East Loomis Basin

Canal Efficiency Study

EXECUTIVE SUMMARY

JUNE 2008

MWH

BUILDING A BETTER WORLD

US Army Corps of Engineers

PCWA

Efficient use of existing developed raw water supplies is a recognized goal of Placer County Water Agency (PCWA). The East Loomis Basin Canal Efficiency Study (Study) was initiated in 2004 by PCWA and the U.S. Army Corps of Engineers (USACE) to characterize the efficiency of the existing raw water delivery within the East Loomis Basin canal system, and to identify and evaluate alternatives that could improve the efficiency of raw water delivery. During the Study, PCWA conducted an extensive and open stakeholder involvement process to help recognize, interpret, and manage important issues, and to assist in developing resources management measures to address these issues. Central to stakeholder involvement was the formation and involvement of the East Loomis Basin Canal Efficiency Study Task Force.

STUDY AREA

The East Loomis Basin canal system was chosen as the site of the Study because the presence of Mammoth Reservoir provides the option of evaluating the full range of alternatives to reduce losses, including piping the entire canal system, and because this system was large enough to be a good representative sample of PCWA's entire canal system. The East Loomis Basin canal system consists of the Perry Canal, East and West Perry canals, and all canals and pipelines deriving their water from Mammoth Reservoir, as shown in Figure 1. Canals and pipelines below Mammoth Reservoir include the Boardman Canal, Mammoth Pipe, Turner Canal, Turner Pump and Pipeline, Laird Pump and Pipeline, Yankee Hill Canal, Hoyt Sloan Pipeline, Stallman Canal, Ferguson Canal, and Baughman Canal.

East Loomis Basin is bounded by Secret Ravine to the north and west, and Miners Ravine to the south and east, which are the two largest watercourses draining the basin. Both ravines are tributaries to Dry Creek, which in turn is a tributary to the Sacramento River via Steelhead Creek. Secret Ravine and Miners Ravine are designated Critical Habitat for Central Valley steelhead, which are Federally listed as Threatened, and the ravines are recognized by the California Department of Fish and Game and National Marine Fisheries Service as the primary production areas in the Dry Creek drainage for California Species of Special Concern fall-run Chinook salmon and Central Valley steelhead. Secret Ravine and Miners Ravine appear to be especially important for spawning and rearing of these anadromous fishes.

STUDY OBJECTIVES

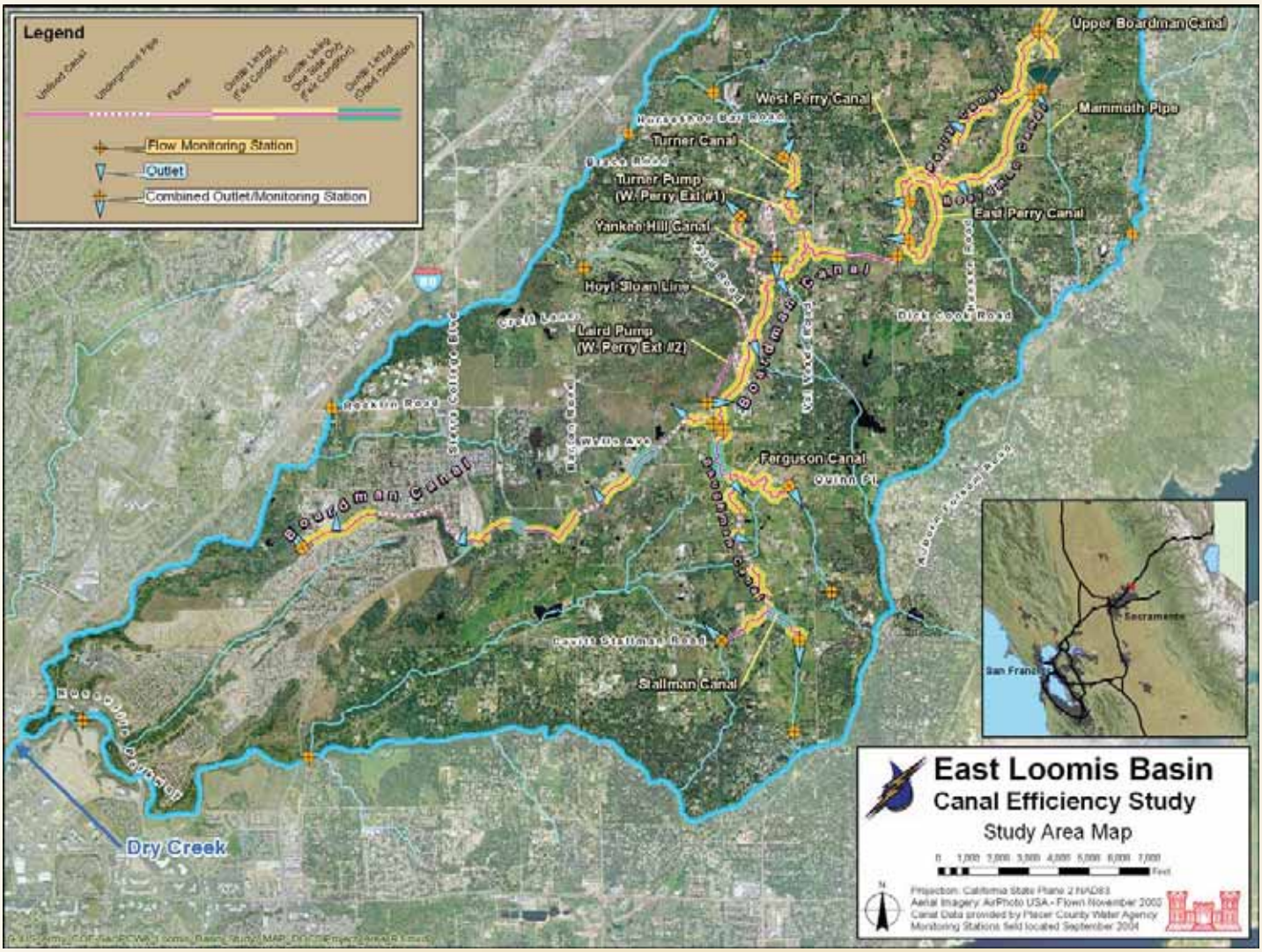
In relation to Study authorities, and with input from Task Force members, the planning objectives described below were developed for the Study. These objectives were used to guide formulation of alternatives to address needs and opportunities, and are separated into primary and secondary objectives. Primary planning objectives are those for which specific alternative plans are formulated to address. Secondary planning objectives are opportunities that are considered in the plan formulation process, but only to the extent possible through pursuit of the primary planning objectives.

- Primary Planning Objective – Formulate alternative plans specifically to address the following:
  - Improve efficiency of raw water delivery and use of existing water supplies within the East Loomis Basin canal system (e.g., reduce losses within system)
- Secondary Planning Objectives – To the extent possible, through pursuit of the primary planning objective, include as features to help accomplish the following opportunities:
  - Improve operational flexibility of the canal system
  - Reduce operation and maintenance requirements of the canal system
  - Improve delivery reliability and quality of raw water to PCWA customers
  - Reduce safety hazards and attractive nuisances in the study area

In addition to the planning objectives, a series of planning principles was established to help guide formulation and evaluation of alternative plans. Many of the principles originate from local policies, practices, and conditions. The principles for use in formulating, evaluating, and comparing alternatives include the following:

- Alternatives should strive to maintain community values and the ecological integrity of environmental resources in the study area.
- Alternatives and their major elements are to be consistent with the identified planning constraints.
- Alternatives should address at minimum the identified primary planning objective, and to the extent possible, the secondary planning objectives.
- Alternatives should avoid impacts to stormwater runoff and drainage in the study area.
- Alternatives should not affect customer usage of purchased water in the study area.

FIGURE 1
EAST LOOMIS BASIN CANAL EFFICIENCY STUDY AREA



POTENTIAL IMPROVEMENTS TO IMPROVE EFFICIENCY OF RAW WATER DELIVERY

Resources management measures are individual components that may be implemented alone, or in combination as alternatives, to improve the efficiency of raw water delivery. Nine categories of resources management measures were considered to address the primary planning objective of the Study, and the following seven categories of measures were retained for alternative plan formulation: (1) upgrade customer turnouts, (2) formalize unauthorized diversion prevention program, (3) operate canal system to reflect water use fluctuations based on real-time data, (4) install remote telemetry, (5) install supervisory control and data acquisition (SCADA) system (6) develop additional water storage, and (7) pipe segments of canal system.

In addition to the No-Action/No Project Alternative (Alternative 1), the following six action alternative plans, summarized in Table 1, were formulated using the resources management measures described above:

- **Alternative 2** – Upgraded Customer Turnouts and Unauthorized Diversion Prevention Program
- **Alternative 3** – SCADA and Remote Telemetry Lite
- **Alternative 4** – SCADA and Remote Telemetry Full
- **Alternative 5** – New Storage, SCADA, and Remote Telemetry
- **Alternative 6** – New Storage, Piping, SCADA, and Remote Telemetry
- **Alternative 7** – Piping of Entire Canal System

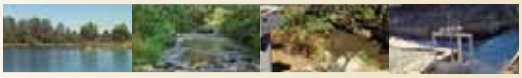


TABLE 1
ALTERNATIVE PLANS TO IMPROVE WATER DELIVERY EFFICIENCY (PRIMARY PLANNING OBJECTIVE)

ALTERNATIVE PLAN	MEASURE(S)									
				Install and Use Remote Telemetry or SCADA				Add Water Storage	Pipe Open Segments	
	Upgrade Customer Turnouts Pilot-Scale Study	Formalize Unauthorized Diversion Prevention Program	Operate Canal System Based on Real-Time Data	Boardman Canal Below Mammoth Reservoir	End of Turner Canal	Boardman Canal at Head of Baughman	End of Baughman Canal	Boardman Canal at Head of Baughman	Sub- systems 4 and 5	Entire System
Alternative 1 No-Action/No-Project										
Alternative 2 Upgraded Customer Turnouts and UDPP	✓	✓								
Alternative 3 SCADA and RT Lite	✓	✓	✓	SCADA		RT				
Alternative 4 SCADA and RT Full	✓	✓	✓	SCADA	RT	SCADA	RT			
Alternative 5 New Storage, SCADA, and RT	✓	✓	✓	SCADA	RT	SCADA	RT	✓		
Alternative 6 New Storage, Piping, SCADA, and RT	✓	✓	✓	SCADA	RT	RT		✓	✓	
Alternative 7 Piping of Entire Canal System										✓

Key:
RT = remote telemetry
SCADA = supervisory control and data acquisition
UDPP = Unauthorized Diversion Prevention Program
✓= Measure included in alternative

Table 2 compares key accomplishments, consistency with planning principles, costs, and cost efficiency for each of the alternatives. Total construction and operating costs of the alternatives vary significantly, with construction costs of up to $56.4 million and annual operating costs of up to $3.1 million. Cost efficiency of alternative plans, defined as the cost of an alternative divided by estimated reduction of losses from the canal system, ranges from $17 per acre-foot of saved water to $1,218 per acre-foot.

Evaluation of alternative plans was based on consideration of four evaluation criteria described in the 1983 U.S. Water Resources Council Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. These criteria include (1) effectiveness, (2) efficiency, (3) acceptability, and (4) completeness. Table 3 summarizes the results of applying the four criteria to the alternatives plans for this Study.

TABLE 2
SUMMARY OF ALTERNATIVE PLAN ACCOMPLISHMENTS AND COSTS

	Alternative 1 No-Action/ No-Project	Alternative 2 Upgraded Customer Turnouts & UDPP	Alternative 3 SCADA and Remote Telemetry Lite		Alternative 4 SCADA and Remote Telemetry Full	Alternative 5 New Water Storage, SCADA, and Remote Telemetry	Alternative 6 New Storage, Piping, SCADA, and Remote Telemetry	Alternative 7 Piping of Entire Canal System
			3A	3B				
Accomplishments of Alternatives								
Reduces of water losses from canal system/ water savings (acre-feet/year)		390	990	680	1,270	1,350	1,850	2,580
Addresses secondary planning objectives		✓	✓	✓	✓	✓	✓	✓
Consistency of Alternatives with Planning Principles								
Maintains ecological integrity of environmental resources	✓	✓		✓				
Is consistent with other identified planning principles		✓	✓	✓	✓	✓	✓	✓
Alternative Costs								
Total Construction Costs	$0	$50,800	$509,600	$509,600	$957,800	$6,025,200	$25,483,600	$56,454,000
Total Annual Costs	$0	$6,700	$33,700	$33,700	$60,100	$335,900	$1,457,500	$3,138,600
Alternative Cost Efficiency ($/acre-feet)								
Cost efficiency of Upgraded Customer Turnouts & UDPP	--	$17	$17	$17	$17	$17	$37	--
Cost efficiency of SCADA/Remote Telemetry/ Storage/Piping	--	--	$45	$93	$61	$343	$870	$1,217
Overall Cost Efficiency ($/acre-feet)	**--**	**$17**	**$34**	**$50**	**$47**	**$249**	**$788**	**$1,217**

Key:
-- = Not applicable
SCADA = Supervisory control and data acquisition
UDPP = Unauthorized Diversion Prevention Program

TABLE 3
ALTERNATIVE PLAN COMPARISON SUMMARY

CRITERIA	Alternative 1 No-Action/ No-Project	Alternative 2 Upgraded Customer Turnouts & UDPP	Alternative 3 SCADA and Remote Telemetry Lite		Alternative 4 SCADA and Remote Telemetry Full	Alternative 5 New Water Storage, SCADA, and Remote Telemetry	Alternative 6 New Storage, Piping, SCADA, and Remote Telemetry	Alternative 7 Piping of Entire Canal System
			3A	3B				
Effectiveness	None	Low	Medium	Low to Medium	Medium	Medium	Medium to High	High
Efficiency	None	High	Medium	Medium	Low to Medium	Low	Low	Very Low
Acceptability	None	High	Low	High	Low	Low	Low*	Low*
Completeness	None	High	Medium	Medium	Medium	Low to Medium	Low to Medium	Low to Medium
RELATIVE RANKING	None	Highest	Low to Medium	Medium	Low	Low	Low	Low

Note:
* *Many stakeholders may prefer not to pipe the entire East Loomis Basin canal system, resulting in less support for Alternative 7.*
Key:
SCADA = Supervisory control and data acquisition

KEY FINDINGS AND CONCLUSIONS

Based on water balance results for the canal system and receiving streams, the Study found that the condition of existing aquatic and terrestrial resources in the study area are dependent on the canal system. While canal operations (including unregulated releases and customer return flows) contribute to flows in Secret Ravine and Miners Ravine, and their tributaries year-round, the canal system contributions dominate dry season flows.

The Study concluded that the East Loomis Basin canal system is operated quite efficiently. While some losses are inherent and unavoidable in an open canal system, other losses represent opportunities to conserve water. Based on water balance results, canal system efficiencies are higher during the irrigation season compared to the winter delivery season. Losses related to conveyance (evaporation, seepage, unregulated releases) are minor, representing 12 percent of total flow during summer months.

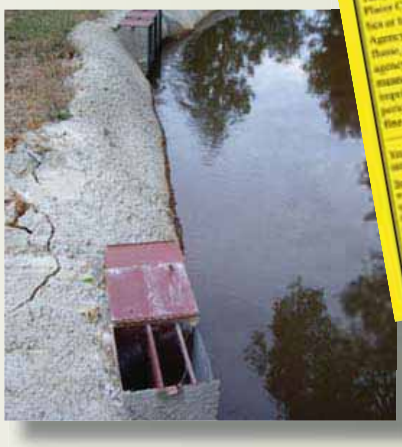
The Study identified unauthorized diversions (i.e., theft) as a substantial loss component in the canal system. Once theft was identified as an issue, PCWA was proactive in addressing unauthorized diversions through extensive outreach and disciplinary actions. Efforts to reduce unauthorized diversions have been successful.

Implementation of alternatives that substantially reduce canal system losses would be very costly and likely require extraordinary rate increases for raw water customers to offset high costs of some alternatives. Additionally, alternatives that greatly reduce canal system losses would have significant direct adverse environmental impacts to biological resources, including reducing flows to Critical Habitat for Central Valley steelhead in Secret and Miners ravines.

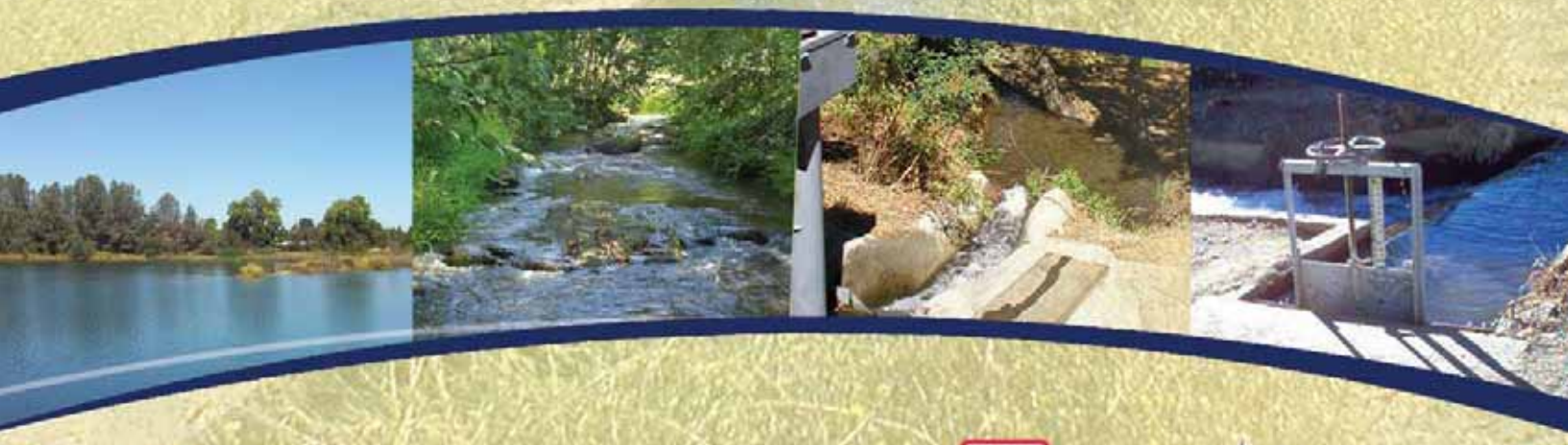
This Study recommends implementation of Alternative 2. The Recommended Plan is highly cost-efficient, has a high degree of acceptability, and would have very minor environmental effects. Implementation of Alternative 2 – Upgraded Customer Turnouts and Unauthorized Diversion Prevention Program would result in the following benefits:

- Anticipated reduction in frequency and magnitude of canal system losses attributed to excess customer deliveries and unauthorized diversions.
- Likely improvement in water delivery reliability to customers with upgraded customer turnouts
- Reduced operations and maintenance requirements
- Improved screen/orifice accessibility

Findings from the Study are applicable to other PCWA service areas. Resources management measures to reduce canal losses included in the Recommended Plan are likely applicable to segments of the PCWA canal system outside the East Loomis Basin, and may further reduce water losses within the PCWA canal system from excess deliveries and unauthorized diversions. Additionally, the interrelationships observed between the East Loomis Basin canal system, tributaries, and ravines in the study area are likely representative of canal system/stream interactions in other PCWA service areas.



The historical character of Placer County is based on a heritage of water resources. An intricate network of canals and flumes conveyed water from Sierra Nevada rivers and streams to mines during the California Gold Rush. The same canals and flumes transported water to orchards of plums, peaches, pears, and apples, Placer County's new gold, during the early 1900s. Today, the water system, operated by Placer County Water Agency, delivers wholesale and retail water to more than 250,000 people, serving homes, farms, businesses, cities, and special districts and private water purveyors in many parts of Placer County. Water conveyed in the PCWA canal system also contributes to flow in nearby streams, which support fish and wildlife.



MWH
BUILDING A BETTER WORLD

US Army Corps of Engineers

PCWA