CHAPTER 4: WATER RESOURCES MANAGEMENT

Introduction

The following description of water resources is a combination of original text and text taken directly from Placer County Water Agency's (PCWA) 2001 American River Pumping Station DEIR and the City of Auburn's 1997 Auburn Wastewater Facility Plan FEIR. While these documents provided the majority of the text, the specific text is not quoted due to the extensive intermingling of wording from the three principal sources.

Water Management Practices

Water management practices in Auburn Ravine, Coon Creek, and Doty Ravine are different than most small East Side foothill tributary streams. Since these watersheds are relatively small, very little of the stream flow is from natural runoff. Most of the stream flow is water imported from the Yuba, Bear, and American River watersheds through various means to meet domestic and agricultural needs in western Placer County and southeastern Sutter County. While winter stream flows are dominated by discharges from wastewater treatment facilities and runoff from rainfall events, summer flows are dominated by irrigation water deliveries to farms, golf courses, and ranches on the valley floor. This is a unique situation for small foothill streams where the normal situation is for stream flows to gradually decline over the spring, summer, and early fall until the first rainstorms occur.

Auburn Ravine has good summer flow conditions in the foothills and downstream to a point well west of Lincoln. Coon Creek's situation is similar to Auburn Ravine, except that nearly all irrigation water is diverted out of the channel just downstream of State Route (Highway 65) during the irrigation season. Water in the Coon Creek channel downstream of this diversion point is primarily groundwater inflows or agricultural return flows. Doty Ravine also has good summer flow conditions due to the delivery of irrigation water, but flows generally cease, except for leakage and return flows from agricultural operations, downstream of Nevada Irrigation District's (NID) Doty South Diversion Dam just west of Crosby Herold Road northeast of Lincoln. These flow levels provide more aquatic habitat than was available historically, although summer and early fall water temperatures reach into the 75+ °F range in downstream areas.

Winter flows vary widely between and among the primary watersheds. Auburn Ravine's winter flow peaks can range from a few hundred cubic feet per second (cfs) to an estimated 100-year flow event exceeding 17,000 cfs. Coon Creek's peak flows can range from several hundred cfs in smaller events to more than 22,000 cfs in a hundred year event. Doty Ravine has a much smaller watershed area than either Auburn Ravine or Coon Creek, but flows can exceed 11,000 cfs in a hundred year event. Markham Ravine, whose watershed is entirely on the valley floor, carries flood flows downstream to the East Side Canal. While flood flows are not gauged in this channel, the City of Lincoln's Markham Ravine Flood Management Study does provide estimates of these flows (James McCloud, City of Lincoln, pers. comm.). Peak flows for Markham Ravine are estimated to reach 5,000 cfs for a hundred year event. The East Side Canal and Cross Canal serve as conduits for floodwaters from the three

primary watersheds (and three smaller watersheds to the south including King Slough, Pleasant Grove Creek, and Curry Creek). Since the Cross Canal drains into the Sacramento River, its water surface elevations are determined by the flood height of the Sacramento River. As the Sacramento River rises in elevation, backwatering occurs in the Cross Canal and eventually the East Side Canal. Flood depths can reach 14 feet in lower reaches of the Cross Canal and the East Side Canal.

The critical low flow period generally occurs in October when irrigation season ends and flows from imported sources cease or greatly diminish. Flows during this period (generally early October until winter rains are sufficient to generate additional natural stream flow) are often only a few cfs and this causes a substantial decrease in aquatic habitat in the low gradient portions of the Auburn Ravine, Doty Ravine, and Coon Creek watersheds. In Auburn Ravine, this situation occurs from near Joiner Parkway in Lincoln, downstream to its confluence with the East Side Canal. With a flow of only 1-2 cfs, the wetted channel is much narrower than normal and often covered with only a few inches of water. While the flows in Doty Ravine are also only a few cfs, the habitat loss is much less because of the higher gradient, pool and riffle nature of the channel. A relatively small volume of water flow can keep the pools full and riffles biologically functional because the water elevations in the pools generally keep the water above the streambed surface. Extensive beaver activity and associated dams also impound water in the channel. Coon Creek while having some of the same characteristics as both Auburn Ravine and Doty Ravine, is different for two reasons. First, Coon Creek has about a 2 cfs daily inflow from the discharge of Placer County's SMD-1 wastewater treatment plant located near State Route 49 (Highway 49) plus 7.5 cfs of dilution water purchased from NID during the summer and fall months. Second, the channel characteristics of Coon Creek upstream of McCourtney Road are one of generally higher gradient (many pool/riffle complexes) with larger bedrock formed pools. Given these two characteristics, much of the aquatic habitat in Coon Creek remains relatively unchanged in low flow periods.

While Markham Ravine is a focus of this ERP, flows in this watershed are predominantly seasonal, limited to urban run-off and precipitation. Markham Ravine generally supports no natural flow; however, it does support some freshwater habitat due to irrigation return flows. Because flows in this watershed are minimal, Markham Ravine is not discussed further in this chapter.

Water Conveyance

Given the natural hydrology of the Auburn Ravine and Coon Creek watersheds (i.e., natural water flows generated by fall/winter rainfall events with summer/early fall flows historically very limited or zero) water management practices are the single most important factor influencing the water dependent resources in the area. The use of Auburn Ravine, Doty Ravine, and Coon Creek to convey irrigation water to the western and southeastern side of Placer and Sutter counties, respectively, creates unique summertime habitats not found in other foothill locations.

Auburn Ravine

Water Sources

Water has been imported into Auburn Ravine for over 150 years. Early settlers and miners developed canal systems to bring water into the watershed for a variety of uses. Currently, water is imported into the Auburn Ravine watershed from two primary sources: the Yuba/Bear River watershed and, to a lesser degree, the American River watershed. In the Yuba/Bear watershed, NID developed the Yuba-Bear River Power Project and the Pacific Gas and Electric Company (PG&E) developed the Drum-Spaulding Project. Water from both projects is conveyed primarily via the Drum, Bear River, Lower Combie, Upper Boardman, and South Canals to western Placer County. PG&E project water is used to operate its hydropower plants and to fulfill its water supply contract obligations to PCWA and NID.

In the mid-1960s, PCWA developed the Middle Fork Project (MFP), a multi-purpose water development project designed to utilize waters of the Middle Fork American River and Rubicon River for irrigation, domestic and commercial water supplies, and hydroelectric generation. The project includes two reservoirs, five diversion dams, five power plants, and related facilities. The MFP is operated first to meet required fish flows, then to meet PCWA's water demands, and finally to maximize hydroelectric generation.

PCWA currently diverts American River water at its seasonal American River pump station at Auburn. In the early 1960's, the federal government began construction of Auburn Dam, which resulted in the removal of PCWA's permanent pumping station. In turn, the U.S. Bureau of Reclamation (Reclamation) was obligated to annually install and remove a seasonal pump station if PCWA so requested. Each spring Reclamation would install the seasonal pumps and then remove the equipment in late autumn to avoid damage to the facility from rain and high river flows. The Bureau is now in the process of replacing the seasonal pump station with year around permanent pump station because of PCWA's need for continuous access to American River water. This pump station lifts the river water 250 feet into the Auburn Tunnel. This water could then be released into Auburn Ravine or lifted another 200 feet into the South Canal for use in western Placer County.

A subset of the water imported into Auburn Ravine is the discharge from the City of Auburn's WWTP. While this water is part of the overall imports, its fate is of particular importance because the discharge from this plant contributes from 2% of the July flow near the Lozanos Road Bridge to nearly 20% of the total flow in November near the WWTP (City of Auburn 1997). November effluent volumes are heavily influenced by stormwater and infiltration contributions. The important fact is that daily discharge from the WWTP maintains much of the aquatic habitat in the upper reaches of Auburn Ravine by maintaining pool volumes and groundwater surface elevations adjacent to the channel. Natural runoff also contributes to the channel during this time of the year.

Water Management

The contract between Placer County Water Agency (PCWA) and PG&E states that PCWA can receive up to 100,400 acre-feet annually (AFA). Because of physical restrictions on the Bear River Canal through which all of the supply is conveyed, PCWA is limited to a diversion of 244 cfs (485 acre-feet per day or a maximum of 177,000 acre-feet per year). PCWA delivers this water to its Service Area Zone 1, which generally includes the area from Bowman on the northeast, Folsom Lake on the east, and the city's of Lincoln and Rocklin on the south and west.

The Wise Powerhouse, operated by PG&E, is located about 1,000 feet upstream of the City of Auburn's Waste Water Treatment Plant (WWTP). It generates power using flow from the Yuba, Bear, and North Fork American rivers brought to the powerhouse via the Wise Penstock. Water from the powerhouse can be discharged either into the Auburn Ravine or into PG&E's South Canal, which carries it to the Newcastle Powerhouse outside of the Auburn Ravine watershed. During the irrigation season, from April through October, PG&E releases water at two locations in Auburn Ravine for delivery to NID's customers: directly from the powerhouse into the Auburn Ravine and from an elevated span of South Canal, where it crosses the ravine just upstream of the Auburn WWTP. NID uses Auburn Ravine to convey water to downstream diversions at the Auburn Ravine One Canal and the Hemphill Canal.

PG&E also releases water from South Canal into Auburn Ravine near the Lozanos Road Bridge for use by the PCWA. PCWA also diverts some water from the South Canal via the Dutch Ravine Canal. Part of this flow goes into Dutch Ravine, which joins Auburn Ravine downstream of NID's Auburn Ravine One Canal. PCWA contracts with the South Sutter Water District (SSWD) to act as its watermaster for the distribution of water flowing down Auburn Ravine to PCWA's agricultural customers.

PG&E operates the Wise Project year round, except when it shuts down the system for scheduled maintenance and repair, generally between October 15 and November 30. During this period, no flows are discharged from the Wise Powerhouse to either the South Canal or Auburn Ravine. When this occurs, PCWA pumps water into the Auburn Tunnel from the American River at its American River Pumping Plant and then lifts this water into the South Canal for delivery to the Foothill Water Treatment Plant. Infrequently, some American River water continues down the Auburn Tunnel into the Auburn Ravine where it is discharged about a half mile downstream of the City WWTP.

During the summer months (April through October), PG&E operates the Wise Powerhouse with discharges released to Auburn Ravine for use by NID and releases to the South Canal for downstream use by PCWA. Maximum average water discharges into Auburn Ravine from the Wise Powerhouse occur during June, July, and August. During the winter months (November through March), PG&E operates the system to meet PCWA's consumptive use, but the primary focus is power generation. Often during this period, flows though Wise Powerhouse are greater than the capacity of the South Canal. PG&E spills excess flows into Auburn Ravine. At times, generally in October and November, there is no water released or spilled into Auburn Ravine. Flow discharge from the powerhouse is the dominant source of

water in this section of the stream. These flows from the Wise Powerhouse greatly augment the natural flows of the Ravine, particularly after May, when natural Auburn Ravine flows decline to minimum levels.

When computed at the intersection of Highway 65, near Lincoln, flow in the stream comes primarily from runoff and groundwater during the fall, winter, and spring months, rather than from irrigation releases. However, after May, natural flows continue to decline to minimal levels, leaving only the imported flows and the small contribution by the WWTP in the stream channel.

The percentage of total stream flow downstream contributed by the City of Auburn WWTP discharge ranges from a minimum level of about 2.5 percent in mid-summer to about 17 percent in the spring. Agricultural return flows are not included in this analysis.

Downstream of Highway 65 in Lincoln, water is transmitted to various diversion locations. Just west of Nelson Lane, a large set of pumps is used to periodically withdraw water for irrigation. South Sutter Water District diverts water on the Aitken Ranch, downstream of the confluence with Orchard Creek. South Sutter also diverts water at diversion points near Pleasant Grove Road and Coppin Dam in the East Side Canal, immediately downstream of the Auburn Ravine/East Side Canal confluence.

The City of Lincoln historically has not discharged effluent from its wastewater treatment plant on Nicolaus Road. However, the City of Lincoln is currently constructing a new wastewater treatment and reclamation facility (WWTRF) on land adjacent to Orchard Creek. The proposed discharge from the WWTRF will occur in the vicinity of Moore Road. The initial discharge permit allows a discharge of 3.3 million gallons per day (mgd), which is equivalent to 5.1 cfs. Maximum build out for the City is estimated at 12 mgd (18.6 cfs). The WWTRF could be transformed into a regional treatment facility with an ultimate capacity of 30-33 cfs (46.4-51.0 cfs). Final discharge volumes and the spatial and temporal timing of discharges have not been decided at this time. Having a full time discharge of this magnitude would dramatically change the character of the stream, its aquatic fauna, and provide habitat enhancement opportunities that do not currently exist.

Coon Creek

Water Sources

The Placer County Wastewater Treatment Plant (SMD-1), located by Joeger Road in Auburn off Highway 49, discharges treated effluent into Rock Creek. Rock Creek joins Dry Creek about 50 yards downstream of the effluent outfall. Dry Creek continues to flow west to the confluence with Orr Creek, which flows from the northeast. Dry Creek and Orr Creek join together to form Coon Creek, which then flows generally westward to Cross Canal before entering the Sacramento River. The upper half of the Coon Creek basin is characterized by a complex network of irrigation canals managed by NID to carry water imported from the Bear River.

Water Management

NID uses Orr Creek to transport imported water from the Bear River water to downstream agricultural users. Sometimes during dry years or when other operational difficulties dictate, NID transports water by means of Rock Creek. During winter, some water occasionally spills into Dry Creek and Rock Creek from other PG&E facilities; these spills are infrequent. NID's primary diversion from Coon Creek is the Camp Far West Canal.

When compared to natural conditions, existing stream flows are substantially augmented on a seasonal basis by releases from upstream NID and PG&E facilities. During the irrigation season, flows in Orr Creek average about 40 cfs above natural flows. The effluent discharge from SMD-1 is approximately 1.3 mgd, or about 2 cfs, which also augments the natural flows. The Coon Creek watershed has two peaks in flow volume. The first occurs in mid-winter as a result of naturally occurring runoff. A second, smaller peak occurs in mid-spring with the introduction of imported agricultural water to the basin. As natural flows decline, the imported flows continue through the summer on a relatively continuous basis until they stop in October.

Low flows in Dry Creek are approximately 1 to 2 cfs, mostly leakage from upstream PG&E facilities and return flows from irrigation; however, 7.5 cfs of dilution water is purchased from NID during summer and fall. During the maximum flow month in winter, the SMD#1 effluent is only approximately 4 percent of the total flow in Dry Creek. During the irrigation season, water released downstream of the Camp Far West Canal is diverted by a variety of users. In Coon Creek, South Sutter Water District's current water management objective is to have no flow below the South Sutter Water District diversion located west of Highway 65. Water in the channel below this point consists of agricultural return flows from a variety of farm and ranching operations west of Highway 65.

Doty Ravine

Water Source and Management

Doty Ravine receives water from natural runoff and from deliveries made by NID through the Auburn Ravine I and Gold Hill II/Sailor’s Ravine canal system. Winter high flow events can exceed several thousand cfs. During the irrigation season, flows are generally less than 20 cfs, with the management objective of diverting all irrigation water at the Doty South Diversion Dam located just west of Crosby Herold Road. Downstream of this location, the only water in the channel comes from seepage, groundwater recharge, or agricultural return flows. During the non-irrigation season, the channel is charged with 5-6 cfs. Beaver dams are common and result in many dammed pools and resultant changes in water surface elevation. Localized flooding does occasionally occur, but since the watershed is relatively small, the flood flow volumes are much smaller than either Auburn Ravine or Coon Creek upstream of its confluence with Doty Ravine.

Management Concerns

Water management practices in Auburn Ravine, Doty Ravine, and Coon Creek have both positive and negative effects on the ecological function and value of the four streams addressed in this assessment. Without the water imported into these watersheds, most would be dry, or nearly so, for several months of the year. Due to the current water delivery schedules and flow volumes, there are riparian and aquatic habitats over tens of miles of stream channel length that would otherwise be absent. As a result, these streams may support species of concern that would not otherwise have found suitable habitat in this region. At the same time, these enhanced flow regimes provide habitat for non-native species; for example, the regular flow regime may enhance conditions for Himalayan blackberry, a non-native species that crowds out native plants.

Given this dichotomy in ecological impact and effect, Table 4-1 presents a listing of management concerns and identifies the positive and negative impacts to the ecosystem for each concern identified. The management concerns identified in Table 4-1 are based on an assessment of relatively well-established relationships between stream flow, temperature, and flooding regimes on aquatic and riparian habitats. They reflect the findings and conclusions of aquatic and terrestrial surveys, which are described in greater detail in subsequent chapters of this assessment.

Table 4-1. Water Management Issues and Impacts

Management Issue	Negative Ecological and Social Impacts	Positive Ecological and Social Impacts
WMM1. Water is imported for agricultural and municipal and industrial uses only. The distribution, water volume, and timing of water deliveries are based on agricultural and municipal needs; only flow ramping addresses some ecological needs.	WMN1.1. The timing and distribution of water allows ecological communities to arise that historically were not present; however, these communities are restricted by reductions in flow volume in the fall.	WMP1.1. Using the stream channels to deliver large flow volumes of water during the late spring and summer creates miles of aquatic and riparian habitats that would be absent or greatly reduced under historical conditions. Flow ramping minimizes the ecological impacts of sudden changes in flow volumes.
WMM2. Changes in the timing and volume of water imported from the American River may change the timing and flow volumes in Auburn Ravine.	WMN2.1. Increasing the volume and changing the annual timing of water deliveries from this origin has the potential to impact the ecological communities already established in Auburn Ravine. These impacts could result from changes in water temperature or differences in water chemistry from that found in the Yuba/Bear rivers water that has been imported for approximately 150 years. WMN2.2. Potential to increase straying of	WMP2.1. Increased water flows could potentially increase the amount and quantity of higher quality aquatic habitats, especially if the discharge from the WWTRF is placed in Auburn Ravine on a continuous basis. WMP2.2. May increase the presence of splittail in lower Auburn Ravine, East Side

Table 4-1. Water Management Issues and Impacts

Management Issue	Negative Ecological and Social Impacts	Positive Ecological and Social Impacts
	American River origin anadromous fish into Auburn Ravine. WMN2.3. Potential to change the timing and NPDES discharge requirements from the City of Lincoln/Regional Wastewater Treatment and Reclamation Facility (WWTRF). WMN2.4 Increased presence of splittail will raise ESA compliance issues. WMN2.5. Potential to seasonally, significantly reduce water flows in Auburn Ravine between the Wise Powerhouse and Auburn Tunnel exit.	Canal, and Cross Canal.
WMM3. Water transmission facility efficiencies will affect the physical and biological ecosystems in the watersheds.	WMN3.1. Low efficiency water transmission facilities (i.e., unlined canals) requires larger than demand volumes of water being imported into the watersheds because of transmission losses. WMN3.2. Because of low transmission efficiencies, larger volumes of water must be imported to meet actual demand, thereby reducing the volume of water in storage for subsequent years or reducing or eliminating water volume that might be available to be used for ecological purposes (e.g., fall flows for fish migration and maintenance of aquatic ecosystems).	WMP3.1. Low efficiency transmission facilities create a variety of widely distributed aquatic and riparian habitats that would otherwise be lacking in the watersheds. WMP3.2. Seepage from these facilities provides an unquantified volume of water to recharge groundwater basins and eventually the stream channels proper.
WMM4. Water management practices (i.e., timing of water imports and volumes of water in the channels) may create habitat connectivity problems for many species.	WMN4.1. Suitable and stable aquatic production (i.e., anadromous fish and benthic macroinvertebrates) is negatively affected by the low flows in fall when water deliveries are reduced and aquatic habitats are reduced in quantity and quality. WMN4.2. Water limited to meeting agricultural, municipal and industrial demands may result in fragmentation of migratory corridors for chinook salmon and potentially splittail.	WMP4.1. None identified at this time.
WMM5. The methods and techniques currently used to divert water from the stream	WMN5.1. Use of diversion dam structures without fish passage facilities may reduce or eliminate salmon and steelhead	WMP5.1. Current diversion methods are relatively "low tech" and require minimal

Table 4-1. Water Management Issues and Impacts

Management Issue	Negative Ecological and Social Impacts	Positive Ecological and Social Impacts
channels have an impact on ecological processes and functions.	migration up Auburn Ravine, Doty Ravine, and Coon Creek. WMN5.2. Use of diversion dam structures without fish passage facilities may reduce or eliminate salmon and steelhead migration if not managed to reflect migration timing. WMN5.3. Use of diversion dam structures changes stream hydrodynamics, which can result in increased sediment deposition, decreased sediment transport, and increased frequency of flooding. WMN5.4. Diversions without appropriate fish exclusion devices installed have the potential to increase the mortality of listed and native fishes within the watersheds. WMN5.5. Some diversion structures, even without the flashboards installed, could be impediments or barriers to upstream fish passage.	operations and maintenance. WMP5.2. Because many of the diversion dam flashboards are removed in mid-October, many of the diversion dam structures are potential barriers to fish passage in only extreme low flow conditions.
WMM6. Water quality in downstream areas deteriorates because of agricultural return flows.	WMN6.1. Water quality is reduced and water temperatures increased in the lower portions of Auburn Ravine, Doty Ravine, and Coon Creek because of the presence of agricultural return flows. This condition results in a change in fish species composition from native to non-native, pollution and temperature tolerant species.	WMP6. None identified.
WMM7. Creation of a regional Lincoln WWTRF will have both positive and negative impacts on Auburn Ravine and Coon Creek. Note: No EIR has been prepared to assess the impacts of a regional WWTRF with a capacity of 33 mgd.	WMN7.1. Withdrawal of flows from Placer County's Joeger Road WWTP (SMD-1) will have an adverse impact on Rock, Dry, and upper Coon creeks, particularly during low flow or drought periods. WMN7.2. Because flow in upper Auburn Ravine may at times be limited to discharge from the WWTP discharge plant, withdrawal of flow from this facility will reduce flow to near zero in the portion of the channel downstream of Auburn's WWTP	WMP7.1. Removal of effluent flows from SMD-1 will improve the water quality of Rock, Dry, and Coon creeks. WMP7.2. Removal of effluent flows from upper Auburn Ravine will improve the water quality. WMP7.3. Discharge of flows from the regional WWTRF has the potential to have a major positive impact on

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Management Issue	Negative Ecological and Social Impacts	Positive Ecological and Social Impacts
	WMN7.3. Discharge of flows from the regional WWTRF has the potential to have impact on Auburn Ravine water quality, temperature, and nutrient loading, (impacts of a 33 mgd plan would be greater than those discussed in City of Lincoln analysis of a 12 mgd plant). Compliance with the NPDES permit will assure that the impact is minimized as not to adversely affect beneficial uses of the stream including recreation, water supply, and preservation and enhancement of fish, wildlife, and other aquatic resources. WMN7.4. Depending on the timing of discharge flows, the regional facility could have impacts on habitat connectivity and habitat quantity and quality. WMN7.5. Discharge from a regional facility could result in significant impacts to anadromous fish unless fall/early winter flow volumes upstream of the proposed discharge location are sufficient to provide for upstream fish passage. WMN7.6. If the effluent from the regional WWTRF were reclaimed and not discharged to the stream channel, an opportunity to create additional benefits for Auburn Ravine aquatic resources and habitats, as well as habitats outside of the watershed, would not be realized.	stream flows and fish passage downstream of the discharge point.
WMM8. Because of channel capacity problems, management of floodwaters is inadequate to promote ecosystem restoration.	WMN8.1. Historic natural levees were set more widely apart and therefore provided for flood passage in a wide channel with more varied topography and habitat. Lack of this type of channel configuration reduces ecological function and value of the existing channel. Additionally, inability to clear increased sedimentation has decreased channel capacity decreasing the ability of the channel to maintain flows and causing flows to meander overland rather than within the channel, additionally degrading ecological function. WMN8.2. Backwatering from water	WMP8.1. Levees prevent some areas from flooding because they contain stream flows to a defined channel.

Table 4-1. Water Management Issues and Impacts

Management Issue	Negative Ecological and Social Impacts	Positive Ecological and Social Impacts
	surface elevation changes in the Sacramento River results in deep ponding on portions of the lower watersheds. This deep ponding results in long-term inundation of riparian habitat, often significantly reducing its viability. Periodic loss of this riparian habitat has a negative impact on the biological and overall ecological community. WMN8.3. Maintenance requirements on levees designed to accommodate the backwatering caused by the Sacramento River results in reduced upland habitat quality and quantity. WMN8.4. Levee confinement along certain segments of the stream channels results in habitat simplification and a loss of habitat diversity. WMN8.5. Flood flows in excess of 2,000 cfs in Auburn Ravine create flood related problems in Sutter County. Because of these problems, a settlement has been reached between the City of Lincoln and Sutter County, which prohibits discharge of effluent from Lincoln's new WWTRF into Auburn Ravine when the stream's flows exceed 2,000 cfs. This means that dilution of effluent by high flows is not possible, even though this is the best time to discharge effluent from an ecological perspective.	

Summary of Findings

Based on the management issues and conflicts and benefits identified in the table above, the following is a summary of findings with respect to water management issues in the watersheds:

- Current water management practices have a localized positive impact on the quantity and quality of aquatic habitats in the watersheds;

- Current water management practices have a localized negative impact on fish species composition, overall stream production, water quality, juvenile fish survival, adult anadromous fish migration timing and distribution;

- Current flood management practices and structural configurations are inadequate to promote ecosystem restoration.

- Implementation of a regional WWTRF could have positive and/or negative effects on Auburn Ravine, East Side Canal, and the Cross Canal. These would depend on the timing and volume of discharge to Auburn Ravine. Increased fall discharges would increase water depths in the stream, as much as 50 cfs. Increased discharges could also have the negative effect of raising temperatures in Auburn Ravine, which could create problems for fish such as impacts to egg development. Discharges could also create false-attraction flows in the stream at times when no spawning habitat is available. Impacts will depend on specific of plant operation scenarios. If ecological concerns are integrated into the WWTRF planning, there is potential for developing operational scenarios that would have net benefit to aquatic species.

- Changes in the quantity and timing of American River origin water may affect the water temperature regime and/or water chemistry of Auburn Ravine;

- Water transmission facility efficiencies have both positive and negative effects on aquatic, riparian, and wildlife resources in the watersheds, and

- Water management in the watersheds is not integrated with ecological concerns and each management entity is focused primarily on meeting water demands. There is no mandate for formal coordination to address multi-agency management of resources. Addressing the ecological needs of the watersheds will require a more coordinated approach, involving a cooperative effort by the various water management districts. Such an approach may result in opportunities for better water management throughout the region while providing greater flexibility in management to meet ecological needs. For this to occur, ecological impacts of water management need to be factored into water management practices.