

Methodology. Each alternative was evaluated in detail for its effects on the foothill yellow-legged frog, western pond turtle, bald eagle, and willow flycatcher. For the foothill yellow-legged frog, western pond turtle, and willow flycatcher these analyses were limited to the Trinity River Basin. Factors critical to the long-term viability of local populations were identified for the frog, turtle, and flycatcher (see the Attribute column in Table 3-30). These factors were compared to the attributes of the healthy alluvial river model (see Section 3.2). As noted under Vegetation, assessment of these attributes is based on long-term frequencies rather than individual water-year classes. Each alternative was assessed for impacts to attributes that could affect factors critical to the species. Scheduled releases from Lewiston Dam, and the frequency of releases, were used as the basis of comparison for each alternative against the healthy river

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attributes. The assessment of Trinity River water temperature impacts (relevant to the turtle) did not incorporate potential mitigating actions to meet state water temperature objectives (see Water Quality section [3.4]).

TABLE 3-29
Special-status Wildlife Species Occurring or Potentially Occurring in the Central Valley

Common Name	Scientific Name	Status	
		CA	Federal
Insects			
Valley elderberry longhorn beetle	*Desmocerus californicus dimorphus*	—	FT
Amphibians			
California red-legged frog	*Rana aurora draytonii*	CSSC	FT
Reptiles			
Western pond turtle	*Clemmys marmorata*	CSSC	FSC
Giant garter snake	*Thamnophis gigas*	CT	FT
Birds			
Bald eagle	*Haliaeetus leucocephalus*	CE, CFP	FT
American peregrine falcon	*Falco peregrinus anatum*	CE, CFP	None (delisted 8/25/99)
Swainson's hawk	*Buteo swainsoni*	CT	—
California black rail	*Laterallus jamaicensis coturniculus*	CT	FSC
California clapper rail	*Rallus longirostris obsoletus*	CE	FE
Western yellow-billed cuckoo	*Coccyzus americanus occidentalis*	CE	—
Bank swallow	*Riparia riparia*	CT	—
Tricolored blackbird	*Agelaius tricolor*	—	FSC
Saltmarsh common yellowthroat	*Geothlypis trichas sinuosa*	—	FSC
Greater sandhill crane	*Grus canadensis tabida*	CFP	—
White-tailed kite	*Elanus leucurus*	CFP	—
Mammals			
Suisun shrew	*Sorex ornatus sinuosa*	CSSC	FSC
Saltmarsh wandering shrew	*Sorex vagrans halicoetes*	—	FSC
Saltmarsh harvest mouse	*Reithrodontomys raviventris*	CFP	FE

Status Definitions:
FT Listed as threatened under federal Endangered Species Act
FE Listed and endangered under federal Endangered Species Act
FSC Federal Species of Concern
CE Listed as endangered under the California Endangered Species Act
CT Listed as threatened under the California Endangered Species Act
CFP California Fully Protected
CSSC California Species of Special Concern

TABLE 3-30
Wildlife Impacts Compared to the No Action Alternative

Attribute	No Action	Maximum Flow	Flow Evaluation	Percent Inflow	Mechanical Restoration	State Permit
Foothill yellow-legged frog						
Gravel bar habitat suitable for breeding	Continued degradation compared to pre-dam condition	Substantial improvement	Substantial improvement	Slight improvement	Slight improvement	Additional degradation
Pool habitat suitable for adult life stages	Continued degradation compared to pre-dam condition	Substantial improvement	Substantial improvement	Slight improvement	Slight improvement	Additional degradation
Size of snowmelt recession matches natural hydrograph	Snowmelt recession a small fraction of natural recession	Substantial improvement	Improvement	Improvement	Same as No Action	Additional degradation
Timing of snowmelt recession matches natural hydrograph	May not be in sync with snowmelt recession	Improvement	Improvement	Substantial improvement	Same as No Action	Additional degradation
Western pond turtle						
Pool habitat suitable for adults	Continued degradation compared to pre-dam condition	Substantial improvement	Substantial improvement	Improvement	Slight improvement	Additional degradation
Summer water temperatures at natural levels	Summer water temperatures usually below natural levels	Slight improvement	Same as No Action	Improvement	Same as No Action	Improvement
Bald eagle						
Trinity River forage base	Salmon populations would be .08 of TRRP goals	Substantial improvement	Improvement	Slight improvement	Marginal improvement	Decline
Reproduction at Trinity and Lewiston Reservoirs	About 1 eagle chick per occupied nest	Same as No Action	Same as No Action	Same as No Action	Same as No Action	Same as No Action
Modeled young per occupied nest based on Shasta Reservoir water levels	1.10	1.06	1.08	1.09	Same as No Action	1.11
Willow flycatcher						
Early-successional willow habitat	Continued reduction of habitat compared to pre-dam condition	Substantial improvement	Improvement	Slight improvement	Slight improvement	Additional reduction in habitat
Low-flow foraging habitat	Continued reduction of habitat compared to pre-dam condition	Substantial improvement	Improvement	Slight improvement	Slight improvement	Additional reduction in habitat
Egg laying in relation to peak flows	Continued reduction of habitat compared to pre-dam condition	Potential adverse	Slight possibility of adverse	Slight possibility of adverse	Potential adverse	Increased safety

Bald Eagle

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For the bald eagle the analysis also included Shasta Reservoir in the Central Valley. Impacts on bald eagle reproduction at Shasta Reservoir were assessed using modeled long-term average water elevations in April-July and Reclamation's eagle reproduction model (U.S. Bureau of Reclamation, 1992). Because of the uncertainty about cause-and-effect, the results of the model should be viewed cautiously. Impacts of Trinity and Lewiston Reservoir water elevations on bald eagle reproductive success were assessed qualitatively using the assumption that dramatically lower water elevations would lead to lower reproductive success.

As noted in the Vegetation section, flow reductions in the Sacramento River predicted for each of the project alternatives are not expected to have a significant adverse impact on riparian vegetation. Likewise, flow reductions are not expected to affect wildlife associated with riparian habitat along the river corridor. Diversions along the Sacramento River have in part (in addition to available groundwater in many areas) created pocket habitat along canals and near developed agriculture. As the quantity and quality of habitat along the river has been degraded due to flood control, urban encroachment, and agricultural conversion, these pocket habitats have become more valuable ecologically. Some of these pocket habitats include designated habitat for endangered and threatened species such as the Pacific coast aquatic garter snake and the valley elderberry longhorn beetle. However, as discussed under Section 3.3 (Water Management) and Section 3.9 (Land Use) reductions in agricultural water deliveries in the Sacramento Basin are expected to be limited to agricultural water service contractors (primarily associated with the Tehama-Colusa Canal Authority). These reductions are not expected to be substantial enough to appreciably affect irrigation practices in the basin, and would therefore not affect pocket habitats or the wildlife resources associated with them.

Section 3406(d)(5) of the CVPIA mandates that water supplies be increased to a number of national and state wildlife refuges throughout the Central Valley (U.S. Bureau of Reclamation, 1997). Reclamation is currently implementing this section of the CVPIA by constructing and designing new or improved facilities to ensure increased deliveries and reliability. Implementation of any of the alternatives proposed in this DEIS/EIR would not affect the conveyance of additional supplies, as Reclamation is actively pursuing short- and long-term willing sellers to assist in meeting any potential gaps in supplies.

Wildlife along the Klamath River would not be appreciably affected by any of the alternatives as the confluence with the Trinity is approximately 100 miles downstream of Lewiston Dam. Inflow from

the numerous tributaries diminishes the effect of Lewiston Dam releases to negligible levels.

Significance Criteria. Impacts on wildlife would be significant if project implementation would result in any of the following:

- Potential for reductions in the number, or restrictions of the range, of an endangered or threatened wildlife species or a wildlife species that is a candidate for state listing or proposed for federal listing as endangered or threatened
- Potential for substantial reductions in the habitat of any wildlife species including those that are listed as endangered or threatened or are candidates (CESA) or proposed (ESA) for endangered or threatened status
- Potential for causing a wildlife population to drop below self-sustaining levels
- Potential to eliminate an animal community
- Substantial adverse effect, either directly or through habitat modifications, on any wildlife species identified as a sensitive or special-status species in local or regional plans, policies, or regulations
- Substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, or regulations
- Substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means
- A conflict with any state or local policies or ordinances protecting wildlife resources
- A conflict with, or violation of, the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, state, or federal habitat conservation plan relating to the protection of wildlife species

No Action. Table 3-30 discloses the effects of the No Action Alternative on the foothill yellow-legged frog, western pond turtle, bald eagle, and willow flycatcher. In general terms, riverine habitat conditions would remain poor for all species relative to pre-dam conditions. The bald eagle would continue to breed around Trinity, Lewiston, and Shasta Reservoirs at levels comparable to current conditions.

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Foothill Yellow-legged Frog. The No Action Alternative would continue mechanical maintenance of the existing channel rehabilitation projects. These sites would be maintained using bulldozers and other heavy machinery, which may have temporary negative impacts on populations of frogs near the sites. However, once the channel rehabilitation sites are completed, the sites would provide additional habitat for yellow-legged frogs. Artificially timed peak releases would likely continue to contribute to poor reproductive success, leading to further population declines, with potential for local extinctions. The extensive mature riparian vegetation would continue to harbor high densities of mid-size predators (e.g., raccoons), to the detriment of the frog.

Western Pond Turtle. Pool habitat would remain poor due to the No Action flow schedule. Summer release temperatures would continue to be cooler than pre-dam conditions, potentially causing slower growth rates in young turtles and an increase in basking time by all age groups (resulting in increased exposure to predators).

Bald Eagle. Forage levels for bald eagles would continue to be low in the Trinity River. No changes in Shasta and Trinity Reservoir levels are anticipated; thus, no impacts to the local nesting populations are anticipated. The reproductive rate of both populations would still exceed recovery goals.

Willow Flycatcher. Continued maturation of existing early-successional willow habitat would reduce suitable habitat for the species. The lack of wetlands and standing water would limit forage.

Maximum Flow.

Foothill Yellow-legged Frog. The Maximum Flow Alternative would re-establish an alternate bar sequence that would improve gravel bar and pool habitat compared to the No Action Alternative. The timing of peak releases was designed to replicate the natural snowmelt recession, and would better mimic natural conditions than would the No Action Alternative. Overall, this alternative would have a positive effect compared to the No Action Alternative.

Western Pond Turtle. Habitat would improve compared to the No Action Alternative because of the increase in structural diversity, especially in terms of pool habitat. The turtle would also benefit from increased water temperatures in the summer compared to the No Action Alternative.

Bald Eagle. Increases in anadromous fish populations anticipated from this alternative would provide an increased prey base for the bald eagle. This could benefit the local population to the extent that it is currently limited by food availability. Trinity and Shasta Reservoir elevations would decrease slightly on average over the

analysis period. This small reduction is expected to have negligible effects on the reproductive success of the local populations.

Willow Flycatcher. This alternative would result in the greatest increase in early-successional willow habitat of all of the alternatives, increasing potential breeding habitat for this species. Wetlands and standing water would also increase, resulting in increased forage. Although breeding has not been documented, and the peak flows would likely occur prior to initiation of egg laying, there is a slight but unanticipated possibility of mortality to young, which would be a significant adverse effect.

Flow Evaluation.

Foothill Yellow-legged Frog. Gravel bar habitat would be increased compared to the No Action Alternative. The combination of mechanical rehabilitation and increased flow would re-establish an alternate bar geomorphology that would improve pool habitat. However, construction of rehabilitation projects could result in short-term direct mortality of frogs or egg masses. This alternative includes peak flow releases that better mimic natural snowmelt recession than does the No Action Alternative; nevertheless, loss of egg masses is possible in some years because of the fixed release schedules. This alternative is expected to have an overall positive effect on frog populations as a result of improved habitat compared to the No Action Alternative.

Western Pond Turtle. Pool formation and other structural diversity would increase compared to the No Action Alternative. Summer release temperatures would be essentially the same as the No Action Alternative (to the detriment of the turtle); however, the increased structural diversity of the river would result in increased thermal diversity. Construction of rehabilitation sites could cause direct short-term mortality of turtles or hatchlings. Overall, the Flow Evaluation Alternative is slightly beneficial compared to No Action.

Bald Eagle. Increases in anadromous fish populations anticipated from implementation of this alternative would provide an increased prey base for the bald eagle. This would benefit the local population to the extent that it is currently limited by food availability. Reductions in Trinity and Shasta Reservoir water levels and resulting impacts to the local bald eagle population would be negligible.

Willow Flycatcher. Early-successional willow habitat would be increased compared to the No Action Alternative. Wetlands and standing water would increase, resulting in increased forage. Although breeding has not been documented, and the peak flows would likely occur prior to initiation of egg laying, there is a slight but unanticipated possibility of mortality to young, which would be a significant adverse effect. Impacts to young could also occur as a result of the channel rehabilitation projects.

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Percent Inflow.

Foothill Yellow-legged Frog. Gravel bar habitat would be increased through mechanical means, and maintenance would be accomplished with flows. The flow schedule would likely include higher flows than the No Action Alternative, resulting in moderate improvements in alternate bar geomorphology and resultant pool formation. Survival of foothill yellow-legged frog egg masses would be improved compared to No Action since timing of peak flows would be dependent on timing of natural hydrology (with a 1-week lag). The improved habitat and natural timing of peak flows makes this the most beneficial alternative to the frog. However, construction of rehabilitation sites could result in direct short-term mortality of frogs or egg masses.

Western Pond Turtle. Pool formation and other structural diversity would moderately improve compared to the No Action Alternative, resulting in moderate improvements in turtle habitat. Summer water temperatures would move towards the pre-dam temperature regime. The improved habitat and summer temperature conditions make this the most beneficial alternative for this species. However, construction of rehabilitation sites could cause local short-term mortality of adult turtles or hatchlings.

Bald Eagle. Potential increases in anadromous fish populations could have a beneficial effect on the local bald eagle population to the extent that it is currently limited by food availability. Reductions in Trinity and Shasta Reservoir water levels and resulting impacts to the local bald eagle population would be negligible.

Willow Flycatcher. Early-successional willow habitat would be increased to some degree by mechanical rehabilitation and increased flows. Wetlands and standing water would increase, resulting in increased forage. Although breeding has not been documented, and the peak flows would likely occur prior to initiation of egg laying, there is a slight but unanticipated possibility of mortality to young, which would be a significant adverse effect. Impacts to young could also occur as a result of the channel rehabilitation projects.

Mechanical Restoration.

Foothill Yellow-legged Frog. Timing and volume of releases would be the same as No Action, thus would not be beneficial to this species. The increased number of rehabilitation projects would provide improved breeding habitat for frogs. However, construction of the sites could result in short-term mortality of frogs or egg masses.

Western Pond Turtle. This alternative would dredge 10 pools in the Trinity River mainstem and construct 47 additional channel rehabilitation projects. Construction of the sites could cause direct short-

term mortality; however, the activities would benefit the turtle in the long-run by creating additional habitat. Summer flow temperatures would be the same as No Action, and thus would not be beneficial to this species.

Bald Eagle. This alternative would slightly increase forage in the Trinity River. Reservoir elevations would be the same as those identified under the No Action Alternative; and therefore, impacts to reservoir populations would be similar to No Action.

Willow Flycatcher. Early-successional willow habitat would be increased by the mechanical rehabilitation projects proposed under this alternative. Although not anticipated, impacts to young could occur as a result of the channel rehabilitation projects, which would be a significant adverse effect.

State Permit.

Foothill Yellow-legged Frog. Availability of gravel bar and pool habitat would likely decline under this alternative because no channel rehabilitation activities would occur and flows would be reduced. This could accelerate the rate of decline of the species, possibly leading to local extirpation. The benefits of increased water temperatures would be negated by the decrease in available habitat.

Western Pond Turtle. Availability of pool habitat would likely decrease under this alternative because of a lack of channel rehabilitation projects and reduced flows. A potential benefit in the form of increased water temperatures would go unrealized because of the degraded habitat.

Bald Eagle. This alternative would decrease populations of anadromous fish, and thus would have an adverse impact on the local bald eagle population to the degree that it is affected by food availability. There would be a slight increase in Shasta Reservoir elevation and a slight increase in Trinity Reservoir elevation; therefore, reproduction could increase slightly around the reservoirs.

Willow Flycatcher. Reductions in flows compared to the No Action Alternative would allow continued maturation of early-successional willow habitat. Additionally, no new early-successional habitat would be formed by rehabilitation projects. Wetlands and standing water would also decrease, resulting in decreased forage. This alternative would effectively degrade or eliminate any existing habitat for this species.

Existing Conditions versus Preferred Alternative**.** The Preferred Alternative would substantially improve conditions for many species of rare wildlife along the Trinity River compared to existing conditions. The degree and nature of the change would be similar to the

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difference between the Flow Evaluation and No Action Alternatives; however, No Action conditions would likely be even worse than existing conditions because of the continuing degradation of the river.

Mitigation. Flow-related impacts to the willow flycatcher (in the form of destroying nests) would be unmitigatable. The following mitigation should be implemented to ensure potential significant adverse impacts are reduced to a less than significant level:

- Conduct site-specific environmental reviews prior to channel rehabilitation projects, spawning gravel placement, watershed protection work, and other activities not specifically covered by this document (i.e., the non-flow activities). Such reviews shall, when appropriate, include surveys for federal and state endangered, threatened, and proposed species, or for other species if required by permitting agencies (e.g., USFS). If such species are present, actions shall be taken to avoid impacts (e.g., delay construction until after willow flycatcher chicks have fledged).

3.7.3 Wetlands

Affected Environment.

Trinity River Basin. Although information on pre-dam wetlands is sparse, it is likely that more wetlands existed than are currently present.

Wetland acreage has probably declined following dam construction in part because reduced flows now inundate less of the floodplain. Fringe strands of freshwater emergent vegetation, scrub-shrub, and forested wetlands now occur intermittently, where a wider belt of wetland likely existed under pre-dam conditions. Elimination of river meanders has also reduced post-dam wetland acreage by curtailing formation of oxbows and other meander-related features.

Wetland acreage has probably declined following dam construction because reduced flows now inundate less of the floodplain.

Lower Klamath River Basin / Coastal Areas. The lower Klamath River is relatively broad and is able to meander within the floodplain. Accordingly, the Klamath River likely has wetland habitats similar to those on the pre-dam Trinity. Wetland habitats along the lower Klamath River are dominated by cattails, tules, and a variety of sedges and rushes, with salt-tolerant species including cord grass and pickleweed increasing in abundance as the river nears the ocean.

Central Valley. Wetland along the Sacramento River and throughout much of the Bay-Delta are dominated by cattails, tules, and a variety of sedges and rushes, with salt-tolerant species (e.g., cord grass and pickleweed) increasing in abundance with increasing salinity concentrations.

Environmental Consequences.

Methodology. The healthy alluvial river model (see Section 3.2) was used to assess the ability of each alternative to inundate floodplains, and promote channel meandering and avulsions, thereby creating and maintaining wetlands. As noted in the Vegetation and Wildlife sections, flow reductions in the Sacramento River predicted for each of the project alternatives are not expected to have a significant adverse impact on riparian vegetation. As addressed in the Water Resources and Land Use sections, agricultural diversions are expected to continue under all alternatives. While some diversions (associated with increased curtailments to water service contractors) may decrease, pocket habitat created by agricultural diversions, including wetland habitat, are not expected to be substantially affected by implementation of the alternatives because these diversions would continue. As was also noted in the Wildlife section, implementation of any of the alternatives proposed in this DEIS/EIR would not affect the conveyance of additional supplies to meet national and state refuge area needs specified in CVPIA, as Reclamation is actively pursuing short- and long-term willing sellers to assist in meeting any potential gaps in supplies.

Wetlands along the lower Klamath River would not be appreciably affected by any of the alternatives as the confluence with the Trinity is approximately 100 miles downstream of Lewiston Dam. Inflow from the numerous tributaries to the Trinity River diminish the effect of Lewiston Dam releases to negligible levels.

Significance Criteria. Impacts on wetlands would be significant if they would result in any of the following:

- Substantial adverse effect on any riparian habitat
- Substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means
- A conflict with any local policies or ordinances protecting wetland and/or riparian resources
- A conflict with, or violation of, the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, state, or federal habitat conservation plan relating to the protection of wetland resources

No Action. Under the No Action Alternative existing wetlands would be unlikely to change (Table 3-31). This alternative includes a peak flow capable of partially inundating floodplains, thus maintaining remnant wetlands from the pre-dam period.

TABLE 3-31
Wetland Impacts Compared to the No Action Alternative

Attribute	No Action	Maximum Flow	Flow Evaluation	Percent Inflow	Mechanical Restoration	State Permit
Formation of wetlands on the floodplains	Maintenance of existing remnant wetland acreage	Substantial improvement	Substantial improvement	Improvement	Potential loss of some fringe wetlands	Additional degradation

Maximum Flow. The Maximum Flow Alternative could result in the displacement of a small amount of remnant fringe wetlands that remain along some portions of the mainstem Trinity River. However, flows associated with this alternative would inundate wetlands in the floodplain over much larger areas than currently exist. The long-term net impact compared to the No Action Alternative would be beneficial.

Flow Evaluation. The channel rehabilitation projects of the Flow Evaluation Alternative could result in the displacement of a small amount of remnant fringe wetlands that remain along some portions of the mainstem Trinity River. However, implementation of the alternative would result in flows capable of inundating wetlands in the floodplain over much larger areas than currently exist. Because these flows are scheduled for a greater duration than the Maximum Flow Alternative, this alternative might be slightly more effective in maintaining these floodplain wetlands. The long-term increase in wetland areas compared to No Action would be beneficial.

Percent Inflow. The channel rehabilitation projects of the Percent Inflow Alternative could result in the displacement of a small amount of remnant fringe wetlands that remain along some portions of the mainstem Trinity River. However, the alternative would inundate more of the floodplain, on average, than the No Action Alternative. This would be a beneficial effect, although to a lesser degree than the Maximum Flow and Flow Evaluation Alternatives, because total flows would be less in most years.

Mechanical Restoration. The channel rehabilitation projects of the Mechanical Restoration Alternative could result in the displacement of a small amount of remnant fringe wetlands that remain along some portions of the mainstem Trinity River. Other than those losses, the impacts would be identical to the No Action Alternative.

State Permit. The reduced flows of the State Permit Alternative would reduce the amount of existing wetlands because it would likely create a narrower channel than currently exists. Flows would be insufficient to inundate the floodplain and maintain wetland areas. Wetlands would be reduced compared to the No Action Alternative, which would be a significant adverse impact.

Existing Conditions versus Preferred Alternative. The Preferred Alternative would increase wetland conditions along the Trinity River compared to existing conditions (in terms of restoring to pre-dam conditions). The degree and nature of the change would be similar to the difference between the Flow Evaluation and No Action Alternatives; however, existing conditions are likely to be less severe than No Action conditions (i.e., year 2020) because of the continuing degradation of the river.

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Mitigation. There would be no significant adverse flow-related impacts to wetland resources; however, the mechanical channel rehabilitation projects and other ground-disturbing activities could impact wetland resources. The following mitigation should be implemented to ensure that potential significant adverse impacts are reduced to a less than significant level:

- Conduct pre-construction delineation of wetland areas at sites that may contain wetlands.
- Consult with the Corps on potential impacts to wetland resources.

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3.8 Recreation

Operation of the TRD and Shasta Divisions of the CVP affects numerous recreational opportunities such as fishing, boating, and camping associated with the Trinity River, as well as Trinity, Lewiston, Shasta, and Whiskeytown Reservoirs. This section evaluates impacts in the Trinity River Basin, Lower Klamath River Basin / Coastal Area, and Central Valley with regard to riverine and reservoir recreational opportunities, use, and benefits. Recreation opportunities refer to the availability of a particular type of recreation activity (e.g., the opportunity to canoe is directly dependent on suitable river flows). Recreational use is a measure of the actual user days for a particular recreational activity, and is often measured in ***recreation visitor days*** (RVDs). Recreation benefits measure the monetary value that recreationists would be willing to pay, over and above what they actually pay, to participate in recreation activities. The Trinity River Basin and the lower Klamath River Basin are the primary focus of the Riverine section (3.8.1) because most impacts to recreation opportunities and use would occur in these basins. Trinity and Shasta Reservoirs are the primary focus of the Reservoir section (3.8.2) because these reservoirs were assumed to be most directly affected by changes in Trinity and Shasta Division operations.

The Trinity River Basin and the lower Klamath River Basin are the primary focus of the Riverine section because most impacts to recreation opportunities and use would occur in these basins.

3.8.1 Riverine

Affected Environment.

Trinity River Basin. The Trinity River, from Lewiston Dam downstream to Weitchpec, is about 110 miles long and spans several management jurisdictions. These jurisdictions in turn influence the management of recreation resources within the Trinity River Basin. The federal government owns and manages about 72 percent of the land within Trinity County. Between Lewiston Dam and the confluence of the North Fork of the Trinity River, portions of the river are under the jurisdiction of BLM. Between the confluence of the North Fork and the confluence with the New River, the Trinity River is managed by the USFS Shasta-Trinity National Forest. Between the New River and the Hoopa Valley Indian Reservation, the Trinity River is managed by the USFS Six Rivers National Forest. The Trinity River Basin also has several wilderness areas managed by the USFS, including the Trinity Wilderness Area, the Chanchelulla Wilderness Area, and the Trinity Alps Wilderness Area. As the river crosses the Hoopa Valley Indian Reservation it is managed by the Hoopa Valley Tribe. Portions of the river that cross private land are within the jurisdiction of Trinity or Humboldt Counties.

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The entire mainstem of the Trinity River was designated a National Wild and Scenic River by the Secretary in 1981, primarily because of the river's anadromous fishery.

Federal, State, and Local Plans/Wild and Scenic River Designations. Congress enacted the National Wild and Scenic Rivers Act in 1968, in an effort to protect free-flowing rivers with "outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural or other similar values." The entire mainstem of the Trinity River was designated a National Wild and ***Scenic River*** by the Secretary in 1981, primarily because of the river's anadromous fishery. In addition, the reach of the river downstream from Lewiston Dam was classified as having distinctive scenic quality and high peak flow viewer sensitivity[10]. Approximately 97.5 miles of the river are also classified as recreational under the Act.

The USFS Shasta-Trinity National Forest classifies the Trinity River from the North Fork downstream to Cedar Flat as recreational, and from Cedar Flat downstream to the river's confluence with New River as scenic. The USFS Six Rivers National Forest classifies the portions of the Trinity River within its jurisdiction as recreational. USFS management goals are to:

- Protect the scenic and recreational portions of the Trinity River in a free-flowing condition
- Manage the river and its immediate environment
- Protect and enhance the value (its anadromous fishery) for which the river was originally designated as a National Wild and Scenic River
- Maintain the river environment in a natural state for anadromous fisheries while providing for recreation opportunities that do not adversely affect the values for which the river segments were nominated

The mainstem Trinity River is also classified as recreational and scenic under the California Wild and Scenic Rivers Act. State management requirements and restrictions are similar to those of the national system.

Trinity County regulates the Trinity River Wild and Scenic River corridor with four zoning ordinances: an Open Space District, a Scenic Conservation Overlay Zone, a Flood Hazard Zoning District, and a Floodplain Management Ordinance. These ordinances cite specific development standards and establish permitted uses within the corridor. Humboldt County regulates the Wild and Scenic River corridor with a Wild and Scenic ***General Plan*** designation, a Hazards and Resource section in the Willow Creek Community Plan, and a Flood Plain zone district.

[10] At peak flows, the scenic qualities of the river are enhanced.

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In addition, the Trinity River has several designations in the Trinity County General Plan, including Intensive Recreation Area, Intensive Recreation Reservoir Site, and Urban Recreation Area. Trinity County's objective is to reserve land for recreational facilities and encourage private recreational development and other open-space uses that are characteristic and beneficial to the local residents while meeting current and future needs. Additional information about federal, state, and local recreation plans and Wild and Scenic River designations is provided in the Recreation Resources Technical Appendix D.

Recreation Resources and Opportunities. During the primary recreation season, water-dependent and water-enhanced Trinity River recreation includes boating, kayaking, canoeing, rafting, inner-tubing, fishing, swimming, wading, camping, gold panning, nature study, picnicking, hiking, and sight-seeing[11]. In addition, fishing for chinook salmon, steelhead, and rainbow and brown trout is a major recreational activity on the Trinity River throughout the remainder of the year.

Developed recreation areas along the Trinity River consist of private campgrounds, resorts, and lodges; public campgrounds and picnic areas; and fishing access sites. About 34 developed recreation sites are located within 0.5 mile of the Trinity River. More than 200 river access sites were inventoried in 1979 between Lewiston Dam and Weitchpec.

Recreation Use and Economics. Based on USFS information, an estimated 214,000 RVDs were spent on the Trinity River in 1995. The most popular recreation activities on the Trinity River are boating, swimming, hiking, and fishing. The net economic value (or recreation benefit) to persons who recreated along the Trinity River in 1995 is estimated to be $9.9 million. This value represents the monetary amount that recreationists are willing to pay, over and above what they actually paid, to recreate along the Trinity River.

Lower Klamath River Basin / Coastal Area. Recreation associated with the Klamath River and coastal areas is generally dominated by fishing. The primary recreational use along the lower Klamath River is salmon and steelhead fishing. Camping, hiking, and boating (drifting, inner-tubing, and canoeing) also occur. Ocean sportfishing for salmon is popular in coastal waters (see Ocean Fishery Economics [Section 3.5.4] for information on ocean fishing).

In 1995, anglers spent an estimated 8,900 days sportfishing for salmon and steelhead along the lower Klamath River. Based on an

Lower Klamath River Salmon & Steelhead Fishing

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[11] The primary recreation season is defined as Memorial Day to Labor Day, or approximately the last week of May to the end of the first week in September.

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estimated value of $65 per day, the angler benefits of sportfishing for salmon and steelhead along the lower Klamath River were $580,000 in 1995.

Central Valley. The Sacramento and San Joaquin Rivers provide a variety of water-dependent recreational opportunities including boat and shore fishing, pleasure boating and rafting, beach use, and swimming. In addition, water-enhanced activities such as camping, picnicking, and sight-seeing occur along the rivers.

Environmental Consequences.

Methodology. Two methodological approaches were used to assess impacts: one to estimate effects on recreation opportunities in the Trinity River Basin and Lower Klamath River Basin / Coastal Area, and one to estimate changes in recreation use and benefits. These two approaches vary substantially. The recreation opportunities analysis measures impacts to recreation opportunities based on weekly flow releases by water-year class from Lewiston Reservoir during the primary recreation season. The recreation use and benefits analysis predicts the overall effects to recreation use and benefits on an annual basis based on flow conditions under two water-year scenarios (average and dry)[12]. Use and benefits results are presented in this DEIS / EIR for the average water condition analysis only; results of the dry water condition are presented in the Recreation Resources Technical Appendix D. The recreation use and benefits analysis is somewhat more comprehensive than the recreation opportunities analysis since it considers the entire river, the entire year, and variables other than flow (i.e., fish harvest).

Two methodological approaches were used to assess impacts: one to estimate effects on recreation opportunities in the Trinity River Basin and Lower Klamath River Basin/Coastal Area, and one to estimate changes in recreation use and benefits.

Recreation Opportunities Methodology. The mainstem of the Trinity River is the primary focus of the recreational opportunities analysis. During the primary recreation season, Trinity River flows are most influenced by Lewiston releases in the summer months given tributary flow is generally not much of a factor during this period. Many of the recreation activities, in particular white-water kayaking and rafting, are most prevalent downstream of the river's confluence with the North Fork of the Trinity River. Impacts to recreational opportunities within the lower Klamath River Basin, aside from sportfishing, are considered to be less than significant as the limited amount of recreation that does occur in this reach of the river is not substantially influenced by Lewiston Dam releases. (Impacts to ocean sportfishing are discussed in Section 3.5.4, Ocean Fishery Economics.)

[12] Hydrologic data from the average period (1922-1990) and dry period (1928-1934) were used in the analysis.

The evaluation of impacts to riverine recreation opportunities along the Trinity River consisted of a multi-step process. Significant flow thresholds were developed in conjunction with the USFS, BLM, and a commercial outfitter to identify effects on water-dependent and water-enhanced recreational activities on the Trinity River (e.g., white-water rafting and kayaking, swimming, wading, fishing, and camping). A "Preferred / Threshold Flow" range was developed for each of the recreational activities. The preferred / threshold flow range is the range within which a specific user group (e.g., white-water kayakers) prefers to participate in a particular recreational activity on the Trinity River. River flows outside this range are assumed to adversely affect opportunities for the specific recreational activity. The evaluation was limited to the primary recreation season, which was defined as Memorial Day to Labor Day (i.e., the last week of May to the end of the first week of September). Weekly flows were reviewed for each water-year class (extremely wet, wet, normal, dry, and critically dry) for each alternative[13]. If the preferred flows would not be met within a particular week or series of weeks for an alternative, it was assumed that the associated recreational opportunity would be adversely affected, resulting in a significant impact. The alternatives were compared to the No Action Alternative. See Recreation Resources Technical Appendix D for further information about the recreation opportunities analysis.

The preferred/threshold flow range is the range within which a specific user group (e.g., white water kayakers) prefers to participate in a particular recreational activity on the Trinity River.

Recreation Use and Benefits Methodology. The methodology for determining recreation use and benefits within the Trinity River Basin and the Lower Klamath River Basin / Coastal Area is based on river flow and fish population conditions. Annual recreation use relationships were estimated for four activities that occur along the river: boating, swimming, fishing, and hiking and other river-enhanced activities (i.e., off-river activities). The relationship of river flow and fish populations to these activities was generally found to be positive, implying the greater the flow or fish population, the greater the expected inriver recreation use.

Data collected by the National Biological Service (now called Biological Resources Division and located within USGS) in a direct-mail survey were used to quantify the relationship between river visitation and river flow and salmon populations. (See the Recreation Resources Technical Appendix D for the regression equations that specify these relationships.) Predicted data on river flows from the PROSIM model were used in the boating, swimming, and off-river activity equations[14]. Information on the number of returning salmon and steelhead (see Section 3.5.1) were used to

[13] Flow hydrographs were used for the opportunities analysis because this weekly data allowed for detailed evaluation of impacts to recreation opportunities.

[14] Monthly data from PROSIM were used in the recreation use analysis because the use estimating models were specified in terms of monthly hydrology.

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predict the number of fishing trips that would be taken under each of the alternatives.

Economic benefits were estimated using average per-day values derived from a study by Walsh et al., (1992). The study compiled more than 250 estimates of recreation benefits for different activities and developed mean and median estimates for the activities. The values used in this analysis are as follows: fishing, $65 per day; boating, $36 per day; swimming, $26 per day; and hiking and other off-river activities, $33 per day. The values found in the Walsh et al., report were indexed to 1997. (Additional information about this methodology is provided in the Recreation Resources Technical Appendix D.)

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In addition to evaluating the effects on recreation opportunities and use and benefits, the project alternatives were evaluated for consistency with Trinity and Humboldt County recreation objectives and State/Federal Wild and Scenic River designations. Flow-related impacts to riverine recreation opportunities and use within the Central Valley were considered to be negligible because of the minor effect TRD changes would have on Sacramento River[15] and San Joaquin River flows in regards to recreational opportunities and use.

Impacts on riverine recreation in the Central Valley were evaluated based on a review and comparison of PROSIM flow output for the Sacramento River below Keswick Dam for each alternative. Boating activities (in particular such activities related to fishing) are the primary activity on the river. Review of the results indicate that flows in the Sacramento River would be within the range that supports boating activities (2,000-12,000 cfs as indicated in the CVPIA PEIS) more frequently under the Maximum Flow, Flow Evaluation, and Percent Inflow Alternatives than under the No Action Alternative. Flows under the State Permit Alternative would be outside the range slightly more often (2 percent more frequently over the 69-year period and 3 percent more frequently over the wet period) compared to No Action. This small change is not expected to significantly affect boating opportunities occurring on the Sacramento River. Further analysis of the beneficial effects of the alternatives on boating opportunities in the Sacramento River was not evaluated. River flows downstream of Keswick Dam would be increasingly affected by tributary flow and were therefore not evaluated. PROSIM assumptions held San Joaquin River operations constant across alternatives, thus holding riverine recreational opportunities constant across alternatives as well.

Significance Criteria. Flow thresholds were developed in conjunction with the USFS, BLM, and a commercial outfitter to identify adverse

[15] See also Section 3.3, Water Resources.

effects on existing water-dependent and water-enhanced recreational activities on the Trinity River (Table 3-32). Deviations from these preferred flows compared to the No Action Alternative were considered significant. In addition to the flow thresholds, the following criteria were also used to determine significant impacts to riverine recreation:

- Substantial increase in turbidity so as to negatively impact recreation aesthetics
- Incompatibility with the Federal or State Wild and Scenic River designation, defined as jeopardizing the river's anadromous fishery resources or scenic and recreational qualities
- Non-compliance with Trinity and Humboldt Counties recreation resource objectives
- Ten percent or greater reduction in recreation use compared to No Action levels. (This threshold was established based on the expected margin of error in the analytical tools used in the assessment, and because 10 percent suggests a fairly substantial reduction in recreation quality.)

TABLE 3-32
Preferred Recreation Flow Ranges/Thresholds[a]

Activity	Preferred Flow Ranges (cfs)
Canoeing	200-1,500
Drift-boat and drift-raft fishing	200-1,500
White water (i.e., kayaking and rafting)	300-8,000
Recreational mining	350-600
Shore fishing	300-800
Swimming/inner-tubing	150-800
Wading	300-800
Campground Use Precluded	**Flow Threshold**
Steel Bridge, Douglas City	8,000 or greater
Steiner Flat, North Fork	10,000 or greater
Poker Bar	12,000 or greater

[a]Trinity River flows in the Preferred Flow/Threshold range during the primary recreation season (Memorial Day to Labor Day) as measured at the Lewiston gage.

No Action.

Trinity River Basin. Trinity River flows associated with the No Action Alternative are within the preferred range for drift-boat fishing, drift-raft fishing, canoeing, white water kayaking/rafting, and camping at campgrounds along the river throughout the primary recreation season in all water-year classes (Table 3-33 at end of Section 3.8.1). However, shore fishing, swimming/inner-tubing, wading, and recreational mining are constrained by flows during a 2- to 3-week

period in late May and early June. Recreation use to the year 2020 is expected to increase from current conditions at a rate similar to population growth in the northern California area. Annual recreation benefits in the year 2020 are estimated to be $14.5 million during average water conditions (Table 3-34 at end of Section 3.8.1). Boating[16] accounts for about 37 percent of the total benefits, with swimming and fishing accounting for 26 percent and 19 percent, respectively.

This alternative is marginally consistent with Trinity and Humboldt Counties' recreation objectives and State/Federal Wild and Scenic River designations. The alternative would generally not interfere with riverine recreation activities, would maintain the free-flowing condition of the river[17], and would not adversely affect (compared to current levels) the value for which the river was designated Wild and Scenic (the anadromous fishery).

Lower Klamath River Basin/Coastal Area. Annual sportfishing use and benefits of the lower Klamath River under the No Action Alternative consist of 13,200 visitor days and a recreation benefit of $858,000 (Table 3-34).

Maximum Flow.

Trinity River Basin. Under the Maximum Flow Alternative, many recreational activities, including canoeing, drift-boat fishing, drift-raft fishing, recreational mining, wading, shore fishing, swimming, and inner tubing are significantly impacted for multiple weeks during the primary recreation season because Trinity River flows are higher than the preferred threshold range for these activities. Generally, these recreation activities are impacted by high water flows in the earlier half of the primary recreation season. However, white-water kayaking and rafting are not constrained at any time during any water-year class under this alternative, nor is campground use precluded at any time. See Recreation Resources Technical Appendix D for the specific weeks and water-year classes in which recreation activities are impacted.

Despite the temporary adverse impacts to those activities discussed above, overall annual recreation use of the Trinity River is still expected to increase by 137,000 visitor days on average, or about 33 percent, as compared to No Action levels (Table 3-34). Boating and off-river activities are expected to increase the most. Annual recreation benefits are estimated to increase by $4.8 million.

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16 Includes all forms of boating, including kayaking, canoeing, and rafting.

17 "Free-flowing" as defined by the National Wild and Scenic Rivers Act prohibits the authorization of future construction of dams, diversion works, and any other minor structures along the river corridor.

This alternative is consistent with Trinity and Humboldt County recreation objectives and State/Federal Wild and Scenic River designations. The alternative would not substantially interfere with riverine recreation activities, would maintain the free-flowing condition of the river, and would not adversely affect the value for which the river was designated Wild and Scenic (the anadromous fishery).

Lower Klamath River Basin/Coastal Area. Opportunities to sportfish for salmon and steelhead along the lower Klamath River are expected to substantially increase under the Maximum Flow Alternative. Annual sportfishing use and benefits are estimated to increase by 28 percent compared to levels under the No Action Alternative (Table 3-34).

Flow Evaluation.

Trinity River Basin. Under the Flow Evaluation Alternative, canoeing, drift-boat fishing, drift-raft fishing, recreational mining, swimming, inner tubing, shore fishing, and wading are significantly impacted during a portion of the primary recreation season because flows are higher than the preferred threshold range for these activities. Recreation activities are typically impacted more during extremely wet, wet, normal, or dry water years; and less impacted during the critically dry water-year class. Campground use is not constrained at any time during the primary recreation season at Poker Bar, Steiner Flat, and North Fork campgrounds. However, use of Steel Bridge and Douglas City campgrounds is constrained during the last week in May in the extremely wet water-year class. In addition, white water kayaking and rafting are constrained during the same week at the end of May during the extremely wet water-year class when Trinity River flows exceed the upper preferred threshold of 8,000 cfs for white-water activities. In general, however, those who prefer flows on the higher end of the preferred range would experience improved conditions compared to No Action. See Recreation Resources Technical Appendix D for the specific weeks and water-year classes in which recreation activities are impacted.

Recreation-related impacts from constructing the mechanical channel rehabilitation projects would occur as a result of short-term increases in turbidity during the recreation season. Aesthetic impacts would be significant to recreationists in proximity to the resultant turbid plume.

Despite the adverse temporary impacts, overall annual recreation use on the Trinity River is expected to increase by 91,600 visitor days, or about 22 percent, as compared to No Action levels (Table 3-34). Boating and fishing activities are expected to increase the most. Annual recreation benefits are estimated to increase by $3.3 million.

Recreation Benefits

Long-term Average Water Conditions

NO ACTION	
Trinity	$14.5 million
Klamath	$858,000
MAXIMUM FLOW	
Trinity	+$14.3 million
Klamath	+$1.1 million
FLOW EVALUATION	
Trinity	+$17.8 million
Klamath	+$1.1 million
PERCENT INFLOW	
Trinity	+$14.3 million
Klamath	+$923,000
MECHANICAL RESTORATION	
Trinity	+$14.0 million
Klamath	+$897,000
STATE PERMIT	
Trinity	-$8.9 million
Klamath	-$812,500

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This alternative is consistent with Trinity and Humboldt County recreation objectives and State / Federal Wild and Scenic River designations. The alternative would not substantially interfere with riverine recreation activities, would maintain the free-flowing condition of the river, and would not adversely affect the value for which the river was designated Wild and Scenic (the anadromous fishery).

Lower Klamath River Basin/Coastal Area. Opportunities to sportfish for salmon and steelhead along the lower Klamath River are expected to substantially increase under this alternative. Annual sportfishing use and benefits are estimated to increase by 3,200 days and $208,000, or 24 percent compared to No Action levels (Table 3-34).

Percent Inflow.

Trinity River Basin. Under the Percent Inflow Alternative, canoeing, drift-boat fishing, drift-raft fishing, recreational mining, swimming, inner-tubing, shore fishing, wading, and white-water kayaking and rafting are all significantly constrained for multiple weeks during the primary recreation season under all water-year classes. Recreation activities are typically constrained by high flows during the early weeks of the primary recreation season and by low flows at the end of the season. However, campground use is not precluded at any time under any water-year class. See Recreation Resources Technical Appendix D for the specific weeks and water-year classes in which recreation activities are impacted.

Increased turbidity would occur as a result of constructing the mechanical channel rehabilitation projects, leading to significant aesthetic impacts to recreationists participating in activities in proximity to the resultant turbid plume.

Annual recreation use of the Trinity River is expected to decrease by 7,300 visitor days, or about 2 percent, as compared to No Action levels. Lower river flows associated with this alternative in dry years would reduce swimming, boating, and off-river use, offsetting the predicted increase in sportfishing use resulting from higher fish populations. Annual recreation benefits are estimated to decrease by $135,300.

This alternative is consistent with Trinity and Humboldt County recreation objectives and State / Federal Wild and Scenic River designations. The alternative would generally not interfere with riverine recreation activities, would maintain the free-flowing condition of the river, and would not adversely affect the value for which the river was designated Wild and Scenic (the anadromous fishery).

Lower Klamath River Basin/Coastal Area. Opportunities to sportfish for salmon and steelhead along the lower Klamath River are expected to increase under the Percent Inflow Alternative. Annual sportfishing

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use and benefits are estimated to increase by 8 percent compared to No Action levels (Table 3-34).

Mechanical Restoration.

Trinity River Basin. Flow-related recreation opportunities would generally not be affected by the Mechanical Restoration Alternative compared to No Action levels because the flows are identical. Significant turbidity-related impacts would occur from the construction of the mechanical channel rehabilitation projects included as part of the alternative. The watershed protection work included as part of this alternative could affect recreational opportunities in the Trinity River Basin depending on the location of the work.

Under the Mechanical Restoration Alternative, annual recreation use on the Trinity River is expected to increase by 2,100 visitor days, or about 1 percent, compared to No Action levels. This increase is the result of increased sportfishing opportunities. Annual recreation benefits are estimated to increase by $135,000.

This alternative is consistent with Trinity and Humboldt County recreation objectives and State/Federal Wild and Scenic River designations. The alternative would generally not interfere with riverine recreation activities, would maintain the free-flowing condition of the river, and would not adversely affect the value for which the river was designated Wild and Scenic (the anadromous fishery).

Lower Klamath River Basin/Coastal Area. Opportunities to sportfish for salmon and steelhead along the lower Klamath River are expected to increase under the Mechanical Restoration Alternative. Annual sportfishing use and benefits are estimated to increase by 5 percent compared to No Action levels (Table 3-34).

State Permit.

Trinity River Basin. Under the State Permit Alternative, significant impacts to all recreation activities except swimming, inner-tubing, and camping would occur because flows in the Trinity River would be 150 cfs during the recreation season. This alternative would result in a reduction of 160,000 visitor days and $5.5 million in recreation benefits. The 38 percent reduction in recreation use is considered significant.

Under the State Permit Alternative, significant impacts to all recreation activities except swimming, inner-tubing, and camping would occur because flows in the Trinity River would be 150 cfs during the recreation season.

In addition to the significant impacts on recreation opportunities and use and benefits, this alternative would be inconsistent with the river's Wild and Scenic River Act designation, primarily because flows would be reduced to a level that adversely impacts the anadromous fishery. The State Permit Alternative also would be inconsistent with the recreation objectives of Trinity and Humboldt Counties.

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Lower Klamath River Basin/Coastal Area. Opportunities to sportfish for salmon and steelhead along the lower Klamath River are expected to decrease under this alternative due to reduced fish populations as compared to the No Action Alternative. Annual sportfishing use and benefits are estimated to decrease by 5 percent compared to No Action levels (Table 3-34).

Existing Conditions versus Preferred Alternative.

Trinity River Basin. Because existing conditions and the No Action Alternative are identical in terms of hydrologic conditions (i.e., flows released from Lewiston Reservoir), the implementation of the Preferred Alternative would result in similar impacts to recreation opportunities as described in the Flow Evaluation Alternative (compared to No Action). Because the Preferred Alternative also includes the watershed protection component from the Mechanical Restoration Alternative, recreational opportunities could be affected depending on the location of the work (which would be addressed in site-specific environmental reviews).

Unlike the recreation opportunities analysis, the recreation use and benefits analysis identified a change between existing conditions (i.e., 1995) and the Preferred Alternative in the year 2020. Recreation use and benefits under the Preferred Alternative would increase as a result primarily of population growth in Northern California and its effect on the demand for recreation activities along the Trinity River. Annual recreation use of the Trinity River would increase by 223,100 visitor days, or about 80 percent compared to 1995 existing conditions (Table 3-34). About 60 percent of the increase is due to the effect of population growth on recreation demand; the remaining 40 percent is attributable to implementation of the Preferred Alternative.

Lower Klamath River Basin/Coastal Area. The implementation of the Preferred Alternative would result in no impacts to boating, swimming, and camping opportunities in the Lower Klamath River Basin / Coastal Area compared to 1995 existing conditions. Recreation use and benefits would increase, primarily as a result of population growth and its effect on the demand for recreation opportunities along the lower Klamath River. Annual recreation use of the lower Klamath River would increase by 7,500 visitor days, or about 85 percent compared to 1995 existing conditions. About 57 percent of the increase is due to the effect of population growth on recreation demand; the remaining 43 percent is attributable to implementation of the Preferred Alternative.

Mitigation. Significant flow-related impacts to recreation opportunities and use for the Maximum Flow, Flow Evaluation, Percent Inflow, and State Permit Alternatives would be unmitigable. For the

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TABLE 3-33
Riverine Recreation Opportunities – Trinity River

		Recreation Opportunity Constraints During the Primary Recreation Season[a, b]					
Resource Concern	**Preferred Flow Range (cfs)**	**No Action/Existing Conditions**	**Maximum Flow**	**Flow Evaluation**	**Percent Inflow**	**Mechanical Restoration**	**State Permit**
Canoeing	200-1,500	No constraint[c]	Constrained 8 weeks in **extremely wet** and **wet** years. Constrained 6 weeks in **normal** and **dry** years. Constrained 5 weeks in **critically dry** years.	Constrained 7 weeks in **extremely wet**, **wet** years and **normal** years. Constrained 1 week in **dry** years. Not constrained during **critically dry** years.	Constrained 8 weeks in **extremely wet**, **wet**, **normal**, and **dry** years. Constrained 10 weeks in **critically dry** years.	No constraint	Constrained 15 weeks (the entire primary recreation season) in **all** water-year classes.
Camping							
Steel Bridge, Douglas City	8,000 or less	No constraint	No constraint	Constrained 1 week in **extremely wet** years.	No constraint	No constraint	No constraint
Steiner Flat, North Fork	10,000 or less	No constraint	No constraint	No constraint	No constraint	No constraint	No constraint
Poker Bar	12,000 or less	No constraint	No constraint	No constraint	No constraint	No constraint	No constraint
Drift-boat fishing	300-1,500	No constraint	Constrained 8 weeks in **extremely wet** and **wet** years. Constrained 6 weeks in **normal** and **dry** years. Constrained 5 weeks in **critically dry** years.	Constrained 7 weeks in **extremely wet**, **wet** and **normal** years. Constrained 1 week in **dry** years. Not constrained during **critically dry** years.	Constrained 9 weeks in **extremely wet, wet** and **normal** years. Constrained 10 weeks during **dry** years. Constrained 12 weeks during **critically dry** years.	No constraint	Constrained 15 weeks (the entire primary recreation season) in **all** water-year classes.
Drift-raft fishing	200-1,500	No constraint	Constrained 8 weeks in **extremely wet** and **wet** years. Constrained 6 weeks in **normal** and **dry** years. Constrained 5 weeks in **critically dry** years.	Constrained 7 weeks in **extremely wet**, **wet** and **normal** years. Constrained 1 week in **dry** years. Not constrained during **critically dry** years.	Constrained 8 weeks in **extremely wet, wet, normal,** and **dry** years. Constrained 10 weeks in **critically dry** years.	No constraint	Constrained 15 weeks (the entire primary recreation season) in **all** water-year classes.
White water (i.e., kayaking and rafting)	300-8,000	No constraint	No constraint	Constrained 1 week in extremely **wet** years. Not constrained in wet, normal, dry, and critically dry years.	Constrained 4 weeks in **extremely wet** years. Constrained 7 weeks in **wet** years. Constrained 9 weeks in **normal** years. Constrained 10 weeks in **dry** years. Constrained 12 weeks in **critically dry** years.	No constraint	Constrained 15 weeks (the entire primary recreation season) in **all** water-year classes.
Recreational mining	350-600	Constrained 3 weeks in **all** water-year classes.	Constrained 10 weeks in **extremely wet** years. Constrained 15 weeks (entire recreation season) in **wet, normal, dry,** and **critically dry** years.	Constrained 8 weeks in **extremely wet**, **wet**, and **normal** years. Constrained 3 weeks in **dry** and **critically dry** years.	Constrained 13 weeks in **extremely wet**, **wet**, **dry**, and **critically dry** years. Constrained 14 weeks in **normal** years.	Constrained 3 weeks in **all** water-year classes.	Constrained 15 weeks (the entire primary recreation season) in **all** water-year classes.
Swimming/inner-tubing	150-800	Constrained 2 weeks in **all** water-year classes.	Constrained 9 weeks in **extremely wet** years. Constrained 11 weeks in **wet** years. Constrained 8 weeks in **normal** and **dry** years. Constrained 15 weeks (entire recreation season) in **critically dry** years.	Constrained 7 weeks in **extremely wet**, **wet**, and **normal** years. Constrained 3 weeks in **dry** and **critically dry** years.	Constrained 9 weeks in **extremely wet** years and **dry** years. Constrained 10 weeks in **wet, normal** and **critically dry** years.	Constrained 2 weeks in **all** water-year classes.	No constraint

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TABLE 3-33
Riverine Recreation Opportunities – Trinity River

		Recreation Opportunity Constraints During the Primary Recreation Season[a, b]					
Resource Concern	**Preferred Flow Range (cfs)**	**No Action/Existing Conditions**	**Maximum Flow**	**Flow Evaluation**	**Percent Inflow**	**Mechanical Restoration**	**State Permit**
Shore fishing	300-800	Constrained 2 weeks in **all** water-year classes.	Constrained 9 weeks in **extremely wet** years. Constrained 11 weeks in **wet** years. Constrained 8 weeks in **normal** and **dry** years. Constrained 15 weeks in **critically dry** years.	Constrained 7 weeks in **extremely wet**, **wet**, and **normal** years. Constrained 3 weeks in **dry** and **critically dry** years.	Constrained 12 weeks in **all** water-year classes.	Constrained 2 weeks in **all** water-year classes.	Constrained 15 weeks (the entire primary recreation season) in **all** water-year classes.
Wading	300-800	Constrained 2 weeks in **all** water-year classes.	Constrained 9 weeks in **extremely wet** years. Constrained 11 weeks in **wet** years. Constrained 8 weeks in **normal** and **dry** years. Constrained 15 weeks in **critically dry** years.	Constrained 7 weeks in **extremely wet**, **wet**, and **normal** years. Constrained 3 weeks in **dry** and **critically dry** years.	Constrained 12 weeks in **all** water-year classes.	Constrained 2 weeks in **all** water-year classes.	Constrained 15 weeks (the entire primary recreation season) in all water-year classes.

[a]See Recreation Resources Technical Appendix D for more specific information about weekly flows impacts to recreation opportunities.

[b]The primary recreation season is defined as Memorial Day to Labor Day (approximately the last week in May to the end of the first week in September).

[c]Flows within preferred range during the entire primary recreation season for all year classes.

Table 3-34
Summary of Impacts to Riverine Recreation Use and Benefits[a]

		Compared to No Action											
	No Action	Maximum Flow		Flow Evaluation		Percent Inflow		Mechanical Restoration		State Permit		Existing Conditions[b]	
Resource Concern		Amount	Percent Change	Amount	Percent Change	Amount	Percent Change	Amount	Percent Change	Amount	Percent Change	Amount	Preferred Alternative Percent Change from Existing Conditions
Trinity River													
Boating													
Recreation Benefits[c] (million $)	5.4	7.6	41	6.8	27	5.1	-4	5.4	0	1.2	-78	3.7	87
Visitor Days	149,208	210,783	41	190,028	27	143,674	-4	149,208	0	33,208	-78	101,823	87
Fishing													
Recreation Benefits (million $)	2.8	3.6	30	3.5	25	3.0	8	3.0	5	2.7	-4	1.9	83
Visitor Days	42,894	55,578	30	53,503	25	46,123	8	44,970	5	41,049	-4	29,272	83
Swimming													
Recreation Benefits (million $)	3.8	4.7	25	4.4	17	3.7	-2	3.8	0	3.1	-17	2.6	71
Visitor Days	144,284	181,034	25	168,580	17	141,598	-2	144,284	0	120,381	-17	98,386	71
Off-river Activities													
Recreation Benefits (million $)	2.6	3.4	33	3.0	21	2.5	-3	2.6	0	2	-24	1.7	77
Visitor Days	77,487	103,316	33	93,399	21	75,181	-3	77,487	0	59,268	-24	52,879	77
Total Trinity River Recreation Benefits (million $)	*14.5*	*19.3*	*33*	*17.8*	*23*	*14.3*	*-1*	*14.6*	*1*	*8.9*	*-38*	*9.9*	*80*
Total Trinity River Visitor Days	*413,873*	*550,711*	*33*	*505,510*	*22*	*406,576*	*-2*	*415,949*	*0*	*253,906*	*-39*	*282,300*	*79*
Lower Klamath River[d]													
Recreation Benefits ($)	$858,000	1.1 million	28	1.1 million	24	$923,000	8	$897,000	5	$812,500	-5	$578,500	84
Visitor Days	13,200	16,900	28	16,400	24	14,200	8	13,800	5	12,500	-5	8,900	84

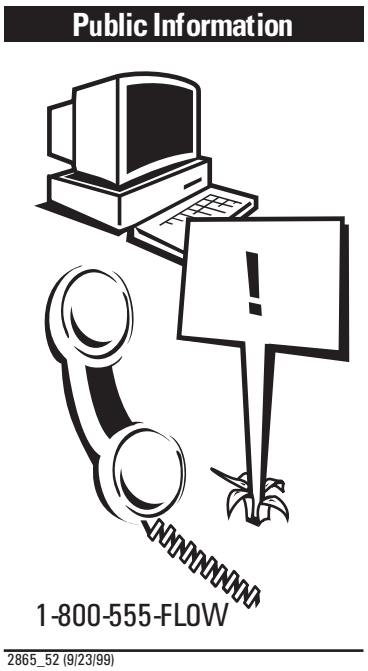
[a] Long-term average water conditions.
[b] 1995 existing conditions.
[c] Benefits are estimated based on the following per-day values, as derived from each activity presented in Walsh, 1992. Boating: $36/day; Fishing: $65/day; Swimming: $26/day; Off-River: $33/day, and are expressed in 1997 dollars.
[d] Includes sportfishing for salmon and steelhead only.

other significant recreation impacts, the following mitigation should be implemented to reduce impacts to less than significant levels:

- Impacts on public safety from river flows that are too high or too low (i.e., outside the preferred range of flows) should be mitigated by implementing the following: (1) posting signs at river access points showing daily flows, (2) offering a toll-free telephone number so recreationists can obtain daily flow information, and (3) posting daily flows on the Internet.

  To minimize impacts on recreation activities from turbidity associated with channel rehabilitation projects the construction areas should be isolated using concrete barriers or other effective methods. Construction activities that increase river turbidity should be conducted late in the day. (See Mitigation in the Water Quality section [3.4].)

- Watershed protection work should be coordinated with all applicable federal, state, and local agencies to avoid recreational areas and periods of high use.



3.8.2 Reservoirs

This section focuses primarily on Shasta, Trinity, and Folsom Reservoirs because the alternatives would primarily affect recreation opportunities and use at these three sites. Other CVP/SWP reservoirs are not discussed in detail because no appreciable recreation impacts are anticipated at these facilities given reservoir elevations are not expected to change substantially due in part to the fact that Lewiston, Whiskeytown, and Keswick are regulating reservoirs. As such, boat ramp availability and reservoir fishery habitat would not be adversely affected (see Section 3.3 Water Resources, as well as Water Resources/Water Quality Technical Appendix A for additional information on reservoir levels). There are no affected reservoirs located in the Lower Klamath River Basin/Coastal Area.

Affected Environment.

Trinity River Basin. Trinity Reservoir and surrounding lands are managed by the USFS and are a unit within the Whiskeytown-Shasta-Trinity National Recreation Area. Trinity Reservoir, when full, has 145 miles of shoreline with a substantial number of coves and bays. The reservoir features 4 marinas, 10 boat launches, 20 campgrounds, and 2 swimming areas. Recreation opportunities in the vicinity of Trinity Reservoir include powerboating, sailing, houseboating, swimming, water-skiing, camping, hunting, fishing, hiking, and sight-seeing. Reservoir levels fluctuate seasonally, and have been as low as 220 feet below full (full is defined as the top of the Trinity Reservoir glory hole, or 2,370 msl). Operation of a number of recreation-related facilities is constrained by water levels

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(Table 3-35). Recreation use of Trinity Reservoir was estimated at about 485,000 RVDs in 1995, generating about $5.3 million in recreation benefits.

TABLE 3-35
Trinity Reservoir Elevations at which Facility Operations Are Adversely Affected

Facility	Elevation Threshold	Effect
Stuart Fork Boat Ramps	50-foot drop[a] (2,320 msl)	Cease operation
Fairview Boat Ramp	60-foot drop (2,310 msl)	Cease operation
Major Marinas	60-foot drop (2,310 msl)	Must move facilities
Trinity Center Boat Ramp	75-foot drop (2,295 msl)	Cease operation
Campgrounds	100-foot drop (2,270 msl)	Marked decrease in use
Minersville Ramp	200-foot drop (2,170 msl)	Cease operation

[a] "Drop" is identified as drop in reservoir levels below the Trinity Reservoir "glory hole."

Lewiston Reservoir and the surrounding lands are managed by the USFS. The reservoir has approximately 16 miles of shoreline. The reservoir is generally kept full, as it is used as a regulating reservoir for releases from Trinity Reservoir. Recreation facilities include campgrounds, a picnic area, boat ramp, and marina. Camping, fishing, and boating are the primary activities at the reservoir. Low water temperatures generally make this reservoir unsuitable for water-contact activities (e.g., swimming).

Central Valley. Shasta Reservoir and surrounding lands are managed by the USFS and are a unit of the Whiskeytown-Shasta-Trinity National Recreation Area. The reservoir has 370 miles of shoreline. It has a highly developed system of recreation facilities including 6 public boat ramps and 13 private marinas. Popular water-dependent recreation activities are powerboating, houseboating, water-skiing, and fishing. Important water-enhanced activities include camping, hunting, and sight-seeing. The reservoir has no designated swimming areas; however, individuals swim from boats or adjacent to campgrounds. There are 22 drive-to public campgrounds at the reservoir. Four other campgrounds are accessible only by boat. Recreation use in 1995 was an estimated 3.5 million RVDs, generating an estimated $38.0 million in recreation benefits.

Whiskeytown Reservoir and surrounding lands are managed by the National Park Service (NPS) and are a unit of the Whiskeytown-

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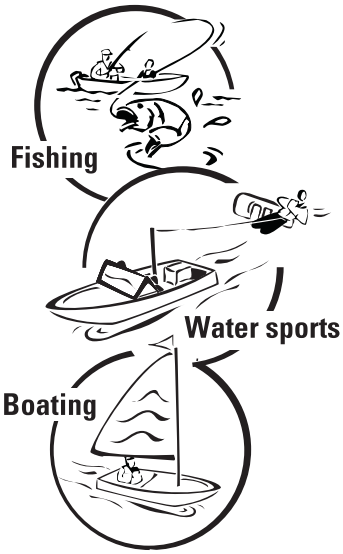
Shasta-Trinity National Recreation Area. The reservoir has 36 miles of shoreline; it features one marina, three boat ramps, and several campgrounds and day-use facilities. Picnicking, camping, swimming, boating, water-skiing, jetskiing, fishing, and hunting are important recreational activities at the reservoir. The reservoir is normally maintained at a relatively stable water level given its status as a regulating reservoir between Trinity and Keswick Reservoirs. Boat ramps and marinas are impacted when reservoir levels drop from 10 to 15 feet. Recreation use was estimated at 279,000 RVDs in 1992.

Reservoir-related Recreation Opportunities



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Keswick Reservoir is managed by the BLM and Shasta County. The reservoir has 19 miles of shoreline; it is served by one boat ramp on the west shore above Spring Creek. Fishing, boating, and sightseeing are the primary activities, with fishing being most popular. Water-contact activities, such as swimming and skiing are less popular because of the cold water temperature. Water levels fluctuate daily because the reservoir regulates releases to the Sacramento River. In 1992, recreation use at Keswick Reservoir totaled about 500 RVDs.

Other key reservoirs within the Central Valley include Folsom Reservoir in the Sacramento area, Oroville Reservoir (an SWP facility) near Oroville, and San Luis Reservoir near Los Banos. Folsom Reservoir contains a warmwater fishery of large and smallmouth bass, sunfish, and catfish, and a coldwater fishery of rainbow trout that is stocked by CDFG on an annual basis. Oroville Reservoir contains a warmwater fishery for largemouth, spotted, and smallmouth bass and catfish; and a coldwater fishery for rainbow and brown trout and chinook salmon. More than 30 fish species are known to occur in San Luis Reservoir, but the principal gamefish has been striped bass. In 1992 about 300,000 RVDs occurred at Folsom Reservoir, about 420,000 at Oroville Reservoir, and about 210,000 at San Luis Reservoir.

Environmental Consequences.

Methodology. Similar to the approach used to evaluate impacts on riverine resources, separate methodologies were used to assess impacts on recreation opportunities versus use and benefits. The evaluation of impacts to opportunities consisted of a multi-step process. Published sources were used to establish reservoir surface-water elevations (i.e., thresholds) that if not met, would result in impacts to certain water-dependent and water-enhanced recreation facilities (e.g., boat ramps and campgrounds). Reservoir levels for May-September were analyzed over the 69-year PROSIM simulation period for each alternative. Although the primary recreation season takes place from Memorial Day (the last week of May) to Labor Day (the first week in September), the entire months of May and

September were included in the evaluation because partial months of data are not available from PROSIM data. Therefore, 5 entire months of PROSIM data were analyzed to assess impacts to recreation opportunities at Trinity, Shasta, and Folsom Reservoirs. The number of months in which reservoir levels dropped below the preferred threshold was then determined. A percentage of "Recreation Facility Availability" was developed and compared to the No Action Alternative (See Table 3-36 at end of Section 3.8.2). The recreation facilities selected in this analysis are most representative of how all the ramps, campgrounds, and marinas on each reservoir would be affected by each of the alternatives.

Annual recreation use at Trinity and Shasta Reservoirs was estimated using regression equations that were developed based on historical water level and use data (see Recreation Resources Technical Appendix D for these equations). Two types of data were used to estimate the reservoir level / recreation use relationships: predicted hydrology data from PROSIM, as well as 20 years of annual use data (1972-1991). Reservoir water levels at the end of September were used as the key predictor variable in the equations (i.e., reservoir levels in September are a good indicator of levels throughout the recreation season). The number of annual RVDs was then predicted for each alternative using September water elevation data from PROSIM along with 2020 population projections for Northern California.

Recreation benefits were estimated using an average value of $10.90 per visitor day as derived from a study of reservoir users at Isabella Reservoir (Loomis, 1995). (See Recreation Resources Technical Appendix D for further information). All values were indexed to 1997 dollars.

The effect of the project alternatives on water-surface elevations at Lewiston, Keswick, Whiskeytown, Oroville, and San Luis Reservoirs were also evaluated. It was determined that none of the project alternatives would result in significant changes to water-surface elevations, and hence recreation opportunities, use, and benefits as compared to the No Action Alternative as described above. Therefore, impacts to these reservoirs are not discussed. (See Water Resources / Water Quality Technical Appendix A for water elevation modeling results, as well as Recreation Resources Technical Appendix D.)

Significance Criteria. Impacts to water-dependent and water-enhanced recreation activities at Trinity and Shasta Reservoirs were considered significant if there was:

- A 10 percent or greater change in the frequency of recreation facility availability as compared to No Action levels. (This

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criteria was based on the assumed margin of accuracy in the analytical tools used in the assessment, and because it suggests a fairly substantial reduction in recreation opportunities.)

- A 10 percent or greater reduction in recreation use compared to No Action levels. (This criteria was based on the assumed margin of accuracy in the analytical tools used in the assessment, and because it suggests a fairly substantial reduction in recreation quality.)

No Action.

Trinity River Basin. Under the No Action Alternative, use of certain boating facilities, such as the Stuart Fork boat ramps, Fairview Ramp, and major marinas would continue to be moderately constrained during the recreation season (See Table 3-36). Recreation use of Trinity Reservoir is expected to be about 796,000 visitor days in 2020. Annual recreation benefits are estimated to be $8.7 million (Table 3-37 at end of Section 3.8.2).

Central Valley. Under the No Action Alternative, Shasta Reservoir levels would remain similar to existing conditions because the timing and volume of TRD exports would be similar to existing levels. Use of certain boating facilities, such as the McCloud Arm Ramps, the Sacramento Arm Ramps, and the Sacramento Arm Marina would continue to be moderately constrained during the recreation season. Recreation use of Shasta Reservoir is expected to be about 5.7 million visitor days in 2020, generating about $61.9 million in recreation benefits.

Impacts to Folsom Reservoir recreation opportunities follow the same pattern as Shasta Reservoir. Reservoir levels would remain similar to existing conditions because the timing and volume of TRD exports would be similar to existing levels. Use of some recreation facilities, including beach areas, campgrounds, and picnicking areas would continue to be moderately constrained during the recreation season (Table 3-36).

Under the Maximum Flow Alternative, Trinity Reservoir levels would generally be lower than No Action levels during the recreation season.

Maximum Flow.

Trinity River Basin. Under the Maximum Flow Alternative, Trinity Reservoir levels would generally be lower than No Action levels during the recreation season. A number of major recreation facilities would be less available compared to No Action levels (Table 3-36). This decrease in facility availability would be a significant impact. Annual recreation use of Trinity Reservoir is expected to decrease by 30,000 visitor days, or about 4 percent, compared to No Action levels. Recreation benefits would decrease by $327,000 annually.

Central Valley. Shasta Reservoir water elevations would decline under this alternative compared to No Action levels, but not to a significant degree. Annual recreation use is expected to decrease by 466,000 visitor days, or about 8 percent, compared to No Action levels. Recreation benefits would decrease by $5.1 million annually.

Folsom Reservoir water elevations would decline under this alternative compared to No Action levels. The reservoir surface area would decrease, and boating would be impacted to a significant degree. Impacts to other recreation opportunities, including the operation of boat ramps, the marina, beaches, and campgrounds would not be significant compared to No Action (Table 3-36).

Flow Evaluation.

Trinity River Basin. Trinity Reservoir water-surface elevations would not be significantly below threshold levels for any of the major facilities under this alternative. Recreation facility availability would increase slightly compared to No Action levels. Annual recreation use is expected to increase by 6,600 visitor days, or about 1 percent, compared to No Action levels. Recreation benefits would increase by $71,900 annually.

Central Valley. Shasta Reservoir elevations would drop slightly under this alternative, but these declines would not result in a significant impact to any of the recreation facilities. Annual recreation use of the reservoir is expected to decrease by 99,300 visitor days, or about 2 percent, compared to No Action levels. Recreation benefits would decrease by $1.1 million.

Similar to Shasta Reservoir, Folsom Reservoir water elevations would drop slightly under this alternative, but these declines would not result in a significant impact to any of the recreation facilities.

Percent Inflow.

Trinity River Basin. Under the Percent Inflow Alternative, Trinity Reservoir levels would drop slightly in summer months compared to No Action levels, resulting in a slight decrease in the useability of certain recreation facilities, including the Stuart Fork Ramp, the Fairview Ramp, and the Trinity Center Ramp. However, no significant decrease in facility availability is anticipated. However, campground use is predicted to increase slightly compared to No Action conditions because of better access conditions. Overall, annual recreation use of Trinity Reservoir is expected to increase by 13,500 visitor days, or about 2 percent, compared to No Action levels. Recreation benefits would increase by $147,200 annually.

Central Valley. Shasta Reservoir elevations would drop slightly, but not to a degree that would significantly impact the availability of

recreation facilities. Annual recreation use of Shasta Reservoir would decrease by 9,100 visitor days, or less than 1 percent, compared to No Action levels. Recreation benefits would decrease by $99,200 annually.

Under this alternative, Folsom Reservoir elevations would drop slightly, but not to a degree that would significantly impact the availability of recreation facilities.

Mechanical Restoration. Impacts to reservoir recreation would be the same as those under the No Action Alternative.

State Permit.

Trinity River Basin. Under the State Permit Alternative, Trinity Reservoir levels would be slightly higher during the primary recreation season as compared to the No Action Alternative. The availability of recreation facilities would increase compared to No Action levels. Annual recreation use of Trinity Reservoir would increase by 44,800 visitor days, or about 6 percent. Recreation benefits would increase by $488,300 annually.

Central Valley. Under the State Permit Alternative, Shasta Reservoir elevations would increase slightly, but recreation facilities would be relatively unaffected compared to No Action levels (See Table 3-36). Annual recreation use of Shasta Reservoir would increase by 104,100 visitor days, or about 3 percent, compared to No Action levels. Recreation benefits would increase by $1.1 million annually.

Under this alternative, Folsom Reservoir elevations would increase slightly, but recreation facilities would be relatively unaffected compared to No Action levels.

Existing Conditions versus Preferred Alternative. The difference between existing conditions (i.e., 1995) and the Preferred Alternative in the year 2020 would be identical to the difference between the Flow Evaluation Alternative and No Action in terms of reservoir opportunities. However, reservoir recreation use and benefits would increase due to the effect of population growth on recreation demand.

Table 3-38 summarizes the effects of the project alternatives to recreation opportunities, use, and benefits as compared to No Action.

Mitigation. Implementation of the following mitigation measures would reduce Trinity and Shasta Reservoir water elevation-related impacts to less than significant levels:

- All affected boat ramps should be extended a sufficient distance to accommodate the new water elevations.

- Marina owners should be compensated for costs associated with moving their facilities or constructing new facilities as a result of the new water elevations.
- Campground facilities should be modified or funding provided to accommodate the new water elevations.

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TABLE 3-36
Summary of Impacts to Trinity, Shasta, and Folsom Reservoir Recreation Opportunities

	Projected Recreation Facility Availability During the Recreation Season[a]												
	No Action	Maximum Flow	Percent Change	Flow Evaluation	Percent Change	Percent Inflow	Percent Change	Mechanical Restoration	Percent Change	State Permit	Percent Change	Existing Conditions	Preferred Alternative Percent Change from Existing Conditions
Facility and Threshold Elevation (msl)													
Trinity Reservoir													
Stuart Fork Ramps (2,320)	42	9	-33	42	0	41	-1	42	0	56	14	46	4
Fairview Ramp & Major Marina Relocations Required (2,310)	52	18	-34	52	0	50	-2	52	0	62	10	55	3
Trinity Center Ramp (2,295)	62	35	-27	63	1	59	-3	62	0	72	10	63	1
Campground Use (2,270)	74	64	-10	79	5	80	6	74	0	84	10	80	6
Minersville Ramp (2,170)	99	99	0	100	1	100	1	99	0	100	1	100	1
Shasta Reservoir													
McCloud Arm Ramps (952)	92	89	-3	90	-2	90	-2	92	0	92	0	93	1
Sacramento Arm Ramps (950)	92	89	-3	91	-1	92	0	92	0	92	0	94	2
Sacramento Arm Marina (937)	93	89	-4	93	0	94	1	93	0	94	1	95	2
Pit Arm Ramps (907)	98	93	-5	96	-2	98	0	98	0	99	1	98	0
Centimudi Ramp (844)	100	97	-3	100	0	100	0	100	0	100	0	100	0
Folsom Reservoir													
Last boat ramp out of operation (360)	98	99	1	98	0	98	0	98	0	98	0	99	1
Limited lake surface area (boating constrained at 400)	87	89	-10	83	-4	86	-1	87	0	89	2	89	2
Marina closes (405)	80	82	-8	76	-4	79	-1	80	0	83	3	82	2
Decline in campground/picnicking use (430)	56	56	-3	53	-3	54	-2	56	0	55	-1	56	0
Beach area inundated (450)	31	32	-2	30	-1	30	-1	31	0	31	0	32	1

[a]The primary recreation season is defined as approximately Memorial Day to Labor Day.

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TABLE 3-37

Summary of Impacts to Reservoir Use and Benefits[a]

	No Action	Maximum Flow		Flow Evaluation		Percent Inflow		Mechanical Restoration	State Permit		Existing Conditions[b]	
Resource Concern		**Amount**	**Percent Change from No Action**	**Amount**	**Percent Change from No Action**	**Amount**	**Percent Change from No Action**		**Amount**	**Percent Change from No Action**	**Amount**	**Preferred Alternative Percent Change from Existing Conditions**
Trinity Reservoir												
Recreation Benefits[c] (million $)	8.7	8.4	-4	8.7	1	8.8	2	Same as No Action	9.2	6	5.3	66
Visitor Days	796,200	766,200	-4	802,800	1	809,700	2	Same as No Action	841,000	6	484,900	66
Shasta Reservoir												
Recreation Benefits (million $)	61.9	56.9	-8	60.9	-2	61.8	0	Same as No Action	63.1	2	38.0	60
Visitor Days	5,682,700	5,216,500	-8	5,583,400	-2	5,673,600	0	Same as No Action	5,786,800	2	3,483,100	60

[a] Long-term average water conditions only.
[b] 1995 existing conditions.
[c] All benefits are expressed in 1997 dollars.

Notes:
Impacts shown for long-term average water conditions only. See Recreational Technical Appendix D for dry water conditions.

TABLE 3-38
Trinity, Shasta and Folsom Reservoir Recreation Opportunities, Use, and Benefits [a,b]

	Recreation Facility Availability During the Recreation Season											
	Existing Conditions	No Action	Maximum Flow		Flow Evaluation		Percent Inflow		Mechanical Restoration		State Permit	
	Facility Availability (Percentage)	Facility Availability (Percentage)	Facility Availability (Percentage)	Percent Change from No Action	Facility Availability (Percentage)	Percent Change from No Action	Facility Availability (Percentage)	Percent Change from No Action	Facility Availability (Percentage)	Percent Change from No Action	Facility Availability (Percentage)	Percent Change from No Action
Trinity Reservoir												
Stuart Fork Ramps (2,320 msl)	46	42	9	-33	42	0	41	-1	42	0	56	14
Fairview Ramp & major marina relocations (2,310 msl)	55	52	18	-34	52	0	50	-2	52	0	62	10
Trinity Center Ramp (2,295 msl)	63	62	35	-27	63	1	59	-3	62	0	72	10
Campground use (2,270 msl)	80	74	64	-10	79	5	80	6	74	0	84	10
Minersville Ramp (2,170 msl)	100	99	99	0	100	1	100	1	99	0	100	1
Shasta Reservoir												
McCloud Arm Ramps (952 msl)	93	92	89	-3	90	-2	90	-2	92	0	92	0
Sacramento Arm Ramps (950 msl)	94	92	89	-3	91	-1	92	0	92	0	92	0
Sacramento Arm Marina (937 msl)	95	93	89	-4	93	0	94	1	93	0	94	1
Pit Arm Ramps (907 msl)	98	98	93	-5	96	-2	98	0	98	0	99	1
Centimudi Ramp (844 msl)	100	100	97	-3	100	0	100	0	100	0	100	0
Folsom Reservoir												
Last boat ramp out of operation (360 msl)[c]	99	98	95	-3	98	0	98	0	98	0	98	0
Limited lake surface area (boating constrained at 400 msl)	89	87	77	-10	83	-4	86	-1	87	0	89	2
Marina closes (405 msl)	82	80	72	-8	76	-4	79	-1	80	0	83	3
Decline in campground/picnicking use (430 msl)	56	56	53	-3	53	-3	54	-2	56	0	55	-1
Beach area inundated (450 msl)	32	31	29	-2	30	-1	30	-1	31	0	31	0

	Estimated Annual Recreation Use and Change in Benefits Compared to No Action											
	Existing Conditions	No Action	Maximum Flow		Flow Evaluation			Percent Inflow		Mechanical Restoration		State Permit	
			Amount	Percent Change from No Action	Amount	Percent Change from No Action	Percent Change from Existing Conditions	Amount	Percent Change from No Action	Amount	Percent Change from No Action	Amount	Percent Change from No Action
Trinity Reservoir													
Recreations Benefits (million $)	5.3	8.7	8.4	-4	8.8	1	66	8.8	2	8.7	0	9.2	6
Visitor Days[d]	484,900	796,200	766,200	-4	802,800	1	66	809,700	2	796,200	0	841,000	6
Shasta Reservoir													
Recreations Benefits (million $)	38.0	61.9	56.9	-8	60.4	-2	60	61.8	0	61.9	0	63.1	2
Visitor Days	3,483,100	5,682,700	5,216,500	-8	5,583,400	-2	60	5,673,600	0	5,682,700	0	5,786,800	2

[a] Estimated annual recreation use and change in benefits were identified for only Trinity and Shasta Reservoirs given they were assumed to be the reservoirs most directly affected by the change in Trinity and Shasta Division operations.
[b] Long-term average water conditions.
[c] Data Source: Draft PEIS. U.S. Bureau of Reclamation, 1997.
[d] Number of recreation visitor days (RVDs).

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