EL DORADO IRRIGATION DISTRICT FIVE-YEAR CONSERVED WATER TRANSFER PROJECT
CEQA Initial Study/Negative Declaration

May 2024

El Dorado Irrigation District

Table of Contents

LIST OF TABLES

LIST OF FIGURES

ATTACHMENTS

A. Tully and Young, 2021. Updated Main Ditch Water Loss Analysis with 2020 Data. December 30, 2021.
B. GEI Consultants 2023. Technical Memorandum – Main Ditch Seepage Analysis. May 2, 2023.

Acronyms / Abbreviations

AF	Acre Feet
AQMD	Air Quality Management District
CAAQS	California Ambient Air Quality Standards
CAL FIRE	California Department of Forestry and Fire Protection
CARB	California Air Resources Board
cfs	Cubic feet per second
CVP	Central Valley Project
DOC	California Department of Conservation
DTSC	California Department of Toxic Substances Control
DWR	California Department of Water Resources
EID or District	El Dorado Irrigation District
FMMP	Farmland Mapping and Monitoring Program
General Plan	El Dorado County General Plan
GHG	Greenhouse Gases
LAR	Lower American River
MMTCO2e	Million Metric Tons of Carbon Dioxide Equivalent
MRZ	Mineral Resource Zone
NAAQS	National Ambient Air Quality Standards
piping project	Upper Main Ditch Piping Project
PM	Particulate Matter
proposed project	Temporary Conserved Water Transfer Project
Reclamation	United States Bureau of Reclamation
SFAR	South Fork American River
SMARA	Surface Mining and Reclamation Act
SRA	State Responsibility Area
SWP	State Water Project
SWRCB	State Water Resources Control Board
USEPA	United States Environmental Protection Agency
VMT	Vehicles Miles Traveled
WWD	Westlands Water District

1 Introduction

El Dorado Irrigation District (EID) has prepared this initial study/negative declaration (IS/ND) to address the potential environmental consequences of the proposed EID Five-year Conserved Water Transfer (proposed project). This document has been prepared in accordance with the California Environmental Quality Act (CEQA) (Public Resources Code Section 21000 et seq.) and the State CEQA Guidelines (California Code of Regulations Section 15000 et seq.).

An IS is prepared by a lead agency to determine if a project may have a significant effect on the environment (State CEQA Guidelines Section 15063[a]), and thus to determine the appropriate environmental document. In accordance with State CEQA Guidelines Section 15070, a "public agency shall prepare a proposed negative declaration or mitigated negative declaration when: (a) The Initial Study shows that there is no substantial evidence that the project may have a significant impact on the environment, or (b) The Initial Study identifies potentially significant effects but revisions to the project plans or proposal are agreed to by the applicant and such revisions would reduce potentially significant effects to a less-than-significant level."

As described in the environmental checklist (Chapter 3), the project would not result in any significant environmental impacts, nor would the project require revisions to reduce any impacts to a less-than-significant level. Therefore, an IS/ND is the appropriate document to approve the proposed project in compliance with the requirements of CEQA. This IS/ND conforms to these requirements and to the content requirements of State CEQA Guidelines Section 15071.

1.1 CEQA Lead Agency

Under CEQA, the lead agency is the public agency with primary responsibility over approval of the project. EID is the CEQA lead agency because they are responsible for carrying out the proposed project. The purpose of this document is to present to decision-makers and the public information about the environmental consequences of implementing the proposed project. This disclosure document is being made available to the public for review and comment. This IS/ND will be available for a 30-day public review period from May 15, 2024 to June 13, 2024.

This document is available for review at:

El Dorado Irrigation District
2890 Mosquito Road
Placerville, CA 95667

Submit email comments to ConservedWaterTransfer@eid.org and include the name and mailing address of the commenter in the body of the email and "Conserved Water Transfer Comment" in the subject line. Comments may be submitted by mail to:

Brian Deason, Environmental Resources Supervisor
El Dorado Irrigation District
2890 Mosquito Road
Placerville, CA 95667

Written comments (including via e-mail) must be received by 5:00 p.m. on June 13, 2024. After comments are received from the public and reviewing agencies, EID may (1) adopt the ND and approve the project; (2) undertake additional environmental studies; or (3) abandon the project. If the project is approved, EID may elect to, but is not required to, proceed with the project.

1.2 Summary of Findings

Chapter 3, “Environmental Checklist,” contains the analysis and discussion of potential environmental impacts of the proposed project. Based on the issues evaluated in that chapter, EID has determined that the proposed project would not result in any significant impacts and, therefore, no mitigation is required or proposed. The proposed project would result in no impacts related to the following issue areas:

- Aesthetics
- Agriculture and Forestry Resources
- Air Quality
- Cultural Resources
- Geology and Soils
- Greenhouse Gas Emissions,
- Hazards and Hazardous Materials
- Land Use and Planning
- Mineral Resources
- Noise
- Population and Housing
- Public Services
- Recreation
- Utilities and Service Systems
- Transportation
- Tribal Cultural Resources
- Wildfire

The proposed project would result in less-than-significant impacts related to the following issue areas:

- Biological Resources
- Energy
- Hydrology and Water Quality
- Mandatory Findings of Significance

1.3 Document Organization

This IS is organized as follows:

Chapter 1: Introduction. This chapter provides an introduction to the environmental review process. It describes the purpose and organization of this document as well as presents a summary of findings.

Chapter 2: Project Description. This chapter describes the purpose of and need for the proposed project, identifies project objectives, and provides a detailed description of the project.

Chapter 3: Environmental Checklist. This chapter presents an analysis of a range of environmental issues identified in the CEQA Environmental Checklist and determines if project actions would result in no impact, a less-than-significant impact, a less-than-significant impact with mitigation incorporated, or a potentially significant impact.

Chapter 4: References. This chapter lists the references used in preparation of this IS.

2 Project Description

2.1 Project Overview

The El Dorado Irrigation District (EID) proposes to implement the Five-year Conserved Water Transfer (proposed project) which involves the transfer up to 740 acre-feet (AF) annually of its pre-1914 water right water to Westlands Water District. The proposed project includes potential annual transfers of conserved water from 2024 - 2028.

The source of water available for transfer is EID's pre-1914 direct diversion water right from the South Fork of the American River (SFAR)[1]. The water made available for transfer is water that was previously lost through evaporation and seepage from the earthen and unlined Upper Main Ditch (Upper Main Ditch) and that is now conserved through a new piped conveyance (Main Pipeline). The Main Pipeline conveys water from the El Dorado Forebay to the Reservoir 1 Water Treatment Plant (WTP) for treatment and delivery of water to EID's service area for consumptive use. The amount of water conserved with the operation of the Main Pipeline is estimated based on historic losses from the Upper Main Ditch and is dependent on the amount and timing of EID's diversions into the Main Pipeline. Based on EID's forecasted operations during the defined transfer period (July through September), EID estimates that a maximum of up to 740 AF of conserved water will be available for transfer annually. The actual transfer quantity of conserved water will depend on hydrologic conditions and consumptive demand patterns leading up to and during the transfer period during 2024 – 2028.

2.2 Background

2.2.1 EL DORADO IRRIGATION DISTRICT AND CONSERVED WATER

EID provides water to a population of more than 125,000 people within its service area for municipal, industrial, and irrigation uses, as well as wastewater treatment and recycled water services, to meet the growing needs of its customers. EID's service area is located in El Dorado County on the western slope of the Sierra Nevada Mountains. EID also owns and operates the El Dorado Hydroelectric Project, which is licensed by the Federal Energy Regulatory Commission (FERC) and consists of 4 storage reservoirs (Echo Lake, Lake Aloha, Caples Lake, Silver Lake), the El Dorado Diversion Dam on the SFAR, approximately 22 miles of flumes, canals, siphons, and tunnels that make up the El Dorado Canal, the El Dorado Forebay that re-regulates water for hydropower and consumptive uses, and a powerhouse.

EID has implemented, and continues to implement, projects, programs and policies that achieve water conservation. Existing law, under Water Code sections 1010 and 1011, establishes that a water rights holder who reduces water diversion/use as a result of conserving water is authorized to use, sell, exchange or otherwise transfer such water. Water Code section 1011 defines "water conservation" as the "use of less water to accomplish the same purpose or purposes of use allowed under the existing appropriative right." One such project that achieved significant water conservation for EID and its customers is the Upper Main Ditch Piping Project (piping project). The piping project converted the prior

[1] EID's pre-1914 water right for direct diversion of up to 70 cubic feet per second (cfs) from the SFAR; reported under Supplemental Statement of Water Diversion and Use No. S009034

water conveyance through the open and unlined Upper Main Ditch, to a secure raw water transmission pipeline (i.e., Main Pipeline). The Main Pipeline conveys water from the El Dorado Forebay to the Reservoir 1 WTP for treatment and delivery of water to EID's service area for consumptive use. The piping project was completed during spring 2022. With the new Main Pipeline, EID is able to conserve water that would have otherwise been lost through evaporation and seepage from the Upper Main Ditch. Thus, EID is able to use less water to accomplish the same domestic purpose of use, due to the water conserved through the piped conveyance system.

The amount of water conserved annually through the piping project is calculated based on the historic water losses through the Upper Main Ditch, applied to current diversions into the Main Pipeline and the water deliveries for domestic purposes to EID's Reservoir 1 WTP. The calculation of conserved water is described in Section 2.6. The amount of conserved water available for transfer is subject to adjustments to account for the estimated water historically lost from the Upper Main Ditch through seepage that reached the SFAR prior to the piping project and therefore is not available for transfer because it was previously available to downstream water users. The procedure to calculate the amount of water available for transfer is described in Section 2.6.

2.2.2 WESTLANDS WATER DISTRICT

WWD was formed in 1952 and encompasses more than 600,000 acres of farmland in western Fresno and Kings Counties. WWD serves water for approximately 600 family-owned farms that average 900 acres in size. Water is typically delivered to WWD through Central Valley Project (CVP) facilities. After it is released from CVP reservoirs, the water is typically pumped from the Sacramento-San Joaquin Delta (Delta) via the U.S Bureau of Reclamation (Reclamation) C.W. “Bill” Jones pumping plant (Jones pumping plant). In the event there is limited capacity at federal facilities, water may also be delivered via the State Water Project (SWP) facilities at the California Department of Water Resources (DWR) Harvey O. Banks pumping plant (Banks pumping plant). Water is then pumped to San Luis Reservoir or directly to WWD via the San Luis Canal.

2.3 Project Location

Figure 1 provides an overview of the location where the transfer water originates in EID's service area and the flow path to WWD's service area. The 740 AF of transfer water originates in the SFAR watershed and is made available from the operation of EID's newly constructed Main Pipeline that conveys water from the El Dorado Forebay to the Reservoir 1 WTP located in Pollock Pines in El Dorado County. Transfer water would either be diverted at the El Dorado Diversion Dam for non-consumptive hydropower purposes and conveyed via El Dorado Powerhouse back to the SFAR or in the event that the El Dorado Powerhouse is not operating the transfer water would not be diverted at the El Dorado Diversion Dam and would remain instream in the SFAR. Figure 2 provides a schematic of the flow paths where the transfer water originates in the SFAR. The transfer water would then flow into Folsom Reservoir, where the water will be re-regulated by Reclamation and would be conveyed to the lower American River (LAR) via Lake Natoma. From the LAR, water would flow to the Sacramento River and then to the Delta. Transfer water would be re-diverted at the Jones pumping plant or Banks pumping plant and pumped to San Luis Reservoir or directly to WWD via the San Luis Canal.

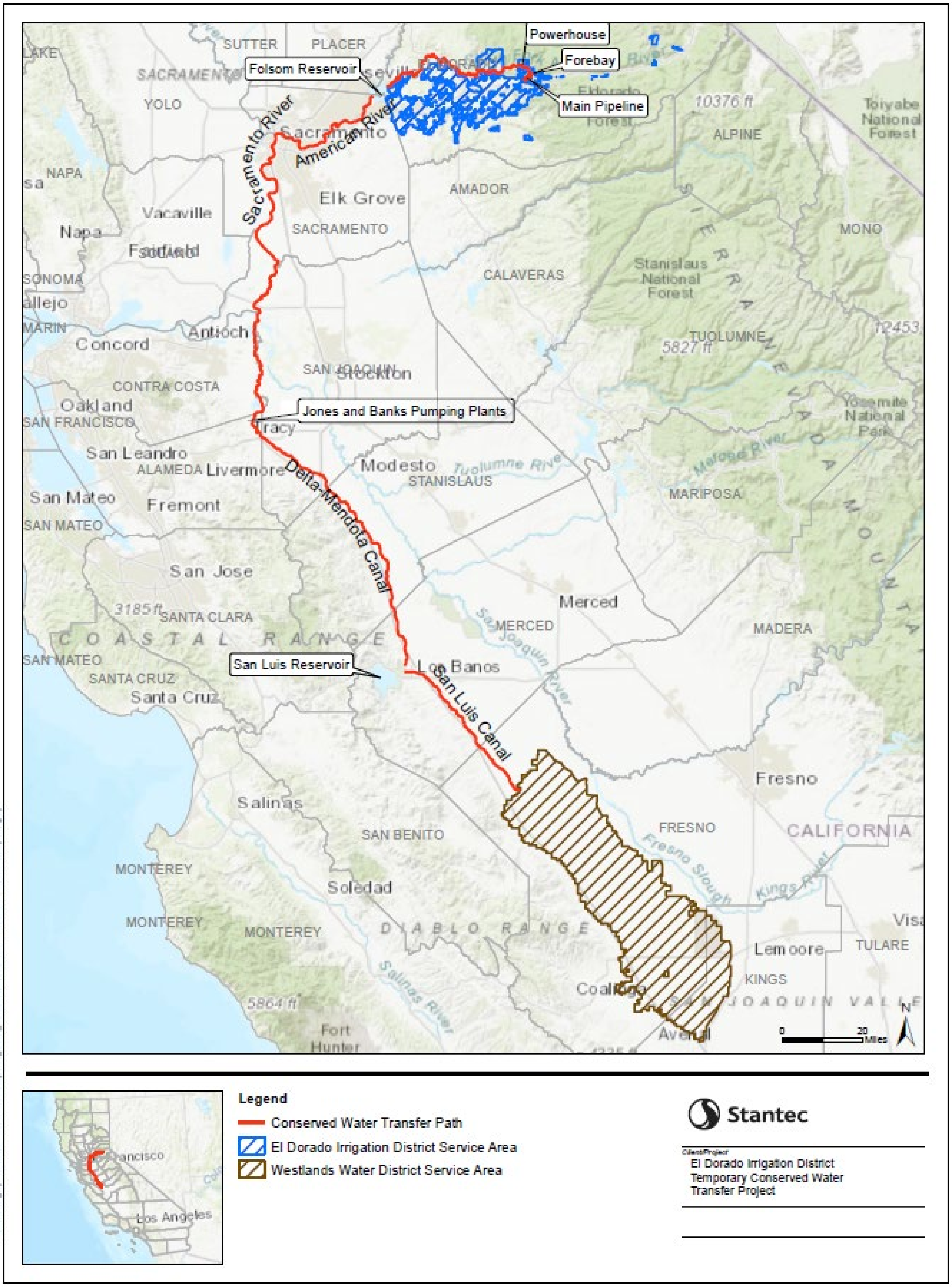


Figure 1: Project Location

2.4 Project Objectives

The project objectives are to:

1. Provide for the beneficial use of water conserved from the piping project by transferring conserved water annually during the 2024 – 2028 period; and

2. Generate non-rate revenue through the sale of water to offset the costs of EID's operations, thereby reducing the pressure on customer rate revenue.

2.5 Proposed Project

Under the proposed project, EID would transfer up to 740 AF annually of its pre-1914 water right[2] that has been conserved by EID to WWD for use in their service area during the 2024 – 2028 irrigation seasons. The source of water for this temporary water transfer is water that has been conserved by EID from the conversion of an earthen unlined ditch to a pipeline.

The 740 AF of transfer water is annually made available as a result of water conserved through EID's previously described piping project, which EID completed in 2022. By completing the piping project, EID is able to conserve water that otherwise would be lost through seepage and evaporation from the unlined ditch. As a result of the piping project, EID's water diversions from the SFAR at the El Dorado Diversion Dam to meet consumptive demands are reduced due to the conservation achieved by the piping project. Water that was previously lost through seepage and evapotranspiration from the unlined ditch is now conserved by the piping project. Therefore, EID can divert less water to meet the same customer consumptive demands as EID did prior to the pipeline project. The conserved water would either remain instream in the SFAR or be used for non-consumptive hydropower production and then returned into the SFAR and flow into Folsom Reservoir (see Figure 2).

The amount of water conserved annually through the piping project is calculated based on historic water losses through the Upper Main Ditch, applied to current diversions into the Main Pipeline and the water deliveries for domestic purposes to EID's Reservoir 1 WTP. The calculation of conserved water is described in Section 2.6. The amount of conserved water available for transfer is subject to adjustments to account for the estimated water historically lost from the Upper Main Ditch that reached the SFAR prior to the piping project and therefore is not available for transfer because it was previously available to downstream water users. The procedure to calculate the amount of water available for transfer is described in Section 2.6.

Under the proposed project, the conserved transfer water would be re-regulated by Reclamation at Folsom Reservoir and would be conveyed to the LAR via Lake Natoma. From the LAR, the transfer water would flow to the Sacramento River and then to the Delta. Transfer water would be re-diverted at the

[2] The source of water is EID's pre-1914 water right S009034 that allows for direct diversions of up to 70 cubic feet per second from the SFAR.

Jones pumping plant or Banks pumping plant and pumped to San Luis Reservoir or directly to WWD via the San Luis Canal.

The transfer water released from Folsom Reservoir for delivery to WWD would be coordinated with the systemwide operation of the CVP and SWP. Coordinated operations of the CVP and SWP are subject to compliance with the National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS) 2019 Biological Opinions for the Long-Term Operation of the CVP and SWP (2019 BiOps) (USFWS 2019; NMFS 2019), SWRCB Water Rights Decision 1641 (D-1641), as well as any temporary or modified regulatory requirements that may be in effect. Reclamation would provide the transfer water in such a manner that would not disrupt normal CVP and SWP operations, while complying with all current flow standards for the LAR from Lake Natoma to the confluence with the Sacramento River, 2019 BiOps, as well as the most up-to-date regulatory requirements for the Delta. The transfer water would also be subject to the terms and conditions specified in the Warren Act Contract between Reclamation and WWD and/or a Conveyance Agreement with DWR, which would include terms to apply carriage losses to the transfer water to protect water quality in the Delta and account for conveyance losses during delivery (e.g., up to an estimated 30% carriage loss through the Delta and additional 5% percent for conveyance losses for the use of the canal system).

The actual transfer quantity of transfer water will depend on hydrologic conditions and consumptive demand patterns leading up to and during the transfer period; however, the quantity will not exceed 740 AF annually during 2024 – 2028.

With or without the proposed transfer, the conserved water would either be diverted from the SFAR at the El Dorado Diversion Dam for non-consumptive hydropower purposes and conveyed via El Dorado Powerhouse back to the SFAR or in the event that the El Dorado Powerhouse is not operating the conserved water would not be diverted at the El Dorado Diversion Dam and would remain instream in the SFAR. Figure 2 provides a schematic of the flow paths where the conserved water originates in the SFAR. Transfer water would then remain instream to flow into Folsom Reservoir. With the proposed transfer, the conserved transfer water will then be re-regulated by Reclamation for delivery to WWD for use in their service area south of the Delta.

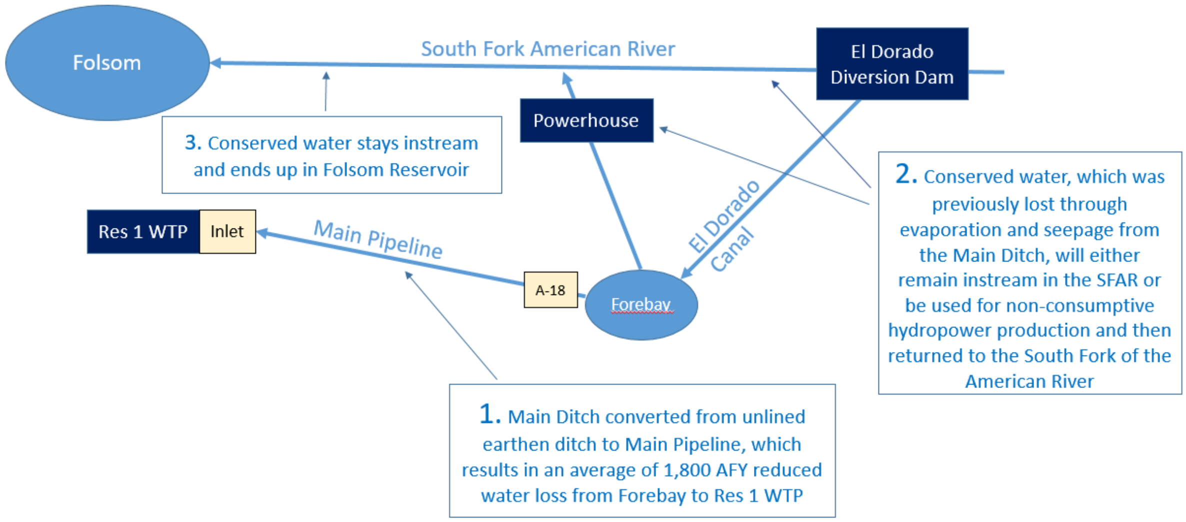


Figure 2. Schematic of Conserved Water from EID's Main Pipeline

2.6 Quantity of Water

The amount of conserved water available for transfer each year will be calculated based on historical water losses from the Upper Main Ditch in terms of percentage of water conveyed, applied to actual diversions into EID's new Main Pipeline from the El Dorado Forebay to the Reservoir 1 WTP as measured by gage A-18. This allows calculation of the amount of water that would have been historically lost through conveyance in the Upper Main Ditch, which is now conserved through conveyance through the Main Pipeline. The diversion data from gage A-18 will be used to calculate the amount of water that would have historically been lost from the Main Ditch due to evaporation and seepage prior to the piping project (i.e., conserved water available). The amount of conserved water available for transfer is subject to adjustments to account for water historically lost from the Main Ditch through seepage that reached the SFAR prior to the piping project and therefore is not available for transfer because it was previously available to downstream water users. The following discussion summarizes the findings of studies performed to 1) quantify the water losses associated with Upper Main Ditch water conveyance prior to the piping project and 2) quantify the amount of seepage losses from the Upper Main Ditch that historically returned to the SFAR. The complete technical memorandums documenting these studies are included as attachments to this IS:

1. Attachment A – Tully and Young, 2021. Updated Main Ditch Water Loss Analysis with 2020 Data. December 30, 2021.
2. Attachment B – GEI Consultants 2023. Technical Memorandum – Main Ditch Seepage Analysis. May 2, 2023.

The first step in determining the amount of water available for transfer is to determine the amount of water that would have been lost through the Upper Main Ditch prior to the piping project but which is now conserved. This amount of water that would have been lost from the Upper Main Ditch prior to the piping project is the amount of conserved water available due to operation of the new Main Pipeline. Tully and

Young (2021) used historical gage data from the Upper Main Ditch prior to the piping project to develop a methodology to calculate the amount of water loss that historically occurred in the Upper Main Ditch due to seepage and evaporation (Attachment A). The analysis included the review of past studies of water loss within the Upper Main Ditch, as well as comparisons of recent gage data collected from 2010 to 2020. Historic gage data for water diverted into the Upper Main Ditch prior to the piping project was compared with gage data taken at the inlet to the Reservoir 1 WTP, to calculate the amount of water lost along the Upper Main Ditch conveyance. This analysis concludes that water losses from the Upper Main Ditch prior to the piping project varied by flow and season as depicted in Table 1.

Table 1. Calculated water loss estimates of Main Ditch by flow and season

Flow (cfs)	October 1 – March 31	April 1 – September 30
5 - 10	28%	33%
10.1 - 15	25%	29%
15.1 - 20	18%	22%
20.1 - 25	14%	16%
25.1 - 30	12%	14%
30.1 - 35	10%	12%
35.1 - 40	9%	11%

The amount of conserved water made available through the conveyance of the Main Pipeline will be calculated using flow data measured at gage A-18 (diversions into the Main Pipeline) and applying the correlated loss percentage from the Upper Main Ditch conveyance by flow and season as presented in Table 1. As an example, if the average daily flow measured at gage A-18 from June through September was approximately 19 cfs, the loss percentage would be 22%, which equals approximately 4 cfs (8 AF/day) of conserved water. Using this methodology, approximately 1,064 AF of water would be conserved during the period from June 1 to September 30. This calculation represents the amount of water that is conserved by conveying the water through the Main Pipeline, by calculating the amount of water that would have otherwise been diverted and lost if the water had instead been conveyed through the Upper Main Ditch.

The next step in determining the amount of water available for transfer is to account for seepage water lost from the Upper Main Ditch that historically reached the SFAR prior to the piping project and therefore is not available for transfer because it was previously available to downstream water users. GEI Consultants (2023) prepared a technical analysis to evaluate the amount of seepage losses from the Upper Main Ditch that reached the SFAR prior to the piping project (Attachment B). This study used a water balance approach to evaluate the amount of water moving through the local geological formations by considering recharge variables such as rainfall/snowfall and Main Ditch seepage losses, along with discharge variables such as evapotranspiration of the forest lands and outflow from the study area, such as surface flows to the perennial streams and subsurface outflow. The analysis revealed that the rainfall/snowfall associated with different water year types was a primary factor in the amount of seepage losses reaching the SFAR, and therefore water year type would provide a reasonable means to estimate seepage losses under any particular year that could have historically reached the SFAR.

The water year categories are based on DWR's Bulletin 120 forecast of April through July unimpaired flow for the American River below Folsom Lake, which are updated monthly from February to May, with the final water year type determined in May. The water year types are classified into five categories based on the following criteria:

- Wet = exceeding 125 percent of the average
- Above Normal (AN) = less than 125 percent but greater than or equal to 100 percent of average
- Below Normal (BN) = less than 100 percent but greater than or equal to 75 percent of average
- Dry = less than 75 percent but greater than or equal to 50 percent of average
- Critically Dry (CD) = less than 50 percent of average

The results of the technical analysis are summarized in Table 2.

Table 2. Percent of Seepage Losses Reaching the SFAR by Water Year Type Based on Water Deliveries to the Main Ditch and Seepage Losses for the 2010 to 2020 Period*

Water Year Type	Percent of Seepage Losses Reaching the SFAR
WET	33%
AN	26%
BN	23%
DRY	12%
CD	6%

*Source: GEI Consultants (2023)

For the 2024 – 2028 period, EID intends to apply the most conservative estimate for the percent of seepage losses reaching the SFAR (i.e., 33% discount factor) regardless of the actual water year designations in 2024 – 2028. Therefore, 33% of the amount of conserved water available that is subject to this discount factor is not available for transfer. This discount factor only applies to seepage losses from the Upper Main Ditch and does not apply to evaporation losses. For the 2024 – 2028 period, it is conservatively estimated that 92% of the losses from the Upper Main Ditch were from seepage. The remaining 8% of losses is assumed to be from evaporation from the Upper Main Ditch, and this quantity of conserved water is not subject to the discount factor for the percent of seepage losses reaching the SFAR.

Table 3 illustrates how the amount of conserved water available for transfer is calculated. The total amount of conserved water available annually (Column A = 1,064 AF) assumes an average daily rate of diversion into the Main Pipeline of approximately 19 cfs (measured by gage A-18) for the period from June 1 through September 30. With this operational scenario, the amount of conserved water by month is 262 AF in June, 270 AF in July, 270 AF in August, and 262 AF in September (total = 1,064 AF) and the corresponding amount available for transfer is 182 AF in June, 188 AF in July, 188 AF in August, and 182 AF in September (total = 740 AF). The actual amount of conserved water available for transfer in each year will be based on actual diversions into EID's new Main Pipeline to the Reservoir 1 Water Treatment Plant as measured by gage A-18.

Table 3. Method of determining amount of conserved water available for transfer annually (AF)

	Amount of conserved water available (June – Sept.)	Evaporation Losses (8%)*	Amount of conserved water subject to SFAR discount	Discount factor (33%)**	Seepage Losses available after discount	Total available for transfer
Column	A	B	C	D	E	F
Calculation	Gage data with water loss estimates from Table 1 applied	A x 8%	A - B	C x 33%	C – D	B + E
June	262	21	241	80	161	182
July	270	22	248	82	166	188
August	270	22	248	82	166	188
September	262	21	241	80	161	182
Total	**1,064**	**86**	**978**	**324**	**654**	**740**

* For the 2024 – 2028 period, it is conservatively estimated that 92% of the losses from the Upper Main Ditch were from seepage. The remaining 8% of losses is assumed to be from evaporation and therefore not subject to the discount factor for the percent of seepage losses reaching the SFAR.

** For the 2024 – 2028 period, EID intends to apply the most conservative discount factor for the percent of seepage losses reaching the SFAR (i.e., 33%) regardless of the actual water year designations in 2024 – 2028.

2.7 Reporting and Tracking Procedures

This section describes the procedures EID proposes to employ to report and track information necessary to verify and adjust if needed the amount of conserved water available for transfer.

1. Estimating the amount of conserved water available for transfer

    - EID prepares forecast of June 1 through September 30 diversions into the Main Pipeline (gage A-18) for delivery to Reservoir 1 WTP.

    - Using the forecasted diversions, EID estimates the amount of water available for transfer by applying the methods described in the previous section (Quantity of Water – Table 3).

2. Reporting diversions

    - EID compiles gage A-18 data on a monthly basis to track the actual diversions into the Main Pipeline.

    - Using gage A-18 data, EID provides notification of any necessary adjustments to the amount of conserved water available for transfer.

    - EID provides final report calculating the amount of conserved water made available for transfer by applying the methods described in the previous section (Quantity of Water – Table 3). Consistent with Water Code 1011, the final report calculates the reduction in the use of the District's direct diversion water right through the reduced water losses achieved by the conservation piping project.

3. Reporting transfer water delivery to Jones pumping plant or Banks pumping plant

    - EID to provide records documenting the conveyance of transfer water from Folsom Reservoir to the Jones pumping plant or Banks pumping plant.

    - EID to provide documentation that the delivery of transfer water complied with all current flow standards for the LAR from Lake Natoma to the confluence with the Sacramento River, 2019 BiOps, as well as the most up-to-date regulatory requirements for the Delta.

4. Summary Report
    - Following transfer, EID to provide a summary report showing an accounting of this water to verify it is trackable.

2.8 Schedule

The conveyance of conserved water from Folsom Reservoir would begin as soon as federal and/or regulatory approvals are received, and WWD and EID have coordinated with Reclamation each year. Reclamation would provide the conserved water available for transfer from Folsom Reservoir to federal or state export facilities on a schedule that is mutually agreeable and/or beneficial to Reclamation and WWD, and in such a manner that would not disrupt normal CVP and SWP operations while complying with all current flow standards for the LAR from Lake Natoma to the confluence with the Sacramento River, biological opinions for the coordinated operation of the SWP and the CVP, as well as the most up-to-date regulatory requirements for the Delta as directed by the SWRCB.

3 Environmental Checklist

1. Project Title:	El Dorado Irrigation District Five-year Conserved Water Transfer
2. Lead Agency Name and Address:	El Dorado Irrigation District 2890 Mosquito Road Placerville, CA 95667
3. Contact Person and Phone Number:	Brian Deason, Environmental Resources Supervisor El Dorado Irrigation District Phone: (530) 642-4064 bdeason@eid.org
4. Project Location:	Water would be released from El Dorado Irrigation District facilities in El Dorado County; flow through El Dorado, Sacramento, San Joaquin, Stanislaus, Merced, Fresno, and Kings Counties.
5. Project Sponsor's Name and Address:	El Dorado Irrigation District
6. General Plan Designation:	Various, see Section 3.11
7. Zoning:	Various, see Section 3.11
8. Description of Project:	EID proposes to transfer up to 740 acre-feet (AF) annually of its pre-1914 water right water to WWD for use during the 2024 – 2028 period. The source of water for this water transfer is water that has been conserved by EID from the conversion of an earthen unlined ditch to a pipeline. Additional detail is provided in Section 2, "Project Description."
9. Surrounding Land Uses and Setting:	See "Environmental Setting" discussion under each issue area in Chapter 3, "Environmental Checklist."
10. Other Public Agencies Whose Approval is Required:	See Section 2.9, "Regulatory Requirements, Permits, and Approvals."

Environmental Factors Potentially Affected

The environmental factors checked below would potentially be affected by this project (i.e., the project would involve at least one impact that is a “Potentially Significant Impact”), as indicated by the checklist on the following pages.

☐ Aesthetics	☐ Agricultural and Forestry	☐ Air Quality
☐ Biological Resources	☐ Cultural Resources	☐ Energy
☐ Geology/Soils	☐ Greenhouse Gas Emissions	☐ Hazards and Hazardous Materials
☐ Hydrology/Water Quality	☐ Land Use/Planning	☐ Mineral Resources
☐ Noise	☐ Population/Housing	☐ Public Services
☐ Recreation	☐ Transportation/Traffic	☐ Tribal Cultural Resources
☐ Utilities/Service Systems	☐ Wildfire	☐ Mandatory Findings of Significance

Determination

On the basis of this initial evaluation:

☒ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because revisions to the project have been made by or agreed to by the project proponent. A MITIGATED NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have an impact on the environment that is “potentially significant” or “potentially significant unless mitigated” but at least one effect (1) has been adequately analyzed in an earlier document pursuant to applicable legal standards and (2) has been addressed by mitigation measures based on the earlier analysis, as described on attached sheets. An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, because all potentially significant effects (a) have been analyzed adequately in an earlier ENVIRONMENTAL IMPACT REPORT or NEGATIVE DECLARATION pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier ENVIRONMENTAL IMPACT REPORT or NEGATIVE DECLARATION, including revisions or mitigation measures that are imposed upon the project, nothing further is required.

(signature)	May 14, 2024
Signature	Date
Brian Deason, Environmental Resources Supervisor	
Printed Name	

4 Impact Analysis

4.1 Aesthetics

I. AESTHETICS Would the Project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
a) Have a substantial adverse effect on a scenic vista?				X
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a State scenic highway?				X
c) In non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?				X
d) Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?				X

4.1.1 ENVIRONMENTAL SETTING

The proposed project would transfer up to 740 AF of conserved water through existing waterways and infrastructure from EID facilities located in El Dorado County to the WWD service area in Fresno and Kings Counties. Highway 50 from Placerville to eastern Lake Tahoe is an Officially Designated Scenic Highway and Highway 49 is designated as an Eligible scenic highway by the California Department of Transportation California State Scenic Highway System (Caltrans 2024). No designated state scenic highways are located within the WWD service area (Caltrans 2024). The El Dorado County General Plan (General Plan) does not have any designated scenic vistas, however maintaining natural landscapes are a focus identified in multiple goals and objectives in the General Pan (El Dorado County 2004, as amended). No designated scenic vistas are located within the WWD service area, however both the Fresno County and Kings County general plans contain policies for the preservation of agriculture and scenic resources (Fresno County 2000; Kings County 2010). The LAR (from Lake Natoma to the confluence with the Sacramento River) is designated under the National Wild and Scenic Rivers Act of 1968 (National and Wild Scenic Rivers System 2024).

Impact Discussion

a) Would the Project have a substantial adverse effect on a scenic vista?

Finding: No Impact

There are no formally designated scenic vistas in or near the proposed project nor does the proposed project include any changes in the visual environment or changes in baseline conditions such that changes to a scenic vista or natural landscape would occur, therefore there would be no impact to scenic vistas.

b) Would the Project substantially damage scenic resources, including, but not limited to, trees, rock outcroppings and historic buildings within a State Scenic Highway?

Finding: No Impact

As discussed in Section 3.1.1, Environmental Setting, above, Highway 50 is the only Officially Designated State Scenic Highway near the proposed project and Highway 49 is listed as an Eligible State Scenic Highway within the vicinity of the proposed project (Caltrans 2024). However, the proposed project would involve the transfer of conserved water, which would not change or alter any of the views from or around Highway 50 or Highway 49. There would be no impact.

c) Would the Project in non-urbanized areas, substantially degrade the existing visual character or quality of public views of the site and its surroundings? (Public views are those that are experienced from publicly accessible vantage point). If the project is in an urbanized area, would the project conflict with applicable zoning and other regulations governing scenic quality?

Finding: No Impact

The proposed project would not result in any substantial changes in flows in the existing waterways and infrastructure as the transfer water is conveyed from EID facilities to the WWD service area. No construction or substantial operational changes would occur in the area. Therefore, the proposed project would result in no impact related to the existing visual character and quality of public views of the site and its surroundings in non-urbanized areas or conflict with any applicable zoning and other regulations governing scenic quality in urbanized areas.

d) Would the Project create a new source of substantial light or glare which would adversely affect day or nighttime views in the area?

Finding: No Impact

The proposed project does not involve any construction or operational activities that would result in additional light or glare in the area. There would be no impact.

4.2 Agricultural and Forestry Resources

II. AGRICULTURAL AND FORESTRY RESOURCES Would the Project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?				X
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?				X
c) Conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?				X
d) Result in the loss of forest land or conversion of forest land to non-forest use?				X
e) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?				X

4.2.1 ENVIRONMENTAL SETTING

Agricultural uses and zoning occur in both the EID and WWD service areas, and the lands include areas that are designated as Prime Farmland, Farmland of Statewide Importance, and Unique Farmland by the California Department of Conservation (DOC) (DOC 2018). Approximately 5 million AF of water from Reclamation's Central Valley Project is used for agriculture (Reclamation 2024a).

Under the California Land Conservation Act of 1965, also known as the Williamson Act, local governments can enter into contracts with private property owners to protect land (within agricultural preserves) for agricultural and open space purposes. Lands under active Williamson Act contracts are located in both the EID and WWD service areas (DOC 2024).

The following California Public Resources Code sections are referenced in the impact discussion in Section 3.2.2 below:

- California Public Resources Code Section 12220(g): "Forest land" is land that can support 10-percent native tree cover of any species, including hardwoods, under natural conditions, and that allows for management of one or more forest resources, including: timber, aesthetics, fish and wildlife, biodiversity, water quality, recreation, and other public benefits.
- California Public Resources Code Section 4526: "Timberland" means land, other than land owned by the federal government and land designated by the board as experimental forest land, which is available for, and capable of, growing a crop of trees of a commercial species used to

produce lumber and other forest products, including: Christmas trees. Commercial species shall be determined by the board on a district basis.

- California Public Resources Code Section 51104(g): "Timberland production zone" or "TPZ" means an area which has been zoned pursuant to Section 51112 or 51113 and is devoted to and used for growing and harvesting timber, or for growing and harvesting timber and compatible uses, as defined in subdivision (h). With respect to the general plans of cities and counties, "timberland preserve zone" means "timberland production zone".

4.2.2 IMPACT DISCUSSION

a) Would the Project convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?

Finding: No Impact

As discussed in Section 3.2.1, Environmental Setting, above, EID and WWD service areas includes areas that are designated as Prime Farmland, Farmland of Statewide Importance, and Unique Farmland under the Farmland Mapping and Monitoring Program (FMMP) (DOC 2018). The transfer of conserved water would not result in reductions of supplies to existing customers within the EID service area thus no project-related changes in farmland would occur in the County that could impact farmland. The conserved water that was previously lost water through evaporation and seepage from the Upper Main Ditch, would be used for non-consumptive hydropower production and then returned to the SFAR and then flow to Folsom Reservoir. From Folsom Reservoir, the water would be re-regulated for delivery to WWD for use in their service areas south of the Delta, helping to sustain agricultural operations within the WWD service area during the current drought. The proposed project would not convert farmland to nonagricultural uses and could prevent farmland from becoming fallowed. No impact would occur.

b) Would the Project conflict with existing zoning for agricultural use or a Williamson Act contract?

Finding: No Impact

As discussed under question “a” above, the proposed project would not result in any changes to farmland, including lands zoned for agriculture or Williamson Act contracted lands, nor would there be any reduction in water provided to any of these lands. There would be no impact.

c) Would the Project conflict with existing zoning for, or cause rezoning of, forest land (as defined in Public Resources Code section 12220(g)), timberland (as defined by Public Resources Code section 4526), or timberland zoned Timberland Production (as defined by Government Code section 51104(g))?

Finding: No Impact

There are numerous areas that meet the definition of forestland, timberland, and timberland production zones within EID’s service area and in the vicinity of the proposed project, however, the proposed project would not result in changes of water supplies that flow into these areas and would thus not result in any physical changes. The transfer of conserved water would not result in changes to lands zoned for forest use or timberland use, nor would there be any changes in water provided to any of these lands. No timberland is located in the WWD service area. There would be no impact.

d) Would the Project result in the loss of forest land or conversion of forest land to non-forest use?

Finding: No Impact

As discussed under question “c” above, the proposed project would not result to any physical changes to forest land, nor would there be any changes in water supplies provided to forest land in the area. No construction or substantial operational changes would occur as a result of the proposed project such that loss of forest land or conversion of forest land to non-forest use would occur. There would be no impact.

e) Would the Project involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use or conversion of forest land to non-forest use?

Finding: No Impact

As discussed under question “a” through “d” above, the proposed project would not result in any changes to the physical environment or reductions in water use such that conversion of agriculture or forest lands would occur. There would be no impact.

4.3 Air Quality

III. AIR QUALITY Would the Project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
a) Conflict with or obstruct implementation of the applicable air quality plan?				X
b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?				X
c) Expose sensitive receptors to substantial pollutant concentrations?				X
d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?				X

4.3.1 ENVIRONMENT SETTING

The EID service area is located in the Mountain Counties Air Basin which lies along the northern Sierra Nevada, close to or contiguous with the Nevada border, and covers an area of roughly 11,000 square miles. The El Dorado County Air Quality Management District attains and maintains air quality conditions in El Dorado County and the Amador County Air Pollution Control District attains and maintains air quality conditions in Amador County.

The WWD service area is located in the San Joaquin Valley Air Basin, which includes all of Fresno and Kings Counties as well as several other Central Valley counties. The San Joaquin Valley Air Pollution Control District implements air quality management strategies to attain and maintain Central Valley air quality standards.

GENERAL AIR QUALITY ENVIRONMENTAL SETTING

The federal Clean Air Act and the California Clean Air Act required the U.S. Environmental Protection Agency (EPA) and California Air Resources Board (ARB) to establish health-based air quality standards at the federal and state levels. National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS) were established for the following criteria pollutants: carbon monoxide (CO), ozone, sulfur dioxide (SO2), nitrogen dioxide (NO^2), particulate matter less than 10 microns in diameter (PM_{10}), particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), and lead. These standards have been established with a margin of safety to protect the public's health. Both EPA and ARB designate areas of the state as attainment, nonattainment, maintenance, or unclassified for the various pollutant standards according to the federal Clean Air Act (CAA) and the California Clean Air Act (CCAA), respectively.

An "attainment" designation for an area signifies that pollutant concentrations did not violate the NAAQS or CAAQS for that pollutant in that area. A "nonattainment" designation indicates that a pollutant concentration violated the standard at least once, excluding those occasions when a violation was caused by an exceptional event, as identified in the criteria. A "maintenance" designation indicates that the area previously had nonattainment status and currently has attainment status for the applicable pollutant; the area must demonstrate continued attainment for a specified number of years before it can be redesignated as an attainment area. An "unclassified" designation signifies that data do not support either an attainment or a nonattainment status.

Under the NAAQS, the EID and WWD service areas are designated as nonattainment for 8-hour ozone, and the western portion of the EID service area and all of the WWD service area are designated as nonattainment for $PM_{2.5}$. Under the CAAQS, the EID and WWD service areas are designated as nonattainment for ozone and PM_{10}, and the WWD service area is designated as nonattainment for $PM_{2.5}$ (California Air Resources Board [CARB] 2022).

4.3.2 IMPACT DISCUSSION

a) Conflict with or obstruct implementation of the applicable air quality plan?

Finding: No Impact

Air quality plans describe air pollution control strategies to be implemented by an air district, city, county, or region. No construction activities are proposed with the project and no long-term operational or maintenance activities that would generate emissions are proposed. The conserved water would augment WWD existing water supply for use in their service area and would be used for irrigation of agricultural crops. Although agricultural operations may generate air quality emissions, these land uses are existing land uses that would occur without the project. If the proposed project did not occur, WWD would buy water from another water purveyor, pump groundwater to serve the existing land uses in their service areas, and/or fallow existing irrigated agricultural crops. Because water transfer operations and agricultural operations would be within the historic range of typical use, the proposed project would not generate new emissions that would conflict with or obstruct implementation of an air quality plan. There would be no impact.

b) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard?

Finding: No Impact

The analysis of cumulative effects focuses on whether implementing a specific project would result in cumulatively considerable emissions to a significant cumulative impact. For the reasons discussed under "a" above, the proposed project would not generate new air quality emissions and existing agriculture water use would not increase as a result of the project. Therefore, the proposed project would not result in a cumulatively considerable incremental contribution to a significant cumulative impact. There would be no impact.

c) Expose sensitive receptors to substantial pollutant concentrations?

Finding: No Impact

Sensitive receptors are defined as facilities or land uses (e.g., residences, schools, hospitals) that include members of the population that are particularly sensitive to the effects of air pollutants, such as children, the elderly, and people with illnesses. Although there are numerous sensitive receptors within the vicinity of the proposed project, the transfer of water would not result in any construction or substantial changes in operational activities that would result in increased emissions which could adversely affect these sensitive receptors. There would be no increases in pollutant concentrations as a result of the proposed project. There would be no impact.

d) Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people?

Finding: No Impact

Land uses associated with odor complaints typically include agricultural uses, wastewater treatment plants, food processing plants, chemical plants, composting, refineries, landfills, dairies, fiberglass molding, and other industrial uses. As discussed under questions “a” through “c” above, the proposed project would not result in any construction activities or substantial changes in operations that could result in increased emissions or pollutants in the area. Therefore, the proposed project would not create new objectionable odors or any other emissions that would adversely affect a substantial number of people. There would be no impact.

4.4 Biological Resources

IV. BIOLOGICAL RESOURCES Would the Project:	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporation**	**Less than Significant Impact**	**No Impact**
a) Have a substantial adverse effect, either directly or through habitat modifications, on any species in local or regional plans, policies, or regulations, or regulated by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?			X	
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the California Department of Fish or U.S. Fish and Wildlife Service?				X
c) Have a 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?				X
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?			X	
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?				X
f) Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or State habitat conservation plan?				X

4.4.1 ENVIRONMENTAL SETTING

The proposed project involves the transfer of up to 740 AF annually of conserved water that originates from the operation of EID's facilities located in El Dorado County, California. Water that would have historically been diverted for consumptive use and lost in the Upper Main Ditch conveyance through seepage and evaporation is now water that is conserved by the Main Pipeline conveyance and either remains instream or is diverted for non-consumptive hydropower production and then returned to the SFAR. Thus, water previously lost through Upper Main Ditch conveyance losses is now conserved water being made available for the proposed transfer (see Section 2.5 for complete description of proposed project). Conserved transfer water would be conveyed from Folsom Reservoir, through Lake Natoma, the LAR, the Sacramento River, the Delta, and ultimately be delivered to WWD for use in their service area located south of the Delta.

While there are numerous special status terrestrial species that are present within the project area, potential effects to these species are not analyzed further in this document because no effects to terrestrial species are anticipated. Implementation of the proposed project involves the potential transfer of up to 740 AF annually of conserved water through existing facilities and natural waterways from June through September during each year of the five-year period from 2024 - 2028. The proposed project does not involve any ground disturbance or construction. Given the lack of ground disturbance or construction, the small volume of water to be transferred, and the short duration of an annual transfer, it is reasonable to conclude that there would be no effect to these terrestrial species or their habitat and therefore, potential impacts to these species are not analyzed further in this document.

The affected environment for aquatic biological resources in the Action Area is described below in two parts: 1) the SFAR upstream of Folsom Reservoir and 2) Folsom Reservoir to the WWD's service area.

SFAR upstream of Folsom Reservoir

The SFAR is located on the west slope of the Sierra Nevada mountain range and is characterized by forested slopes and steep canyons. The SFAR is characterized by deep, fast runs flowing into cascades or falls, deep pools, and riffle habitat that support both native and non-native fish species. Fish species present in the South Fork between El Dorado Diversion Dam and Folsom Reservoir include hardhead (Mylopharadon conocephalus), Sacramento pikeminnow (Ptychocheilus grandis), speckled dace (Rhinichthys osculus), California roach (Lavinia symmetricus), Sacramento sucker (Catostomus occidentalis), rainbow trout (Oncorhynchus mykiss), brown trout (Salmo trutta), brook trout (Salvelinus fontinalis), prickly sculpin (Cottus asper), and riffle sculpin (Cottus gulosus). Special status aquatic biological resources that are documented in the SFAR and/or its tributaries include foothill yellow-legged frog (Rana boylii), red-legged frog (Rana draytonii), and western pond turtle (Actinemys marmorata).

EID diverts water from the SFAR at the El Dorado Diversion Dam near Kyburz. Water not diverted at the El Dorado Diversion Dam remains instream in the SFAR and flows to Folsom Reservoir. If diverted, water is conveyed approximately 22 miles via the El Dorado Canal to the El Dorado Forebay located in Pollock Pines. At the El Dorado Forebay, water is re-regulated and delivered for either consumptive use through the Main Pipeline or for hydropower generation at the El Dorado Powerhouse. Water that is used for hydropower generation is returned to SFAR and flows to Folsom Reservoir. EID's conserved water either remains instream in the SFAR below the El Dorado Diversion Dam or is used for non-consumptive hydropower production and then returned into the SFAR.

Folsom Reservoir to the WWD's Service Area

Folsom Reservoir is the principal reservoir on the American River, with a maximum storage capacity of 977,000 AF. Reclamation operates Folsom Dam and Reservoir for many reasons including water supply, water quality in the Delta (primarily to prevent salinity intrusion from the Pacific Ocean), and for endangered and threatened species. Reclamation has contracts with the following agencies for water supply from Folsom Reservoir: EID, City of Roseville, Sacramento County Water Agency, Sacramento County (assignment from Sacramento Municipal Utility District), San Juan Water District, East Bay Municipal Utility District, Sacramento Municipal Utility District, Placer County Water Agency, and City of Folsom (Reclamation 2022).

Folsom Reservoir supports a "two-story" fishery during the stratified portion of the year (April through November), with warmwater species using the upper, warmwater layer and coldwater species using the deeper, colder portion of the reservoir. Native species that occur in the reservoir include hardhead and Sacramento pikeminnow. However, introduced largemouth bass, smallmouth bass, spotted bass, bluegill, black and white crappie (Pomoxis nigromaculatus and P. annularis), and catfish (Ictalurus spp. and Ameiurus spp.) constitute the primary warmwater sport fisheries of Folsom Reservoir. The coldwater sport species present in the reservoir include rainbow and brown trout, kokanee salmon (Oncorhynchus nerka), and Chinook salmon (Oncorhynchus tshawytscha), all of which are currently or have been stocked by California Department of Fish and Wildlife (CDFW). Although brown trout are no longer stocked, a population still remains in the reservoir. Because these coldwater salmonid species are stream spawners, they do not reproduce within Folsom Reservoir. However some spawning by one or more of these species may occur in the tributaries upstream of Folsom Reservoir (Reclamation 2015; 2022).

Folsom Reservoir's coldwater pool is important not only to the reservoir's coldwater fish species identified above, but also is important to LAR fall-run Chinook salmon and Central Valley steelhead (Oncorhynchus mykiss). Seasonal releases from the reservoir's coldwater pool provide thermal conditions in the LAR that support annual in-river production of these salmonid species. However, Folsom Reservoir's coldwater pool must be managed to facilitate coldwater releases during the warmest months (July through September) to provide maximum thermal benefits to over-summering juvenile steelhead rearing in the LAR, and coldwater releases during October and November to maximally benefit fall-run Chinook salmon immigration, spawning, and embryo incubation.

Consequently, management of the reservoir's coldwater pool on an annual basis is essential to providing thermal benefits to both fall-run Chinook salmon and steelhead, within the constraints of coldwater pool availability (Reclamation 2015; 2022).

Releases from Folsom Dam are conveyed to Lake Natoma, which serves as the Folsom Dam afterbay. Lake Natoma is operated as a re-regulating reservoir that accommodates the diurnal flow fluctuations caused by the power peaking operations at Folsom power plant. Nimbus Dam, along with Folsom Dam, regulate water releases to the LAR. The LAR flows approximately 23-mile from Nimbus Dam to the confluence of the Sacramento River. The Sacramento River flows approximately 55 miles where it meets the San Joaquin River at the head of the Delta. Federal- and/or State- listed species within the Action Area include (winter- and spring-run Chinook salmon, steelhead, delta smelt [Hypomesus transpacificus], and green sturgeon [Acipenser medirostris]); and State species of special concern (late fall-run Chinook salmon, green sturgeon, hardhead, longfin smelt [Spirinchus thaleichthys], river lamprey [Lamptera ayresi], Sacramento perch [Archoplites interruptu], Sacramento splittail [Pogonichthys macrolepidotus], and California roach) (Reclamation 2015; 2022).

The Delta estuary and tributaries also support a diverse community of resident fish which includes, but is not limited to, Sacramento sucker, prickly and riffle sculpin, California roach, hardhead, hitch, Sacramento blackfish, Sacramento pikeminnow, speckled dace, Sacramento splittail, tule perch, inland silverside, black crappie, bluegill, green sunfish, largemouth bass, smallmouth bass, white crappie, threadfin shad, carp, golden shiner, black and brown bullhead, channel catfish, white catfish, and a variety of other species which inhabit the more estuarine and freshwater portions of the Bay-Delta system (Moyle 2002).

From the Delta, deliveries to WWD are re-diverted at the Jones pumping plant or Banks pumping plant and pumped to San Luis Reservoir or directly to WWD via the San Luis Canal. In the event there is limited capacity at federal facilities, water may also be delivered via the SWP facilities at DWR's Banks pumping plant.

Reclamation operates Folsom Reservoir in coordination with the systemwide operation of the CVP and SWP. Coordinated operations of the CVP and SWP are subject to compliance with the 2019 BiOps (USFWS 2019; NMFS 2019), SWRCB D-1641, as well as any temporary or modified regulatory requirements that may be in effect. Reclamation facilitates water transfers in such a manner that does not disrupt normal CVP and SWP operations, while complying with all current flow standards for the LAR from Lake Natoma to the confluence with the Sacramento River, 2019 BiOps, as well as the most up-to-date regulatory requirements for the Delta. The transfer water would also be subject to the terms and conditions specified in the Warren Act Contract between Reclamation and WWD and/or a Conveyance Agreement with DWR, which would include terms to apply carriage losses to the transfer water to protect water quality in the Delta and account for conveyance losses during delivery (e.g., up to an estimated 30% carriage loss through the Delta and additional 5% percent for conveyance losses for the use of the canal system).

4.4.2 IMPACT DISCUSSION

a) Have a substantial adverse effect, either directly or through habitat modifications, on any species in local or regional plans, policies, or regulations, or regulated by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?

Finding: Less Than Significant

Potential Effects Above Folsom

There would be no impact to biological resources, either directly or through habitat modifications, on any species in local or regional plans, policies, or regulations, or regulated by the CDFW or USFWS with the proposed project at facilities and waterways upstream of Folsom Reservoir. With or without the proposed project, the conserved water would either remain instream in the SFAR or be used for non-consumptive hydropower production and then returned into the SFAR and flow into Folsom Reservoir. Therefore, the delivery of up to 740 AF of EID's conserved water to Folsom Reservoir is considered the baseline condition. As such, the proposed transfer will not change the timing or volume of water entering Folsom Reservoir and would not influence the temperature of the water entering Folsom Reservoir. Because there would be no change to instream flows or water temperatures upstream of Folsom Reservoir associated with implementation of the proposed project, there would be no impact, direct or indirect, to protected species that may be present in the area upstream of Folsom Reservoir.

Potential Effects Below Folsom Reservoir

As previously described, there would be no change to instream flows or water temperature in the SFAR upstream of Folsom Reservoir associated with the proposed project. As such, there would be no change in reservoir storage or reservoir water temperature or corresponding changes to the volume of coldwater pool in Folsom Reservoir with implementation of the proposed project. Because there would be no change in the volume of the coldwater pool, implementation of the proposed project would not affect Reclamation's management of the coldwater pool for the protection of aquatic species downstream of Folsom Reservoir.

Reclamation would be responsible for coordination and scheduling the volume and timing of releases of transfer water from Folsom Reservoir for delivery to the WWD. For previous EID reservoir re-operation transfers, Reclamation has made releases of approximately 9 cfs (18 acre-feet per day) from Folsom Reservoir to facilitate delivery of non-Project water to WWD for use in their service area south of the Delta (Reclamation 2022; EID 2022). Using the operational scenario provided in Section 2.6, the amount of conserved water that would be available for transfer each year with implementation of the proposed project is 182 AF in June, 188 AF in July, 188 AF in August, and 182 AF in September (total = 740 AF). With these volumes, releases from Folsom Reservoir as small as approximately 4 cfs (8 acre-feet per day) would be sufficient to convey the transfer water downstream for delivery to the WWD's service area. For comparison, instream flows in the LAR in 2022, a dry water year, ranged from approximately 1,500 cfs to 5,300 cfs during June through September (DWR 2023a). In 2021, a critically dry water year, instream flows in the LAR ranged from approximately 600 cfs to 2,000 cfs from June through September (DWR 2023b). Even under the lowest flow condition during this period (i.e., 600 cfs) releases of 4 cfs – 9 cfs would only represent 0.6% – 1.5% of the total flow in the LAR. This exceedingly small change in instream flows in the LAR with implementation of the proposed project would have no discernable effects relative to the No Action Alternative. As such, there would be minimal impact, direct or indirect, to aquatic resources in the LAR with implementation of the proposed project.

From the LAR, transfer water would flow to the Sacramento River and then to the Delta. The relative proportion of transfer water would be further reduced when introduced to the flows in the Sacramento River and Delta. As such, discernable effects to aquatic resources would be unlikely in the Sacramento River or Delta with implementation of the proposed project.

From the Delta, transfer water would be re-diverted at the Jones pumping plant or Banks pumping plant and pumped to San Luis Reservoir or directly to WWD via the San Luis Canal. Once re-diverted at the Jones pumping plant or Banks pumping plant, the transfer water would be conveyed in existing canals and facilities that do not provide suitable habitat for special status aquatic species. As such, there would be no impact to aquatic resources from the Jones pumping plant or Banks pumpng plant to the WWD's service area with implementation of the proposed project.

Implementation of the proposed project would result in no change to reservoir inflow and/or storage or corresponding changes to the volume of coldwater pool in Folsom Reservoir. The proposed project would not result in a change of sufficient magnitude to instream flows along waterways that would be utilized to convey the transfer water from Folsom Reservoir to WWD's service area south of the Delta to affect protected species that may be present in the area downstream of Folsom Reservoir. Additionally, the conveyance of transfer water from Folsom Reservoir to WWD's service area would be coordinated with the systemwide operation of the CVP and SWP, including compliance with the 2019 BiOps, as well as the most up-to-date regulatory requirements for the Delta as directed by the SWRCB. As such, potential impacts, direct or indirect, to protected species that may be present in the area downstream of Folsom Reservoir would be considered less than significant.

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the California Department of Fish or U.S. Fish and Wildlife Service?

Finding: No Impact

With or without the proposed project, there would be no change to instream flows upstream of Folsom Reservoir associated with implementation of the proposed project and as such there would be no potential adverse effect on any riparian habitat or other sensitive natural community. The release of conserved water from Folsom Reservoir for delivery to WWD would be integrated into Reclamation's current operations and is anticipated to be within the historic range of operational levels and flow regimes for all involved waterways. Given the relatively small quantity of conserved water to be transferred and that the operations would be coordinated with system-wide CVP and SWP operations, there would be no adverse effects on any riparian habitat or other sensitive natural community. There would be no impact.

c) Have a 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?

Finding: No Impact

With or without the proposed project, there would be no change to instream flows upstream of Folsom Reservoir associated with implementation of the proposed project and as such there would be no potential adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act. The release of conserved water from Folsom Reservoir for delivery to WWD would be integrated into Reclamation's current operations and is anticipated to be within the historic range of operational levels and flow regimes for all involved waterways. Given the relatively small quantity of conserved water to be transferred and that the operations would be coordinated with system-wide CVP and SWP operations, there would be no adverse effects on federally protected wetlands as defined by Section 404 of the Clean Water Act. There would be no impact.

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?

Finding: Less than Significant

With or without the proposed transfer, there would be no change to instream flows upstream of Folsom Reservoir associated with implementation of the proposed project and as such there would be no potential to substantially interfere with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites. The release of conserved water from Folsom Reservoir for delivery to WWD would be integrated into Reclamation's current operations and is anticipated to be within the historic range of operational levels and flow regimes for all involved waterways. Given the relatively small quantity of conserved water to be transferred and that the operations would be coordinated with system-wide CVP and SWP operations, there would negligible potential for the proposed project to interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors or impede the use of native wildlife nursery sites. Impacts would be less than significant.

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

Finding: No Impact

The proposed project would not conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance. There would be no impact.

f) Conflict with the provisions of an adopted habitat conservation plan, natural community conservation plan, or other approved local, regional, or State habitat conservation plan?

Finding: No Impact

The proposed project would not conflict with a habitat conservation plan, natural community conservation plan, or other approved local, regional, or state habitat conservation plan. There would be no impact.

4.5 Cultural Resources

V. CULTURAL RESOURCES Would the Project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
a) Cause a substantial adverse change in the significance of a historical resource as identified in Section 15064.5?				X
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?				X
c) Disturb any human remains, including those interred outside of dedicated cemeteries?				X

4.5.1 ENVIRONMENTAL SETTING

The Sierra Nevada and Central Valley of California contain a wide range of ecological zones that have supported prehistoric and historic people for thousands of years. Their long record of occupation and activities has left numerous prehistoric and historic-era remains on the landscape, including scattered artifacts, the remains of seasonal and long-term occupation, human interments, buildings, structures, and in some cases heavily altered landscapes.

4.5.2 IMPACT DISCUSSION

a) Cause a substantial adverse change in the significance of a historical resource as identified in Section 15064.5?

Finding: No Impact

The proposed project does not include any construction activities or substantial operational changes that could impact historical resources. The conserved water would be transferred through existing facilities and would not result in construction or alteration of any of these facilities. There would be no impact.

b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to Section 15064.5?

Finding: No Impact

The proposed project does not include any construction activities or substantial operational changes and there would be no ground disturbing activities that would impact archaeological resources. The conserved water would be transferred through existing facilities and would not result in construction or alteration of any of these facilities. There would be no impact.

c) Disturb any human remains, including those interred outside of dedicated cemeteries?

Finding: No Impact

The proposed project does not include any construction activities or substantial operational changes that could impact human remains. The conserved water would be transferred through existing facilities and would not result in construction or alteration of any of these facilities. No ground disturbing activities would occur as part of the proposed project. There would be no impact.

4.6 Energy

VI. Energy **Would the Project:**	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporation**	**Less than Significant Impact**	**No Impact**
a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?			X	
b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?				X

4.6.1 ENVIRONMENTAL SETTING

EID uses utility grid power throughout its service area through approximately 168 different Pacific Gas & Electric Company (PG&E) service connections to provide drinking water, wastewater, recycled water, and recreational services. EID also operates the 21-megawatt El Dorado Hydroelectric Project, which is located on the SFAR and utilizes direct diversions and releases from storage from four upstream reservoirs (Silver Lake, Caples Lake, Lake Aloha, and Echo Lake) to generate hydroelectric power. Power generated at the El Dorado Powerhouse is delivered to the PG&E transmission system at the Powerhouse switchyard.

PG&E owns and operates electricity infrastructure throughout Northern California that includes power lines, powerhouses, and substations. PG&E operates the powerhouses located at Chili Bar on the SFAR.

Reclamation operates Folsom and Nimbus Dams to generate hydroelectric power. Folsom is a 198-megawatt peaking powerplant which is dedicated first to meeting the requirements of the CVP facilities. The remaining energy is marketed to various preference customers in northern California. This plant also provides power for the pumping plant, which supplies the local domestic water supply (Reclamation 2024b). Nimbus Dam, located 7 miles downstream of Folsom Dam on the American River, regulates releases made through Folsom Dam. Nimbus Powerplant's two generators have a capacity of 7.8-megawatts (Reclamation 2024c).

The San Luis & Delta Mendota Water Authority operates the Jones Pumping Plant for Reclamation. The pumping plant near Tracy, California, lifts water at the southern end of the Delta into the canal system, which delivers water to CVP water service contractors, exchange contractors, and wildlife refuges. The pumping plant lifts water nearly 200 feet from the Delta into the canal system through 15-foot diameter pipes with six 22,500-horsepower motors capable of pumping a total of 8,500 acre-feet per day (Reclamation 2024d). DWR operates the Banks pumping plant at Clifton Court Forebay just south of Stockton, CA. Banks contains 11 pumps lift the water 244 feet from the Delta into the canal system and can pump up to 10,300 cfs (WEF 2024).

No natural gas is directly consumed to operate EID facilities involved in the proposed project.

4.6.2 IMPACT DISCUSSION

a) Result in potentially significant environmental impact due to wasteful, inefficient, or unnecessary consumption of energy resources, during project construction or operation?

Finding: Less Than Significant

The proposed project does not include any construction activities, therefore there would be no potential to result in wasteful, inefficient, or unnecessary consumption of energy resources during construction.

The conserved water will be used for non-consumptive hydropower production at EID's El Dorado Powerhouse, returned to the South Fork of the American River, and then flow into Folsom Reservoir. At Folsom Reservoir the water would be re-regulated for delivery to WWD for use in their service areas south of the Delta. Given the relatively small quantity of water proposed for transfer, the proposed project would result in a negligible increase in the overall pumping at the Jones pumping plant or Banks pumping plant to pump the transfer water for distribution. Furthermore, the energy being consumed is for the conveyance of water, which is a necessary resource for agriculture, manufacturing, and drinking water, and would therefore not be considered wasteful. There would be no permanent or substantial changes to flows and therefore, operation of the proposed project would not result in wasteful, inefficient, or unnecessary consumption of energy resources. Impacts would be less than significant.

b) Conflict with or obstruct a state or local plan for renewable energy or energy efficiency?

Finding: No Impact

There are no energy policies or plans that would be applicable to the proposed project and therefore there would be no impact.

4.7 Geology and Soils

VII. GEOLOGY AND SOILS Would the Project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:				
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.				X
ii) Strong seismic ground shaking?				X
iii) Seismic-related ground failure, including liquefaction?				X
iv) Landslides?				X
b) Result in substantial soil erosion or the loss of topsoil?				X
c) Be located on geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?				X
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code, creating substantial risks to life or property?				X
e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?				X
f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?				X

4.7.1 ENVIRONMENTAL SETTING

EID's service area is located within the geomorphic province of the Sierra Nevada, which is a northwest trending mountain range that extends for 400 miles in length, and 40 to 100 miles in width. Sierra Nevada bedrock consists of varied rock types and geological ages, from Paleozoic metamorphic to Holocene sedimentary and volcanic rock.

WWD's service area is located in the geomorphic province of the Great Valley. The Great Valley is an alluvial plain about 50 miles wide and 400 miles long in the central part of California. Its northern part is the Sacramento Valley, drained by the Sacramento River and its southern part is the San Joaquin Valley drained by the San Joaquin River. The Great Valley is a trough in which sediments have been deposited almost continuously since the Jurassic (DOC 2002a).

Active faults are present within all of the geomorphic providences in proximity to the proposed project.

4.7.2 IMPACT DISCUSSION

a) Directly or indirectly cause potential substantial adverse effects, including the risk of loss, injury, or death involving:

i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.

ii) Strong seismic ground shaking?

iii) Seismic-related ground failure, including liquefaction?

iv) Landslides?

Finding: No Impact

The proposed project involves the transfer of conserved water that would occur through existing facilities and waterways and would result in no physical changes to these facilities and would therefore not result in an increased risk. The proposed project would not directly or indirectly cause potential substantial adverse effects involving rupture of a known fault, strong seismic ground shaking, seismic induced ground failure, or landslides. There would be no impact.

b) Result in substantial soil erosion or the loss of topsoil?

Finding: No Impact

The proposed project does not include any construction activities or movement of soils. The transfer of conserved water would occur through existing facilities and waterways and would result in no physical changes to these facilities. Therefore, there would be no increased potential for erosion with the proposed project. There would be no impact.

c) Be located on geologic unit or soil that is unstable, or that would become unstable as a result of the Project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse?

Finding: No Impact

The proposed project does not include any construction activities or movement of geologic units or soils. The transfer of conserved water would occur through existing facilities and waterways and would result in no physical changes to these facilities. None of these existing facilities are located within geologic units that are unstable. There would be no impact.

d) Be located on expansive soil, as defined in Table 18 1 B of the Uniform Building Code, creating substantial risks to life or property?

Finding: No Impact

The proposed project does not include any construction activities or development of new facilities or structures that would have the potential to be located on expansive soils. The transfer of conserved water would occur through existing facilities and waterways and would result in no physical changes to these facilities. There would be no impact.

e) Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater?

Finding: No Impact

The proposed project would not include septic tanks or wastewater treatment. There would be no impact.

f) Directly or indirectly destroy a unique paleontological resource or site or unique geologic feature?

Finding: No Impact

The proposed project does not include any construction activities or substantial operational changes that could impact paleontological resources. The conserved water would be transferred through existing facilities and would not result in construction or alteration of any of these facilities. No ground disturbing activities would occur as part of the proposed project. There would be no impact to paleontological resources.

4.8 Greenhouse Gas Emissions

VIII.GREENHOUSE GAS EMISSIONS Would the Project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?				X
b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?				X

4.8.1 ENVIRONMENTAL SETTING

California is a substantial contributor of global greenhouse gases (GHGs), emitting over 420 million metric tons of carbon dioxide equivalent (MMTCO2e) per year. GHGs are global in their effect, which is to increase the earth's ability to absorb heat in the atmosphere. As primary GHGs have a long lifetime in the atmosphere, accumulate over time, and are generally well-mixed, their impact on the atmosphere is mostly independent of the point of emission. Every nation emits GHGs and as a result makes an incremental cumulative contribution to global climate change; therefore, global cooperation will be required to reduce the rate of GHG emissions enough to slow or stop the human-caused increase in average global temperatures and associated changes in climatic conditions. Emissions of GHGs contributing to global climate change are attributable, in large part, to human activities associated with on-road and off-road transportation, industrial/manufacturing, electricity generation by utilities and consumption by end users, residential and commercial on-site fuel usage, and agriculture and forestry. Emissions of CO2 are, largely, byproducts of fossil fuel combustion.

Assembly Bill 32 was established by CARB to provide statewide GHG emissions cap for 2020, adopt mandatory reporting rules for significant sources of GHG, and adopt comprehensive Climate Action Scoping Plans to help identify how emission reductions will be achieved. Assembly Bill 32 was then amended by Senate Bill 32 on September 16, 2016, and further required that statewide GHG emissions are reduced to 40 percent below the 1990 level by the year 2030 (CARB 2018). In 2022, CARB released the latest scoping plan, which lays out a path to achieve the carbon neutrality targets set by AB 1279 as well as reduce GHG emissions by 85 percent below 1990 levels no later than 2045 (CARB 2022).

The CEQA Guidelines focus on the effects of GHG emissions as cumulative impacts, and therefore GHG emissions should be analyzed in the context of CEQA's requirements for cumulative impact analyses (CEQA Guidelines Section 15064[h][3]). A project's incremental contribution to a cumulative impact can be found not cumulatively considerable if the project would comply with an approved plan or mitigation program that provides specific requirements to avoid or substantially lessen the cumulative problem within the geographic area of the project.

4.8.2 IMPACT DISCUSSION

a) Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment?

Finding: No Impact

The proposed project does not include any construction or substantial operational activities that would increase GHG emissions. Water would be transferred through the existing facilities and no alterations of these facilities would occur. Therefore, because the proposed project would not result in any construction or substantial operational changes, the proposed project would not generate any new GHG emissions that would have a significant impact on the environment.

The conserved water transferred to WWD would be used for agricultural activities that may contribute to GHG emissions. The conserved water would augment WWD existing water supply for use in their service area and would be used for irrigation of agricultural crops. Although agricultural operations may generate GHG emissions, these land uses are existing land uses that would occur without the project. If the proposed project did not occur, WWD would buy water from another water purveyor or pump groundwater to serve the existing land uses in their service areas. Because water transfer operations and agricultural operations would be within the historic range of typical use, the proposed project would not generate new GHG emissions that would otherwise be generated in any given year. Additionally, given the relatively small quantity of water being transferred (up to 740 AF) compared to the average volume of water utilized for agricultural purposes in the Central Valley (5 million AF from the CVP), the GHG emissions produced by implementation of the proposed project would not be considered to have a significant impact on the environment. There would be no impact.

b) Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases?

Finding: No Impact

The proposed project would not conflict with plans, policies, or regulations prepared or established to reduce GHG emissions. As discussed under question “a” above, water would be transferred through the existing facilities and no alterations of these facilities would occur. There would be no impact.

4.9 Hazards and Hazardous Materials

IX. HAZARDS AND HAZARDOUS MATERIALS Would the Project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?				X
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?				X
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?				X
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?				X
e) For a Project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project result in a safety hazard or excessive noise for people residing or working in the Project area?				X
f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?				X
g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires?				X

4.9.1 ENVIRONMENTAL SETTING

General Hazards

Hazardous materials such as diesel, gasoline, oils, and lubricants are typically associated with construction activities and industrial uses. No hazardous materials are associated with the proposed project.

Schools

There are numerous schools located within EID and WWD service areas, most of which are centered around developed areas.

Airports

There are numerous airports within EID and WWD service areas.

Cortese List Sites

The Cortese list, which is compiled pursuant to Government Code Section 65962, is used to comply with CEQA requirements and provides a list of the known locations of hazardous material release sites. The EnviroStor and GeoTracker databases, which are managed by the California Department of Toxic Substances Control (DTSC) and SWRCB, respectively, are used to determine the proximity of a project to the nearest hazardous materials site. A desktop review of both the EnviroStor and GeoTracker databases identified numerous hazardous materials sites throughout EID's service area and WWD's service area (DTSC 2024, SWRCB 2024), however there are no known hazardous materials sites within the proposed project area.

Wildfires

The severity of wildland fires is influenced primarily by vegetation, topography, and weather (temperature, humidity, and wind). The California Department of Forestry and Fire Protection (CAL FIRE) hazard severity scale considers vegetation, climate, and slope to evaluate the level of wildfire hazard in a State Responsibility Area (SRA). CAL FIRE designates three levels of Fire Hazard Severity Zones (Moderate, High, and Very High) to indicate the severity of fire hazard in a particular geographical or SRA area. El Dorado County and the EID service area contain areas that include Very High, High, and Moderate fire zones, as identified on the Fire Hazard Severity Zone Viewer developed by CAL FIRE (CAL FIRE 2024). WWD's service area is located within a Local Responsibility Area and does not have fire hazard severity zones defined.

4.9.2 IMPACT DISCUSSION

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

Finding: No Impact

The proposed project does not include any construction activities or substantial changes in operational activities that would result in increased transport, use, or disposal of hazardous materials. Water would be transferred through existing facilities and waterways and no new sources of hazardous materials would be created as a result of the proposed project. There would be no impact.

b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

Finding: No Impact

The proposed project does not include any construction activities or substantial changes in operational activities that would result in increased risk of release of hazardous materials. Water would be transferred through existing facilities and waterways and no new sources of hazardous materials would be created as a result of the proposed project. There would be no impact.

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school?

Finding: No Impact

Although there are schools located within 0.25 mile of EID facilities, the proposed project does not include any increases in hazardous materials or emissions. There are no construction activities associated with the proposed project and no substantial changes in operational activities such that increases in hazardous materials or emissions would occur. There would be no impact.

d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?

Finding: No Impact

As discussed in Section 3.9.1, Environmental Setting, above, there are numerous hazardous materials/Cortese listed sites within EID's service area and WWD's service area (DTSC 2024, SWRCB 2024). However, the proposed project does not include substantial changes in operational use such that interference or interaction with any of these sites could occur. Water would be transferred through existing facilities and waterways and no changes to these facilities would occur. There would be no impact.

e) For a Project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the Project result in a safety hazard or excessive noise for people residing or working in the Project area?

Finding: No Impact

There are several airports in the EID service area, however the proposed project does not include any construction activities or substantial changes in operational use such that safety hazards or excessive noise would occur. Water would be transferred through existing facilities and waterways and no changes to these facilities would occur. There would be no impact.

f) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

Finding: No Impact

The proposed project does not include any construction activities or substantial changes in operational activities which would interfere with an adopted emergency response plan or emergency evacuation plan. Water would be transferred through existing facilities and waterways and no changes to these facilities would occur. There would be no impact.

g) Expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires?

Finding: No Impact

Although there are portions of El Dorado County and the EID service area that are within Very High and Moderate fire hazard severity zones (CAL FIRE 2024), the proposed project does not include any construction activities or substantial operational changes that would expose people or structures, either directly or indirectly, to a significant risk of loss, injury or death involving wildland fires. Water would be transferred through existing facilities and waterways and no changes to these facilities would occur. WWD’s service area is located within a Local Responsibility Area and does not have fire hazard severity zones defined by CAL FIRE, no features of the proposed project would increase the fire danger in the WWD’s service area. There would be no impact.

4.10 Hydrology and Water Quality

X. Hydrology and Water Quality **Would the Project:**	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporation**	**Less than Significant Impact**	**No Impact**
a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality?			X	
b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?				X
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:				
i) Result in substantial on-or offsite erosion or siltation;			X	
ii) Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on-or offsite;			X	
iii) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or			X	
iv) Impede or redirect flood flow			X	
d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?				X
e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?				X

4.10.1 ENVIRONMENTAL SETTING

<u>Hydrology</u>

EID's water sources are provided from surface water from the west slope of the Sierra Nevada in the SFAR and the Cosumnes River watersheds. Surface water is diverted from streams and reservoirs and conveyed via canals and pipelines. Access to groundwater is relatively limited when compared to surface water due to geologic conditions and the related fragmented/fractured rock groundwater system found in EID's service area, although wells remain a primary source of water in rural areas.

The proposed project involves the annual transfer of up to 740 AF of conserved water that originates from the operation of EID's facilities located in El Dorado County, California. Water that would have historically been diverted for consumptive use and lost in the Upper Main Ditch conveyance through seepage and evaporation is now water that is conserved by the Main Pipeline conveyance and is available to either remain instream or be diverted for non-consumptive hydropower production and then returned to the SFAR. Thus, water previously consumed through Upper Main Ditch conveyance losses is now conserved water available for potential transfer. Conserved water would be conveyed in the SFAR to Folsom Reservoir, through Folsom Dam, Lake Natoma, the LAR, the Sacramento River, the Delta, the canal system, and ultimately be delivered to WWD's service area located south of the Delta.

The affected environment for water resources in the Action Area is described in two parts: 1) the SFAR upstream of Folsom Reservoir and 2) Folsom Reservoir to the WWD's service area.

SFAR upstream of Folsom Reservoir

The SFAR is located on the west slope of the Sierra Nevada mountain range and is characterized by forested slopes and steep canyons. The South Fork American River is 850 square miles, 90 miles long, and originates in the high Sierra in the Eldorado National Forest. The river flows west, receiving Silver Creek, a major tributary, and flows past the town of Coloma where it then turns southwest, receiving Weber Creek before entering Folsom Reservoir (SRWP 2023).

EID diverts water from the SFAR at the El Dorado Diversion Dam near Kyburz. Water not diverted at the El Dorado Diversion Dam remains instream in the SFAR and flows to Folsom Reservoir. If diverted, water is conveyed approximately 22 miles via the El Dorado Canal to the El Dorado Forebay located in Pollock Pines. At the El Dorado Forebay, water is re-regulated and delivered for either consumptive use through the Main Pipeline or for hydropower generation at the El Dorado Powerhouse. Water that is used for hydropower generation is returned to SFAR and flows to Folsom Reservoir. EID's conserved water either remains instream in the SFAR below the El Dorado Diversion Dam or is used for non-consumptive hydropower production and then returned into the SFAR.

Folsom Reservoir to the WWD's Service Area

Releases from Folsom Dam are conveyed to Lake Natoma, which serves as the Folsom Dam afterbay. Lake Natoma is operated as a re-regulating reservoir that accommodates the diurnal flow fluctuations caused by the power peaking operations at Folsom power plant. Nimbus Dam, along with Folsom Dam, regulate water releases to the LAR. The LAR flows approximately 23-mile from Nimbus Dam to the confluence of the Sacramento River. The Sacramento River flows approximately 55 miles where it meets the San Joaquin River at the head of the Delta.

From the Delta, deliveries to WWD are re-diverted at the Jones Pumping Plant or Banks pumping plant and pumped to San Luis Reservoir or directly to WWD via the San Luis Canal.

Reclamation operates Folsom Reservoir in coordination with the systemwide operation of the CVP and SWP. Coordinated operations of the CVP and SWP are subject to compliance with the current BiOps associated with long-term operations of the CVP and SWP. Current operations are under the 2019 BiOps (USFWS 2019; NMFS 2019), SWRCB D-1641, as well as any temporary or modified regulatory requirements that may be in effect. Reclamation facilitates water transfers in such a manner that does not disrupt normal CVP and SWP operations, while complying with all current flow standards for the LAR from

Lake Natoma to the confluence with the Sacramento River, 2019 BiOps, as well as the most up-to-date regulatory requirements for the Delta. The transfer water would also be subject to the terms and conditions specified in the Warren Act Contract between Reclamation and WWD, which would include terms to apply carriage losses to the transfer water to protect water quality in the Delta and account for conveyance losses during delivery (e.g., up to an estimated 30% carriage loss through the Delta and additional 5% percent for conveyance losses for the use of the canal system).

Water Quality

SWRCB requires water providers to conduct a source water assessment to help protect the quality of water supplies. The assessment describes where a water system's drinking water comes from, the types of polluting activities that may threaten the quality of the source water, and an evaluation of the water's vulnerability to the threats.

Updated assessments of EID's drinking water sources were most recently completed in 2023. EID source water is considered most vulnerable to recreation, residential sewer, septic system, and urban runoff activities, which are associated with constituents detected in the water supply. EID source water is also considered most vulnerable to illegal activities, dumping, fertilizer, pesticide and herbicide application, forest activities, and wildfires. EID's water quality monitoring program includes taking samples of raw and treated water throughout the year from many locations in EID's service area. Analyses cover more than 100 different constituents. No maximum contaminant level violations were detected in the most recent reported samplings (EID 2023).

4.10.2 IMPACT DISCUSSION

a) Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality?

Finding: Less Than Significant

Given the documented quality of EID's water supply (EID 2023) and relatively small amount of conserved water to be transferred, the proposed project would not violate water quality standards or waste discharge requirements. The proposed water transfer would use existing infrastructure and waterways operating within all applicable requirements. The proposed project would not include construction activities that could temporarily degrade surface or groundwater. Transfer water would be used in lieu of groundwater and therefore agricultural activities in the WWD service area would not change as a result of the proposed project and no new violations in water quality standards or waste discharge requirements are expected to occur. Therefore, impacts would be considered less than significant.

Potential Effects Above Folsom

There would be no potential to violate water quality standards or waste discharge requirements or otherwise substantially degrade surface or groundwater quality in the waterways upstream of Folsom Reservoir. With or without the proposed project, the conserved water would either remain instream in the SFAR or be used for non-consumptive hydropower production and then returned into the SFAR and flow into Folsom Reservoir. Therefore, the delivery of up to 740 AF of EID's conserved water to Folsom Reservoir is considered the baseline condition. The proposed project will also not change the timing or volume or quality of water entering Folsom Reservoir. Because there would be no change to instream flows or water quality upstream of Folsom Reservoir associated with implementation of the proposed project, there would be no impact, direct or indirect, to hydrology or water quality.

Potential Effects Below Folsom Reservoir

Each year, Reclamation would schedule the volume and timing of releases of transfer water from Folsom Reservoir for delivery to WWD. For previous EID reservoir re-operation transfers, Reclamation has made releases of approximately 9 cfs (18 acre-feet per day) from Folsom Reservoir to facilitate delivery of non-Project water to WWD for use in their service area south of the Delta (Reclamation 2022; EID 2022). Using the operational scenario provided in Section 2.6, the amount of conserved water that would be available annually for transfer with implementation of the proposed project is 182 AF in June, 188 AF in July, 188 AF in August, and 182 AF in September (total = 740 AF). With these volumes, releases from Folsom Reservoir as small as approximately 4 cfs (8 acre-feet per day) would be sufficient to convey the transfer water downstream for delivery to WWD's service area. For comparison, instream flows in the LAR in 2022, a dry water year, ranged from approximately 1,500 cfs to 5,300 cfs during the June through September time period (DWR 2023a). In 2021, a critically dry water year, instream flows in the LAR ranged from approximately 600 cfs to 2,000 cfs during the June through September time period (DWR 2023b). Even under the lowest flow condition during this period (i.e., 600 cfs) releases of 4 cfs – 9 cfs would only represent 0.6% – 1.5% of the total flow in the LAR. This exceedingly small change in instream flows in the LAR with implementation of the proposed project would have no discernable effects. As such, direct or indirect impacts to water resources in the LAR with implementation of the proposed project would be less than significant.

From the LAR, transfer water would flow to the Sacramento River and then to the Delta. The relative proportion of transfer water would be further reduced when introduced to the flows in the Sacramento River and Delta. The transfer water will also be subject to the terms and conditions specified in the Warren Act Contract between Reclamation and WWD and/or a Conveyance Agreement with DWR, which would include terms to apply carriage losses to the transfer water to protect water quality in the Delta (e.g., up to an estimated 30% carriage loss through the Delta). The carriage losses help maintain a constant salinity level at a given location or provide the additional outflow needed to offset the degradation to water quality as a result of increased exports for transfers (DWR 2019). In practice, carriage water is assessed by dedicating a portion of the transfer water as Delta outflow to keep Delta salinity at the same level as it would have been in the baseline (or without-transfer) conditions (DWR 2019). Given the application of carriage losses on the transfer water, the impact to water resources in the Sacramento River or Delta with implementation of the proposed project would be less than significant.

From the Delta, transfer water would be re-diverted at the Jones pumping plant or Banks pumping plant and pumped to San Luis Reservoir or directly to WWD via the San Luis Canal. The transfer water would be subject to the terms and conditions specified in the Warren Act Contract between Reclamation and WWD and/or a Conveyance Agreement with DWR, which would include terms to account for conveyance losses during delivery (e.g., approximately 5% percent for conveyance losses for the use of the canal system). Given the application of conveyance losses on the transfer water, there would be no impact to water resources from the Jones pumping plant or Banks pumping plant to WWD's service area with implementation of the proposed project.

Implementation of the proposed project would result in no change to reservoir inflow and/or storage or corresponding changes to the volume of coldwater pool in Folsom Reservoir. The proposed project would result in no change of sufficient magnitude to instream flows along waterways that would be utilized to convey the transfer water to affect water resources from Folsom Reservoir to WWD's service area south of the Delta. Additionally, the conveyance of transfer water from Folsom Reservoir to WWD's service area would be coordinated with the systemwide operation of the CVP and SWP, including compliance with the 2019 BiOps, as well as the most up-to-date regulatory requirements for the Delta. Additionally, the transfer water would also be subject to the terms and conditions specified in the Warren Act Contract between Reclamation and WWD and/or Conveyance Agreement with DWR, which would include terms to apply carriage losses to the transfer water to protect water quality in the Delta and account for conveyance losses during delivery (e.g., up to an estimated 30% carriage loss through the Delta and additional 5% percent for conveyance losses for the use of the canal system). As such, potential impacts, direct or indirect, to water resources that may be present in the area downstream of Folsom Reservoir would be considered less than significant.

b) Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin?

Finding: No Impact

No substantial effects on groundwater hydrology would occur from proposed project. Flows in the affected waterways upstream of Folsom Reservoir would be the same with or without the proposed project and flows downstream of Folsom Reservoir would be within typical ranges normally experienced during the transfer period and would not have a noticeable impact on either accretion from or depletion from the affected waterways. WWD participates and directs groundwater monitoring, management, and banking operations within their service area to improve groundwater levels. The proposed project provides WWD with a surface water supply and would not increase groundwater usage within WWD's service area. No impact would occur.

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:

- ***i) Result in substantial on-or offsite erosion or siltation;***
- ***ii) Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on-or offsite;***
- ***iii) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff; or***
- ***iv) Impede or redirect flood flow?***

Finding: Less Than Significant

The proposed project would not include construction activities that could result in substantial on-or offsite erosion or siltation, substantially increase the rate or amount of surface runoff, create or contribute runoff water, or impede or redirect flood flows. The proposed project would use existing facilities and waterways operating within all applicable requirements. Flows in the affected waterways upstream of Folsom Reservoir would be the same with or without the proposed project and flows downstream of Folsom Reservoir would be within typical ranges normally experienced during the transfer period. Given the relatively small amount of conserved water to be transferred, the conveyance of the conserved water from Folsom Reservoir to WWD would not result in substantial on-or offsite erosion or siltation, substantially increase the rate or amount of surface runoff, create or contribute runoff water, or impede or redirect flood flows. Therefore, impacts would be considered less than significant.

d) In flood hazard, tsunami, or seiche zones, risk release of pollutants due to project inundation?

Finding: No Impact

The proposed project would not result in inundation by seiche, tsunami, or mudflow. There would be no impact.

e) Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan?

Finding: No Impact

The proposed project would not include construction activities that could temporarily degrade water quality and the proposed project would not result in degradation of existing water quality at any of the involved facilities or waterways. The project would not involve the use of groundwater. In addition, water usage and agricultural operations within the WWD service areas would not change as a result of the proposed project. Use of the surface water from the proposed project in the WWD service area would potentially result in a decrease in groundwater pumping due to increased surface water supplies which would help aid in groundwater sustainability. With the project, Reclamation would provide the conserved water from Folsom Reservoir to federal or state export facilities to WWD on a schedule that is mutually agreeable and/or beneficial to Reclamation and WWD, and in such a manner that would not disrupt normal CVP and SWP operations while complying with all current flow standards for the LAR from Lake Natoma to the confluence with the Sacramento River, biological opinions for the coordinated operation of the SWP and the CVP, as well as the most up-to-date regulatory requirements for the Delta as directed by the SWRCB. Therefore, the project would not interfere with implementation of a water quality control plan or sustainable groundwater management plan and no impact would occur.

4.11 Land Use and Planning

XI. LAND USE AND PLANNING Would the Project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
a) Physically divide an established community?				X
b) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?				X

4.11.1 ENVIRONMENTAL SETTING

Land uses are varied throughout El Dorado County and the EID service area and can include, but are not limited to, commercial, residential, agricultural lands, recreational areas, industrial, residential, open space, and public facilities (EID 2013). Similar to land uses in EID's service area, land uses in WWD's service area include agriculture, residential, commercial, industrial, public facilities, agricultural lands, open space, and recreational areas.

4.11.2 IMPACT DISCUSSION

a) Physically divide an established community?

Finding: No Impact

The proposed project does not include any construction activities or substantial operational changes that could result in division of an established community. The water transfer would occur through existing facilities and no changes to these facilities are proposed. There would be no impact.

b) Cause a significant environmental impact due to a conflict with any land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect?

Finding: No Impact

The proposed project does not include any construction activities or substantial operational changes that could result in changes in land use or conflict with an applicable land use plan, policy, or regulation adopted for the purpose of avoiding or mitigating an environmental effect. The water transfer would occur through existing facilities and no changes to these facilities are proposed. There would be no impact.

4.12 Mineral Resources

XII. MINERAL RESOURCES **Would the Project:**	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporation**	**Less than Significant Impact**	**No Impact**
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?				**X**
b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?				**X**

4.12.1 ENVIRONMENTAL SETTING

El Dorado County contains a wide variety of mineral resources and Mineral Resource Zones (MRZ) as designated by the Surface Mining and Reclamation Act of 1975 (SMARA) (El Dorado County 2003). Sand, gravel, and oil have been mapped in the vicinity of the WWD service area (Fresno County 2000).

4.12.2 IMPACT DISCUSSION

a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?

Finding: No Impact

The proposed project does not include any construction activities or substantial operational changes that could result in loss of availability of a known mineral resource. The water transfer would occur through existing facilities and no changes to these facilities are proposed. There would be no impact.

b) Result in the loss of availability of a locally important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?

Finding: No Impact

The proposed project does not include any construction activities or substantial operational changes that could result in loss of availability of a locally important mineral resource site delineated on a local general plan, specific plan, or other land use plan. The water transfer would occur through existing facilities and no changes to these facilities are proposed. There would be no impact.

4.13 Noise

XIII. Noise **Would the Project result in:**	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporation**	**Less than Significant Impact**	**No Impact**
a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or applicable standards of other agencies?				**X**
b) Generation of excessive groundborne vibration or groundborne noise levels?				**X**
c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?				**X**

4.13.1 ENVIRONMENTAL SETTING

The existing noise environment in a project area is characterized by the area's general level of development because the level of development and ambient noise levels tend to be closely correlated. Areas which are not urbanized are relatively quiet, while areas which are more urbanized are noisier as a result of roadway traffic, industrial activities, and other human activities. Typical noise sources in EID's service area include highways and roadways, business centers and commercial areas, recreational areas and activities, and natural sources (e.g., wildlife, flowing water, wind, etc.). Typical noise sources in WWD's service area include equipment for agricultural production, highways and roadways, business centers and commercial areas, recreational areas and activities, air traffic, and natural sources (e.g., wildlife, flowing water, wind, etc.).

4.13.2 IMPACT DISCUSSION

a) Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or applicable standards of other agencies?

Finding: No Impact

The proposed project does not include any construction activities or substantial changes in operational activities which could result in increased noise levels. The water transfer would occur through existing facilities and no changes to these facilities are proposed, therefore there would be no increases in noise levels in excess of standards established in the local general plans or applicable standards of other agencies. There would be no impact.

b) Generation of excessive groundborne vibration or groundborne noise levels?

Finding: No Impact

The proposed project does not include any construction activities or substantial changes in operational activities which could result in increased groundborne vibration or groundborne noise levels. The water transfer would occur through existing facilities and no changes to these facilities are proposed, therefore there would be no increases in groundborne vibrations. There would be no impact.

c) For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

Finding: No Impact

While there are several airports in the EID and WWD service areas, the proposed project does not include any construction activities or substantial changes in operational use such that any increases in noise would occur. Water would continue to be transferred through existing facilities and waterways and no changes to these facilities would occur. There would be no impact.

4.14 Population and Housing

XIV. Population and Housing **Would the Project:**	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporation**	**Less than Significant Impact**	**No Impact**
a) Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?				**X**
b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?				**X**

4.14.1 ENVIRONMENTAL SETTING

The population in El Dorado County in 2023 was 192,215 with EID providing service to more than 125,000 people throughout the County (USCB 2023, EID 2024). WWD serves water for approximately 600 family-owned farms in Fresno and Kings Counties.

4.14.2 IMPACT DISCUSSION

a) Induce substantial unplanned population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through extension of roads or other infrastructure)?

Finding: No Impact

The proposed project would not result in a long-term or permanent water supply that would allow construction of new homes or businesses or extension of roadways or other infrastructure that could increase the population in the vicinity of the proposed project. Implementing the proposed project would not directly or indirectly induce substantial population growth. The proposed project could prevent agricultural land from becoming fallowed, but it would not expand agricultural activities beyond existing levels. Further, the transfer water would be conveyed through existing facilities and waterways and no changes to these facilities would occur. No impact would occur

b) Displace substantial numbers of existing people or housing, necessitating the construction of replacement housing elsewhere?

Finding: No Impact

The proposed project does not include construction or substantial changes in operational activities that could result in displacement of substantial numbers of people. There would be no impact.

4.15 Public Services

XV. PUBLIC SERVICES Would the Project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:				
Fire protection?				X
Police protection?				X
Schools?				X
Parks?				X
Other Public Facilities?				X

4.15.1 ENVIRONMENTAL SETTING

EID's service area is generally located within unincorporated areas of El Dorado County and is protected by numerous police and fire protection districts which provide police and fire protection services to residents and businesses throughout the County. Fresno and Kings County Sheriff's Departments and Fire Protection Districts operate in the WWD service area.

School districts in the vicinity of the EID facilities where the conserved water originates include Pollock Pines Elementary School District and Camino Union School District. School districts in the WWD service area include Mendota Unified School District, Central Union School District, and Coalinga-Huron School District.

EID owns and operates several recreational facilities, including facilities at Jenkinson Lake and Silver Lake (Sly Park Recreation Area). Several recreational areas are located in the WWD service area, including fishing access and Mendota Wildlife Management Area.

4.15.2 IMPACT DISCUSSION

a) Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:

Fire Protection?
Police Protection?
Schools?
Parks?
Other Public Facilities?

Finding: No Impact

The proposed project would not result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered governmental facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services. The proposed project would not create any new structures or uses or result in population growth that would affect schools, fire protection, police protection, parks, or other public facilities. The proposed project would not include any construction activities and all operational activities would occur within the existing infrastructure and waterways. No impact would occur.

4.16 Recreation

XVI. Recreation Would the project:	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?				X
b) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?				X

4.16.1 ENVIRONMENTAL SETTING

EID owns and operates several recreational areas including the facilities at Jenkinson Lake/Sly Park Recreation Area and Forebay Reservoir. The SFAR is a popular recreational area, especially in spring and summer months and includes trails, rafting, kayaking, and fishing opportunities. Several recreational areas are located in the WWD service area, including fishing access and Mendota Wildlife Management Area.

4.16.2 IMPACT DISCUSSION

a) Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

Finding: No Impact

The proposed project would not create any new structures or uses or result in population growth that would cause increased use of existing parks or other recreational facilities in the area. The proposed project would not include any construction activities and all operational activities would occur within the existing infrastructure and waterways. No impact would occur.

b) Include recreational facilities or require the construction or expansion of recreational facilities that might have an adverse physical effect on the environment?

Finding: No Impact

The proposed project would not create any new structures or uses or result in the construction or expansion of recreational facilities in the area. The proposed project would not include any construction activities and all operational activities would occur within the existing infrastructure and waterways. The project would not alter flows in the SFAR or inflows into Folsom, nor would the project affect water levels at any recreational facility. No impact would occur.

4.17 Transportation

XVII. Transportation **Would the project:**	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporation**	**Less than Significant Impact**	**No Impact**
a) Conflict with a program, plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities				**X**
b) Conflict or be inconsistent with CEQA Guidelines section 15064.3, subdivision (b)?				**X**
c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?				**X**
d) Result in inadequate emergency access?				**X**

4.17.1 ENVIRONMENTAL SETTING

Major roadways within the El Dorado County and the EID service area include Highway 50, which travels in an east/west direction through the County, as well as Highway 49, which travels in a north/south direction through the county. Surface roadways and country roadways are distributed throughout the county near cities and in rural areas, respectively. Roads in the WWD service area are primarily rural in character. Interstate 5 runs in a north-south direction along the western boundary of the WWD service area.

4.17.2 IMPACT DISCUSSION

a) Conflict with a program, plan, ordinance or policy addressing the circulation system, including transit, roadway, bicycle, and pedestrian facilities?

Finding: No Impact

The proposed project does not include any construction activities or substantial changes in operational activities which would interfere with existing programs, plans, ordinances, or policies addressing the circulation system in the area. The project will not alter normal agricultural operations within WWD. No additional vehicles would be added to roadways as a result of the proposed project. There would be no impact.

b) Conflict or be inconsistent with CEQA Guidelines section 15064.3, subdivision (b)?

Finding: No Impact

The proposed project does not include any construction activities or substantial changes in operational activities that would increase vehicle miles travelled (VMT). The project will not alter normal agricultural operations within WWD. In addition, the proposed water transfer would not result in long-term changes in land uses or new facilities that would cause increases in VMT and no additional vehicles would be added to roadways as a result of the proposed project. There would be no impact.

c) Substantially increase hazards due to a geometric design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

Finding: No Impact

The proposed project does not include any construction activities or substantial changes in operational activities which could create increased hazards or incompatible uses. The project will not alter normal agricultural operations within WWD. No additional vehicles would be added to roadways as a result of the proposed project. There would be no impact.

d) Result in inadequate emergency access?

Finding: No Impact

The proposed project does not include any construction activities or substantial changes in operational activities which would interfere with emergency access in the area. Water would be transferred through existing facilities and waterways and no changes to these facilities would occur. The project will not alter normal agricultural operations within WWD. No additional vehicles would be added to roadways as a result of the proposed project. There would be no impact.

4.18 Tribal Cultural Resources

XVIII. Tribal Cultural Resources	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:				
a) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k)?				X
b) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe?				X

4.18.1 ENVIRONMENTAL SETTING

Prior to the arrival of Euroamericans in the region, California was inhabited by groups of Native Americans speaking more than 100 different languages and occupying a variety of ecological settings. California Native Americans are classified and subdivided into four subculture areas, Northwestern, Northeastern, Southern, and Central. The Central area encompasses the current project area and includes the Nisenan or Southern Maidu and Northern Sierra Miwok. The Washoe also utilized the Project area but are included in the Great Basin culture area. Nisenan inhabited the drainages of the Yuba, Bear, and American rivers, and also the lower reaches of the Feather River, extending from the east banks of the Sacramento River on the west to the mid-/high elevations of the western flank of the Sierra Nevada. Northern Sierra Miwok inhabited the southern end of the area bounded on the north by the Cosumnes River, extending beyond the Calaveras River to the south, demarcated on the west by the 500-foot elevation contour, and continuing toward the east to beyond the snowline. Washoe historically inhabited the region east of the crest of the Sierra Nevada into Carson Valley, extending from the Walker River in the south to Honey Lake in the north, with peripheral territory extending to the mid-elevations of the west Sierra slope. All three ethnographic groups probably exploited resources in the proposed project area (EID 2018).

<u>AB 52 Consultation</u>

AB 52 applies to those projects for which a lead agency had issued a notice of preparation of an EIR or notice of intent to adopt a negative declaration or mitigated negative declaration on or after July 1, 2015. Therefore, the requirements of AB 52 apply to the proposed project.

Under AB 52, the Shingle Springs Band of Miwok Indians, Torres Martinez Desert Cahuilla Indians, United Auburn Indian Community of the Auburn Rancheria, Wopumnes Nisenan-Mewuk Nation of El Dorado County, and Wilton Rancheria have requested that EID, as a CEQA lead agency, formally notify them of any proposed projects within their geographic area of traditional and cultural affiliation. EID sent formal notification of the project to all of these tribes on October 20, 2023. Responses were requested within 30 days. No responses from tribes or requests for consultation pursuant to AB 52 were received.

4.18.2 IMPACT DISCUSSION

Would the project cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:

a) Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code section 5020.1(k)?

Finding: No Impact

The proposed project does not include any construction activities or substantial operational changes that could impact tribal cultural resources. The conserved water would be transferred through existing facilities and would not result in construction or alteration of any of these facilities. No ground disturbing activities would occur as part of the proposed project. There would be no impact.

b) A resource determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resource Code Section 5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe?

Finding: No Impact

The proposed project does not include any construction activities or substantial operational changes that could impact tribal cultural resources. The conserved water would be transferred through existing facilities and would not result in construction or alteration of any of these facilities. No ground disturbing activities would occur as part of the proposed project. There would be no impact.

4.19 Utilities and Service Systems

XIX. Utilities and Service Systems **Would the project:**	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporation**	**Less than Significant Impact**	**No Impact**
a) Require or result in the relocation or construction of new or expanded water, wastewater treatment or stormwater drainage, electric power, natural gas, or telecommunication facilities, the construction or relocation of which could cause significant environmental effects?				**X**
b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?				**X**
c) Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project's projected demand, in addition to the provider's existing commitments?				**X**
d) Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?				**X**
e) Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?				**X**

4.19.1 ENVIRONMENTAL SETTING

EID provides wide-ranging services for water, wastewater treatment, and recycled water systems, as well as hydropower and parks and recreation for nearly 125,000 residents (EID 2024). WWD serves water for approximately 600 family-owned farms in Fresno and Kings Counties.

4.19.2 IMPACT DISCUSSION

a) Require or result in the relocation or construction of new or expanded water, wastewater treatment or stormwater drainage, electric power, natural gas, or telecommunication facilities, the construction or relocation of which could cause significant environmental effects?

Finding: No Impact

The proposed project involves the transfer of raw water and would not include changes to water treatment facilities for EID or WWD. The proposed project would not require wastewater service and no expansion of existing or construction of new water or wastewater facilities would be required. In addition, the project would not increase demand for natural gas or telecommunication facilities. As discussed in Section 3.6, “Energy,” the proposed water transfer would require pumping to convey the water. However, the project would not require any new or expanded electrical facilities and given the relatively small quantity of water proposed for transfer, the proposed project would result in only a negligible increase in the overall pumping at the Jones pumping plant or Banks pumping plant to pump the transfer water for distribution. There would be no impact.

b) Have sufficient water supplies available to serve the project and reasonably foreseeable future development during normal, dry and multiple dry years?

Finding: No Impact

No new water supplies would be required for the proposed project. In addition, the proposed project would not include any new development that would require public water supplies. Thus, no new or expanded water supply entitlements would be needed. The proposed project includes the temporary transfer of conserved water through existing facilities and waterways. This conserved water supply is not needed to meet EID’s current consumptive demands. The water would be used within the WWD’s service areas in support of ongoing agricultural uses. There would be no impact.

c) Result in a determination by the wastewater treatment provider that serves or may serve the project that it has adequate capacity to serve the project’s projected demand, in addition to the provider’s existing commitments?

Finding: No Impact

The proposed project would not increase wastewater generation. Thus, the proposed project would not exceed a wastewater treatment provider’s capacity. There would be no impact.

d) Generate solid waste in excess of State or local standards, or in excess of the capacity of local infrastructure, or otherwise impair the attainment of solid waste reduction goals?

Finding: No Impact

Any solid waste generated during proposed project activities would be in the WWD service area, and would be incidental and no different than current conditions. No impact would occur.

e) Comply with federal, state, and local management and reduction statutes and regulations related to solid waste?

Finding: No Impact

Any solid waste generated during agricultural activities would be in the WWD service area, would be incidental, and would be disposed in local landfills. Transportation and disposal would be in accordance with all applicable federal, state, and local statutes and regulations. No impact would occur.

4.20 Wildfire

XX. Wildfire **Would the project:**	**Potentially Significant Impact**	**Less Than Significant with Mitigation Incorporation**	**Less than Significant Impact**	**No Impact**
If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project:				
a) Substantially impair an adopted emergency response plan or emergency evacuation plan?				**X**
b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?				**X**
c) Require the installation of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?				**X**
d) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?				**X**

4.20.1 ENVIRONMENTAL SETTING

The severity of wildland fires is influenced primarily by vegetation, topography, and weather (temperature, humidity, and wind). The CAL FIRE hazard severity scale considers vegetation, climate, and slope to evaluate the level of wildfire hazard in a SRA. CAL FIRE designates three levels of Fire Hazard Severity Zones (Moderate, High, and Very High) to indicate the severity of fire hazard in a particular geographical or SRA area. El Dorado County and the EID service area contain areas that include Very High, High, and Moderate fire zones, as identified on the Fire Hazard Severity Zone Viewer developed by CAL FIRE. WWD's service area is located within a Local Responsibility Area and does not have fire hazard severity zones defined (CAL FIRE 2024).

4.20.2 IMPACT DISCUSSION

If located in or near state responsibility areas or lands classified as very high fire hazard severity zones, would the project:

a) Substantially impair an adopted emergency response plan or emergency evacuation plan?

Finding: No Impact

The proposed project does not include any construction activities or substantial changes in operational activities which would interfere with emergency access in the area or impair implementation of an adopted emergency response plan or emergency evacuation plan. Water would be transferred through existing facilities and waterways and no changes to these facilities would occur. There would be no impact.

b) Due to slope, prevailing winds, and other factors, exacerbate wildfire risks, and thereby expose project occupants to pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire?

Finding: No Impact

The proposed project does not include any construction activities or development of new housing or facilities or other land uses where the public would congregate. There would be no project occupants that could be exposed to pollutant concentrations from a wildfire or the uncontrolled spread of a wildfire. Water would be transferred through existing facilities and waterways and no changes to these facilities would occur. There would be no impact.

c) Require the installation of associated infrastructure (such as roads, fuel breaks, emergency water sources, power lines or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment?

Finding: No Impact

No infrastructure (such as roads, emergency water sources, power lines, or other utilities) that may exacerbate fire risk or that may result in temporary or ongoing impacts to the environment are proposed. The proposed project does not include any construction activities or any physical alteration of facilities such that fire risks would be exacerbated. No impact would occur.

d) Expose people or structures to significant risks, including downslope or downstream flooding or landslides, as a result of runoff, post-fire slope instability, or drainage changes?

Finding: No Impact

The proposed project does not include any construction activities which could expose people or structures to significant risks from post-fire flooding or landslides. The water transfer would occur through existing facilities and waterways and no alterations to the facilities are required. There would be no impact.

4.21 Mandatory Findings of Significance

XXII. Mandatory Findings of Significance	Potentially Significant Impact	Less Than Significant with Mitigation Incorporation	Less than Significant Impact	No Impact
a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory?			X	
b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)			X	
c) Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?			X	

4.21.1 IMPACT DISCUSSION

a) Does the project have the potential to substantially degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, substantially reduce the number or restrict the range of an endangered, rare, or threatened species, or eliminate important examples of the major periods of California history or prehistory?

Finding: Less than Significant

The analysis conducted in this IS concludes that implementation of the proposed project would not have a significant impact on the environment. As evaluated in Section 3.4, "Biological Resources," impacts on biological resources would be less than significant. Therefore, the proposed project would not substantially degrade the quality of the environment; substantially reduce the habitat of a fish or wildlife species; cause a fish or wildlife population to drop below self-sustaining levels; threaten to eliminate a plant or animal community; or reduce the number or restrict the range of an endangered, rare, or threatened species.

As evaluated in Section 3.5, “Cultural Resources,” the proposed project would not eliminate important examples of the major periods of California history or prehistory.

Overall, impacts would be less than significant.

b) Does the project have impacts that are individually limited, but cumulatively considerable? (“Cumulatively considerable” means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.)

Finding: No Impact

As discussed in the IS, all of the potential project impacts would result in a less than significant or no impact. Given the relatively small quantity of water proposed for transfer, the temporary nature of the proposed project, and because no construction activities or long-term operations and maintenance activities are necessary to facilitate the proposed project, there would be no impact or less-than-significant impacts on the physical environment. None of the proposed project’s impacts make cumulatively considerable, incremental contributions to significant cumulative impacts. This impact would be less than significant

c) Does the project have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly?

Finding: Less Than Significant Impact

The proposed project would not have environmental effects that will cause substantial adverse effects on human beings, either directly or indirectly. All of the identified impacts were determined to be less than significant or to have no impact. Therefore, the proposed project’s environmental effects would be less than significant.

5 References

California Air Resource Board (CARB). 2019. Area Designations for State Standards. Available: https://ww2.arb.ca.gov/our-work/programs/state-and-federal-area-designations/state-area-designations. Accessed: May 13, 2024.

_____. 2018. Climate pollutants fall below 1990 levels for first time. Available: https://ww2.arb.ca.gov/news/climate-pollutants-fall-below-1990-levels-first-time. Accessed: May 13, 2024.

_____. 2022. Scoping Plan for Achieving Carbon Neutrality. Available: https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents. Accessed: May 13, 2024

California Department of Conservation (DOC) 2018. California Important Farmland Finder. Available: https://www.conservation.ca.gov/dlrp/fmmp. Accessed: May 10, 2024.

______. 2024. Williamson Act Program https://maps.conservation.ca.gov/dlrp/WilliamsonAct/. Accessed: May 10, 2024.

______.2002 California's Geomorphic Province. https://www.conservation.ca.gov/cgs/Documents/Publications/CGS-Notes/CGS-Note-36.pdf. Accessed: May 10, 2024.

California Department of Forestry and Fire Protection (CAL FIRE). 2024. Fire Hazard Severity Zone Viewer. Available: https://osfm.fire.ca.gov/what-we-do/community-wildfire-preparedness-and-mitigation/fire-hazard-severity-zones. Accessed: May 10, 2024.

California Department of Toxic Substances Control (DTSC). 2024. EnviroStor. Available: https://www.envirostor.dtsc.ca.gov/public/map/?myaddress=el+dorado+county. Accessed May 10, 2024.

California Department of Transportation (Caltrans). 2024. California State Scenic Highway System Map. Available: https://dot.ca.gov/programs/design/lap-landscape-architecture-and-community-livability/lap-liv-i-scenic-highways. Accessed: May 10, 2024.

California Department of Water Resources (DWR) 2019. Draft Carriage Water Overview for Non-Project Water Transfers by Anna Fock, State Water Project Analysis Office. October 2019. Available: https://resources.ca.gov/-/media/DWR-Website/Web-Pages/Programs/State-Water-Project/Management/Water-Transfers/Files/Draft_CarriageWaterOverview_20240215.pdf

______.2023a. California Department of Water Resources, California Data Exchange Center. Streamflow data for the American River at Fair Oaks (AFO) for 2022. Accessed online November 7, 2023 at: https://cdec.water.ca.gov/jspplot/jspPlotServlet.jsp?sensor_no=8249&end=&geom=&interval=&cookies=

______.2023b. California Department of Water Resources, California Data Exchange Center. Streamflow data for the American River at Fair Oaks (AFO) for 2021.

Accessed online November 7, 2023 at: https://cdec.water.ca.gov/jspplot/jspPlotServlet.jsp?sensor_no=8249&end=&geom=&interval=&cookies=

El Dorado County. 2004, as amended. El Dorado County General Plan. Last amended December 10, 2019. Available: https://www.eldoradocounty.ca.gov/Land-Use/Planning-Services/Plans-Documents/Adopted-General-Plan. Accessed: May 12, 2024.

_____. 2003. El Dorado County General Plan EIR. Available: https://www.eldoradocounty.ca.gov/Land-Use/Planning-Services/Plans-Documents/Adopted-General-Plan. Accessed: May 12, 2024.

El Dorado Irrigation District (EID). 2024. District Information. Available: https://www.eid.org/about-us/district-information.

_____. 2023. El Dorado Irrigation District 2023 Water Quality Report. Available: https://www.eid.org/home/showpublisheddocument/16999/638502551440730000.

_____. 2018. El Dorado Irrigation District Upper Main Ditch Piping Project Draft Environmental Impact Report. Available: https://www.eid.org/about-us/project-updates/upper-main-ditch-piping-project.

_____. 2013. Integrated Water Resources Master Plan. Prepared by HDR. Available: https://www.eid.org/home/showpublisheddocument/3554/635369711672500000.

_____. EID 2022. Post-Transfer Reporting for the 2022 Order approving the Temporary Transfer of up to 750 Acre-Feet of Water to Westlands Water District. Letter No.: DW2022-12-0086.

Fresno County 2000. Fresno County General Plan Policy Document https://www.fresnocountyca.gov/Departments/Public-Works-and-Planning/divisions-of-public-works-and-planning/development-services-division/planning-and-land-use/general-plan-review-zoning-ordinance-update/general-plan-policy-document. Accessed: May 12, 2024.

Kings County 2010. 2035 General Plan https://www.countyofkingsca.gov/departments/community-development-agency/information/2035-general-plan Adopted by the Kings County Board of Supervisors on January 26, 2010. Accessed May 12, 2024.

National Wild and Scenic Rivers System. 2024. California National System. Available: https://www.rivers.gov/map?river=american. Accessed: May 12, 2024.

U.S. Bureau of Reclamation. 2024a. Central Valley Project. https://www.usbr.gov/mp/cvp/index.html

_____. 2024b. Folsom Powerplant. https://www.usbr.gov/projects/index.php?id=547

_____. 2024c. Nimbus Dam. https://www.usbr.gov/projects/index.php?id=222

_____. 2024d. Jones Pumping Plant. https://www.usbr.gov/mp/mpr-news/docs/factsheets/jones-pumping-plant.pdf

_____. 2022. Draft Environmental Assessment 2022 Temporary Warren Act Contract with Westlands Water District for Conveyance and Storage of Up-to 750 Acre-Feet. Folsom, California. CGB-EA-2022-039. Available: https://www.usbr.gov/mp/nepa/nepa_project_details.php?Project_ID=52006

State Water Resource Control Board (SWRCB). 2024. GeoTracker. Available: https://geotracker.waterboards.ca.gov/map/?CMD=runreport&myaddress=el+dorado+county. Accessed: May 12, 2024.

United States Census Bureau (USCB). 2023. QuickFacts - El Dorado County, California. Available: https://www.census.gov/quickfacts/eldoradocountycalifornia. Accessed: May 12, 2024.

United States Environmental Protection Agency (USEPA). 2024. Current Nonattainment Counties for All Criteria Pollutants. Available: https://www3.epa.gov/airquality/greenbook/ancl.html. Accessed: May 12, 2024.

U.S. Fish and Wildlife Service (USFWS). 2019. Biological Opinion for the Reinitiation of Consultation on the Coordinated Operations of the Central Valley Project and State Water Project. 10-19-2019. Service File No. 08FBTD00-2019-F-0164. Available: https://www.fws.gov/project/central-valley-project-and-california-state-water-project-consultation

U.S. National Marine Fisheries Service. 2019. Biological Opinion on Long-term Operation of the Central Valley Project and the State Water Project. 10-21-2019. Consultation Tracking Number: WCRO-2016-00069. Available: https://www.fisheries.noaa.gov/resource/document/biological-opinion-reinitiation-consultation-long-term-operation-central-valley

Water Education Foundation (WEF) 2024. Clifton Court Forebay and Banks Pumping Plant. https://www.watereducation.org/aquapedia/clifton-court-forebay-and-banks-pumping-plant.

ATTACHMENT A

Tully and Young, 2021. Updated Main Ditch Water Loss Analysis with 2020 Data. December 30, 2021.

Tully & Young
Comprehensive Water Planning

965 University Avenue, Suite 222
Sacramento, California 95825
(916) 669-9357

TECHNICAL MEMORANDUM

To: Brian Deason, EID

Date: December 30, 2021

From: Greg Young
Kris Olof

Subject: Updated Main Ditch Water Loss Analysis with 2020 Data

---

The purpose of this memorandum is to provide the results of an analysis performed by Tully & Young to understand and quantify the water losses associated with water conveyance in the El Dorado Irrigation District's (EID) Upper Main Ditch (Main Ditch). The document refines the analysis from a prior memorandum used to support EID's CEQA document that assessed potential environmental impacts of the proposed project to pipe the water supply that is currently conveyed through the Main Ditch (hereafter the "Project"). Additionally, the document is intended to support EID's efforts to market for transfer the water that would be conserved through implementation of the Project until it is needed to support future growth within EID's service area. This memorandum incorporates the most recent operational data from 2020.

This memo presents the detailed underlying data supporting the analysis, a general characterization of the physical operations of the Main Ditch, and the analysis method and results.

Background and Summary

The purposes of the Project are to improve water conservation by reducing system losses from the unlined Main Ditch, and to improve water quality by piping the water delivered from the El Dorado Forebay (Forebay) to the Reservoir 1 Water Treatment Plant (WTP). Because the Main Ditch is uncovered and unlined, a portion of the water conveyed through the ditch is lost to seepage and evapotranspiration and the WTP has to contend with higher turbidity influent associated with sediment and water of unknown quality entering the ditch after water is released from Forebay. The U.S. Bureau of Reclamation has noted that losses from unlined earthen canals may be estimated to be one-third of the water conveyed or more.[1]

---

[1] Reclamation research project: https://www.usbr.gov/research/projects/detail.cfm?id=845

However, for the Main Ditch, losses throughout the season vary based upon the flow rate. Past flow studies conducted by EID for the Main Ditch (Attachments 1 and 2) indicate losses from the canal due to seepage range from approximately 6% to 33% based on single measurements, depending on flow rate at the time of the measurement. As documented in Attachment 1, a study from 1977, EID's analysis estimated that when conveying the full water right at 40 cfs, approximately 1,300 acre-feet would be lost annually from the Main Ditch. **Table 1** summarizes the results of estimated loss rates including recently completed analysis for 2016 through 2020 operational data. The 2018 and 2019 data includes data for one gauge (referred to a gauge A-18) that was relocated after 2017 and again replaced in the spring of 2019. 2020 data was derived from the SCADA system and from end of year summary reports.

Approach

Digital water meter data was available beginning in 2009 of recorded releases from Forebay into the Main Ditch and from the Main Ditch into the WTP inlet. The loss in this section of the ditch would typically be determined from the difference between these two values with a correction for backwash return flows ahead of the WTP inlet meter. However, this meter was found to be producing erroneous data between 2009 and 2015, which resulted in the prior WTP flow records being deemed unreliable. Prior to the start of 2016 deliveries, the WTP inlet flow meter was replaced and calibrated, assuring more reliable data going forward. Separate single-day ditch flow measurements were also taken at various flow rates over the season (Attachment 3) to supplement and calibrate, if necessary, the WTP inlet meter data. With the improved data source, electronically recorded data (hereafter "SCADA data") during 2016 became the best source for deriving loss estimates and was used for EID's 2016 Upper Main Ditch Annual Water Loss analysis (Attachment 4). In winter 2016/2017, the primary gauge at the upper end of the Main Ditch (A-18) was damaged by winter storms and was replaced and re-calibrated in spring of 2017 prior to operation for the 2017 season, which was delayed until early June due to storm damage to upstream canal conveyance facilities. A comparison of 2017 data for calibration and an estimate of 2017 and 2018 seasonal loss (Attachment 6) are summarized in **Table 1**.

Construction activites on the upper end of the Main Ditch resulted in the replacement of the A-18 gauge again in the spring of 2019 and the installation at a slightly different location than used during 2018. Additionally, the location and water conditions resulted in staff replacing the gauging equipment with a equipment better suited to the site.

Table 1 – Summary of Flow Studies

Flow Study	Flow Rate/Quantity	Loss Estimate
1977 Environmental Assessment – Ditch Flow Measurement[2] (Attachment 1)	18 cfs 40 cfs	1 cfs (6%) 5.1 (13%)
2012 Ditch Flow Measurement (Attachment 2)[3]	8.5 cfs	2.8 cfs (33%)
EID 2016 Single-Day Ditch Flow Measurement (Attachment 3)	13.08 cfs 20.76 cfs 30.92 cfs	2.25 cfs (17.2%) 4.42 cfs (21.3%) 4.5 cfs (14.6%)
EID 2016 Upper Main Ditch Annual Water Loss Analysis - Forebay to Reservoir 1 WTP (Attachment 4)	5,296 af at varying rates over period of operation 3,464 af at 20 cfs July 7 – Sept 30	1,100 af (20.8%) over period of operation 617 ac-ft (17.8%) July 7 – Sept 30
2015 Sage Engineering Ditch Modeling (Attachment 5)	20 cfs 40 cfs	0.8 to 4.2 cfs 0.8 to 4.5 cfs
EID 2017 Upper Main Ditch Annual Water Loss - Forebay to Reservoir 1 WTP (Attachment 6)	4,555 af at 20 cfs over period of operation	867 af (19%) over period of operation
EID 2018 Upper Main Ditch Annual Water Loss - Forebay to Reservoir 1 WTP (Attachment 6)	5,642 af over period of operation 1636 af at 15 cfs June 28th – Aug 21st	1,420 af (25%) over period of operation 315 af (19.2%) June 28th – Aug 21st
EID 2019 Upper Main Ditch Annual Water Loss - Forebay to Reservoir 1 WTP (Attachment 6)	4,445 af over period of operation 2,751 af at 17 cfs June 25th – Sept 14st	1,085 af (24%) over period of operation 680 af (24.7%) June 25th – Sept 14th
EID 2020 Upper Main Ditch Annual Water Loss - Forebay to Reservoir 1 WTP (Attachment 6)	Estimated 3,945 af over period of operation 1,609 af at 15cfs July 26th-Sept 17th	Estaimted 1,211 af (31%) over period of operation 442 af (27.5%) July 26th- Sept 17th

[2] Losses between Forebay and Blair Road were estimated to be 0.8 cfs to 4 cfs (4 to 10 percent) at flow rates of 18 and 40 cfs, respectively. The length of the ditch between Forebay and the Reservoir 1 WTP is approximately 15,400 feet and Blair Road is approximately 3,200 feet upstream of Reservoir 1. When loss estimates are extrapolated to the entire length of the canal, the losses are estimated to be 1 cfs to 5.1 cfs (6 to 13 percent). (SAGE 2015).

[3] The length of the ditch between Forebay and the Reservoir 1 WTP is approximately 15,400 feet and Patrick Lane is approximately 1,800 feet upstream of Reservoir 1. When loss estimates are extrapolated to the entire length of the canal, the losses are estimated to be 2.8 cfs from the originally measured 2.47 cfs.

Tully & Young obtained and analyzed the entirety of the SCADA data collected by EID during 2016, 2017, 2018, 2019, and 2020, as well as recent soils testing and seepage modeling completed in December 2015 by SAGE Engineers (Attachment 5). The 2016, 2017, 2018, 2019, and 2020 data included recorded flows released from Forebay as well as flows entering the WTP. The difference between these two data sets, excluding backwash water returned ahead of the WTP meter, represents estimated water lost during conveyance in the Main Ditch. The 2016 data included a limited flow range (13 cfs to 31 cfs) with most data being collected during a long duration of steady 20 cfs flows. 2017 was operated at 20 cfs flow for the entire operating season which provides an additional 20 cfs data point for **Figure 3**. 2018 was operated at varying flow rates but was steady at around 15 cfs flow for the longest period, and 2019 operated the longest at 17 cfs. 2020 saw operations holding steady at 15 cfs but did have a gauging issue for two weeks at Reservoir 1 at the start of the 15 cfs period. Deriving a broader spectrum of estimated losses over varying flow rates required interpretations and extrapolations using data from the prior studies, professional understanding of hydraulics, and EID operator knowledge to develop relationships between flow rates and estimated losses. The results provide a basis that can be used for estimating historical losses, and for projecting future losses.

The 2016 data also provided enough diurnal detail throughout the summer to understand the approximate portion of flow "lost" to evaporation and bankside vegetation, referred to here as ETc as shorthand for channel evapotranspiration. From this information, the effect of ETc during the summer on overall loss percentages compared to that during winter months was assessed, the results of which are represented in **Table 2**.

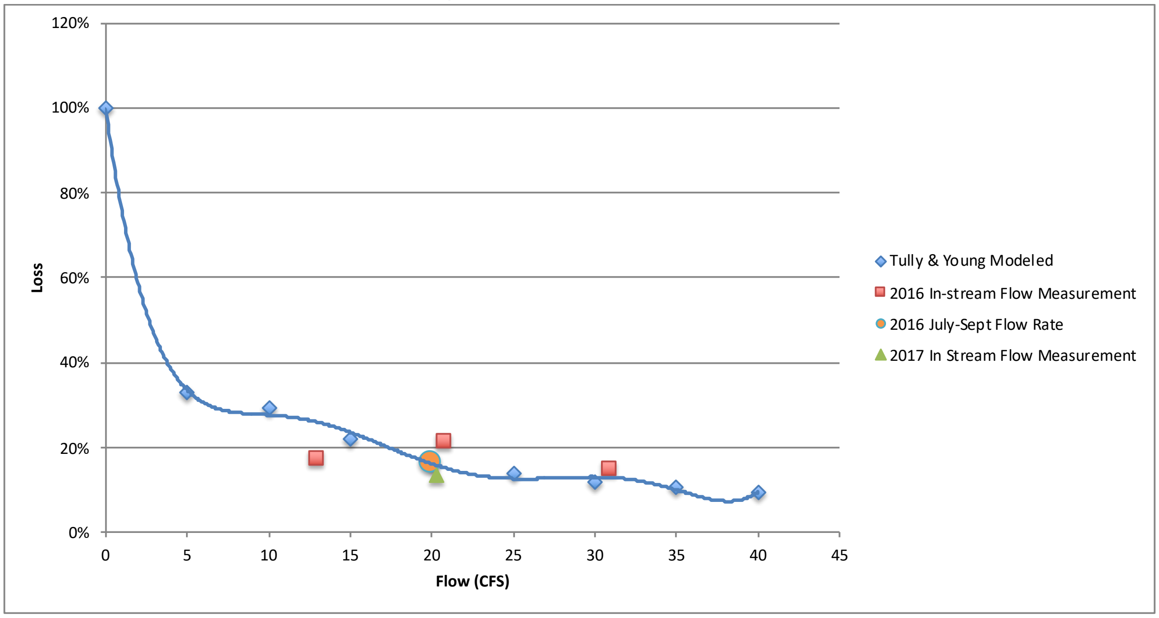
To derive estimated losses for flow rates outside the range recorded during the 2016 operations, several factors were assessed. After discussions with EID staff and review of mathematical models developed using the 2016 data, ditch cross section geometry was assessed to help develop loss rates outside the 2016 empirical range. A topographic survey of the ditch completed by Domenichelli & Associates for pipeline design and stormwater modeling provided cross sectional geometry useful for understanding the relationship between flow and wetted perimeter.

The 2017, 2018, 2019, and 2020 data further supported the conclusions of the 2016 data analysis and shows a clear pattern matching the 2016 ETc estimates.

Analytic Results

One key finding from assessing the full dataset was the percentage of flows lost while traveling between Forebay Reservoir and the WTP varied with the actual flow rate. Using the entire set of 2016 and 2017 data in conjunction with data points from prior studies, a representative curve and equation were developed to correlate flow to the loss percentage. **Figure 1** below demonstrates the derived representation of loss at varying flow rates. Also shown in **Figure 1** are the single ditch flow measurements, separate from the SCADA dataset, taken during the 2016 and 2017 seasons which closely correlate with the derived curve. This figure reflects the entirety of 2016 and 2017 SCADA data for the A-18 gage measuring flows out of Forebay, using the recorded losses at approximately 20 cfs (occurring between July 6 through September 28, 2016), and a best-fit curve derived using the wetted perimeter analysis to reflect loss percentages at a range of flow rates greater and less than the 20 cfs estimate. The wetted perimeter analysis is depicted in **Figure 2**.

Figure 1 – Loss vs. CFS[4]



It is important to note a few critical factors considered while developing the curve:

- Wetted perimeter data was used to model losses at flows greater and less than 20 cfs. The flow rate of 20 cfs was determined by Tully & Young to be the rate with the most accurate data for estimating losses due to the prolonged SCADA data set recorded at that flow.

- The slope and channel configuration, as described in the Domenichelli & Associates topographic survey and accompanying data, shows that wetted perimeter expands rapidly at low flows, but increases much more slowly above 5 cfs. The resulting relationship between average wetted perimeter and flow rate is presented in **Figure 2.**

- Based on available data and operational observation, flows below 5 cfs realize losses of a minimum of 33% and up to 100%.[5] This factor helped establish a functional, polynomial curve to reflect significantly decreasing loss percentages

[4] Since 2009, ditch customer water use between Forebay and the WTP has averaged approximately 28 acre-feet per year. This represents 0.5% of 2016 diversions and 0.2% for the full water right diversion of 15,080 acre-feet and is considered insignificant for this analysis.

[5] 33% minimum losses are tied to the 2012 measurement but are likely higher in this low flow range.

until around 10 cfs, when losses begin to be more consistent. It is noted that the WTP typically avoids operating when flow rates are below 7 cfs due to water quality considerations and operational efficiency objectives.

Comparing Study Results

Comparing the various study results to the modeled best-fit curve in **Figure 1** demonstrates: (1) the 1977 Study estimates higher losses at 40 cfs and lower losses at 18 cfs than the wetted perimeter analysis and the 2016 findings; (2) the SAGE analysis provides a broad theoretical range of loss that bounds the modeled curve; (3) the 2012, 2016, and 2017 single measurement flow data deviates somewhat above and below the derived curve; (4) 2018 measurements in a wetter year still trend nicely with the previously derived curve; (5) 2019 measurements in a normal year were slightly below the curve; and (6) 2020 measurements were slightly above the curve. These comparisons are all represented in **Figure 3**, which illustrates the derived curve under this analysis is a reasonable representation of likely losses.

Figure 2 – Wetted Perimeter vs. CFS

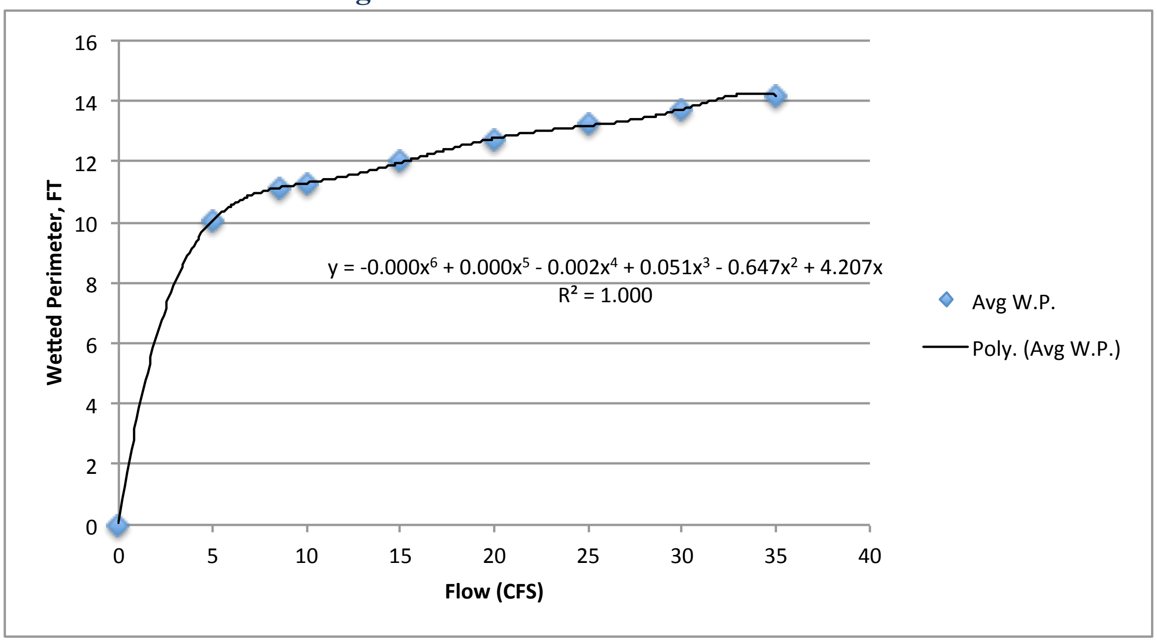
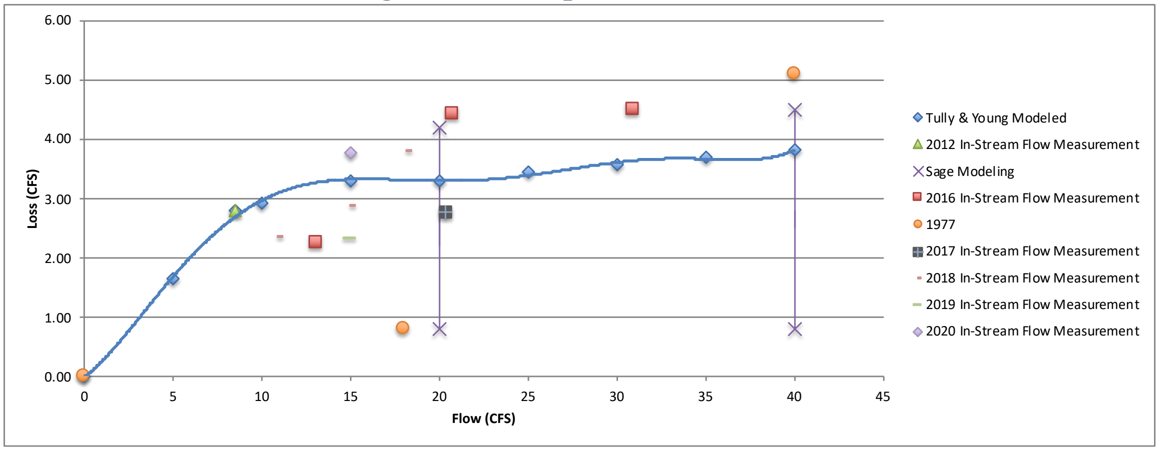


Figure 3 – Comparison of Studies



2020 Canal Flow Measurements Along Length

On 5/26/2020, EID Hydrologists Jordan Baxter conducted measurements in the canal along its length to assess what losses along the entire length. Here are measurement results on 5/26/20:

Magmeter at A18: 12.09 cfs	-Instant flow at time of survey
Reported A18 daily average: 11.97 cfs for day	-1% difference in instant vs average
1000 ft u/s of Pinewood Ln: 10.7 cfs	-11.5% loss
1000 ft d/s Pinewood Ln: 10.13 cfs	-16.2% loss
100 ft u/s Blaire Rd culvert: 7.38 cfs	-39.0% loss
Meter at Res 1 Inlet: 5.36 cfs	-55.7% loss

Unfortunately this was towards the beginning of the season so the canal was not fully wetted and thus we cannot derive any firm information. It does appear that losses are not uniform along the canal length.

Estimating Historic and Future Losses

Because the exact loss is not measurable at each increment of flow, the curve presented in **Figure 1** was translated to a look-up table to reflect the approximate percentage of loss for each increasing 5 cfs increment from 5 cfs to 40 cfs (see **Table 2**). The table also separately represents loss percentages during the two primary delivery periods of October-March and April-September considering the ETc factors described above.[6]

[6] Loss estimates for the April-September period include a component that represents ETc. During the winter period, ETc was assumed to not occur, since channel evaporation is very limited and bank vegetation is essentially dormant.

Table 2 – Seasonal Loss Percentages

	Oct 1-Mar 31	Apr 1-Sept 30
5-10cfs	28%	33%
10.1-15cfs	25%	29%
15.1-20cfs	18%	22%
20.1-25cfs	14%	16%
25.1-30cfs	12%	14%
30.1-35cfs	10%	12%
35.1-40cfs	9%	11%

Using the look-up table, losses can be estimated for the historical monthly flow records for 2009 through 2020 for releases from Forebay (referred to as Gage A-18). **Table 3** below presents the resulting monthly and annual loss estimates. Note that although the flow records indicated flows from Forebay during the months of October through December, the flows were approximately 1 cfs or less to provide ditch customers with water and were thus conservatively reflected as zero loss in the table. This tends to under-estimate seepage losses and does not capture carriage losses that occur during this period.

Table 3 – Calculated Loss

Loss (AF)	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Average
Jan	162	156	139		157	102							143
Feb	180	151	112	122	194	145							151
Mar	167	177	154	145	223	142	136			109			157
Apr	247	179	198	145	256	194	220			187			204
May	268	222	265	231	241	232	226	172		229	185	133	219
Jun	245	205	256	262	240	242	257	240	198	241	239	294	243
Jul	239	221	222	203	248	251	207	228	204	204	257	382	239
Aug	226	229	221	204	221	245	266	205	269	248	258	261	238
Sep	244	222	216	263	239	232	193	199	197	201	146	224	215
Oct	0	0	0	0	0	0	0	0	0	0	0	0	0
Nov	0	0	0	0	0	0	0	0	0	0	0	0	0
Dec	0	0	0	0	0	0	0	0	0	0	0	0	0
Annual Loss	**1,977**	**1,763**	**1,783**	**1,576**	**2,021**	**1,786**	**1,505**	**1,044**	**867**	**1,420**	**1,085**	**1,293**	**1,807**
Total Supplied	**11,585**	**8,289**	**6,998**	**7,318**	**12,048**	**8,663**	**5,421**	**5,467**	**4,555**	**5,642**	**4,445**	**3,945**	**8,617**
Percent Loss	**17%**	**21%**	**25%**	**22%**	**17%**	**21%**	**28%**	**19%**	**19%**	**25%**	**24%**	**33%**	**21%**

The look up table allows losses to also be estimated for historic periods when EID routinely conveyed up to 15,080 acre-feet annually through the Main Ditch. These historic higher flows pre-date the monthly digital records and were therefore not readily available for inclusion in this memo.

Conclusion

Using a look-up table that reflects the varying percentage of loss under different flow conditions and different seasons provides a supportable basis for estimating historic losses, and will be useful for establishing a method to identify quantifiable savings associated with the Project. Based on 2009 to 2020 data, minimum water savings of approximately 900 acre-feet per year and an average of approximately 1,800 acre-feet can be expected to result from piping the water supply that is currently conveyed through the Main Ditch.

Attachments (Available on request)

Attachment 1 – 1977 Ditch Flow Measurement
Attachment 2 – 2012 Ditch Flow Measurement
Attachment 3 – EID 2016 Single-day Ditch Flow Measurement
Attachment 4 – 2016 EID Upper Main Ditch Annual Water Loss Analysis
Attachment 5 – 2015 Sage Engineering Ditch Modeling
Attachment 6 – 2017, 2018, 2019, and 2020 EID Upper Main Ditch Annual Water Loss Analysis

B

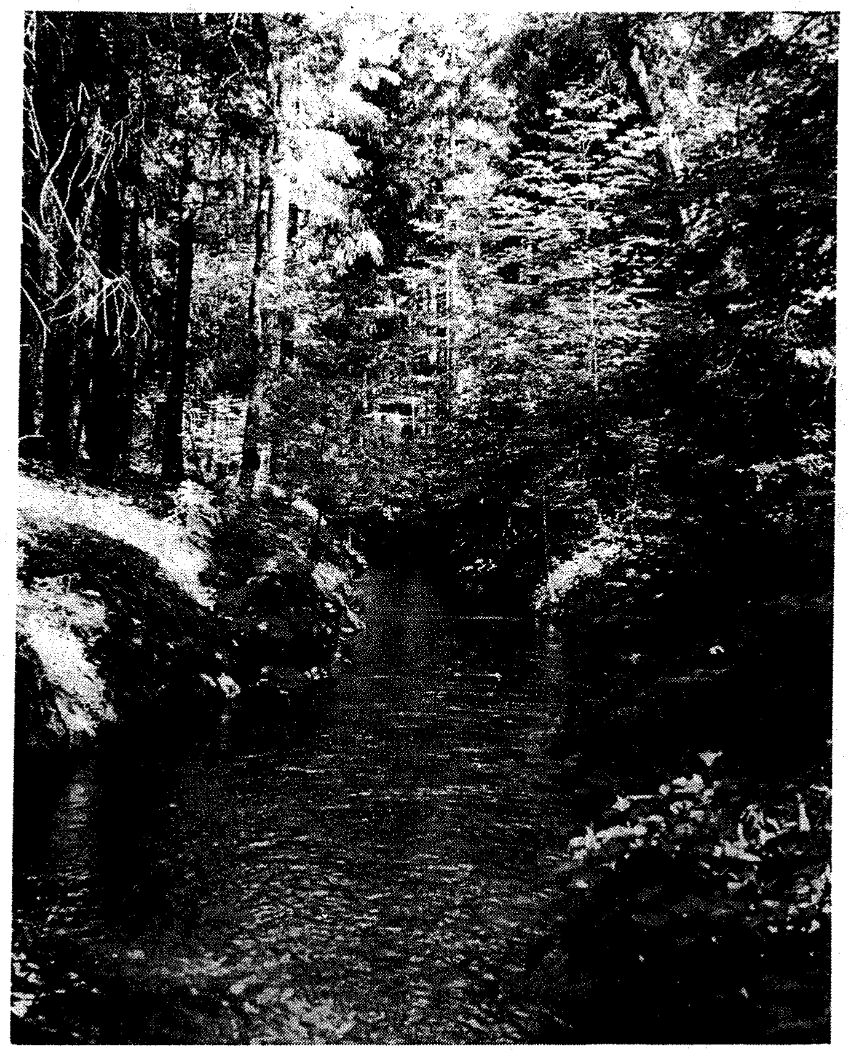
DOPAR LIBRARY

Attachment 1

Excerpt from

Environmental Assessment

Proposed El Dorado Main Canal Pipeline Project



El Dorado Irrigation District

In evaluating any of the proposed actions, it is useful to compare each to the project objectives to determine the degree to which each meets this set of objectives. This comparison is presented in the section on environmental impacts.

Project Need

The need for the project relates directly to each of the foregoing objectives. The purpose of this section is to describe the nature and extent of the need for some action by EID and to present all available information that substantiates and reinforces that need.

Water Losses

Various estimates of water losses from the ditch have been made, but until recently none was substantiated by actual field measurements or tests. On June 7, 1977, Mr. E. M. Padjen, a licensed civil engineer experienced in the measurement of surface flows, was retained by several property owners residing in the Blair Road area to quantify losses in the EID ditch. Mr. Padjen made one set of measurements using a current meter at Pine Wood Lane and another set at the Blair Road crossing of the EID canal. His figures indicate that, at a flow of approximately 15 cfs, losses from the ditch in that 1.7-mile stretch would equal approximately 3 percent of the flow, or slightly less than 0.5 cfs.

In June and July 1977, the EID staff was trained by the U. S. Bureau of Reclamation in the use of current meters to estimate the discharge in the canal. The EID staff took several sets of measurements on the ditch at locations immediately downstream from Forebay Reservoir, at the Pinewood Lane crossing of the ditch, and at the Blair Road crossing of the ditch. While there are some variations in the computed losses, the tests seem to show that at a discharge of 40 cfs that the ditch loses about 9 percent of its flow between Forebay and the Blair Road bridge (about 3.5 cfs). The figures further show that about two-thirds of this loss (6 percent of the ditch flow) is lost between Pinewood Lane and Blair Road at this flow. These figures indicate that at full deliveries to th ditch under the PG&E contract, losses would amount to about 1,260 acre-feet per year in this section. Appendix G further explains these loss estimates.

When considering the test results, it is important to note that the measurement of flowing water in an irregularly-shaped ditch using a current meter is subject to error. Each individual measurement may be off from 5 to 8 percent. It is possible (although not probable) that errors in measuring could account for part or all of the indicated losses. It is also possible that the losses could be greater than those measured. However, it is known that discharges in downstream springs in the Blair Road area increase following an increase in flow in the ditch. This response of the springs is the reverse of the normal rainfall pattern in the area, thus indicating a strong relationship between these spring flows and flows in the ditch, as well as indicating that the seepage losses from the ditch do increase as the water level in the ditch increases.

Estimates of losses for the rest of the ditch are not presently available. Two series of flow measurements were made to evaluate losses downstream from the Blair Road crossing. However, during the days the measurements were made, PG&E changed the flows out of Forebay Reservoir several times. As a result, the measurements are not usable, although they do indicate that some losses may occur. Between Blair Road crossing and Reservoir No. 1, seepage is evident downhill from the canal. No seepage was observed downstream from Reservoir No. 1 along the canal.

As a result, the 1,260 acre-foot per year estimate does understate the losses, to an unknown degree.

Maximize Use of Available Water

During the severe 1977 drought year, EID has had to cut back total district-wide water use by approximately 42 percent. This is one of the greatest reductions in water supply that has had to be imposed in any area of California during the drought. Both domestic and agricultural uses have been cut back significantly. Most dramatic however, has been the effect on the non-commercial agricultural uses which have not been allocated any water whatsoever. Only property owners who are able to demonstrate a commercial and viable agricultural operation have been allocated water for agricultural purposes. This has been necessary to provide adequate water for domestic, commercial, agricultural and industrial endeavors in the district.

The situation is further pointed up by the fact that Sly Park Reservoir had an average annual inflow from 1960 to 1976 of about 35,000 acre-feet. At the end of last year, Sly Park contained only 7,675 acre-feet of water in its 41,000 acre-foot capacity. Inflow for the year amounted to only 3,167 acre-feet -- a new record low. As a result, the principal water supply for EID in 1977 is the flow from Forebay Reservoir through the main canal.

APPENDIX G

COMPUTATION OF SEEPAGE LOSSES FROM EID MAIN CANAL

Flow measurements were made by E. M. Padjen on June 7, 1977 and by EID staff in June and July 1977. The Padjen measurements indicate a loss of 3 percent of the flow between Pinewood Lane and the Blair Road crossing at a flow of 18 cfs. The EID measurements indicate a loss of between 9 and 10 percent between Forebay and Blair Road crossing, with about a 6 percent loss in the reach measured by Padjen, at flows of 40 cfs.

By prorating Padjen's loss estimate back to Forebay, including the Forebay-Pinewood Lane reach which he did not measure, a total of 4.5 percent loss at 18 cfs flow could be postulated. It should then be possible to plot the losses, both by percent loss and by cfs loss, to extrapolate losses for this reach of the canal at any flow. These assumptions are plotted on the attached figures.

The data upon which these charts are based may be in error. The measured flows vary enough from actual flows to account for a good portion of the measured losses, or to substantially understate the losses. Since other evidence corroborates that seepage losses do occur, and that the degree of loss varies with the flow in the canal, the charts have been drawn up and are used as the best available data. They must be used cautiously, however, and accepted as a guide only, not as a definitive answer.

These charts were used to determine the losses used in the assessment, based on the following computations:

<u>Loss at full flow</u>:

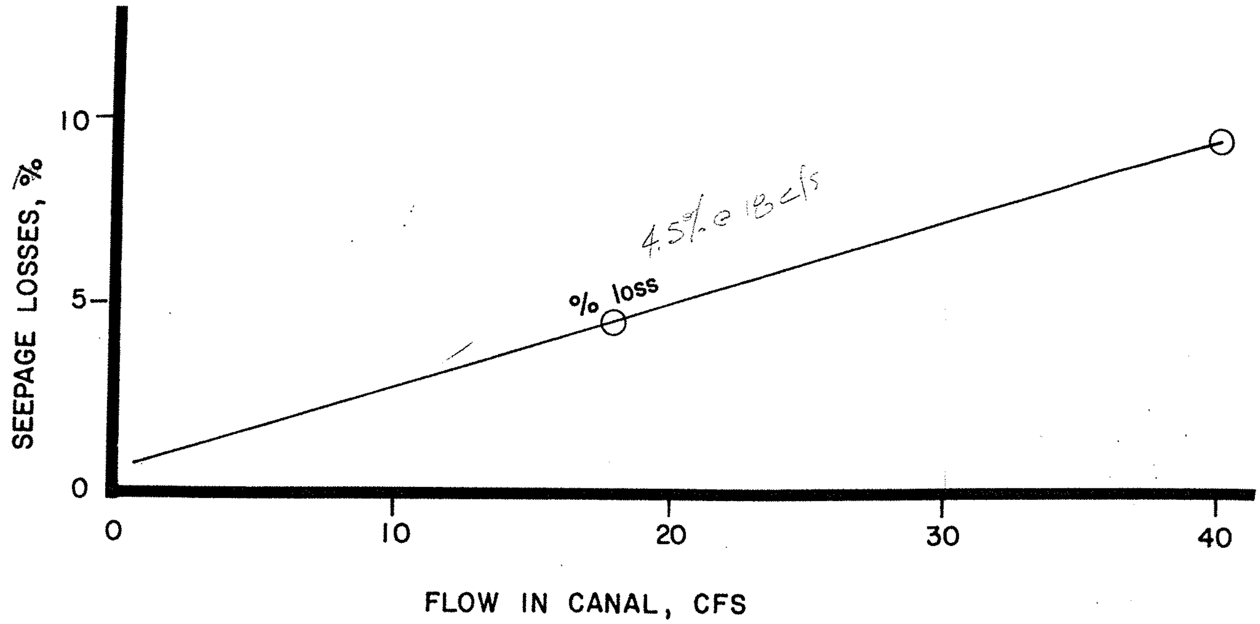
May 15-Oct 15:	4 cfs x 1.98 acre-feet/cfs-day x 152 days	= 1,200 acre-feet
Oct 15-May 15:	0.15 cfs x 1.98 acre-feet/cfs-day x 213 days	= 63 acre-feet
		1,263 acre-feet

<u>Use 1,260 acre-feet</u>

<u>Loss at 7 cfs flow year-around</u>:

0.15 cfs x 1.98 acre-feet/cfs-day x 365 days = 108 acre-feet

<u>Use 110 acre-feet</u>



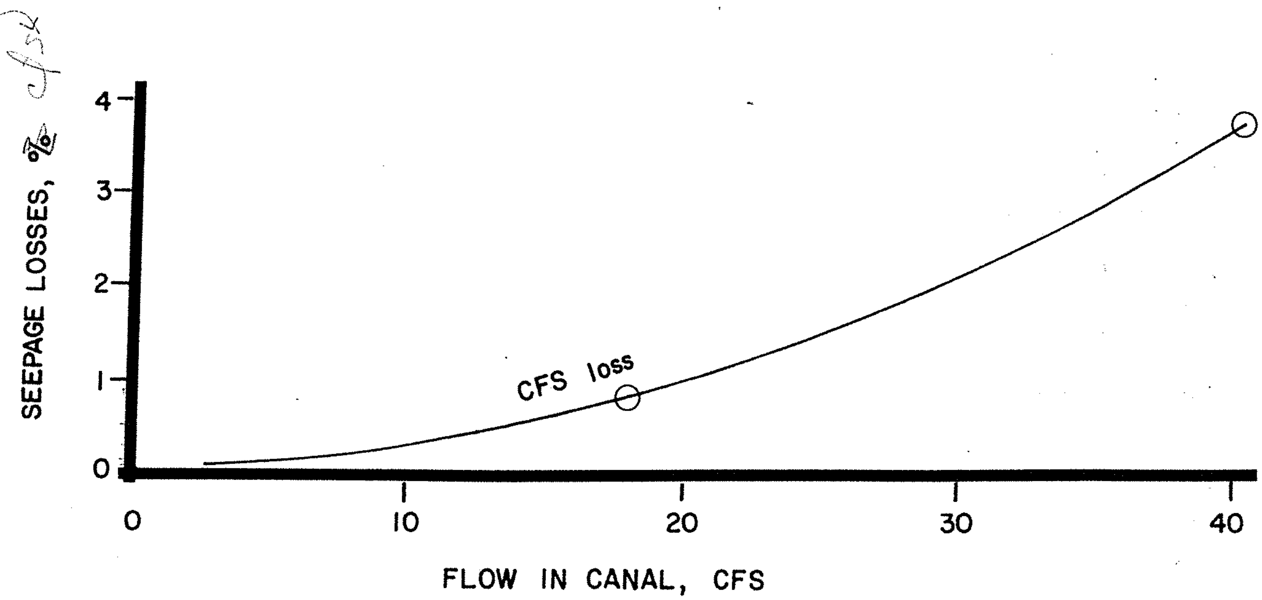
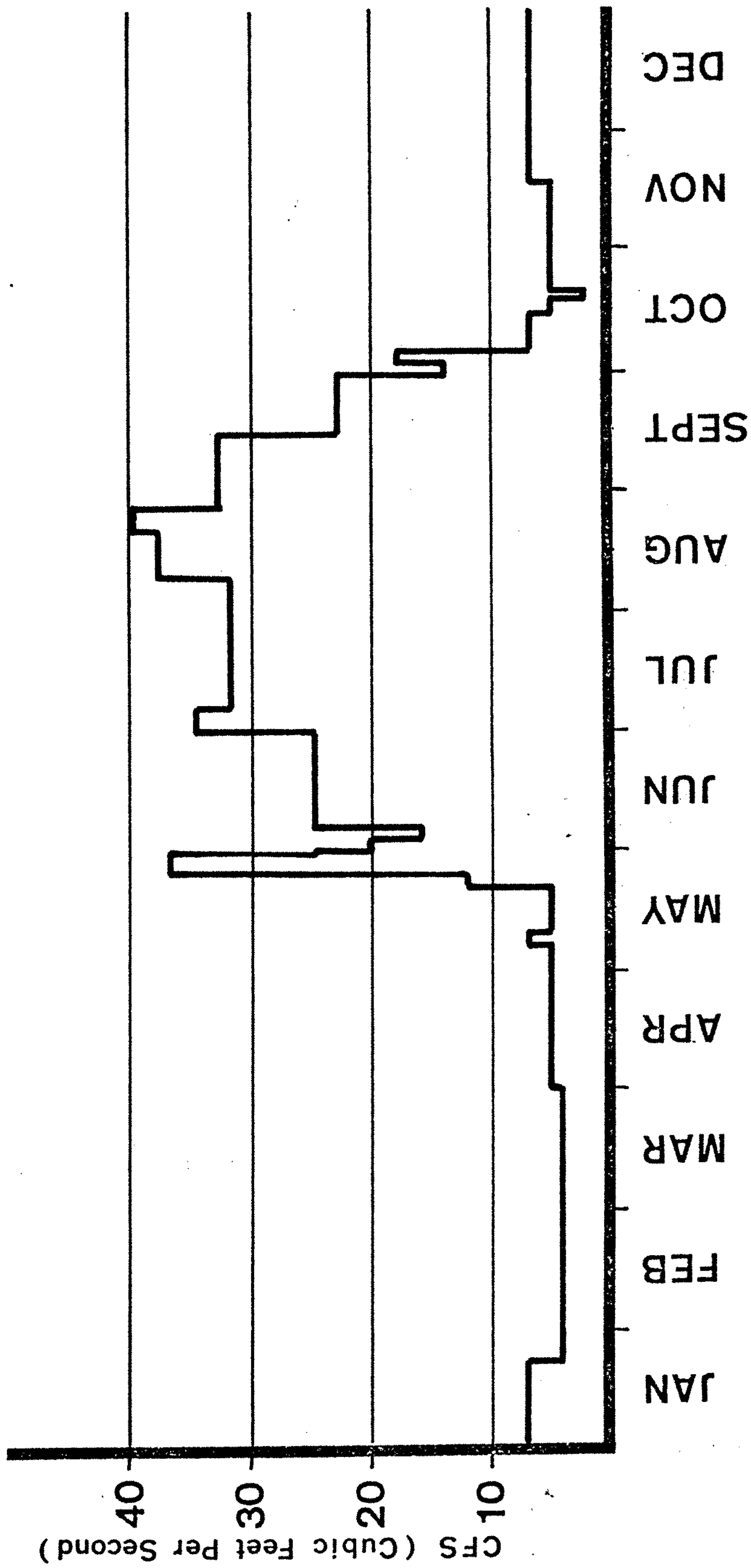
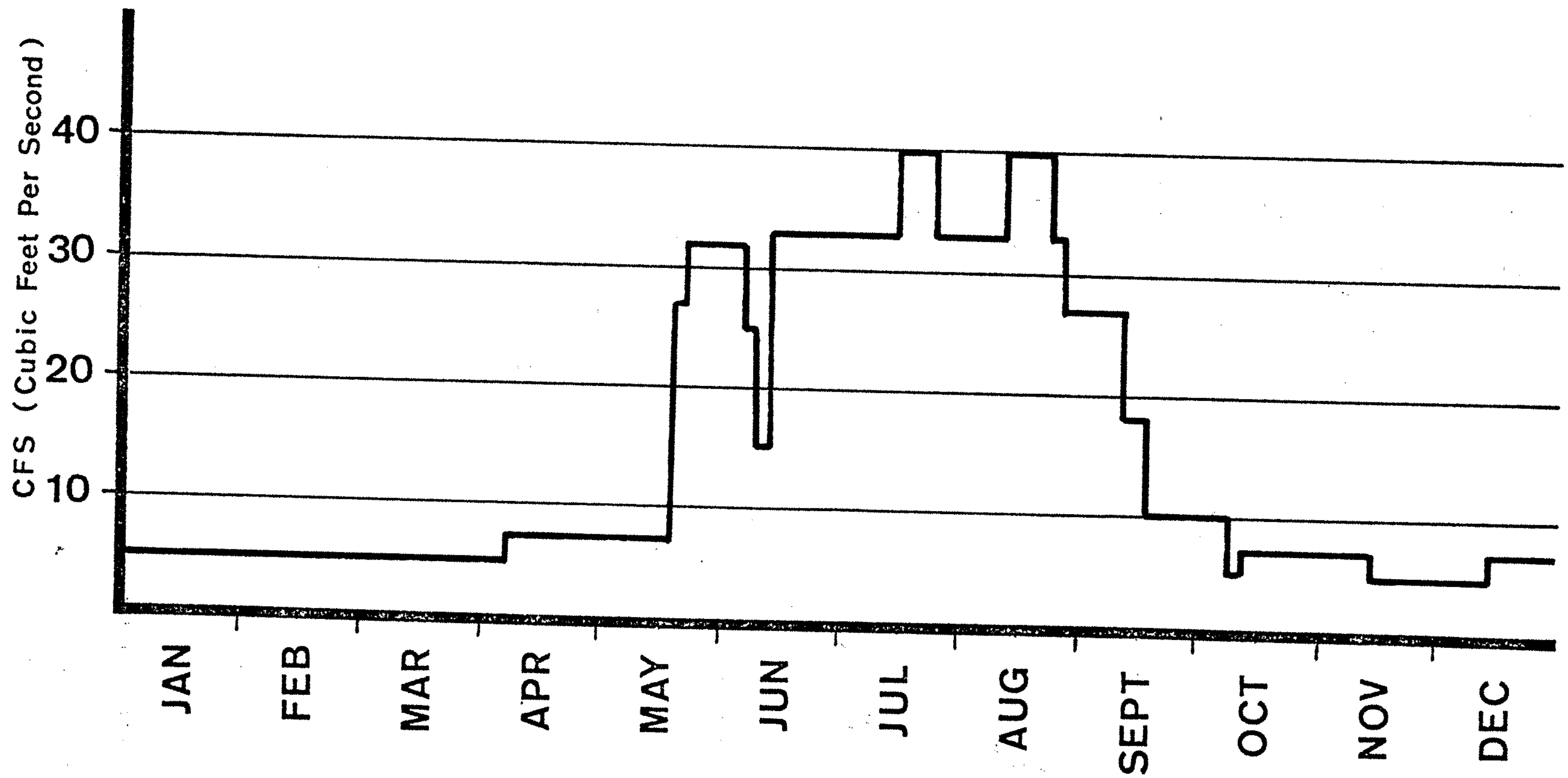


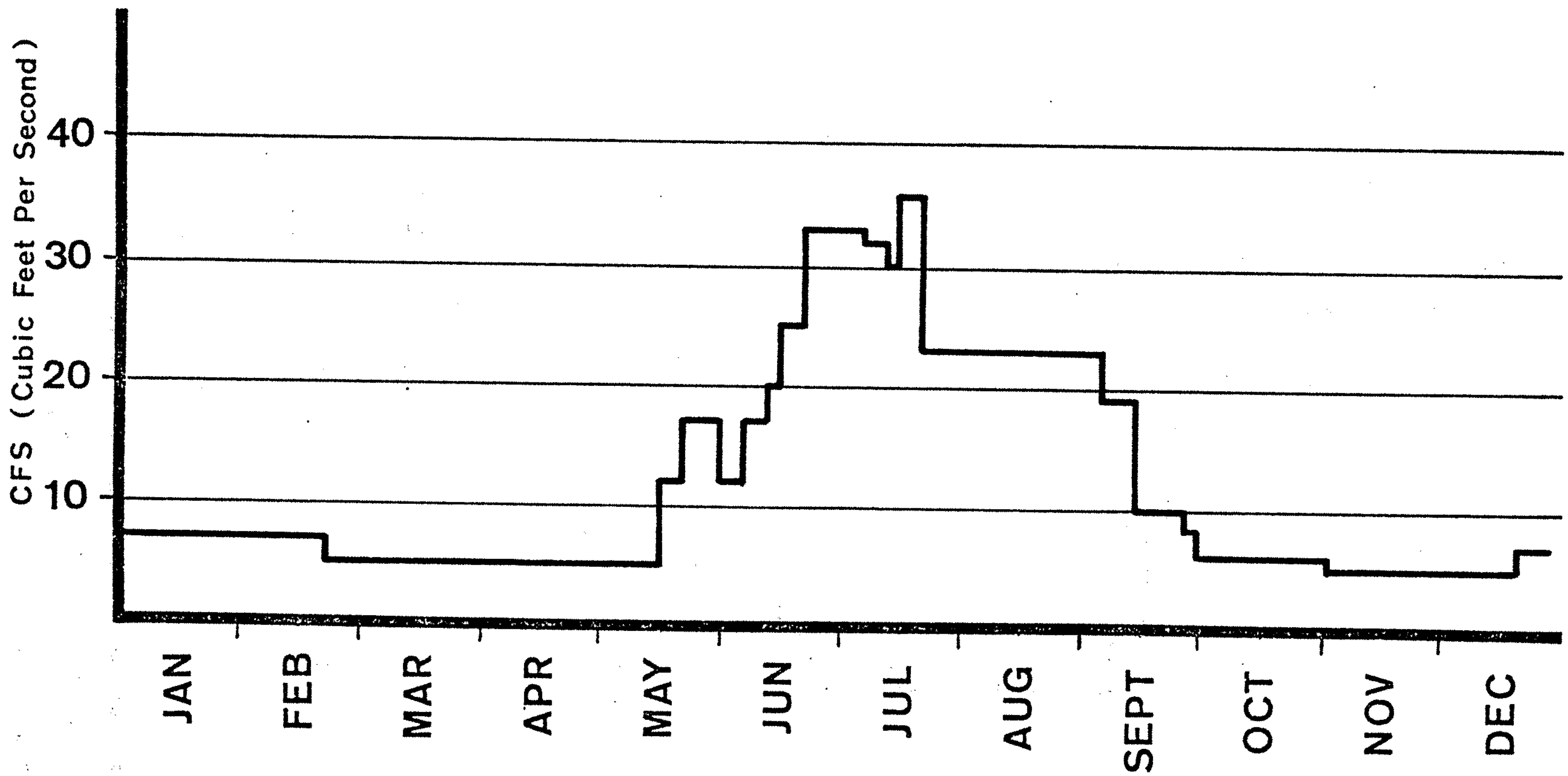
FIGURE GI. APPROXIMATE SEEPAGE LOSSES IN EL DORADO MAIN CANAL, FOREBAY TO BLAIR ROAD CROSSING



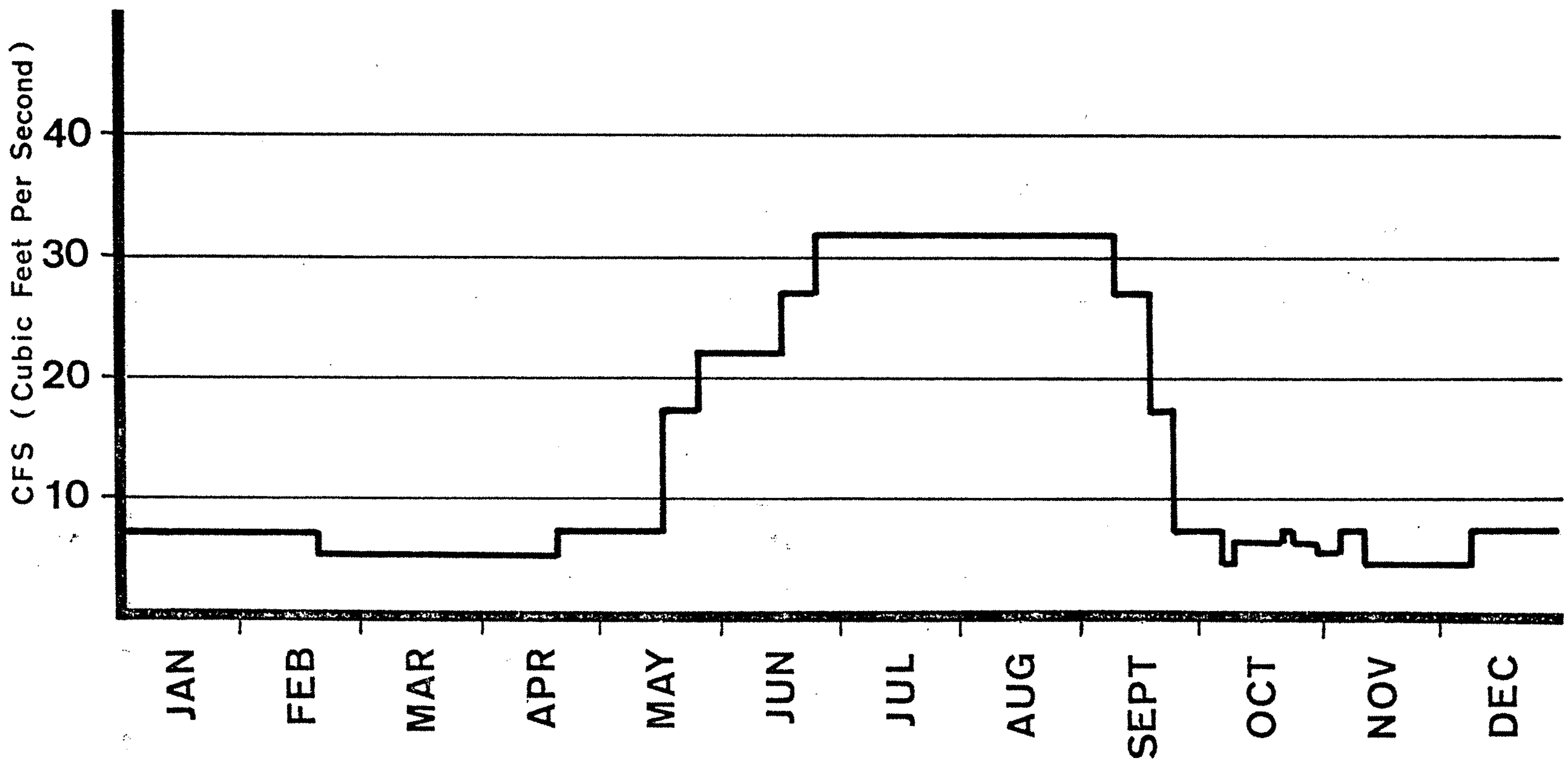
Recorded discharge from Forebay Reservoir in the EID Main Canal for Calendar Year 1969



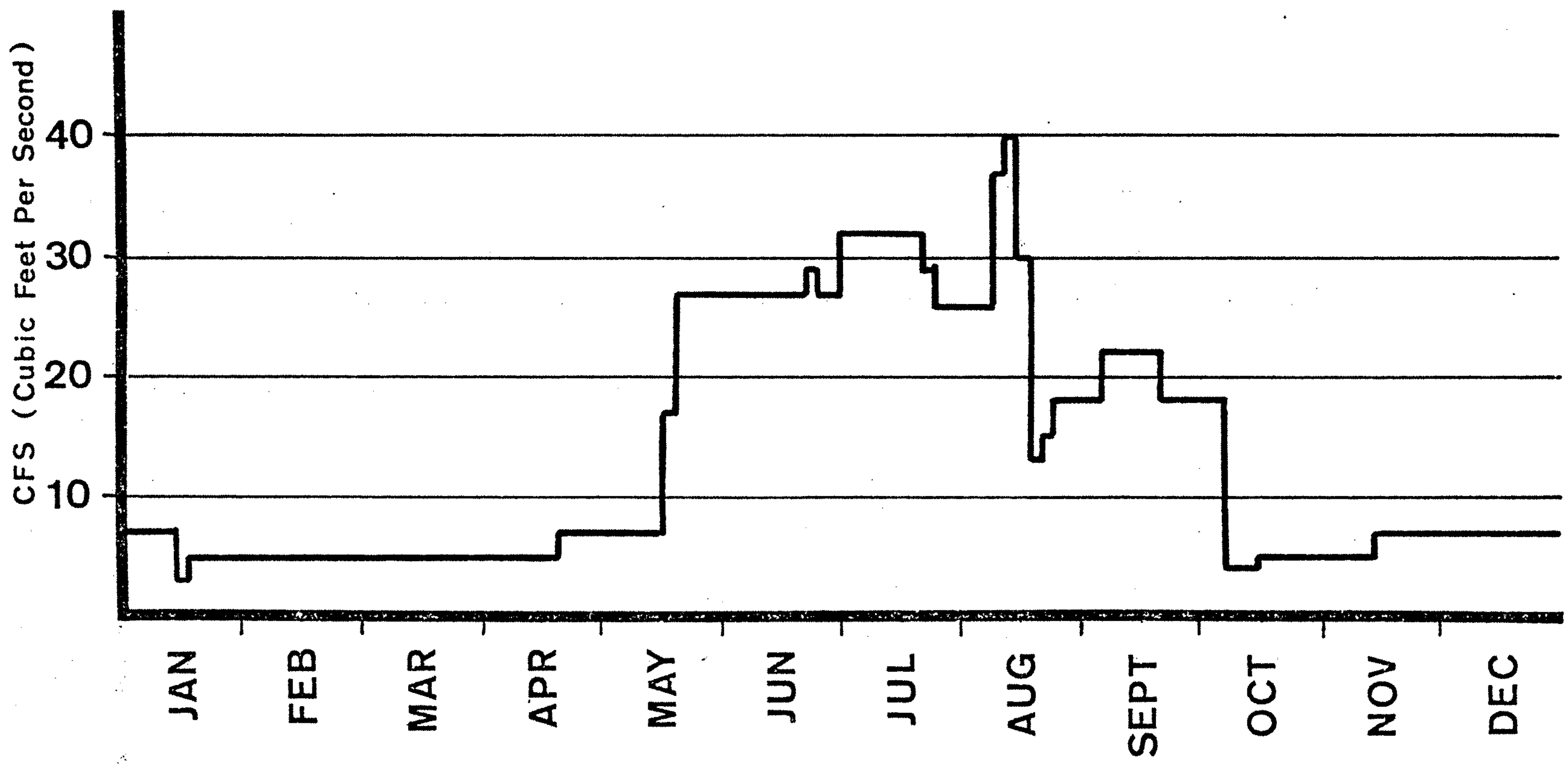
Recorded discharge from Forebay Reservoir in the EID Main Canal for Calendar Year 1970



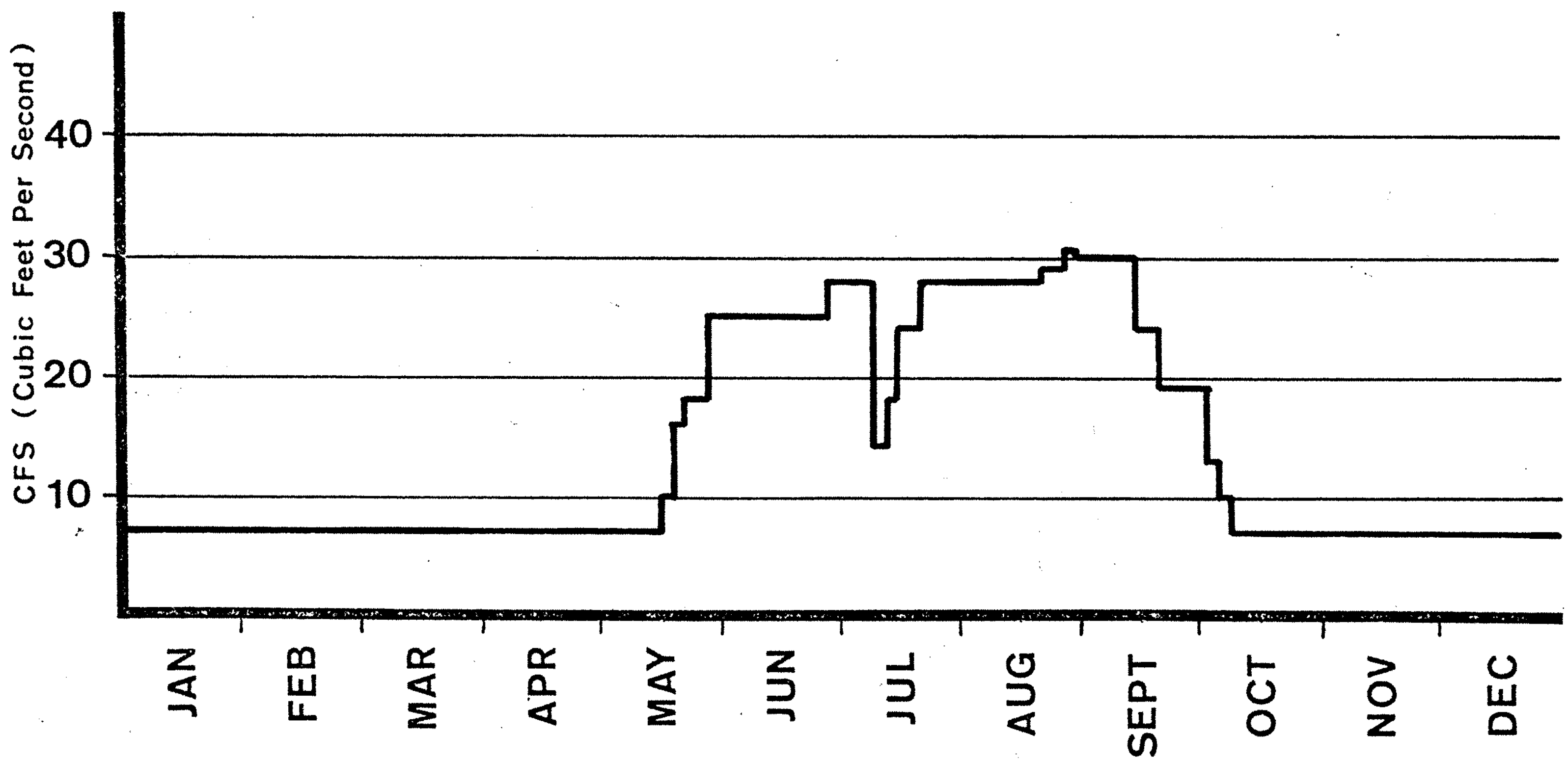
Recorded discharge from Forebay Reservoir in the EID Main Canal for Calendar Year 1971



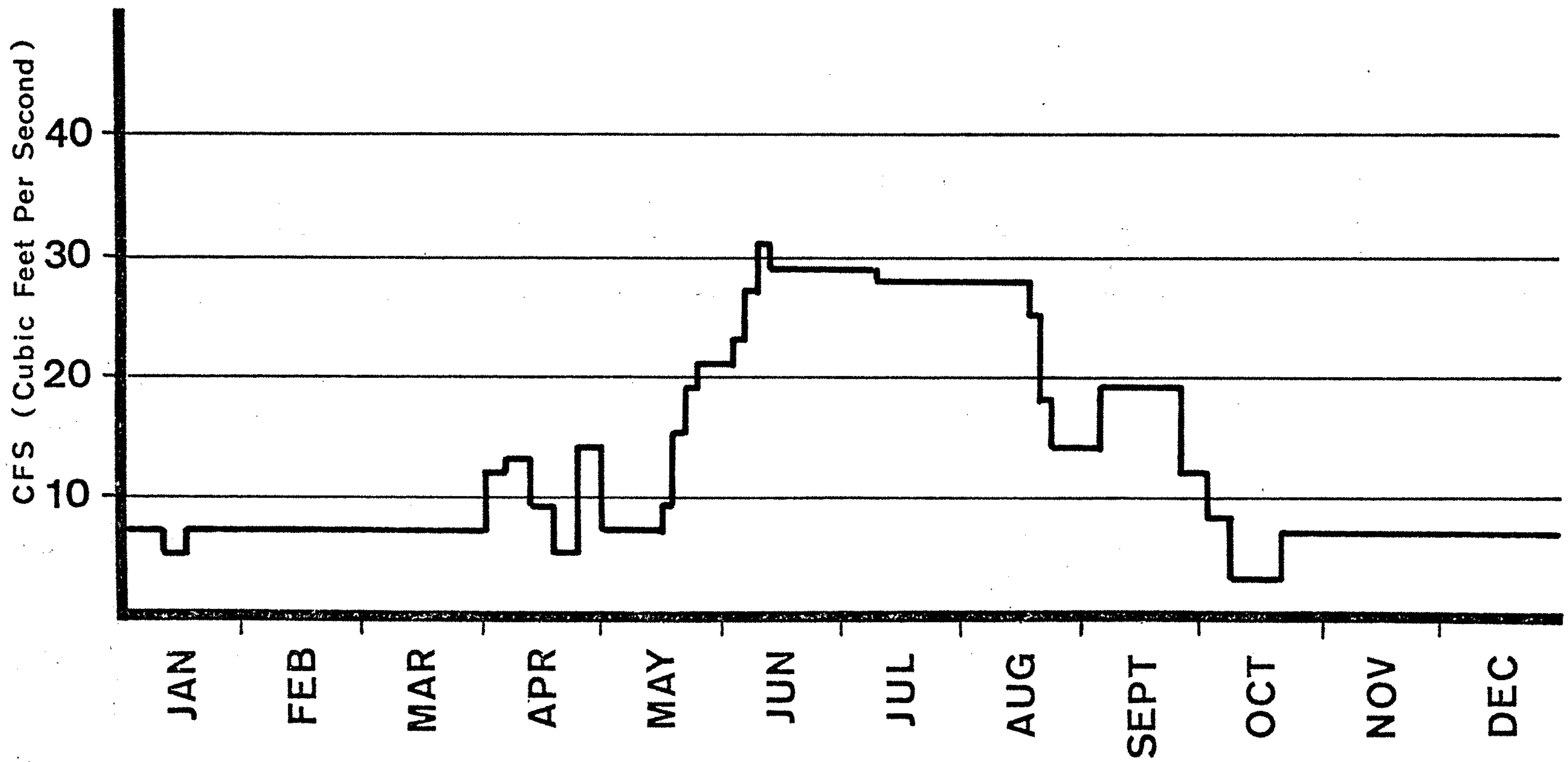
Recorded discharge from Forebay Reservoir in the EID Main Canal for Calendar Year 1972



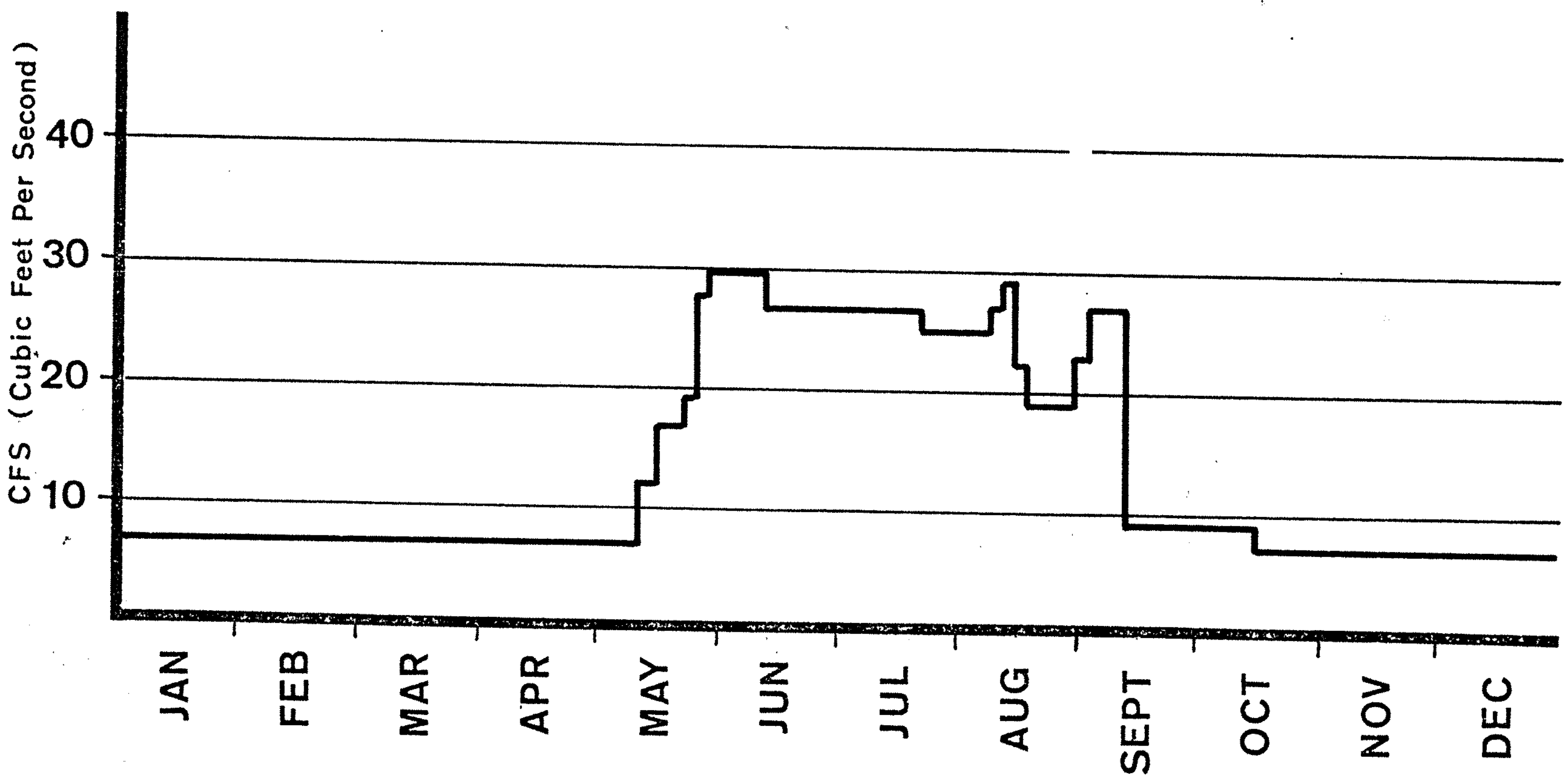
Recorded discharge from Forebay Reservoir in the EID Main Canal for Calendar Year 1973



Recorded discharge from Forebay Reservoir in the EID Main Canal for Calendar Year 1974



Recorded discharge from Forebay Reservoir in the EID Main Canal for Calendar Year 1975



Recorded discharge from Forebay Reservoir in the EID Main Canal for Calendar Year 1976

ERRATA SHEET

Environmental Assessment of Proposed
El Dorado Main Canal Pipeline Project
August 19, 1977

Page 7 under Maximize Use of Available Water, first paragraph, second line: "42 percent" should read "58 percent".

Page 19, bottom of page, last line: "Placer County" should read "El Dorado County".

Page 29, delete first sentence on page, add: "Bacteriological quality has been tested on a long-term basis. Additional, more intensive testing was performed for this report. The discussions in this assessment are based on these recent tests."

Page 37, below the table, add: "Source: Storer and Usinger, 1963."

Page 46, second paragraph, first indented line should read: "Water supply: Georgetown Divide Public Utilities District..."

Page 58, last paragraph, under Water Sources, the sixth sentence, beginning "The Coloma-Lotus Ditch diverts..." should be deleted. Add: "The district has rights to about 6,900 acre-feet per year from the Coloma-Lotus Ditch, and diverts about 600 acre-feet annually. The district also has rights to 1,300 acre-feet on Weber Creek."

Page 61, Table 15 excludes data for the Coloma-Lotus Ditch.

Page 62, Table 16, add to bottom of table: "Source: El Dorado Irrigation District, 1976".

Page 65, third full paragraph, seventh line: "Indian Hill Reservoir" should read "Union Hill Reservoir".

Page 141, in the left margin of the lower chart, the vertical axis "Seepage losses, %" should read "Seepage losses, cfs".

Pages 103-105, Bibliography, add:

California. Department of Finance, Population Research Unit, 1977. Provisional Projections of California Counties to 2000. Report 77P-1, August 1, 1977, photocopy, 6 pp.

EDCPD — see El Dorado County Planning Department.

El Dorado Irrigation District, 1952. The Story of Water: From Miner's Ditch to Sly Park Dam. 16 pp.

Storer, Tracy I., and Robert L. Usinger...

Delete:

EID (additions to) El Dorado...

San Francisco Chronicle...

ENVIRONMENTAL SETTING OF THE PROJECT

Physical Environment

Soils

The soils in the project area are derived from metamorphic or volcanic conglomeritic rocks. The most common soils in the area are the Cohasset loams and the Aiken loams. Minor soils occurring in the project area are the Josephine very rocky or gravelly loams, the Mariposa-Josephine very rocky loam, and the McCarthy cobbly loam. These soils are described below and located on the soil map (Figure 1).

Cohasset Series. The Cohasset series are well drained soils underlain by weathered andesitic conglomerate at a depth of more than 40 inches. These soils are gently sloping to strongly sloping on smooth ridges or are moderately steep to steep on sides of ridges.

Vegetation is mainly coniferous forest and associated hardwoods.

In representative profile, the surface layer is brown and reddish brown, slightly acid cobbly loam about 14 inches thick. The subsoil is reddish-brown and yellowish red, medium acid cobbly heavy loam and cobbly clay loam about 32 inches thick. Parent rock is slightly weathered andesitic conglomerate at a depth of about 46 inches.

The Cohasset soils are a dominant soil type in the project area. The three Cohasset soils found here are: the Cohasset loam, 3-9 percent slope; Cohasset loam, 9-15 percent slope; and the Cohasset loam, 15-30 percent slope.

Aiken Series. The Aiken series are well drained soils underlain by deeply-weathered andesitic conglomerate at a depth of 4 feet or more. The soils are gently sloping to moderately steep on wide smooth ridges and the sides of ridges. Vegetation is mainly coniferous forest and associated hardwoods.

In representative profile, the surface layer is brown and reddish brown, medium acid loam and clay loam about 24 inches thick with subsoil red and yellowish red. Medium acid and strongly acid heavy clay loam and clay are found to a depth of more than 72 inches.

The soil supports woodland and deciduous fruit orchards.

The Aiken soils common in the project area are: Aiken loam, 3-9 percent slope eroded; Aiken loam, 9-15 percent; and the Aiken loam, 15-30 percent slope.

<u>McCarthy Series</u>. The McCarthy series are well drained soils underlain by volcanic conglomerate and Breccia at a depth of 24-40 inches. These soils are strongly sloping on ridges and are steep on side slopes. These soils mainly support coniferous forest and associated hardwoods with scattered areas of brush.

In representative profile, the surface layer is dark grayish brown and brown, slightly acid cobbly loam about 10 inches thick. The subsoil is strong brown, medium acid, very cobbly loam about 28 inches thick. This is underlain by weathered andesitic conglomerate.

The McCarthy soil found in the project area is the McCarthy cobbly loam, 9-50 percent slope.

<u>Josephine Series</u>. The Josephine series are well drained soils underlain by vertically-tilted schists, slates and contact metamorphic rocks at a depth of 40-60 inches. These soils are gently rolling to very steep on mountainous uplands. Vegetation is mainly coniferous forest and associated hardwoods with scattered areas of brush.

In representative profile, the surface layer is yellowish-brown and reddish-yellow, medium acid and strongly acid silt loam about 14 inches thick. The upper part of the subsoil is reddish-yellow, very strongly acid silty clay loam about 19 inches thick. The lower part of the subsoil is yellow, very strongly acid, very gravelly silt loam, and is underlain by slate at a depth of 50 inches.

The two Josephine soils found in the project area are: the Josephine very rocky loam, 15-50 percent slope; and the Josephine gravelly loam, 9-15 percent slope.

<u>Mariposa Series</u>. The Mariposa series are well drained soils underlain by vertically-tilted schists and slate which contact metamorphic rocks at a depth of 15-30 inches, and are restricted to sloping or rolling to very steep terrain on mountainous uplands. Vegetation is mainly mixed coniferous forest and associated hardwoods and brush.

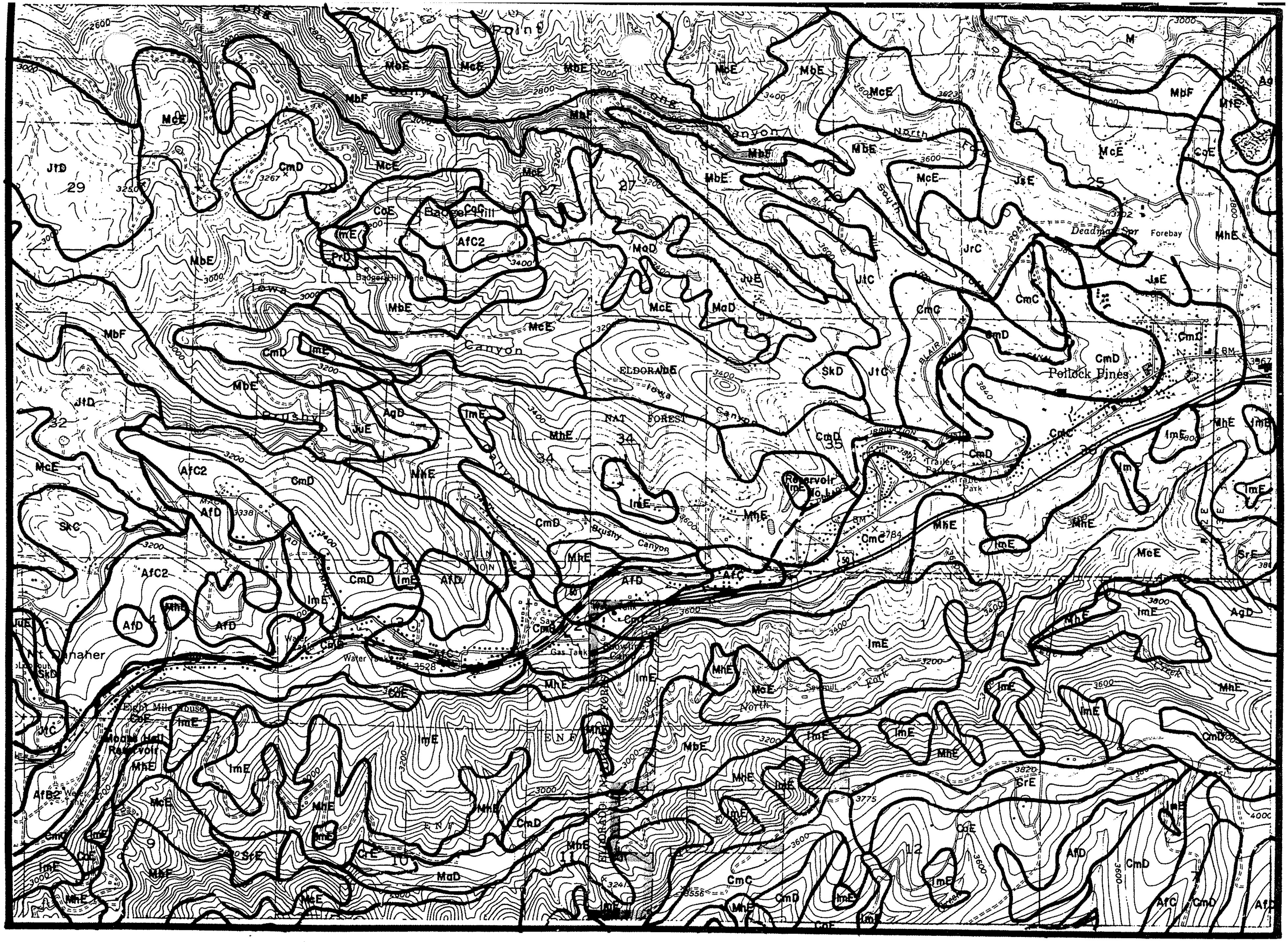


FIGURE 1 SOILS ADJACENT TO EID MAIN CANAL

In representative profile, the surface layer is pink, medium acid, gravelly silt loam about 8 inches thick. The subsoil is reddish yellow, medium acid and strongly acid gravelly silt loam about 18 inches thick. This is underlain by schists or slate at a depth of about 26 inches.

The Mariposa-Josephine very rocky loam is found in the project area.

Soil Permeability and Canal Flows. The EID main canal is affected by the underlying soils in several ways.

First the ditch, as an earth lined channel, is subject to water losses in transit, through seepage. The soils are classified by the Soil Conservation Service (SCS) according to permeability which is a measure of how fast water will move through the soil, expressed in inches per hour. In the project area soil permeabilities are rated as moderate and moderately rapid to moderately slow. (See Table 2). That means the water moves at a rate somewhere between .2 and 6.3 inches per hour depending on local conditions. The range of permeabilities shows the soils can allow substantial amounts of water to percolate, where the more permeable soils exist.

The soils in the project area are all rated by SCS as having severe limitations on their suitability for use as septic tank filter fields. This limitation is due to slope which can be as much as 50 percent. The soil can be very permeable locally and transmit water at a rate up to 6.3 inches per hour.

Geology

The oldest rocks in the project area are Paleozoic graywackes and volcanics (Calaveras formation) laid down in shallow seas between 600 and 230 million years ago. One hundred forty to 70 million years ago these sediments were turned steeply on end, metamorphosed into hornfels, slates and schists and intruded by granitic rocks and gold-bearing quartz veins. These intrusive granitic rocks form the core of the present Sierra Nevada. A long period of erosion followed, wearing down the mountains and depositing gold-bearing gravels in the river beds. In the early Cenozoic (65 million years ago) volcanism on the east side of the Sierra deposited rhyolitic ash and flows (Valley Springs formation). The andesitic tuffs and mud flow breccias of the Mehrten formation were deposited in the middle Cenozoic (about 25 million years ago).

TABLE 2

SOIL CAPABILITIES AND CHARACTERISTICS

Soil	Erosion Hazard	Permeability of Subsoil	Runoff	Septic Tank Filter Field Suitability
Cohasset loam				
CmB, 3-9% slope	Slight	Moderate	Slow to medium	Severe
CmC, 9-15% slope	Slight to moderate	Moderately rapid to moderately slow	Slow to medium	Severe
CmD, 15-30% slope	Slight to high	Moderately rapid to moderately slow	Slow to medium	Severe
Aiken loam				
AfB2, 3-9% slope, eroded	Slight	Moderate	Slow to medium	Severe
AfC, 9-15% slope	Slight to moderate	Moderately rapid to moderately slow	Slow to medium	Severe
AfD, 15-30% slope	Slight to high	Moderately rapid to moderately slow	Slow to medium	Severe
Josephine				
JsE, very rocky loam, 15-50% slope	Slight to high	Moderately rapid to moderately slow	Medium to rapid	Severe
JrC, gravelly loam, 9-15% slope	Slight to moderate	Moderately rapid to moderately slow	Slow to medium	Severe
McCarthy				
MhE, cobbly loam, 9-50% slope	Moderate to high	Moderately rapid to moderately slow	Medium to rapid	Severe
Mariposa-Josephine				
McE, very rocky loam,	Slight to high	Moderately rapid	Medium to rapid	Severe

During the Pliocene (3 million years ago) block faulting uplifted the eastern edge of the Sierra along a major fault. A new, west-flowing stream pattern was established, cutting deep canyons through the volcanic debris and tertiary river deposits into the granitic and meta-volcanic bedrock. The lava flows remain as remnants capping the ridges.

The project area is on the gently sloping west side of the Sierra Nevada block, on a west-trending ridge dividing the South Fork of the American River and Webber Creek.

There are no active faults in the project area. The foothill fault system has had no movement since the late Mesozoic (100 million years ago). Any earthquake shock which could affect the project area would originate in the Basin and Range province to the east. Shocks greater than intensity VI have not occurred in the last 100 years. Shocks of intensity VII to VIII should be anticipated, however, during the next few centuries from very strong earthquakes in the Basin and Range Tectonic province (United States Bureau of Reclamation, 1974).

Surface Water Hydrology and Quality

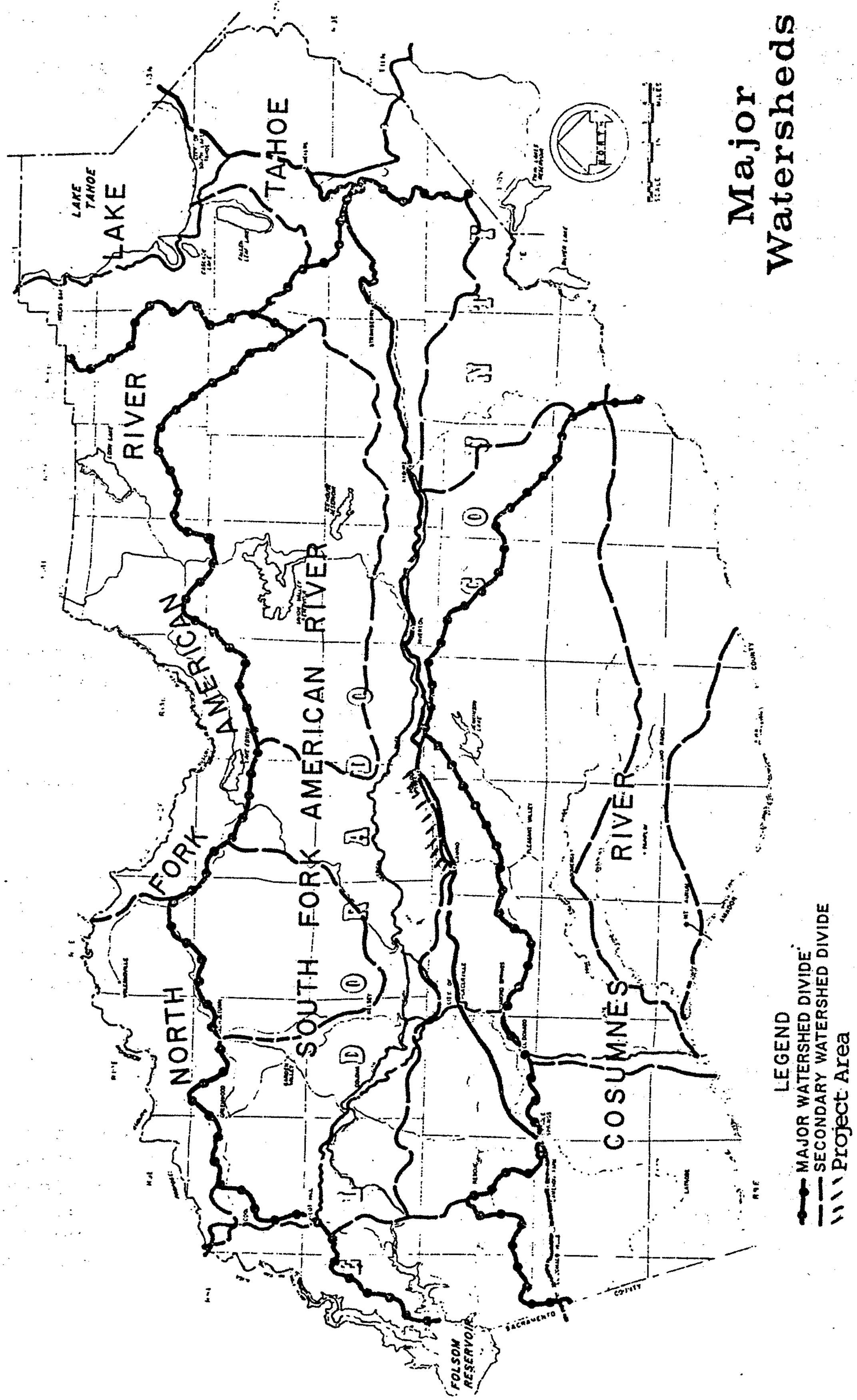
El Dorado County contains 4 major and 18 minor watersheds. The El Dorado Irrigation District encompasses portions of the two largest: the South Fork of the American River and the Cosumnes River watersheds (see accompanying map).

The project area is within the South Fork of the American River drainage basin, near the southerly margin, on a ridge which forms the divide between two minor watersheds.

The water carried in the ditch originates in the South Fork of the American River. Pacific Gas & Electric diverts the water at Kyburz and conveys it 23 miles by gravity as surface flow in a ditch built in the same time period as the EID ditch. The water is delivered to PG&E's Forebay Reservoir, the point of origin of the EID ditch.

Chemical water quality in the ditch is very good. A report of chemical analysis is given in Table 3. .

Physical quality of the water is generally good, although turbidity is a significant problem. Recent tests of physical quality (Table 4) show that turbidity increases significantly as water flows along the ditch. The worst effect occurs in the area downstream from Reservoir No. 1, primarily due to the steep gradient and resulting erosive force of the flows.



Major Watersheds

Table 3

REPORT OF CHEMICAL ANALYSIS
FOREBAY

Location	Res. #1	Forebay	Forebay #5	Camino Ditch
Date Sampled	10-4-71	5-25-76	12-15-76	7-1-76
Hardness	12	10	9	12
Bicarbonate	18	15	15	18
Carbonate	0	0	0	0
Hydroxide	0	0	0	
Alkalinity	15	12	12	15
Calcium	3.6	3.3	2.4	4.0
Magnesium	.73	.58	.71	0.5
Iron (total)	.50	.09	.00	0.02
Manganese	.06	.00	.00	0.01
Sodium	1.2	2.3	2.8	2.9
Potassium	.8	.7		
Chlorides	3.5	3.0	4.3	3.8
Sulfates	1.5	0.	0.	1
Fluorides	.05	.0	.0	0.1
Nitrates	.05	.00	.03	0.02
pH	7.5	7.2	7.1	7.4
Conductivity	31.5 MHOS/cm			105
Color		8		12
Turbidity			.44	2.2

Source: El Dorado Irrigation District, 1977c.

Table 4

PHYSICAL CHARACTERISTICS OF EID DITCH, MEASURED AT 40 CFS FLOW

	Conductivity	Turbidity	Dissolved Oxygen
Forebay Reservoir	300	3 JTUs	8.1
Gilmore Road	290	5	8.1
Upstream from Moose Hall Reservoir	310	15	8.1

Source: El Dorado Irrigation District, August 9, 1977.

Bacteriological quality of the raw ditch water has only recently been tested. Initial tests run by the county indicated fecal-coliform present. The county tests do not indicate the full magnitude of the contamination, so El Dorado ran tests in their own lab. Results from both agencies are summarized in Table 5.

The tests indicate levels typical of untreated raw water supplies. They do not indicate any public health problems to be present at the time of testing. Chlorination would probably disinfect the water sufficiently well to provide for public safety.

Surface runoff from rainfall is intercepted by the canal throughout much of its length. Between Halsey Forebay Reservoir and Reservoir No. 1, all natural drainage courses, overland flow and roadway drainage enters the EID canal. About 345 acres of land are tributary, including residential and commercial acres of Pollock Pines (see Figure 2).

From Reservoir No. 1 to Moose Hall Reservoir, the tributary area is considerably narrower, since the canal more nearly follows the ridge line. In this reach about 100 acres of residential, commercial and vacant land, including considerable frontage on Pony Express Trail, is tributary to the canal. Pipe culverts draining roads in the area frequently empty directly into the canal.

According to EID staff (pers. comm.) the storm drainage of the area has been tributary to the canal since it was constructed over 100 years ago. In effect, this has protected downstream lands from storm drainage water, particularly in the Pollock Pines area. It has also intercepted and diverted whatever natural stream flow occurred in the various drainage courses during the wet season. The frequency and duration of the natural flows in these small streams are unknown.

It is probable that high intensity rainfall or rapid snowmelt in the Camino-Pollock Pines area could cause the flows in the canal to exceed capacity, flooding lands downstream. These occurrences would be short-lived, and none has been formally reported to EID (pers. comm.)

Table 5

1977 BACTERIAL TESTS: RAW CANAL WATER

Date/Agency	Forebay Pump		Reservoir #1		Moose Hall	
	Total Coliform	Fecal Coliform	Total Coliform	Fecal Coliform	Total Coliform	Fecal Coliform
June 27 El Dorado County Health Department	>16	16	>16	16	>16	16
June 29 El Dorado County Health Department		>16		>16		5.1*
July 5 El Dorado County Health Department		16		>16		>16
July 6 El Dorado County Health Department		16		>16		>16
July 11 El Dorado County Health Department		5.1		>16		>16
July 13 El Dorado County Health Department		>16		>16		>16
July 21 El Dorado Irrigation District	140	17	49	9	79	79
July 27 El Dorado Irrigation District	17	17	79	79	240	49
August 2 El Dorado Irrigation District	240	240	350	350	49	49

*Sample inadvertently taken below polymer feed.

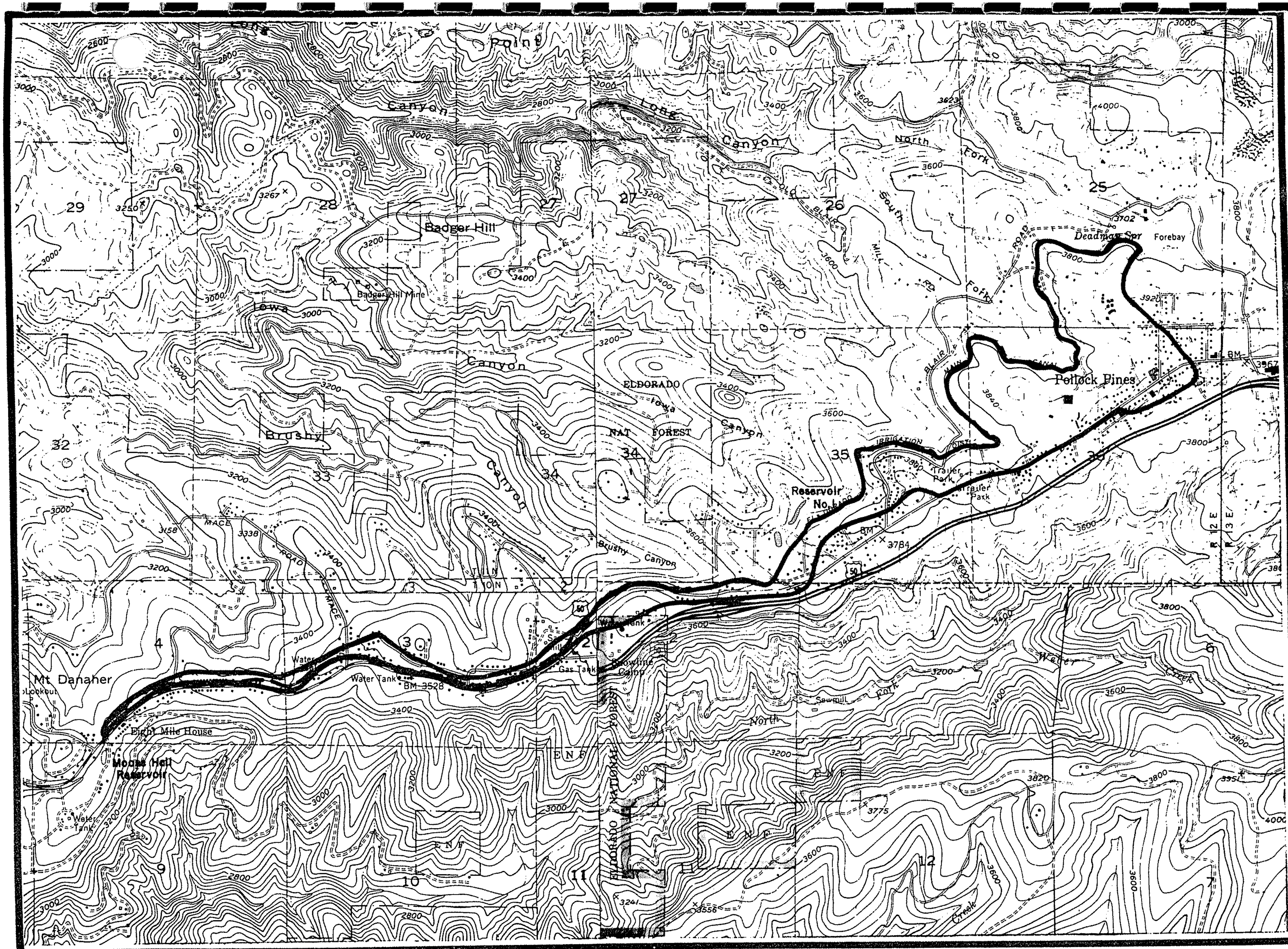


FIGURE 2 DRAINAGE AREAS TRIBUTARY TO EI DORADO MAIN CANAL

Quality of runoff water from undisturbed forest lands in the American River watershed is generally excellent. Urban runoff contains numerous pollutants, including nutrients, significant amounts of heavy metals, pesticides, and fecal-coliform (Sartore, et al., 1974). Since the areas tributary to the canal are a mixture of urban uses and relatively undisturbed forest, the quality of runoff water is anticipated to be of better quality than urban runoff, while containing constituents typical of urban runoff in reduced concentrations.

The timing of runoff is dependent on precipitation. The first heavy rain of the season will carry a sudden surge of accumulated pollutants into the canal at one time. The more closely spaced the periods of runoff are, the lesser the impact of each occurrence relative to pollutant concentration.

Groundwater

Groundwater is a limited source of water to the EID. There are no groundwater basins of any size in the area. Local residents have been able to supply limited amounts for household use by drilling shallow wells, but yields are typically meager (EID, 1977).

Most geologic formations in the area are relatively poor sources of groundwater. Wheeldon (1977), in a recent study of the Camino-Fruitridge-Pollock Pines area, has found the Mehrten formation (in which the ditch is located) to contain pervious zones which could supply groundwater during seasons of adequate rainfall. The Mehrten formation caps the Camino-Pollock Pines Ridge and is underlain by the Calaveras formation (see map). Groundwater seeps down to the impervious Calaveras formation underneath, and then migrates laterally to emerge as springs. Little water is retained as storage and "several dry seasons in a row might deplete this water source if these areas undergo extensive development" (Wheeldon, 1977).

Net available groundwater in the area studied by Wheeldon was estimated at 44,100 acre-feet, (Wheeldon, 1977). This figure was reached by calculating average precipitation times acreage then subtracting estimated evapotranspiration and stream runoff, and was based partly on data from the Pleasant Valley area. The study does not address the feasibility of wells for public water supply.

Seepage losses through the earth-lined canal contribute an estimated 1,260 acre-feet per year to the local groundwater. This seepage from the canal has a strong influence on the local groundwater regime. Springs downslope from the canal demonstrate this influence by mirroring the flow pattern in the canal. The normal hydrologic pattern for stream flow is for the period of peak discharge to occur during the winter and spring period of heavy rainfall. The springs in the Blair Road area exhibit the reverse of this normal pattern, having periods of high flow in the summer when the canal carries an increased flow and low flow in the winter, when the canal carries a reduced flow. Whether flow in these springs is completely dependent on seepage from the canal, or whether canal seepage merely enhances a natural flow is not known.

Groundwater along the ditch probably flows generally towards the northward, being consumptively used by vegetation, surfacing in the springs and streams, or recharging downslope areas. Some of the seepage water probably returns to the South Fork of the American River, but the quantity is not known.

Most of the homes in the Blair Road area and along Old Blair Mill Road rely on individual private wells for their water supply. Seepage from Forebay Reservoir and the EID main canal may provide the primary recharge for these wells. Without actually eliminating seepage from the ditch, it is impossible to estimate the importance of recharge due to ditch losses relative to well yields.

Climate

The western slope of the Sierra Nevada range is charaterized by warm sunny summers and moderate to heavy winter precipitation. Temperatures range from the sub-zero to well above 100 degrees.

Marine air masses travel east from the Pacific and begin their ascent of the Sierra slope heavily laden with water vapor. Precipitation increases with elevation up to about 6,000 feet then decreases. Average seasonal rainfall ranges from 37.6 inches at Placerville (elevation 1,900) to 50 inches at Pacific House (elevation 3,400). Snowfall increases with elevation up to 9,000 feet then decreases. Average seasonal snowfall ranges from 10 inches at Placerville to 50 inches at Pacific House. Precipitation in the past two seasons has been far below normal with water shortages resulting.

Attachment 2

Main Ditch Instream Flow Measurements at Forebay and Patrick lane

AquaCalc 5000 (tm) by JBS Instruments
Firmware Version AQCUSH8c (c)1995-2000

GAGE ID#	Patrick Ln DS of grizzly	
DATE	1/27/2012	
TRANSECT	7	
USER ID#	4675	
SH BEGIN	0.58	
SH END	0.58	
GH BEGIN	0.58	
GH END	0.58	
EST. DISCHARGE	0	
EST. Q (ADJ)	6.04	
METER ID#	1	
AQUACALC ID#	0	
SOUNDING WT.	0	
START MEAS. AT	LEW	
METER TYPE	Pygmy ST2	
METER CONST. C1	0.9604	
	0.0312	
	METER	
METER CONST. C2	CONST. C3	0.96
METER CONST. C4	0.0312	
METER CONST. C5	0	
MEASUREMENT TIME	40	
MEAS. SYSTEM	SAE	
PERCENT SLOPE	0	
TOTAL VERTICALS	18	
TOTAL STATIONS	18	
TOTAL WIDTH	7.5	
TOTAL AREA	10.1	
TOTAL DISCHARGE	6.04	
PCT DIFFERENCE	-29%	
MEAN VELOCITY	0.6	
WETTED PERIMETER	9.74	
HYDRAULIC RADIUS	1.04	
MANNING FACTOR	0	

OB	DIST	DEPTH	ICE	REVS	TIME	COS:VF	LOC	COEF	CLOCK	VEL	AREA	FLOW(Q)	FLAGS
1	0	0	0	0	0	1	6	1	0:00	0	0	0	
2	0.7	0	0	0	0	1	6	1	0:00	0	0	0	
3	1	1.3	0	14	40	1	6	1	11:45	0.367	0.52	0.191	
4	1.5	1.35	0	22	40.9	1	6	1	11:46	0.548	0.675	0.37	1
5	2	1.4	0	30	40.1	1	6	1	11:47	0.75	0.7	0.525	1
6	2.5	1.4	0	37	40.5	1	6	1	11:48	0.909	0.7	0.636	1
7	3	1.4	0	34	40.2	1	6	1	11:49	0.843	0.7	0.59	1
8	3.5	1.4	0	32	40.2	1	6	1	11:50	0.796	0.7	0.557	1
9	4	1.4	0	29	40	1	6	1	11:51	0.727	0.7	0.509	1
10	4.5	1.4	0	29	40	1	6	1	11:52	0.727	0.7	0.509	1
11	5	1.4	0	29	40.5	1	6	1	11:53	0.719	0.7	0.503	1
12	5.5	1.4	0	29	41	1	6	1	11:54	0.71	0.7	0.497	1
13	6	1.4	0	27	40.3	1	6	1	11:55	0.675	0.7	0.473	1
14	6.5	1.4	0	22	41.1	1	6	1	11:55	0.545	0.7	0.382	1
15	7	1.4	0	11	42.4	1	6	1	11:56	0.28	0.7	0.196	
16	7.5	1.4	0	3	43.6	1	6	1	11:58	0.097	0.7	0.068	4
17	8	1.4	0	2	44.5	1	6	1	11:59	0.074	0.49	0.036	4
18	8.2	0	0	0	0	1	6	1	0:00	0	0	0	

AquaCalc 5000 (tm) by JBS Instruments
Firmware Version AQCUSH8c (c)1995-2000

GAGE ID#	A-18	
DATE	1/27/2012	
TRANSECT	6	
USER ID#	4675	
SH BEGIN	0.58	
SH END	0.58	
GH BEGIN	0.58	
GH END	0.58	
EST. DISCHARGE	0	
	8.51	
	METER	
EST. Q (ADJ)	ID#	1
AQUACALC ID#	0	
SOUNDING WT.	0	
START MEAS. AT	REW	
METER TYPE	Pygmy	ST2
METER CONST. C1	0.9604	
METER CONST. C2	0.0312	
METER CONST. C3	0.9604	
METER CONST. C4	0.0312	
METER CONST. C5	0	
MEASUREMENT TIME	40	
MEAS. SYSTEM	SAE	
PERCENT SLOPE	0	
TOTAL VERTICALS	18	
TOTAL STATIONS	18	
TOTAL WIDTH	7.4	
TOTAL AREA	7.89	
TOTAL DISCHARGE	8.51	
PCT DIFFERENCE	0	
MEAN VELOCITY	1.08	
WETTED PERIMETER	8.54	
HYDRAULIC RADIUS	0.92	
MANNING FACTOR	0	

OB	DIST	DEPTH	ICE	REVS	TIME	COS:VF	LOC	COEF	CLOCK	VEL	AREA	FLOW(Q)	FLAGS
1	0	0	0	0	0	1	6	1	0:00	0	0	0	
2	0.8	0	0	0	0	1	6	1	0:00	0	0	0	
3	1.1	0.4	0	42	40.1	1	6	1	10:46	1.037	0.16	0.166	
4	1.6	0.9	0	48	40.2	1	6	1	10:47	1.178	0.45	0.53	1
5	2.1	1.1	0	31	40.4	1	6	1	10:48	0.768	0.55	0.422	
6	2.6	1.2	0	40	40.1	1	6	1	10:49	0.989	0.6	0.593	1
7	3.1	1.1	0	41	40.2	1	6	1	10:50	1.011	0.55	0.556	1
8	3.6	1.25	0	31	40.8	1	6	1	10:51	0.761	0.625	0.476	1
9	4.1	1.3	0	46	40	1	6	1	10:52	1.136	0.65	0.738	1
10	4.6	1.3	0	47	40.2	1	6	1	10:53	1.154	0.65	0.75	1
11	5.1	1.2	0	46	40.1	1	6	1	10:54	1.133	0.6	0.68	1
12	5.6	1.25	0	41	41	1	6	1	10:55	0.992	0.625	0.62	1
13	6.1	1.25	0	45	40.7	1	6	1	10:57	1.093	0.625	0.683	1
14	6.6	1.3	0	48	40.3	1	6	1	10:58	1.175	0.65	0.764	1
15	7.1	1.25	0	59	40.4	1	6	1	10:59	1.434	0.625	0.896	1
16	7.6	1.1	0	54	40.2	1	6	1	11:00	1.321	0.44	0.581	1
17	7.9	0.3	0	25	40.5	1	6	1	11:01	0.624	0.09	0.056	
18	8.2	0	0	0	0	1	6	1	0:00	0	0	0	

Conversation Record

Who: Gene Gutenberger, EID Assistant Hydrographer

Date: December 2, 2015

Subject: Flow metering completed January 27, 2012 to identify losses along Main Ditch

Gene Gutenberger was requested by Reservoir 1 Plant personnel to perform flow monitoring along the Main Ditch because of the low flow reaching the plant compared to releases from Forebay. The flow monitoring was completed on January 27, 2012. The flow rate just downstream of Gage A18 was 8.51 cfs and matched the A18 flow meter. The flow rate at Patrick Land downstream of Grizzly was 6.04 cfs, indicating a 29% loss. Gene indicated that he observed multiple crawdad burrows. Later a crew found larger holes that where repaired by filling them with bentonite.

Prepared by: Tracey Eden-Bishop

Note: According to plant records, the plant started up on January 25, 2012.

Attachment 3

2016 Instream Flow Study

Result Summary

Date	Downstream of Forebay Gage A18 (cfs)	Upstream of Reservoir 1 Inlet (cfs)	Difference (cfs)	Percent Loss (%)
June 1, 2016	13.08	10.83	2.25	17.2%
June 8, 2016	20.76	16.34	4.42	21.3%
July 1, 2016	30.92	26.42	4.50	14.6%

Photographs and discharge measurement summaries attached.

Forebay Gage A-18 (upstream of instream flow measurement site)

Instream flow measurement site downstreatm of Gage A-18

Instream flow measurement site
upstream of Reservoir 1

Instream flow measurement site upstream of Reservoir 1 (looking upstream)

Discharge Measurement Summary

Date Generated: Thu Jun 2 2016

File Information

File Name	A1860116.WAD
Start Date and Time	2016/06/01 09:30:35

Site Details

Site Name	A18 HEAD OF DITCH
Operator(s)	JDB

System Information

Sensor Type	FlowTracker
Serial #	P5644
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.2%	1.5%
Velocity	0.8%	1.9%
Width	0.1%	0.1%
Method	2.0%	-
# Stations	2.6%	-
Overall	**3.5%**	**2.6%**

Summary

Averaging Int.	40	# Stations	19
Start Edge	REW	Total Width	11.400
Mean SNR	46.5 dB	Total Area	9.632
Mean Temp	55.12 °F	Mean Depth	0.845
Disch. Equation	Mid-Section	Mean Velocity	1.3578
		Total Discharge	**13.0779**

Supplemental Data (Gauge Height Change = 0.000ft)

#	Time	Location	Gauge Height	Rated Flow	Comments
1	Wed Jun 1 09:28:05 PDT 2016	0.000	0.730		
2	Wed Jun 1 10:02:17 PDT 2016	3.100	0.730		

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	09:30	14.50	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	09:30	13.80	0.6	1.000	0.6	0.400	1.6722	1.00	1.6722	0.650	1.0868	8.3
2	09:32	13.20	0.6	1.050	0.6	0.420	1.4058	1.00	1.4058	0.630	0.8852	6.8
3	09:34	12.60	0.6	1.100	0.6	0.440	1.5420	1.00	1.5420	0.660	1.0173	7.8
4	09:35	12.00	0.6	1.150	0.6	0.460	1.3606	1.00	1.3606	0.690	0.9383	7.2
5	09:36	11.40	0.6	1.200	0.6	0.480	1.6335	1.00	1.6335	0.720	1.1758	9.0
6	09:38	10.80	0.6	1.250	0.6	0.500	1.4934	1.00	1.4934	0.750	1.1196	8.6
7	09:41	10.20	0.6	1.250	0.6	0.500	1.4984	1.00	1.4984	0.750	1.1233	8.6
8	09:42	9.60	0.6	1.200	0.6	0.480	1.5151	1.00	1.5151	0.720	1.0905	8.3
9	09:44	9.00	0.6	1.000	0.6	0.400	1.4718	1.00	1.4718	0.600	0.8827	6.7
10	09:45	8.40	0.6	0.900	0.6	0.360	1.4593	1.00	1.4593	0.540	0.7876	6.0
11	09:46	7.80	0.6	1.100	0.6	0.440	1.3445	1.00	1.3445	0.660	0.8870	6.8
12	09:47	7.20	0.6	0.900	0.6	0.360	1.1864	1.00	1.1864	0.540	0.6403	4.9
13	09:49	6.60	0.6	0.800	0.6	0.320	1.1060	1.00	1.1060	0.480	0.5305	4.1
14	09:50	6.00	0.6	0.700	0.6	0.280	0.9249	1.00	0.9249	0.420	0.3883	3.0
15	09:51	5.40	0.6	0.500	0.6	0.200	0.7874	1.00	0.7874	0.300	0.2361	1.8
16	09:52	4.80	0.6	0.450	0.6	0.180	0.7844	1.00	0.7844	0.270	0.2118	1.6
17	09:54	4.20	0.6	0.300	0.6	0.120	0.3002	1.00	0.3002	0.255	0.0767	0.6
18	09:54	3.10	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Discharge Measurement Summary

Date Generated: Thu Jun 2 2016

File Information

File Name	MD060116.WAD
Start Date and Time	2016/06/01 11:13:16

Site Details

Site Name	MAIN DITCH ABV RES1
Operator(s)	JDB

System Information

Sensor Type	FlowTracker
Serial #	P5644
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.1%	0.5%
Velocity	0.3%	1.1%
Width	0.1%	0.1%
Method	0.8%	-
# Stations	2.3%	-
Overall	**2.7%**	**1.6%**

Summary

Averaging Int.	40	# Stations	22
Start Edge	REW	Total Width	13.400
Mean SNR	37.8 dB	Total Area	30.428
Mean Temp	57.50 °F	Mean Depth	2.271
Disch. Equation	Mid-Section	Mean Velocity	0.3559
		Total Discharge	**10.8299**

Supplemental Data

#	Time	Location	Gauge Height	Rated Flow	Comments
1	Wed Jun 1 11:11:06 PDT 2016	0.000	2.600		

Discharge Measurement Summary

Date Generated: Thu Jun 9 2016

File Information

File Name	A1860816.WAD
Start Date and Time	2016/06/08 11:40:44

Site Details

Site Name	A18 HEAD OF DITCH
Operator(s)	JDB

System Information

Sensor Type	FlowTracker
Serial #	P5644
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.2%	0.4%
Velocity	0.6%	1.3%
Width	0.1%	0.1%
Method	1.9%	-
# Stations	2.5%	-
Overall	**3.4%**	**1.7%**

Summary

Averaging Int.	40	# Stations	20
Start Edge	REW	Total Width	11.900
Mean SNR	47.0 dB	Total Area	12.471
Mean Temp	58.42 °F	Mean Depth	1.048
Disch. Equation	Mid-Section	Mean Velocity	1.6644
		Total Discharge	**20.7567**

Supplemental Data

#	Time	Location	Gauge Height	Rated Flow	Comments
1	Wed Jun 8 11:36:03 PDT 2016	0.000	0.940		

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	11:40	15.10	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	11:40	14.30	0.6	1.150	0.6	0.460	2.1827	1.00	2.1827	0.805	1.7569	8.5
2	11:43	13.70	0.6	1.250	0.6	0.500	2.1211	1.00	2.1211	0.750	1.5901	7.7
3	11:44	13.10	0.6	1.300	0.6	0.520	2.0531	1.00	2.0531	0.780	1.6006	7.7
4	11:45	12.50	0.6	1.400	0.6	0.560	1.6273	1.00	1.6273	0.840	1.3663	6.6
5	11:46	11.90	0.6	1.450	0.6	0.580	1.6211	1.00	1.6211	0.870	1.4098	6.8
6	11:48	11.30	0.6	1.450	0.6	0.580	1.7339	1.00	1.7339	0.870	1.5080	7.3
7	11:49	10.70	0.6	1.450	0.6	0.580	1.7792	1.00	1.7792	0.870	1.5474	7.5
8	11:50	10.10	0.6	1.450	0.6	0.580	1.7618	1.00	1.7618	0.870	1.5322	7.4
9	11:51	9.50	0.6	1.350	0.6	0.540	1.7851	1.00	1.7851	0.810	1.4454	7.0
10	11:52	8.90	0.6	1.300	0.6	0.520	1.6988	1.00	1.6988	0.780	1.3244	6.4
11	11:53	8.30	0.6	1.300	0.6	0.520	1.7172	1.00	1.7172	0.780	1.3387	6.4
12	11:55	7.70	0.6	1.200	0.6	0.480	1.3504	1.00	1.3504	0.720	0.9720	4.7
13	11:56	7.10	0.6	1.100	0.6	0.440	1.2828	1.00	1.2828	0.660	0.8463	4.1
14	11:57	6.50	0.6	0.950	0.6	0.380	1.3825	1.00	1.3825	0.570	0.7878	3.8
15	11:58	5.90	0.6	0.800	0.6	0.320	1.3665	1.00	1.3665	0.480	0.6555	3.2
16	11:59	5.30	0.6	0.650	0.6	0.260	1.3127	1.00	1.3127	0.390	0.5117	2.5
17	12:01	4.70	0.6	0.550	0.6	0.220	0.9557	1.00	0.9557	0.330	0.3152	1.5
18	12:02	4.10	0.6	0.400	0.6	0.160	0.8261	1.00	0.8261	0.301	0.2484	1.2
19	12:02	3.20	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Discharge Measurement Summary

Date Generated: Thu Jun 9 2016

File Information

File Name	MD060816.WAD
Start Date and Time	2016/06/08 12:50:04

Site Details

Site Name	MAIN DITCH AT RES 1
Operator(s)	JDB

System Information

Sensor Type	FlowTracker
Serial #	P5644
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.1%	0.6%
Velocity	0.4%	1.5%
Width	0.1%	0.1%
Method	0.9%	-
# Stations	2.2%	-
Overall	**2.6%**	**1.9%**

Summary

Averaging Int.	40	# Stations	23
Start Edge	REW	Total Width	13.500
Mean SNR	38.4 dB	Total Area	31.254
Mean Temp	60.79 °F	Mean Depth	2.315
Disch. Equation	Mid-Section	Mean Velocity	0.5227
		Total Discharge	**16.3363**

Supplemental Data

#	Time	Location	Gauge Height	Rated Flow	Comments
1	Wed Jun 8 12:48:04 PDT 2016	0.000	2.670		

Discharge Measurement Summary

Date Generated: Thu Jun 9 2016

File Information		**Site Details**	
File Name	MD060816.WAD	Site Name	MAIN DITCH AT RES 1
Start Date and Time	2016/06/08 12:50:04	Operator(s)	JDB

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	12:50	15.90	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	*12:50*	*15.30*	*0.6*	*0.600*	*0.6*	*0.240*	*0.0489*	*1.00*	*0.0489*	*0.360*	*0.0176*	*0.1*
2	12:51	14.70	0.6	1.200	0.6	0.480	0.3412	1.00	0.3412	0.720	0.2457	1.5
3	12:53	14.10	0.8/0.2	1.700	0.2	1.360	0.4009	1.00	0.3993	1.020	0.4073	2.5
3	12:52	14.10	0.8/0.2	1.700	0.8	0.340	0.3976					
4	12:55	13.50	0.2/0.8	2.100	0.2	1.680	0.5115	1.00	0.4833	1.260	0.6090	3.7
4	12:56	13.50	0.2/0.8	2.100	0.8	0.420	0.4551					
5	12:58	12.90	0.8/0.2	2.300	0.2	1.840	0.6198	1.00	0.5646	1.380	0.7792	4.8
5	12:57	12.90	0.8/0.2	2.300	0.8	0.460	0.5095					
6	12:59	12.30	0.2/0.8	2.600	0.2	2.080	0.6585	1.00	0.6076	1.560	0.9480	5.8
6	13:00	12.30	0.2/0.8	2.600	0.8	0.520	0.5568					
7	13:02	11.70	0.8/0.2	2.750	0.2	2.200	0.7100	1.00	0.6168	1.650	1.0178	6.2
7	13:01	11.70	0.8/0.2	2.750	0.8	0.550	0.5236					
8	13:03	11.10	0.2/0.8	2.900	0.2	2.320	0.7021	1.00	0.5886	1.740	1.0242	6.3
8	13:04	11.10	0.2/0.8	2.900	0.8	0.580	0.4751					
9	13:07	10.50	0.8/0.2	3.100	0.2	2.480	0.6670	1.00	0.5664	1.860	1.0537	6.5
9	13:06	10.50	0.8/0.2	3.100	0.8	0.620	0.4659					
10	13:08	9.90	0.2/0.8	3.000	0.2	2.400	0.6778	1.00	0.6332	1.800	1.1399	7.0
10	13:09	9.90	0.2/0.8	3.000	0.8	0.600	0.5886					
11	13:11	9.30	0.8/0.2	3.000	0.2	2.400	0.6742	1.00	0.5804	1.800	1.0448	6.4
11	13:10	9.30	0.8/0.2	3.000	0.8	0.600	0.4865					
12	13:12	8.70	0.2/0.8	3.000	0.2	2.400	0.6660	1.00	0.5551	1.800	0.9993	6.1
12	13:13	8.70	0.2/0.8	3.000	0.8	0.600	0.4442					
13	13:15	8.10	0.8/0.2	3.000	0.2	2.400	0.6283	1.00	0.6047	1.800	1.0885	6.7
13	13:14	8.10	0.8/0.2	3.000	0.8	0.600	0.5810					
14	13:16	7.50	0.2/0.8	3.000	0.2	2.400	0.6677	1.00	0.5843	1.800	1.0519	6.4
14	13:17	7.50	0.2/0.8	3.000	0.8	0.600	0.5010					
15	13:18	6.90	0.8/0.2	3.000	0.2	2.400	0.6529	1.00	0.5886	1.800	1.0596	6.5
15	13:18	6.90	0.8/0.2	3.000	0.8	0.600	0.5243					
16	13:19	6.30	0.2/0.8	3.000	0.2	2.400	0.6286	1.00	0.5600	1.800	1.0082	6.2
16	13:20	6.30	0.2/0.8	3.000	0.8	0.600	0.4915					
17	13:22	5.70	0.8/0.2	3.000	0.2	2.400	0.5761	1.00	0.4823	1.800	0.8682	5.3
17	13:21	5.70	0.8/0.2	3.000	0.8	0.600	0.3885					
18	13:24	5.10	0.2/0.8	2.900	0.2	2.320	0.5121	1.00	0.4980	1.740	0.8667	5.3
18	13:24	5.10	0.2/0.8	2.900	0.8	0.580	0.4839					
19	*13:27*	*4.50*	*0.8/0.2*	*2.500*	*0.2*	*2.000*	*0.4672*	*1.00*	*0.3574*	*1.500*	*0.5362*	*3.3*
19	*13:26*	*4.50*	*0.8/0.2*	*2.500*	*0.8*	*0.500*	*0.2477*					
20	13:29	3.90	0.6	1.750	0.6	0.700	0.3215	1.00	0.3215	1.311	0.4216	2.6
21	13:30	3.00	0.6	1.000	0.6	0.400	0.1985	1.00	0.1985	0.749	0.1487	0.9
22	13:30	2.40	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Discharge Measurement Summary

Date Generated: Tue Jul 5 2016

File Information

File Name	A1870116.WAD
Start Date and Time	2016/07/01 09:55:14

Site Details

Site Name	A18 MAIN DITCH
Operator(s)	JDB

System Information

Sensor Type	FlowTracker
Serial #	P5644
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.1%	1.0%
Velocity	0.5%	1.6%
Width	0.1%	0.1%
Method	0.9%	-
# Stations	2.0%	-
Overall	**2.5%**	**2.1%**

Summary

Averaging Int.	40	# Stations	25
Start Edge	REW	Total Width	13.650
Mean SNR	46.1 dB	Total Area	17.050
Mean Temp	66.88 °F	Mean Depth	1.249
Disch. Equation	Mid-Section	Mean Velocity	1.8138
		Total Discharge	**30.9246**

Supplemental Data (Gauge Height Change = 0.000ft)

#	Time	Location	Gauge Height	Rated Flow	Comments
1	Fri Jul 1 09:51:41 PDT 2016	0.000	1.230		
2	Fri Jul 1 10:53:58 PDT 2016	3.000	1.230		

Discharge Measurement Summary

Date Generated: Tue Jul 5 2016

File Information	
File Name	A1870116.WAD
Start Date and Time	2016/07/01 09:55:14

Site Details	
Site Name	A18 MAIN DITCH
Operator(s)	JDB

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	09:55	16.65	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	09:55	15.90	0.6	0.500	0.6	0.200	1.7369	1.00	1.7369	0.387	0.6730	2.2
2	09:59	15.10	0.8/0.2	1.500	0.2	1.200	2.7201	1.00	2.4173	0.975	2.3567	7.6
2	09:58	15.10	0.8/0.2	1.500	0.8	0.300	2.1145					
3	10:00	14.60	0.2/0.8	1.600	0.2	1.280	2.9091	1.00	2.5989	0.800	2.0792	6.7
3	10:02	14.60	0.2/0.8	1.600	0.8	0.320	2.2887					
4	10:05	14.10	0.8/0.2	1.700	0.2	1.360	2.6089	1.00	2.3675	0.850	2.0125	6.5
4	10:04	14.10	0.8/0.2	1.700	0.8	0.340	2.1260					
5	10:06	13.60	0.2/0.8	1.700	0.2	1.360	2.4846	1.00	2.1048	0.850	1.7892	5.8
5	10:08	13.60	0.2/0.8	1.700	0.8	0.340	1.7251					
6	10:12	13.10	0.2/0.6/0.8	1.700	0.2	0.680	1.8914	1.00	1.9650	0.850	1.6704	5.4
6	10:12	13.10	0.2/0.6/0.8	1.700	0.6	0.680	1.7766					
6	10:10	13.10	0.2/0.6/0.8	1.700	0.8	1.360	2.4154					
7	10:15	12.60	0.8/0.2	1.800	0.2	1.440	2.2795	1.00	1.7766	0.900	1.5988	5.2
7	10:14	12.60	0.8/0.2	1.800	0.8	0.360	1.2736					
8	*10:16*	*12.10*	*0.2/0.6/0.8*	*1.800*	*0.2*	*1.440*	*2.2762*	*1.00*	*1.7148*	*0.900*	*1.5432*	*5.0*
8	*10:18*	*12.10*	*0.2/0.6/0.8*	*1.800*	*0.6*	*0.720*	*1.7740*					
8	*10:16*	*12.10*	*0.2/0.6/0.8*	*1.800*	*0.8*	*0.360*	*1.0351*					
9	10:20	11.60	0.8/0.2	1.800	0.2	1.440	2.2618	1.00	1.9831	0.900	1.7847	5.8
9	10:19	11.60	0.8/0.2	1.800	0.8	0.360	1.7044					
10	10:21	11.10	0.2/0.8	1.800	0.2	1.440	2.2694	1.00	1.8304	0.900	1.6472	5.3
10	10:22	11.10	0.2/0.8	1.800	0.8	0.360	1.3914					
11	10:24	10.60	0.8/0.2	1.800	0.2	1.440	2.2828	1.00	1.4711	0.900	1.3239	4.3
11	10:23	10.60	0.8/0.2	1.800	0.8	0.360	0.6594					
12	10:25	10.10	0.2/0.8	1.700	0.2	1.360	2.3576	1.00	1.5796	0.850	1.3427	4.3
12	10:26	10.10	0.2/0.8	1.700	0.8	0.340	0.8015					
13	10:30	9.60	0.8/0.2	1.700	0.2	1.360	2.3274	1.00	1.9746	0.850	1.6785	5.4
13	10:29	9.60	0.8/0.2	1.700	0.8	0.340	1.6217					
14	*10:31*	*9.10*	*0.2/0.8*	*1.600*	*0.2*	*1.280*	*2.3009*	*1.00*	*1.8337*	*0.800*	*1.4670*	*4.7*
14	*10:32*	*9.10*	*0.2/0.8*	*1.600*	*0.8*	*0.320*	*1.3665*					
15	*10:34*	*8.60*	*0.2/0.6/0.8*	*1.500*	*0.2*	*1.200*	*2.2933*	*1.00*	*1.5033*	*0.750*	*1.1275*	*3.6*
15	*10:35*	*8.60*	*0.2/0.6/0.8*	*1.500*	*0.6*	*0.600*	*1.5341*					
15	*10:33*	*8.60*	*0.2/0.6/0.8*	*1.500*	*0.8*	*0.300*	*0.6516*					
16	10:38	8.10	0.8/0.2	1.500	0.2	1.200	2.2707	1.00	1.6685	0.750	1.2514	4.0
16	10:37	8.10	0.8/0.2	1.500	0.8	0.300	1.0663					
17	10:40	7.60	0.6	1.400	0.6	0.560	1.4144	1.00	1.4144	0.700	0.9900	3.2
18	10:43	7.10	0.6	1.300	0.6	0.520	1.5607	1.00	1.5607	0.650	1.0143	3.3
19	10:45	6.60	0.6	1.200	0.6	0.480	1.7769	1.00	1.7769	0.600	1.0663	3.4
20	10:46	6.10	0.6	1.000	0.6	0.400	1.8481	1.00	1.8481	0.500	0.9240	3.0
21	10:47	5.60	0.6	0.850	0.6	0.340	1.6755	1.00	1.6755	0.468	0.7834	2.5
22	10:48	5.00	0.6	0.700	0.6	0.280	1.3304	1.00	1.3304	0.420	0.5589	1.8
23	10:49	4.40	0.6	0.500	0.6	0.200	0.4836	1.00	0.4836	0.500	0.2418	0.8
24	10:49	3.00	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Discharge Measurement Summary

Date Generated: Tue Jul 5 2016

File Information

File Name	R1070116.WAD
Start Date and Time	2016/07/01 12:03:34

Site Details

Site Name	RES 1 070116
Operator(s)	JDB

System Information

Sensor Type	FlowTracker
Serial #	P5644
CPU Firmware Version	3.9
Software Ver	2.30
Mounting Correction	0.0%

Units (English Units)

Distance	ft
Velocity	ft/s
Area	ft^2
Discharge	cfs

Discharge Uncertainty

Category	ISO	Stats
Accuracy	1.0%	1.0%
Depth	0.1%	0.8%
Velocity	0.3%	1.3%
Width	0.1%	0.1%
Method	0.9%	-
# Stations	2.4%	-
Overall	**2.8%**	**1.9%**

Summary

Averaging Int.	40	# Stations	21
Start Edge	REW	Total Width	12.799
Mean SNR	43.7 dB	Total Area	25.742
Mean Temp	68.19 °F	Mean Depth	2.011
Disch. Equation	Mid-Section	Mean Velocity	1.0264
		Total Discharge	**26.4219**

Supplemental Data

#	Time	Location	Gauge Height	Rated Flow	Comments
1	Fri Jul 1 12:47:21 PDT 2016	2.401	2.550		

Discharge Measurement Summary

Date Generated: Tue Jul 5 2016

File Information		Site Details	
File Name	R1070116.WAD	Site Name	RES 1 070116
Start Date and Time	2016/07/01 12:03:34	Operator(s)	JDB

Measurement Results

St	Clock	Loc	Method	Depth	%Dep	MeasD	Vel	CorrFact	MeanV	Area	Flow	%Q
0	12:03	15.20	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0
1	12:03	14.40	0.6	0.850	0.6	0.340	0.5774	1.00	0.5774	0.595	0.3437	1.3
2	12:04	13.80	0.6	1.200	0.6	0.480	0.8809	1.00	0.8809	0.720	0.6344	2.4
3	12:08	13.20	0.8/0.2	1.900	0.2	1.520	0.9882	1.00	0.9137	1.140	1.0417	3.9
3	12:07	13.20	0.8/0.2	1.900	0.8	0.380	0.8392					
4	12:09	12.60	0.2/0.8	2.200	0.2	1.760	1.0171	1.00	0.8565	1.320	1.1307	4.3
4	12:10	12.60	0.2/0.8	2.200	0.8	0.440	0.6959					
5	12:12	12.00	0.8/0.2	2.300	0.2	1.840	1.1404	1.00	1.0581	1.380	1.4602	5.5
5	12:11	12.00	0.8/0.2	2.300	0.8	0.460	0.9757					
6	12:13	11.40	0.2/0.8	2.300	0.2	1.840	1.2096	1.00	1.0966	1.380	1.5134	5.7
6	12:14	11.40	0.2/0.8	2.300	0.8	0.460	0.9836					
7	12:16	10.80	0.8/0.2	2.300	0.2	1.840	1.2982	1.00	1.2044	1.380	1.6622	6.3
7	12:15	10.80	0.8/0.2	2.300	0.8	0.460	1.1106					
8	12:17	10.20	0.2/0.8	2.300	0.2	1.840	1.3455	1.00	1.2234	1.380	1.6884	6.4
8	12:18	10.20	0.2/0.8	2.300	0.8	0.460	1.1014					
9	12:20	9.60	0.8/0.2	2.250	0.2	1.800	1.4127	1.00	1.2892	1.350	1.7406	6.6
9	12:19	9.60	0.8/0.2	2.250	0.8	0.450	1.1657					
10	12:21	9.00	0.2/0.8	2.250	0.2	1.800	1.2533	1.00	1.2006	1.350	1.6210	6.1
10	12:22	9.00	0.2/0.8	2.250	0.8	0.450	1.1480					
11	12:24	8.40	0.8/0.2	2.300	0.2	1.840	1.3855	1.00	1.2802	1.380	1.7667	6.7
11	12:23	8.40	0.8/0.2	2.300	0.8	0.460	1.1749					
12	12:25	7.80	0.2/0.8	2.400	0.2	1.920	1.2841	1.00	1.1859	1.440	1.7078	6.5
12	12:26	7.80	0.2/0.8	2.400	0.8	0.480	1.0876					
13	12:28	7.20	0.8/0.2	2.400	0.2	1.920	1.2313	1.00	1.0942	1.440	1.5757	6.0
13	12:27	7.20	0.8/0.2	2.400	0.8	0.480	0.9570					
14	12:29	6.60	0.2/0.8	2.500	0.2	2.000	1.1375	1.00	0.9701	1.500	1.4554	5.5
14	12:30	6.60	0.2/0.8	2.500	0.8	0.500	0.8028					
15	12:32	6.00	0.8/0.2	2.700	0.2	2.160	1.1864	1.00	1.0180	1.620	1.6495	6.2
15	12:32	6.00	0.8/0.2	2.700	0.8	0.540	0.8497					
16	12:33	5.40	0.2/0.8	2.700	0.2	2.160	0.9324	1.00	0.9037	1.620	1.4642	5.5
16	12:34	5.40	0.2/0.8	2.700	0.8	0.540	0.8750					
17	12:36	4.80	0.8/0.2	2.700	0.2	2.160	1.0302	1.00	0.9186	1.620	1.4884	5.6
17	12:35	4.80	0.8/0.2	2.700	0.8	0.540	0.8071					
18	12:37	4.20	0.2/0.8	2.250	0.2	1.800	0.8907	1.00	0.8755	1.686	1.4764	5.6
18	12:38	4.20	0.2/0.8	2.250	0.8	0.450	0.8602					
19	12:42	3.30	0.8/0.2	1.600	0.2	1.280	0.7185	1.00	0.6962	1.438	1.0014	3.8
19	12:40	3.30	0.8/0.2	1.600	0.8	0.320	0.6739					
20	12:40	2.40	None	0.000	0.0	0.0	0.0000	1.00	0.0000	0.000	0.0000	0.0

Rows in italics indicate a QC warning. See the Quality Control page of this report for more information.

Attachment 4

Upper Main Ditch 2016 Water Loss
Forebay to Reservoir 1 Water Treatment Plant

2016 Operations Summary

The Reservoir 1 Water Treatment Plant came on line May 26, 2016. Water loss calculations begin June 1, 2016 to allow for watering up the ditch and stabilizing seepage. Losses are based on the difference between Forebay Gage A-18 and the flow meter at the Reservoir 1 Water Treatment Plant, less backwash water returned ahead of the meter. As shown in Figure 1 and 2, flows were ramped up to 30 cfs in June to allow for incremental instream flow measurement. In early July, the flow rate was reduced to 20 cfs and continued at that rate until the end of September when the water treatment plant was taken off line for Project 184 maintenance. Flow continued in the ditch at 0.5 to 1 cfs to deliver water to ditch customers until late October when flow was shut down to dry up the ditch for construction of the Blair Road Bridge Replacement Project. Total water loss is underestimated to the extent carriage losses associated with delivering water to raw water customers after the treatment plant was taken off line are not included in the calculations. Flow in late June is corrected for meter spikes that resulted in replacement of the parshall flume transducer.

Table 1 – 2016 Upper Main Ditch Water Loss

July 7, 2016 - September 30, 2016		June 1, 2016 - September 30, 2016	
Forebay A-18 Gage	3,464	Forebay A-18 Gage	5,296
Plant Inlet	2,847	Plant Inlet	4196
Water loss	617	Water loss	1,100
Percent loss	17.8%	Percent loss	20.8%

Figure 1 – Forebay versus Reservoir 1 Headworks (Cubic-feet/second)

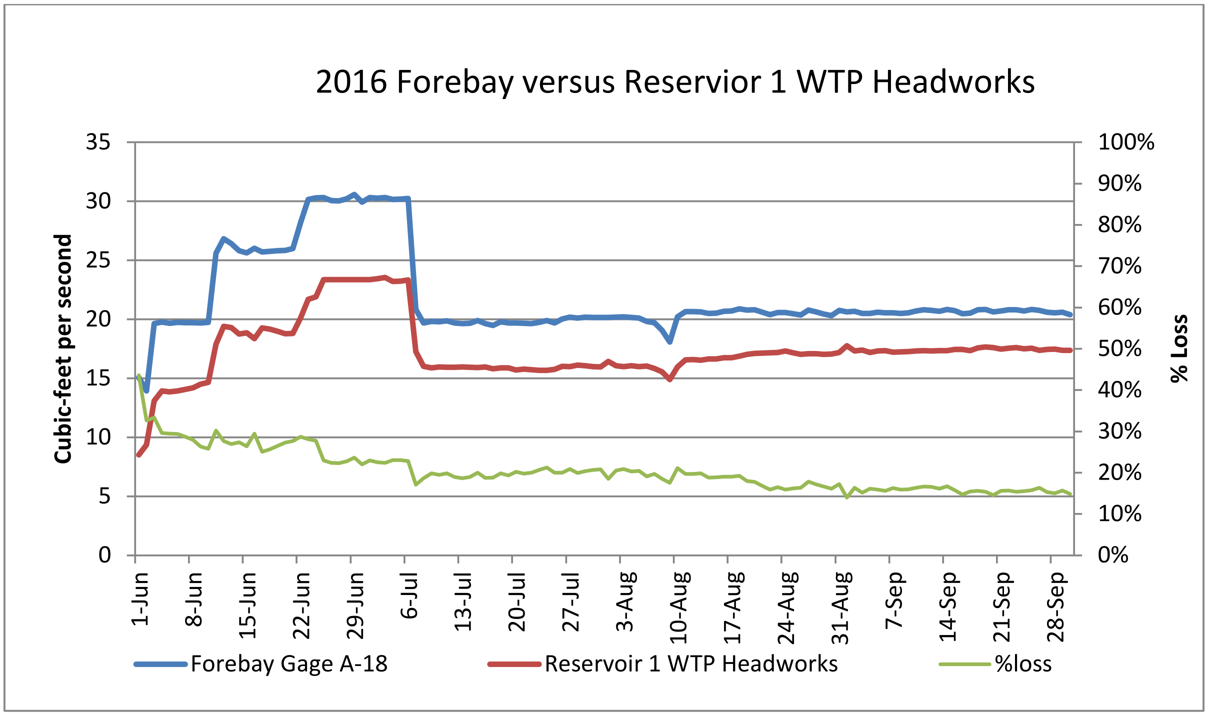
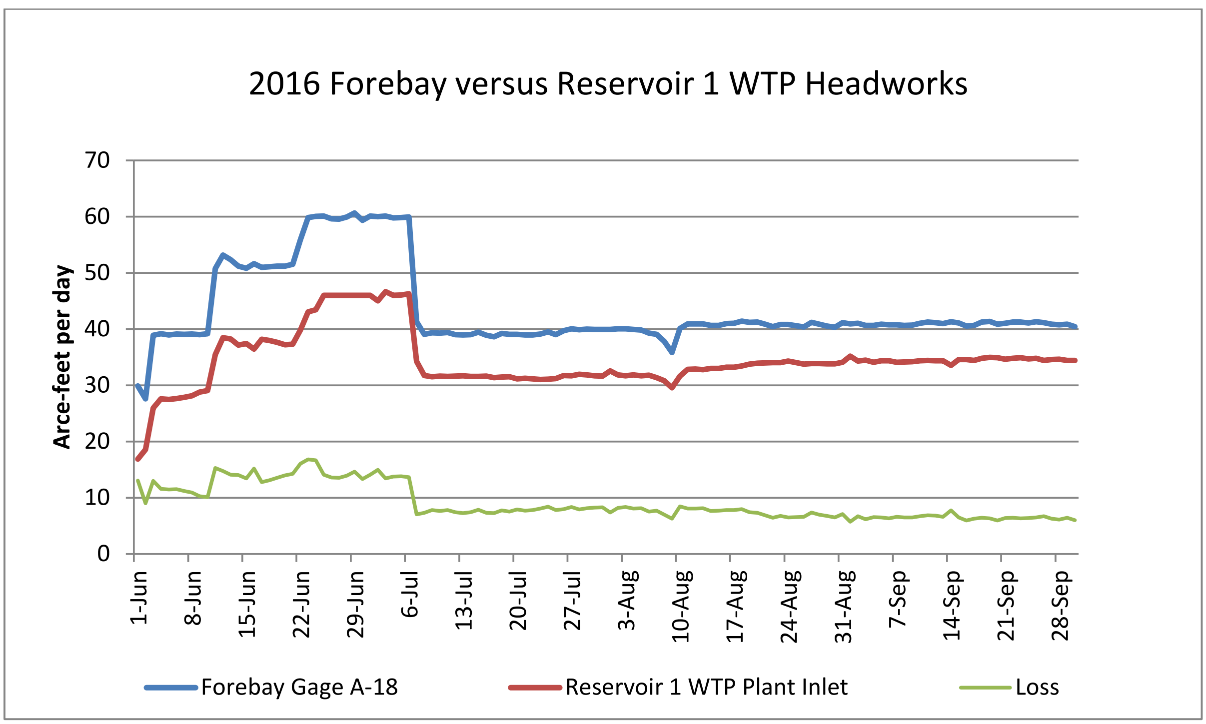


Figure 2 – Forebay versus Reservoir 1 Headworks (Acre-feet/day)



Attachment 5

TECHNICAL MEMORANDUM

To: Tracey Eden-Bishop
El Dorado Irrigation District

From: Ryan M. Abernathy, P.E. # 79136
Zack Washburn, C.E.G. #2624

Date: December 16, 2015

Re: SEEPAGE ESTIMATE
EID Upper Main Ditch
El Dorado County, California
Project No. 15-144.00

SAGE Engineers, Inc. (SAGE) is pleased to submit this memorandum presenting estimates of seepage loss from the approximately 3-mile-long Upper Main Ditch, in El Dorado County, California. This work was performed to assist El Dorado Irrigation District (EID) in securing water conservation grants for the Upper Main Ditch Piping project. The project consists of the construction of a new pipeline within portions of the unlined Upper Main Ditch (canal) alignment, which connects Forebay Reservoir to the Reservoir 1 Water Treatment Plant (WTP). The remaining pipe is proposed to be installed beneath Blair Road, which roughly parallels the existing canal alignment. The pipeline will eliminate approximately 3 miles of open ditch and is intended to reduce water loss between the facilities. Our findings indicate a minimum water loss of 2 to 11 percent due to seepage through the canal at flows of 40 cubic feet per second (cfs), and a 4 to 21 percent loss at flows of 20 cfs. These are likely minimum estimates because they do not include losses associated with animal burrows, areas of shallow and/or fractured rock, evapotranspiration, etc.

This memorandum describes our scope of work, and summarizes observations from a limited geologic reconnaissance, procedures used for percolation and permeability testing, seepage modelling, and estimated losses in the following sections.

SCOPE OF WORK

We performed a limited field exploration program in general accordance with the scope of services presented in our proposal dated November 6, 2015 and our Master Services Agreement with EID dated January 1, 2014. Specifically, our scope consisted of:

- Reviewing readily available geologic maps and reports, and an environmental assessment provided by EID. Based on our literature review and access along the canal, we identified locations suitable for limited field exploration (percolation and permeability testing).
- Performing five (5) percolation (perc) tests in shallow excavations in the canal bottom.
- Driving 3-inch diameter Shelby tubes with a 20 pound slide hammer to collect samples from the canal adjacent to each perc test.

2251 Douglas Blvd., Ste. 200, Roseville, CA 95661, (916) 677-4800
1999 Harrison St., Ste. 1800, Oakland, CA 94612, (510) 701-2266
SAGEengineers.com

- Laboratory testing of five (5) samples for permeability testing using ASTM method D5084.
- Reviewing the results of perc and permeability testing and modelling seepage from the canal using SEEP/W software for 2 soil/rock conditions at flow rates of 20 and 40 cfs.
- Reviewing literature for and estimating the amount of evapotranspiration along the canal.
- Preparing this memorandum, which summarizes geologic conditions, field procedures, test results, modeling, and seepage estimates.

PREVIOUS LOSS ESTIMATES

We reviewed the Environmental Assessment for the Proposed El Dorado Canal Pipeline Project (Jones and Stokes, 1977), which includes estimates of seepage and evapotranspiration losses based on flow measurements performed by Mr. E. M. Padjin (C.E.) and trained EID staff in July of 1977. They found that loss generally scaled with flow rate. Between Forebay Reservoir and the Blair Road crossing (STA[1] 120+50 feet), they estimated losses of 0.8 cfs and 4 cfs (4 to 10 percent) at flow rates of 18 and 40 cfs, respectively (Attachment 1). When these loss estimates are extrapolated to the entire length of the canal that will be replaced (15,400 feet), the losses are estimated to be 1 cfs to 5.1 cfs (6 to 13 percent).

In 2012, EID performed additional flow measurements (EID, 2015a). They measured 8.51 cfs at the upstream end of the canal and 6.04 cfs just downstream of Patrick Lane, which equates to approximately 2.5 cfs (29 percent) water loss. Patrick Lane is approximately 1,800 feet upstream of the water treatment plant. They noted the presence of multiple animal burrows and voids in the canal, the larger of which were later filled with bentonite.

EID continuously measures flow at the Forebay Reservoir water rights reporting gauge A18 and at the Reservoir 1 WTP headworks. Review of flow monitoring data from 2009 through 2014 indicates annual water losses in the range of 10% and 23% (EID, 2015b).

GEOLOGIC RECONASSANCE

To provide geotechnical recommendations for a previous phase of the Upper Main Ditch piping project, we met with Domenichelli & Associates (D&A) on October 22, 2015 to perform a geologic reconnaissance of the upper approximate ½-mile-long reach of the canal from Forebay Reservoir (forebay) to the Pinewood Lane crossing. From STA 1+00 to STA 4+50, we observed fractured meta-sedimentary rock exposed in the bank excavation and locally in the canal bottom. The rock exposed in the bank is generally closely to moderately fractured (2" to 12" spacing), moderately hard, and moderately strong. Although we were not able to fully classify the rock in the canal bottom due to flowing water (<½ cfs), the rock is generally consistent with regional geologic mapping that show this portion of the canal underlain by Paleozoic-aged marine rocks (Wagner et al., 1981).

Farther downstream, from STA 4+50 to Pinewood Lane (STA 25+25), we observed reddish brown fine-grained soil exposed in the banks and berm. We observed similar fine-grained soil with occasional andesitic cobbles during a walkdown from Pinewood Lane to the water treatment plant (STA 158+84) with EID on the same date. The regional geologic map indicates that the portion of the canal downstream of

[1] Approximate stationing (STA) based on AutoCAD drawing received from Domenichelli & Associates on November 24, 2015

STA 4+50 is underlain by volcanic rocks of the Mehrten Formation, which commonly weather to material consistent with the observed soil.

PERCOLATION TESTING

Procedures

SAGE geologists Matt Buche and Zack Washburn met representatives of EID at Forebay Reservoir on November 18th and 19th, 2015 to perform perc testing at select locations on the Upper Main Ditch. Upon arrival, we observed flow in the bottom of the canal, at about the same rate as observed during our October reconnaissance, estimated to be approximately 0.10 cfs coming from intermittent flow from the Forebay Dam seepage pump station. After discussing possible effects of the water on the perc tests with EID, we elected to run the tests on topographic high spots in the canal bottom that were not inundated.

We used a post hole digger (clamshell) to create cylindrical excavations (test holes) in the canal bottom as shown on Attachment 1. The test holes were 6 inches in diameter and ranged from 12 to 18 inches in depth. We placed a folding stick ruler at the base of each test hole to measure water levels during testing. We also placed two inches of gravel in the bottom of the holes to protect from scouring when adding water for the tests. Typically test holes are presoaked to saturate the soil; however, the ground was still saturated by the minor flow in the canal. Accordingly, we did not presoak the test holes.

Each test hole was initially filled with water to a level of 6 inches of above the top of the gravel. We performed falling head tests by measuring the drop in the water level at 30 minute intervals. After each measurement, we added water to raise the water level to the starting elevation (6 inches above the gravel). Testing continued until three consecutive measurements differed by less than 1/8 inch.

Percolation Test Results

Table 1 shows the approximate stationing and measured percolation rates for each of the five tests performed. Flowing water was present at the upper two perc test locations and standing water was observed within 80 lineal feet of the third perc test, located at STA 86+50. The measured percolation rates at these locations may be minimums due to possible increased pore pressure around the test holes.

TABLE 1- SUMMARY OF PERCOLATION TEST RESULTS

Test Location	Material Type	Measured Percolation Rate (min/inch)	Estimated Hydraulic Conductivity[2] (cm/day)	Estimated Hydraulic Conductivity[3] (cm/day)	Estimated Hydraulic Conductivity[4] (cm/day)
4+50	fine-grained soil	96	4	<8.3	4.7
26+00	fine-grained soil	120	4	<8.3	6.3
86+50	fine-grained soil	480	NA[5]	<8.3	1.5
130+00	coarse-grained soil	20	20	16½	47
134+50	coarse-grained soil/weathered rock	8	50	>50	NA

[2] Based on Amoozegar, A., Comparison of saturated hydraulic conductivity and percolation rate: Implications for designing septic tank systems, 1997.

[3] Based on Natural Resources Conservation Service, Table 4 on page 12 of Soil Potential Ratings, Subsurface Sewage Disposal Systems for Single Family Residences, February 2009.

[4] Based on Mulqueen, J. and Rodgers, M., Percolation Testing and Hydraulic Conductivity of Soils for Percolation Areas, 2001.

[5] Not available because percolation rate is beyond the limits of the correlation

The percolation rates range from 8 to 480 minutes per inch (MPI). Based on Soil Conservation Service (SCS) reports, the Environmental Assessment (Jones and Stokes, 1977) cites perc rates ranging from 0.2 to 6.3 inches per hour for the soil along the canal. Converting the SCS rates from inches per hour, yields rates of 9.5 to 300 MPI, similar to our measurements.

To compare the measured perc rates with the following permeability test results, we used 3 different methods to estimate hydraulic conductivity from the percolation rates, as indicated in Table 1. Note that the terms "hydraulic conductivity" and "permeability" are used interchangeably in practice and in this memorandum.

PERMEABILITY TESTING

We collected relatively undisturbed rock and soil samples from the bottom of the canal and berm using a 20 pound slide hammer to drive 3-inch diameter Shelby tubes adjacent to each perc test. We submitted four (4) samples collected from the canal bottom and one (1) from the berm for laboratory permeability testing using ASTM method D5084. Permeability is the measure of the ability of a material to allow fluid to pass through it. Test D5084 measures the rate at which water passes through a fully saturated sample and is usually reported in units of centimeters per second (cm/sec). The permeability test results are included with this memorandum as Appendix A and summarized in the Table 2. Note, the table also provides test results in more usable units of cm/day to allow for better comprehension of the data.

TABLE 2 - SUMMARY OF PERMEABILITY TEST RESULTS

Sample Number	Sample Location	Position in Canal	Lab Test Permeability (cm/sec)	Lab Test Permeability (cm/day)
Perm 1	4+50	berm	1.78 e-4	15.38
Perm 2	26+00	bottom	3.83 e-6	0.33
Perm 3	86+50	bottom	2.87 e-7	0.02
Perm 4	130+00	bottom	1.19 e-6	0.10
Perm 5	134+50	bottom	1.45 e-4	12.53

SEEPAGE MODELING

Procedures

Based on the limited number of samples collected and the potential variability in permeability along the canal, we elected to average the permeabilities measured from the canal bottom samples in our model. We divided the canal into four equal length segments, each representing 3,971 feet of native canal bank and bottom. We used the permeability from sample Perm 1 to model the fill comprising the berm along the full length of the canal. Canal cross sections were established for modeling purposes from the 100-foot-cross sections cut in the Civil 3D file prepared by D&A (D&A, November 2015).

We analyzed the four canal cross sections using SEEP/W version 8.15.3.11339 by GEO-SLOPE, 2012. In our models, we assumed that the canal reaches steady state conditions, meaning that the canal runs at constant head sufficiently long so that the seepage velocities do not vary with time. Furthermore, we assumed that the canal runs constantly so that the soil becomes fully saturated. To help determine that these assumptions and others were appropriate, we ran sensitivity cases that varied the saturated/nonsaturated condition, groundwater table, preferential flow ratios, canal head, and impermeable boundary depth. We found that most of these assumptions did not have a large effect on the seepage volume. See the Seepage Estimates section, below, for further discussion on the sensitivity cases.

The permeabilities used in our models were directly based on the lab-determined values presented in Tables 2 and 3. However, because the permeability values estimated from our percolation testing were generally an order of magnitude higher than the lab values (see Table 3 for comparison), we ran the models with the permeabilities increased by one order of magnitude to establish a potential range of seepage loss.

The models were analyzed assuming both 40 cfs and 20 cfs canal flows. Based on discussions with D&A, this results in approximate canal heads of 2.5 and 1.33 feet, respectively, above the bottom of the canal. The results of the seepage modeling are discussed below.

TABLE 3 – COMPARISON OF LAB PERMEABILITIES WITH ESTIMATED RATES FROM PERC TESTING

Test Location	Lab Test Permeability (cm/sec)	Lab Test Permeability (cm/day)	Estimated Hydraulic Conductivity from Perc Test[3] (cm/day)	Estimated Hydraulic Conductivity from Perc Test[4] (cm/day)	Estimated Hydraulic Conductivity from Perc Test[5] (cm/day)
4+50	1.78 e-4	15.38 (sample from berm)	4 (perc test from bottom)	<8.3 (perc test from bottom)	4.7 (perc test from bottom)
26+00	3.83 e-6	0.33	4	<8.3	6.3
86+50	2.87 e-7	0.02	NA	<8.3	1.5
130+00	1.19 e-6	0.10	20	16 ½	47
134+50	1.45 e-4	12.53	50	>50	NA

Seepage Estimates

Based on the seepage modeling for 40 cfs canal flow, we estimate the seepage losses to range from about 0.8 to 4.5 cfs (2 to 11 percent). For the 20 cfs canal flow, we estimate seepage losses of about 0.8 to 4.2 cfs (4 to 21 percent). As previously mentioned, the range in the loss estimates is primarily due to the difference in conductivities measured from permeability testing (lower values) versus those estimated from percolation testing (higher values).

We found that the seepage models were sensitive to changes in preferential flow direction (horizontal vs. vertical) and depth to an impermeable layer. Bedded clay layers can have a preferential horizontal flow direction typically up to 4 times the vertical direction (ASDSO, 2014). Additionally, most seepage models assume an impermeable layer/boundary at depth. By varying the preferential flow ratio and impermeable boundary depth, we estimate the ranges of water loss presented above. Based on our experience with unlined canals, the uncertainty in the parameters established for the seepage models, the variability of the canal materials in areas not observed for this study, and the sensitivity of the calculated flow estimates to some of the key model parameters, we believe the upper end of our loss estimate range to be more likely than the lower end.

OTHER SOURCES OF POSSIBLE WATER LOSS

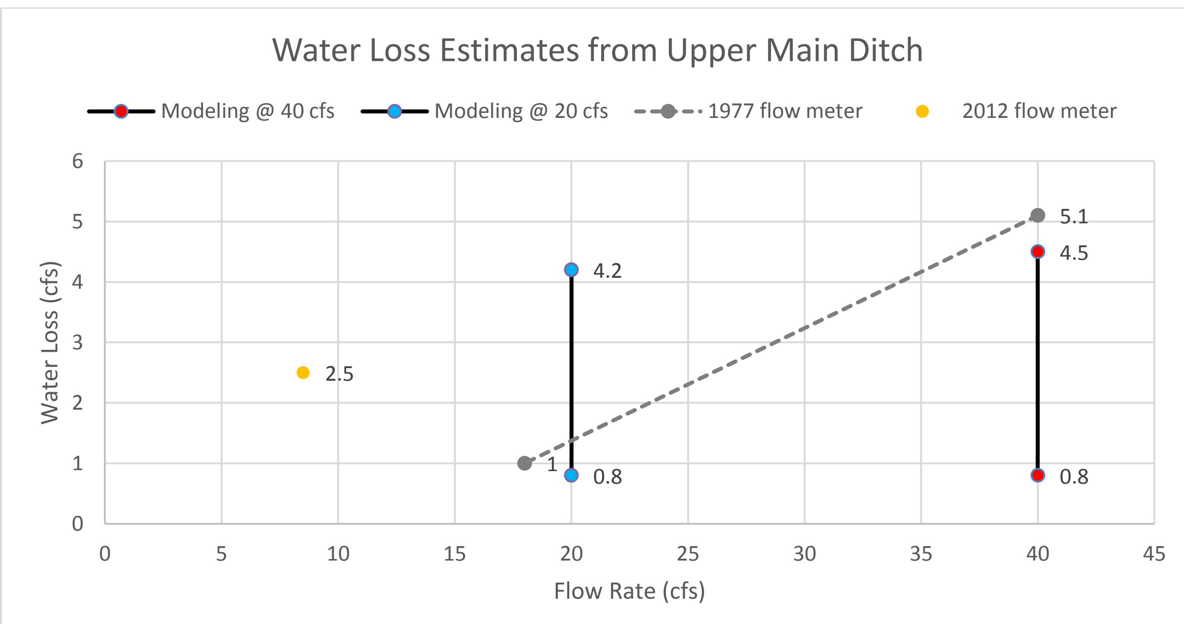
We reviewed readily available publications to estimate potential water loss from the canal due to evapotranspiration (sum of evaporation and transpiration from plants and trees). Although it is difficult to quantify evapotranspiration (ET), there are numerous models that attempt to do so. The models range from simple temperature and radiation-driven equations to more complex algorithms.

We reviewed a study that measured actual evapotranspiration using instruments on towers above the forest canopy at the Blodgett Research Station (Fisher et al., 2004). The research station is located about 10 miles north of the canal, underlain by the same soil type and geologic formation (Cohasset Series soil and Mehrten Formation), and covered with similar trees species (Ponderosa Pine, Douglas Fir, White Fir and Incense Cedar). The instruments measure flux and record up to 200 watts per square meter of evapotranspiration during the summer months. This amount equates to approximately 0.1 cfs or ¼ percent of water loss from the canal due to ET.

We observed rodent burrows in the banks and berm during our reconnaissance and walkdown. It is likely that additional water loss, that is not included in our model, is occurring through burrows and other pathways, such as zones of shallow and/or fractured rock. The observation of seasonal springs that form during the dry summer months on the downhill side of the canal (Jones and Stokes, 1977) suggests that water flows through larger voids or at least areas of higher permeability are present that were not represented in our model.

COMPARISON OF SEEPAGE ESTIMATES AND CONCLUSIONS

The following chart presents water loss estimates from our modeling with those from flow meter measurements for comparison and discussion. At flows of 40 cfs, the <u>high end</u> of the modeled range is similar to the 1977 flow meter estimates. Conversely, at 20 cfs the <u>low end</u> of the modeled range generally coincides with the 1977 measurements. In general, the upper limit of the modeled seepage losses are within the range of Forebay/Reservoir 1 WTP flow metering data (EID, 2015b).



The water loss estimated by EID in 2012 is greater than both the estimates from 1977 data and our seepage. The reason for this is unknown, but may be due to other sources of potential water loss as discussed above, possibly degradation of the berm and resulting increased water loss, or imprecise measurements of the cross sectional area used in the flow meter estimates.

There are numerous factors that contribute to uncertainty in the water loss estimates, including: limited conductivity data with only 5 data points (permeability samples) for 3 miles of canal; and the possible increased pore pressure due to flowing water and resulting lower percolation rates. Also it is important to consider that conductivity values typically range a few orders of magnitude, even within the same soil or rock type. Based on the available data, it appears that at flows of 40 cfs on the order of 10 percent of the water that leaves the forebay is lost during travel to the treatment plant.

LIMITATIONS

This technical memorandum has been prepared for the sole use of El Dorado Irrigation District and its agents, specifically for design of the improvements described herein for the subject project. The seepage estimates presented in this technical memorandum are solely professional opinions based on limited percolation testing, limited permeability testing, SEEP/W modelling, and professional experience with similar projects. SAGE is not responsible for the data and methods presented by others.

The information provided in this technical memorandum is valid for a period of three (3) years from the date of issuance. Conditions may arise that were not apparent at the time of this design (e.g., changes in design geometries, soil design parameters, loadings, etc.). In addition, changes in applicable standard of practice can occur, whether from legislation or the broadening of knowledge. Accordingly, the information provided in this technical memorandum may be invalidated, wholly or partially, by changes outside of our control. Should changes occur that might affect the design presented herein, SAGE should be notified to evaluate the validity of this technical memorandum to those changes. This document may not be reproduced for any other reason than pertains to the project for which it was prepared.

Attachments:

Attachment 1 – Percolation and Flow Test Locations (prepared by D&A)
Appendix A - Sierra Testing Laboratories – Lab Test Results

References:

Amoozegar, A., Comparison of saturated hydraulic conductivity and percolation rate: Implications for designing septic tank systems, 1997.

Association of State Dam Safety Officials (ASDSO), 2014, Dam Safety Technical Seminar, Seepage through Earth Dams, April 1-2, 2014.

Domenichelli & Associates, Civil 3D EID-051-Main Ditch working file, sent November 23, 2015.

Eldorado Irrigation District a, Conversation Record, Flow metering completed January 27, 2012 to identify losses along Main Ditch, December 2, 2015

Eldorado Irrigation District b, personal communication with EID staff, December 16, 2015.

Fisher, J. B., et al., Evapotranspiration models compared on a Sierra Nevada forest ecosystem, 2004.

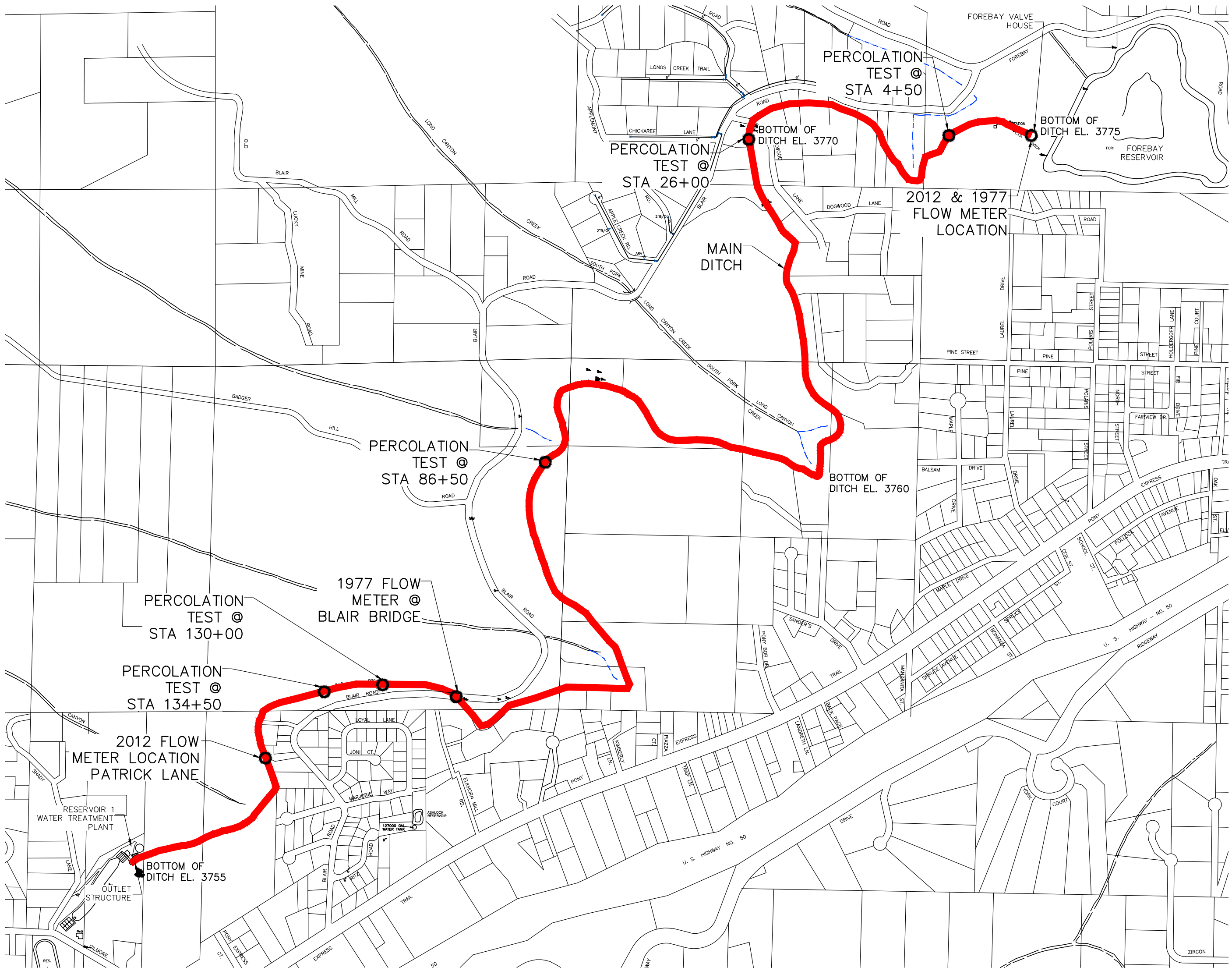
GEO-SLOPE International Ltd., Seepage Modeling with SEEP/W, An Engineering Methodology, July 2012.

Jones and Stokes Associates, Environmental Assessment of the El Dorado Canal Pipeline Project, August 19, 1977.

Natural Resources Conservation Service, Table 4 on page 12 of Soil Potential Ratings, Subsurface Sewage Disposal Systems for Single Family Residences, February 2009, (http://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_010822.pdfVirginia Department).

Mulqueen, J. and Rodgers, M., Percolation Testing and Hydraulic Conductivity of Soils for Percolation Areas, 2001.

Wagner, D.L., Jennings, C.W., Bedrossian, T.L., and Bortugno, E.J, 1981, Geologic Map of the Sacramento Quadrangle, California Division of Mines and Geology, scale 1:250,000.



LEGEND

- MAIN DITCH
- DRAINAGE FLOW LINE
- TEST LOCATION

REV	DATE	BY	DESCRIPTION

SCALE: 1"=400'

WARNING 0 1/2 1 IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

DESIGNED_____
DRAWN_____
CHECKED_____

EL DORADO IRRIGATION DISTRICT

2890 MOSQUITO ROAD - P.O. BOX 1047
PLACERVILLE, CALIFORNIA 95667

EID UPPER MAIN DITCH

PERCOLATION & FLOW TESTING LOCATIONS

FIGURE

Z:\PROJECT FILES\EID-051-UPPER MAIN DITCH DESIGN\PREVIOUS DESIGN\EXHIBIT_ALIGNMENTS.DWG
20151215.160510

HYDRAULIC CONDUCTIVITY TEST REPORT

SAMPLE DATA

Sample Identification: Perm 1A Berm

Location: Roots & Weeds

Remarks:

Sample Depth, ft.: 0-18"

Sample Type: Driven Liner

Lab No.: S44504

TEST RESULTS

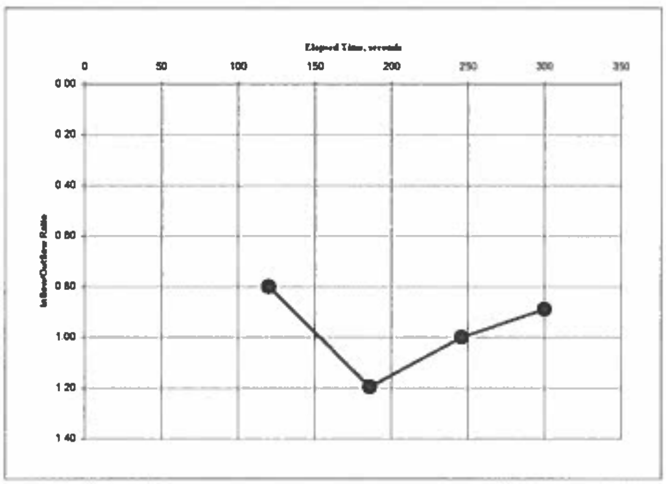
Permeability, cm/sec.: 1.78E-04

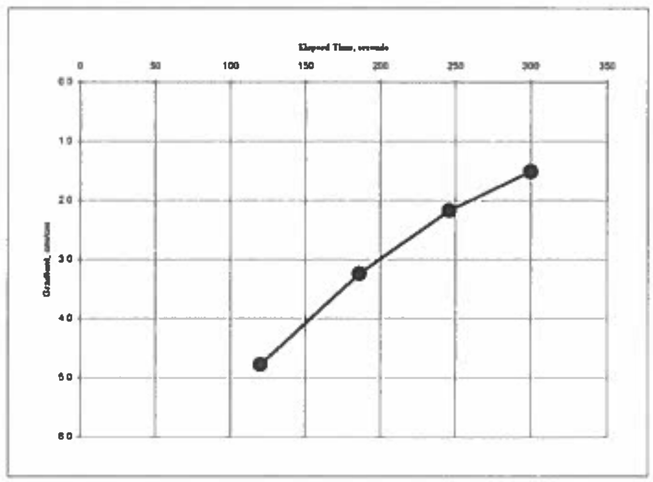
Average Hydraulic Gradient: 2.9

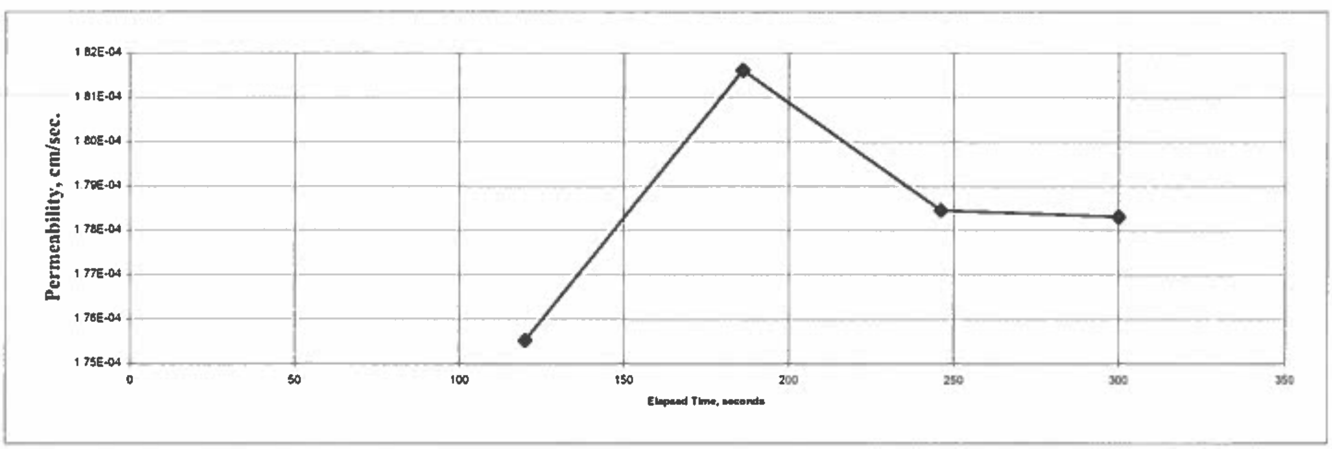
Effective Confining Pressure, psi: 5

TEST SAMPLE DATA

<u>Before Test</u>		<u>After Test</u>	
Specimen Height, cm:	6.73	Specimen Height, cm:	6.73
Specimen Diameter, cm:	7.14	Specimen Diameter, cm:	7.14
Dry Unit Weight, pcf:	72.0	Dry Unit Weight, pcf:	74.3
Moisture Content, %	26.1	Moisture Content, %	34.0







Test Method: ASTM D5084 Method C

PROJECT NUMBER:	**15-120**	November 19, 2015

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

485 Pierroz Rd, Unit D, Placerville, CA 95667
Ph 530-622-1101 Fax 530-622-1191

EID UMD

HYDRAULIC CONDUCTIVITY TEST REPORT

SAMPLE DATA

Sample Identification: Perm 2 Bottom
Sample Depth, ft.: 0-8"
Lab No.: S44505
Location: 0
Sample Type: Driven Liner
Remarks:

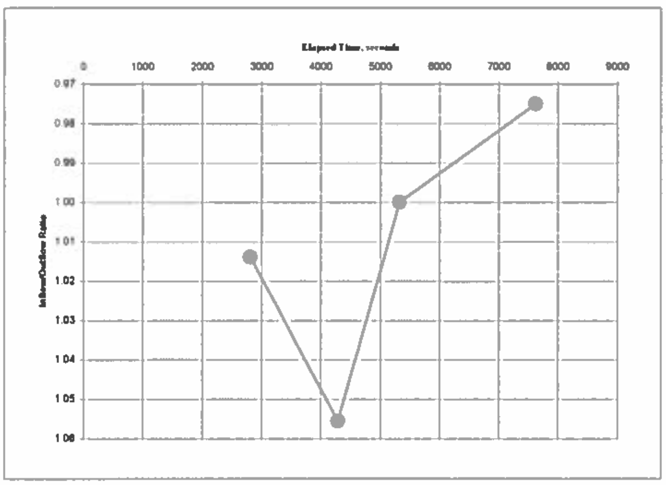
TEST RESULTS

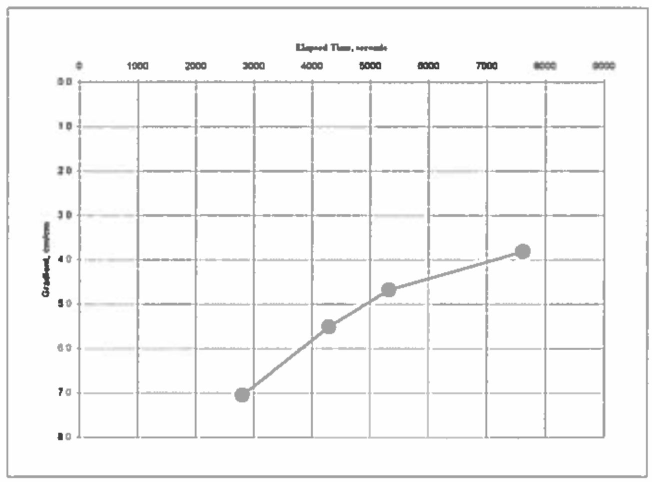
Permeability, cm/sec.: 3.83E-06
Average Hydraulic Gradient: 5.3

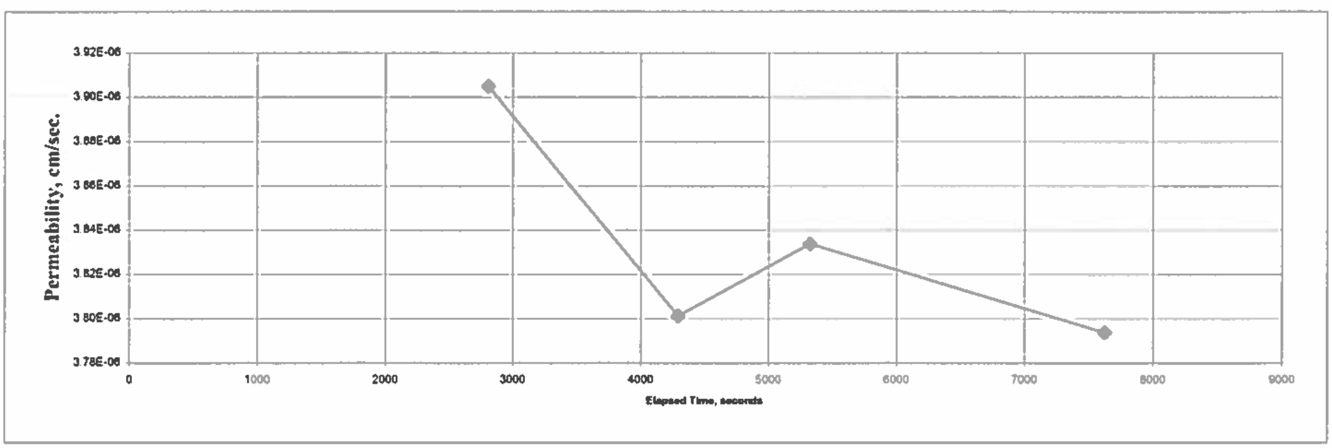
Effective Confining Pressure, psi: 5

TEST SAMPLE DATA

Before Test		After Test	
Specimen Height, cm:	7.11	Specimen Height, cm:	7.11
Specimen Diameter, cm:	7.19	Specimen Diameter, cm:	7.19
Dry Unit Weight, pcf:	80.6	Dry Unit Weight, pcf:	78.7
Moisture Content, %	37.6	Moisture Content, %	41.6







Test Method: ASTM D5084 Method C

PROJECT NUMBER:	15-120	November 19, 2015

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

485 Pierroz Rd, Unit D, Placerville, CA 95667
Ph 530-622-1101 Fax 530-622-1191

EID UMD

HYDRAULIC CONDUCTIVITY TEST REPORT

SAMPLE DATA

Sample Identification: Perm 3 Bottom
Sample Depth, ft.: 0-9"
Lab No.: S44506
Location: 0
Sample Type: Driven Liner
Remarks:

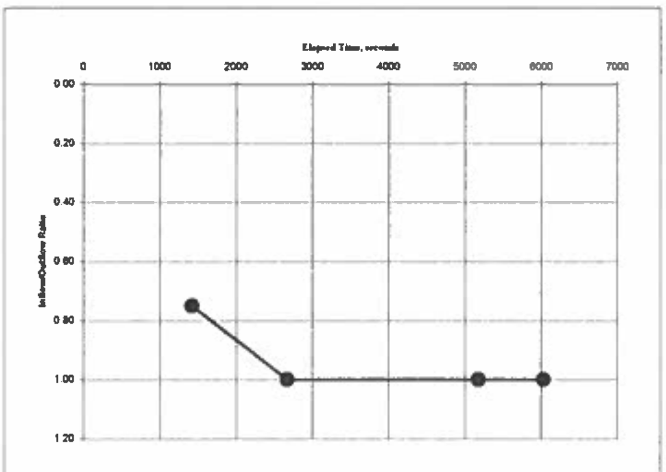
TEST RESULTS

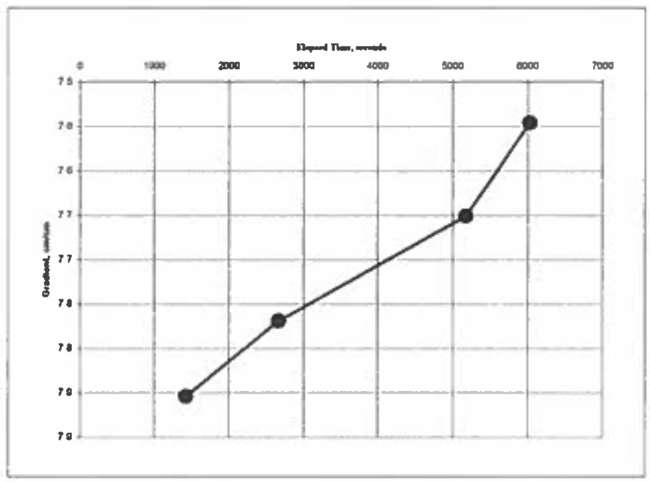
Permeability, cm/sec.: 2.61E-07
Average Hydraulic Gradient: 7.7

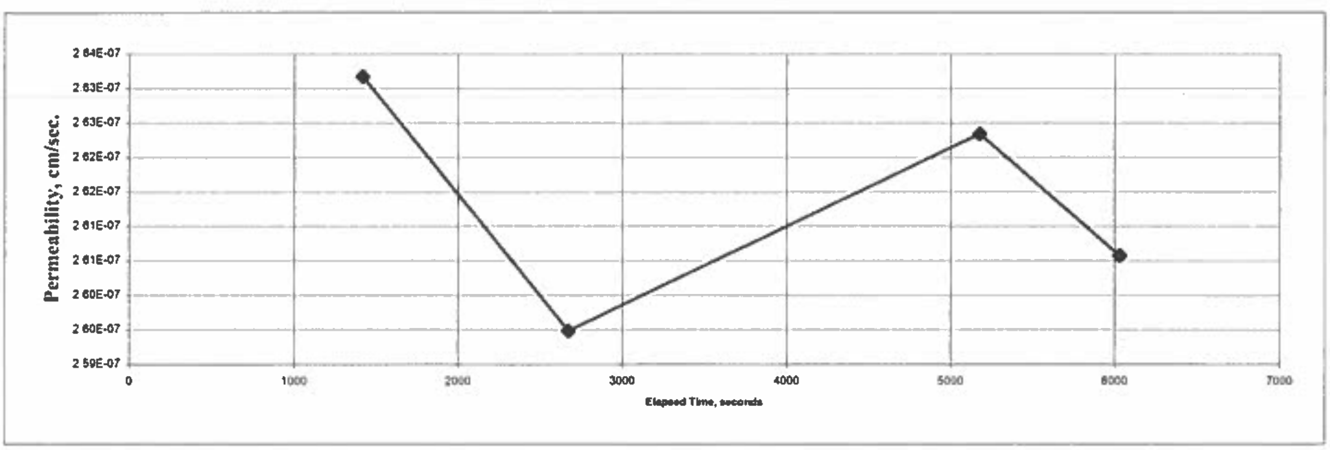
Effective Confining Pressure, psi: 5

TEST SAMPLE DATA

Before Test		After Test	
Specimen Height, cm:	7.62	Specimen Height, cm:	7.62
Specimen Diameter, cm:	7.19	Specimen Diameter, cm:	7.19
Dry Unit Weight, pcf:	83.1	Dry Unit Weight, pcf:	83.0
Moisture Content, %	37.2	Moisture Content, %	39.8







Test Method: ASTM D5084 Method C

PROJECT NUMBER:	15-120	November 24, 2015

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

485 Pierroz Rd, Unit D, Placerville, CA 95667
Ph 530-622-1101 Fax 530-622-1191

EID UMD

HYDRAULIC CONDUCTIVITY TEST REPORT

SAMPLE DATA

Sample Identification: Perm 4 Bottom
Sample Depth, ft.: 0-9"
Lab No.: S44507
Location: 0
Sample Type: Driven Liner
Remarks:

TEST RESULTS

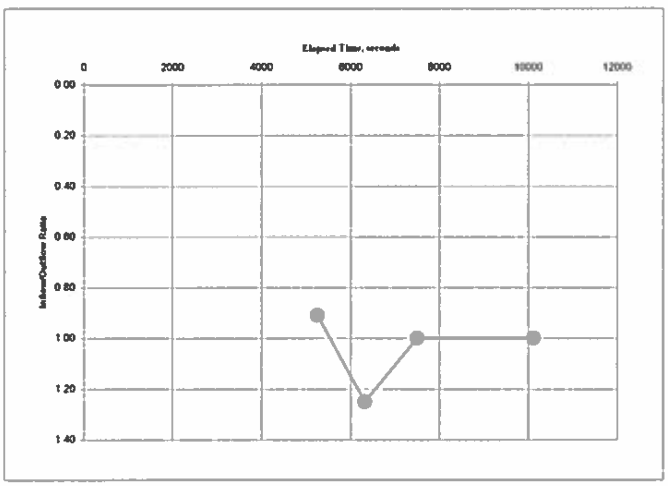
Permeability, cm/sec.: 1.19E-06

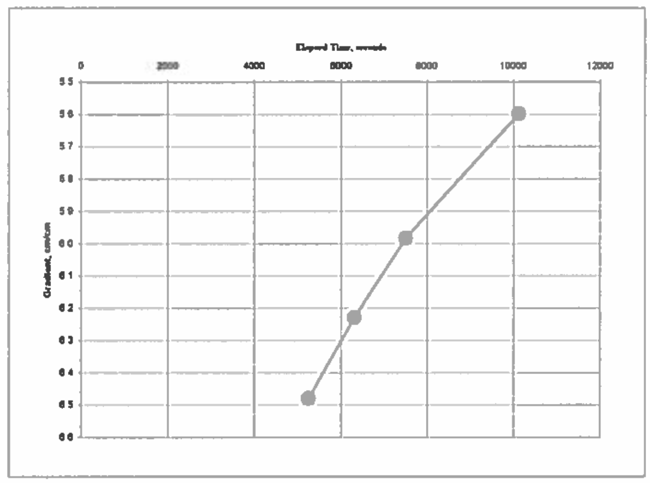
Average Hydraulic Gradient: 6.1

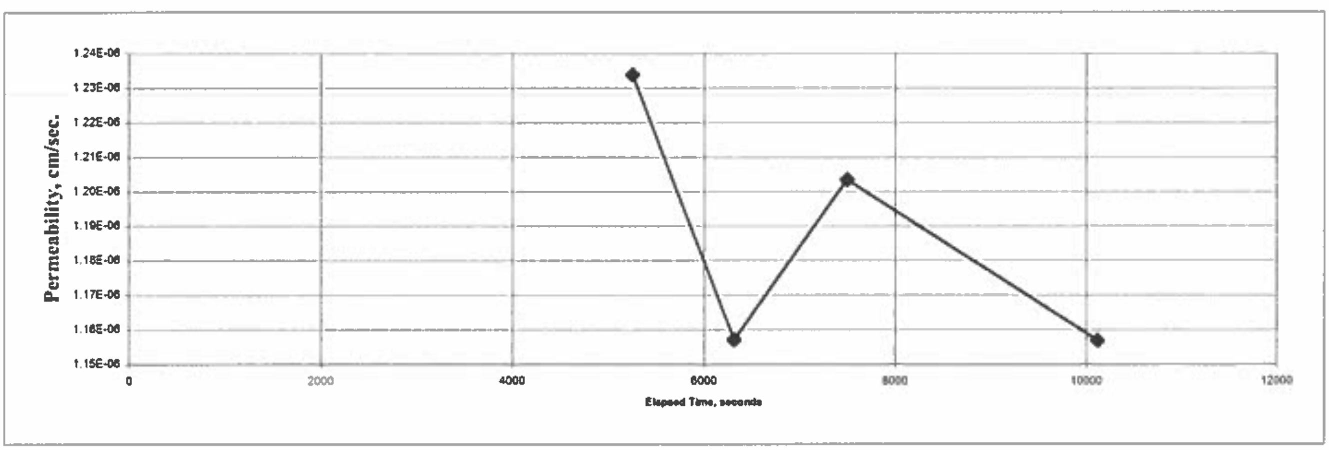
Effective Confining Pressure, psi: 5

TEST SAMPLE DATA

Before Test		**After Test**	
Specimen Height, cm:	7.87	Specimen Height, cm:	7.77
Specimen Diameter, cm:	7.14	Specimen Diameter, cm:	7.14
Dry Unit Weight, pcf:	72.7	Dry Unit Weight, pcf:	74.6
Moisture Content, %	50.8	Moisture Content, %	49.7







Test Method: ASTM D5084 Method C

PROJECT NUMBER:	**15-120**	November 24, 2015	

SIERRA TESTING LABORATORIES, INC.
GEOTECHNICAL AND MATERIALS TESTING SERVICES

485 Pierroz Rd, Unit D, Placerville, CA 95667
Ph 530-622-1101 Fax 530-622-1191

EID UMD

HYDRAULIC CONDUCTIVITY TEST REPORT

SAMPLE DATA

Sample Identification: Perm 5 Bottom — Sample Depth, ft.: 0-9" — Lab No.: S44508

Location: Broken, very weathered rock — Sample Type: Driven Liner

Remarks:

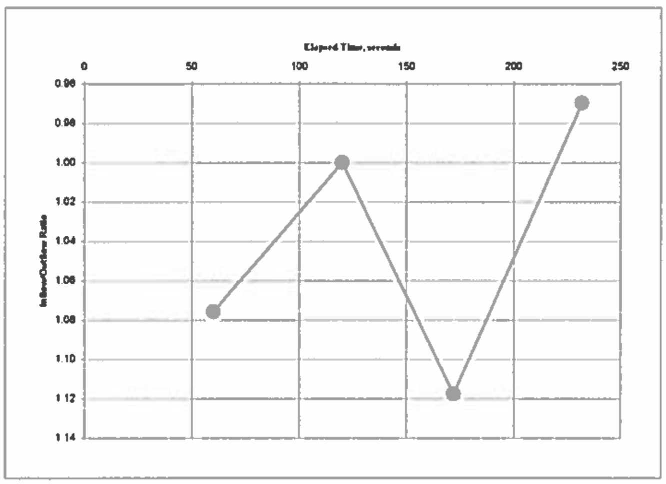
TEST RESULTS

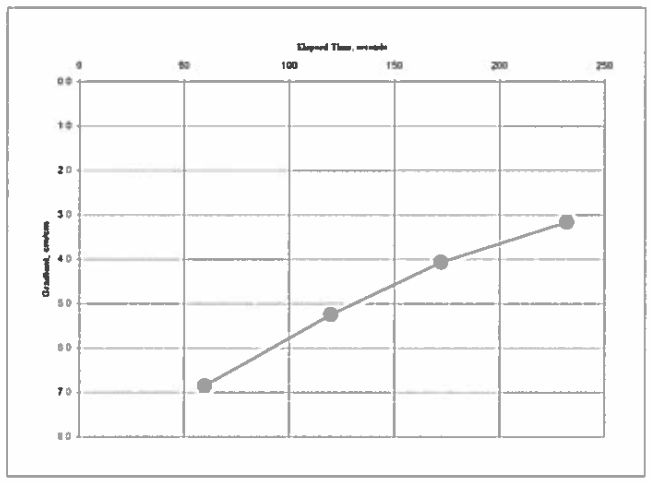
Permeability, cm/sec.: 1.45E-04 — **Average Hydraulic Gradient: 4.8**

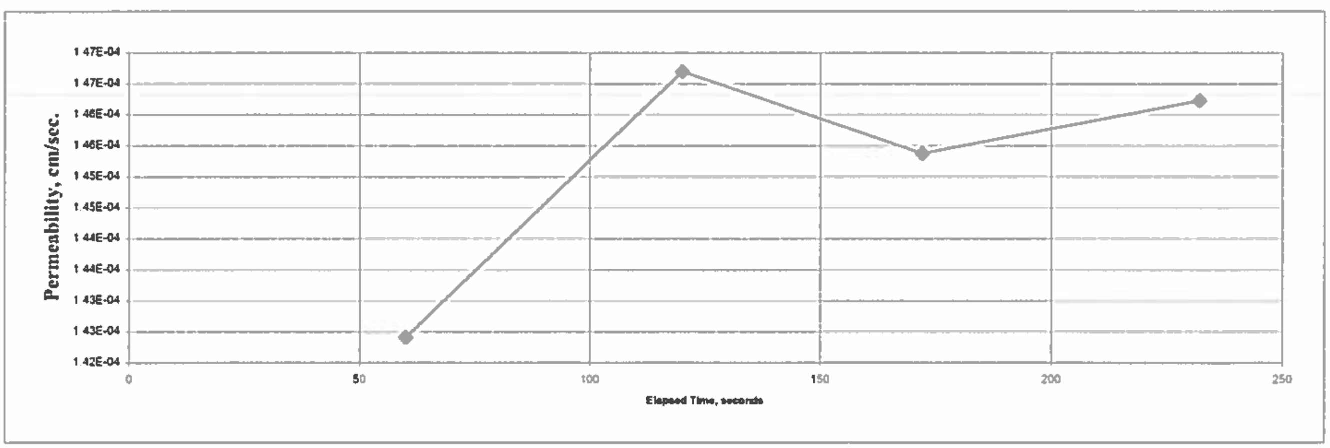
Effective Confining Pressure, psi: 5

TEST SAMPLE DATA

Before Test		After Test	
Specimen Height, cm:	7.62	Specimen Height, cm:	7.62
Specimen Diameter, cm:	7.14	Specimen Diameter, cm:	7.14
Dry Unit Weight, pcf:	60.6	Dry Unit Weight, pcf:	64.7
Moisture Content, %	69.9	Moisture Content, %	60.3







Test Method: ASTM D5084 Method C

PROJECT NUMBER:	15-120	November 19, 2015

SIERRA TESTING LABORATORIES, INC.

GEOTECHNICAL AND MATERIALS TESTING SERVICES

485 Pierroz Rd, Unit D, Placerville, CA 95667

Ph 530-622-1101 Fax 530-622-1191

EID UMD

Attachment 6

Upper Main Ditch 2017, 2018, 2019, and 2020 Water Loss
Forebay to Reservoir 1 Water Treatment Plant

This attachment includes the detailed annual analysis for 2017 through 2020.

2017 Operations Summary

The Reservoir 1 Water Treatment Plant came on line later in 2017 with the plant not ramping up until June 7th. Water began flowing a few days prior to water up the ditch and stabilize losses. Losses are based on the difference between Forebay Gage A-18 and the flow meter at the Reservoir 1 Water Treatment Plant, less backwash water returned ahead of the meter. As shown in Figure 1 and 2, flows were ramped up to 20 cfs in June and continued at that rate until the end of September when the water treatment plant was taken off line for Project 184 maintenance. Flow continued in the ditch at 0.5 to 1 cfs to deliver water to ditch customers until late October. Total water loss is underestimated to the extent carriage losses associated with delivering water to raw water customers after the treatment plant was taken off line are not included in the calculations.

Table 1 – 2017 Upper Main Ditch Water Loss

June 7 through October	
Forebay A-18 Gauge	4,555
Plant Inlet	3,688
Water Loss	867
Percent Loss	19%

Figure 1 – Forebay versus Reservoir 1 Headworks (Cubic-feet/second)

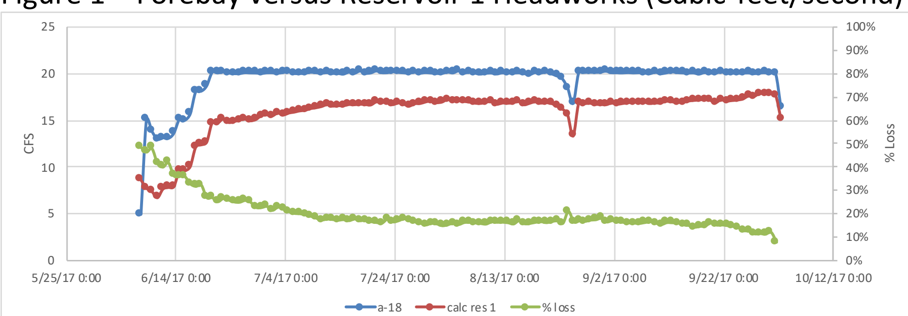
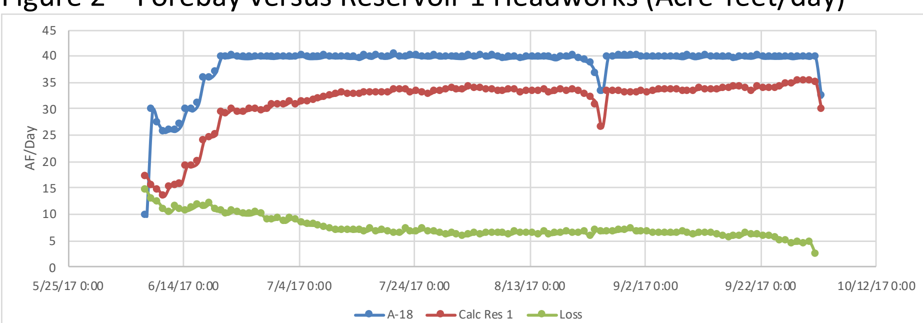


Figure 2 – Forebay versus Reservoir 1 Headworks (Acre-feet/day)



2018 Operations Summary

The Reservoir 1 Water Treatment Plant came on line at the end of March 2018. Ditch flows began a few days before the plant was brought on line to water up the ditch and stabilize losses. Losses are based on the difference between Forebay Gage A-18 and the flow meter at the Reservoir 1 Water Treatment Plant, less backwash water returned ahead of the meter. As shown in Figure 1 and 2, flows were initially in the 10 cfs range early in the spring and were ramet to approximately 18 cfs in early May. A spike in flows in late June reached over 20 cfs but stabilized at 15 cfs through late August before ramping down to 10cfs and continued at that rate until the end of September when and another flow spike over 20 cfs and then the water treatment plant was taken off line for Project 184 maintenance. Flow continued in the ditch at 0.5 to 1 cfs to deliver water to ditch customers until late October. Total water loss is underestimated to the extent carriage losses associated with delivering water to raw water customers after the treatment plant was taken off line are not included in the calculations.

Table 1 – 2018 Upper Main Ditch Water Loss

All season		June 28th – Aug 21st	
Forebay A-18 Gauge	5,642	Forebay A-18 Gauge	1,636
Plant Inlet	4,222	Plant Inlet	1,321
Water Loss	1,420	Water Loss	315
Percent Loss	25%	Percent Loss	19.2%

Figure 1 – Forebay versus Reservoir 1 Headworks (Cubic-feet/second)

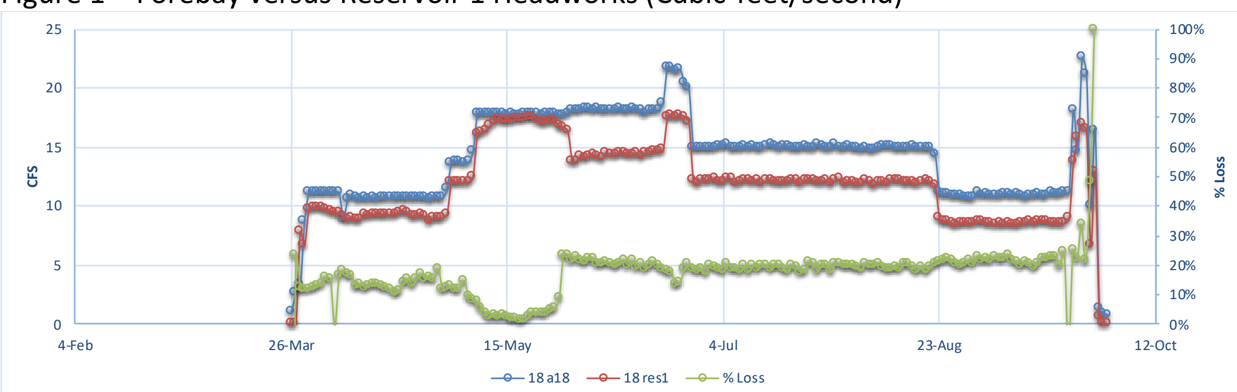
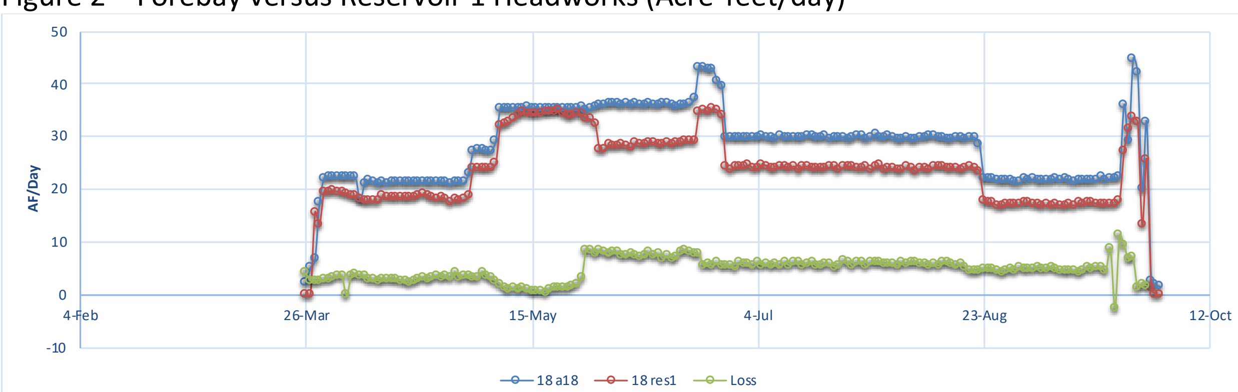


Figure 2 – Forebay versus Reservoir 1 Headworks (Acre-feet/day)



2019 Operations Summary

The Reservoir 1 Water Treatment Plant came on line on May 1 of 2019. Ditch flows began a few days before the plant was brought on line to water up the ditch and stabilize losses. The Gauge A-18 was replaced prior to the start of the season due to construction activates and now records data in a slightly different and more appropriate location. Losses are based on the difference between the new forebay gauge A-18 and the flow meter at the Reservoir 1 Water Treatment Plant, less backwash water returned ahead of the meter. As shown in Figure 1 and 2, flows were initially in the 10 cfs range early for a short period before being increased to 17 cfs in early June. This flow continued until the ditch was taken offline in late September. Total water loss is underestimated to the extent carriage losses associated with delivering water to raw water customers after the treatment plant was taken off line are not included in the calculations.

Table 1 – 2019 Upper Main Ditch Water Loss

All season		June 25th – Sept 14th	
Forebay A-18 Gauge	4,445	Forebay A-18 Gauge	2,751
Plant Inlet	3,361	Plant Inlet	2,071
Water Loss	1,085	Water Loss	680
Percent Loss	24%	Percent Loss	24.7%

Figure 1 – Forebay versus Reservoir 1 Headworks (Cubic-feet/second)

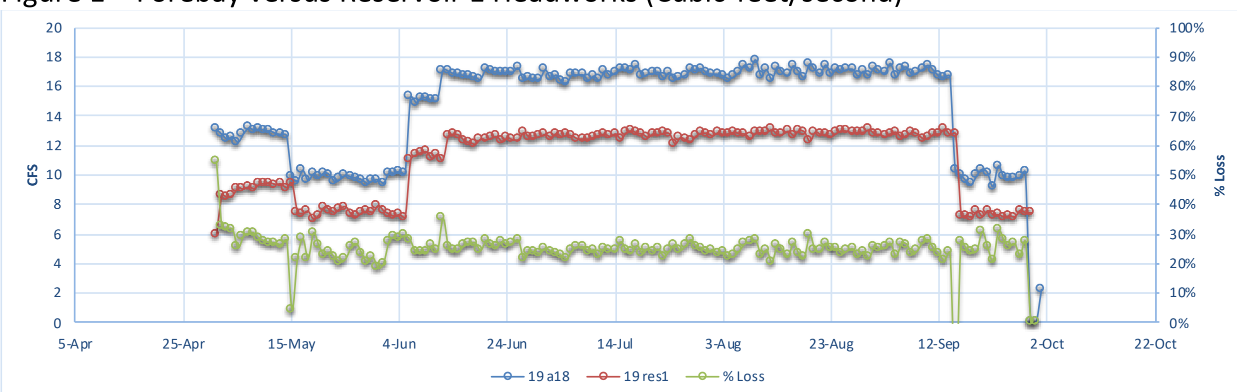
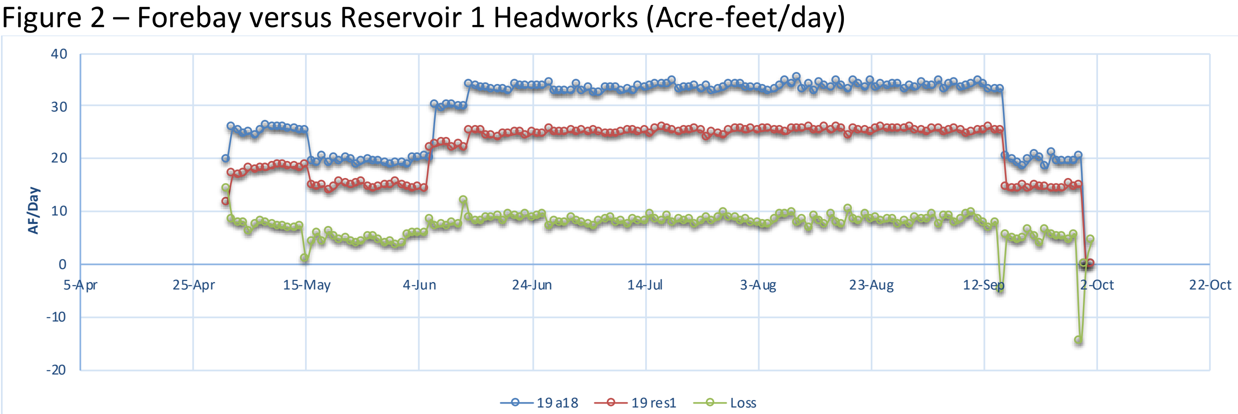


Figure 2 – Forebay versus Reservoir 1 Headworks (Acre-feet/day)



2020 Operations Summary

The Reservoir 1 Water Treatment Plant came on line on May 14 of 2020. Ditch flows began a few days before the plant was brought on line to water up the ditch and stabilize losses. The Gauge A-18 was replaced in 2019 at a new location. 2020 data is from the same location as 2019. Losses are based on the difference between the new forebay gauge A-18 and the flow meter at the Reservoir 1 Water Treatment Plant, less backwash water returned ahead of the meter. As shown in Figure 1 and 2, flows were initially in the 12 cfs range early for a short period before being increased to 15 cfs in July. This flow continued until the ditch was taken offline in late September. Total water loss is underestimated to the extent carriage losses associated with delivering water to raw water customers after the treatment plant was taken off line are not included in the calculations. Due to a gauge error at the Plant Inlet, data from July 1 to July 24th must be ignored resulting in losses estimated during this period. Figure 3 and 4 show the revised Forebay vs Headworks with estimated data to replace erroneous data. Data in Figures 3 and 4 was estimated using A-18 data and the loss projections from Table 2 in the December 2021 updated memo. Given that the error occurred early in the use period, a conservative loss estimate is appropriate.

Table 1 – 2020 Upper Main Ditch Water Loss

All season (estimated)		July 26th – Sept 17th	
Forebay A-18 Gauge	3,945	Forebay A-18 Gauge	1,609
Plant Inlet	2,734	Plant Inlet	1,167
Water Loss	1,211	Water Loss	442
Percent Loss	31%	Percent Loss	27.5%

Figure 1 – Forebay versus Reservoir 1 Headworks (Cubic-feet/second)

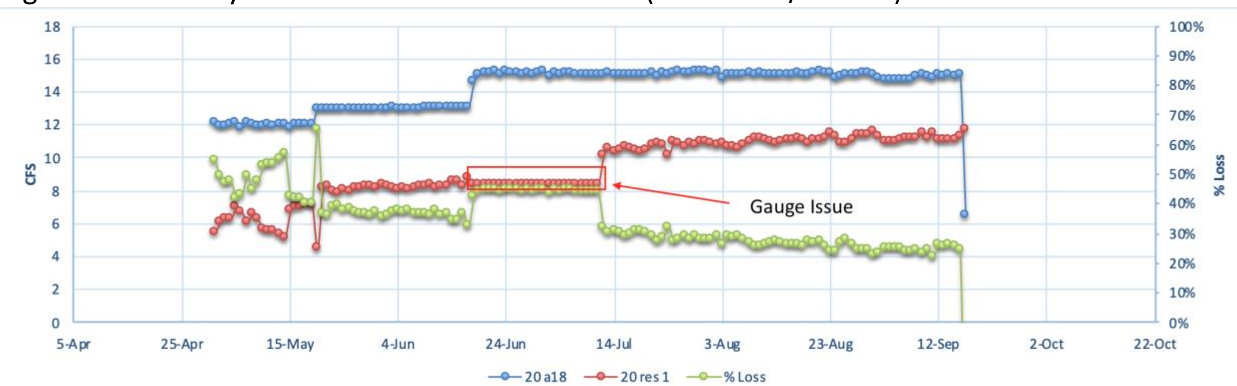


Figure 2 – Forebay versus Reservoir 1 Headworks (Acre-feet/day)

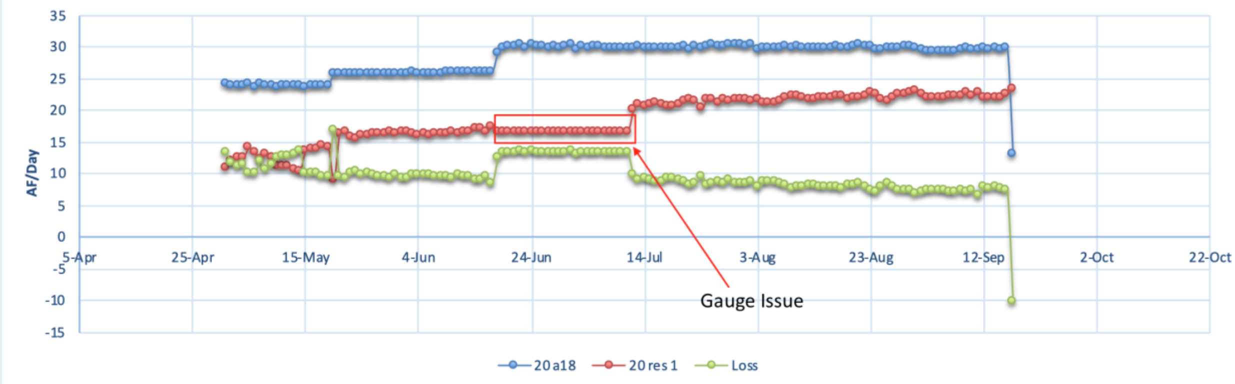


Figure 3 – Forebay versus Reservoir 1 Headworks (Cubic-feet/second)

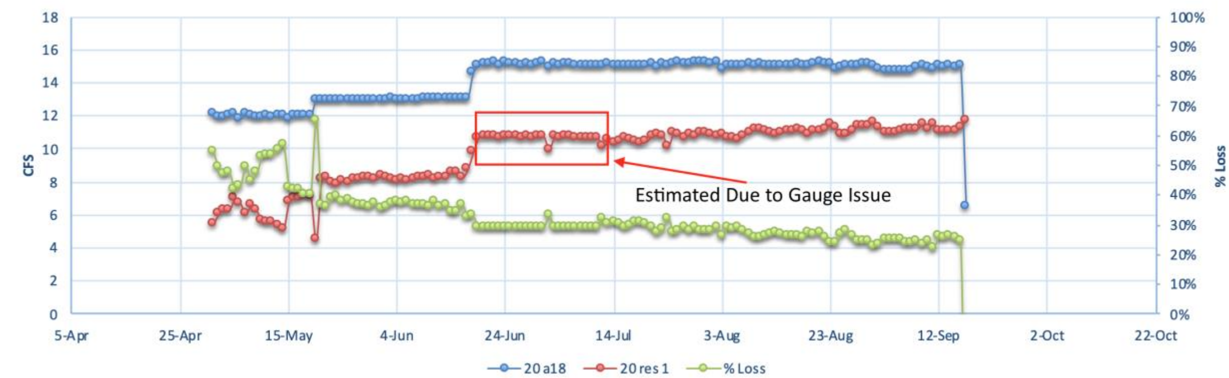
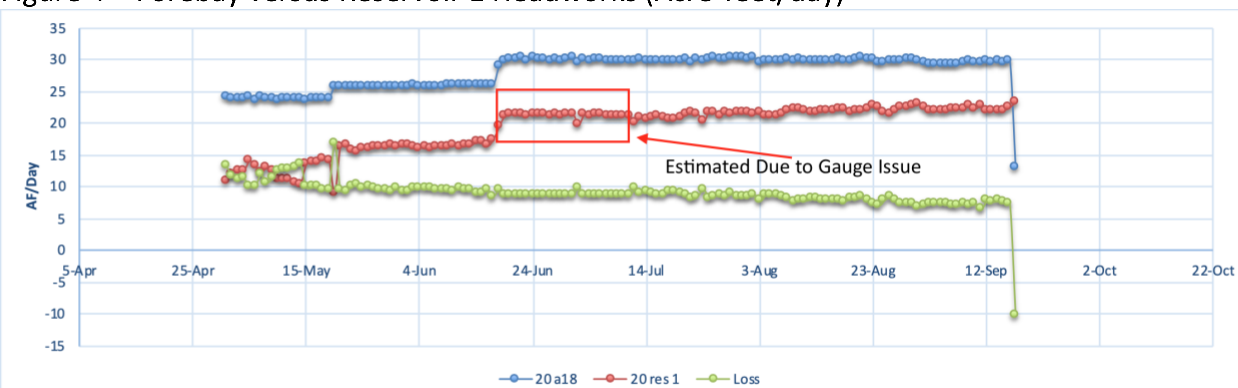


Figure 4 – Forebay versus Reservoir 1 Headworks (Acre-feet/day)



ATTACHMENT B

GEI Consultants 2023. Technical Memorandum – Main Ditch Seepage Analysis.
May 2, 2023

Technical Memorandum

To:	Brian Deason, El Dorado Irrigation District
From:	Michael Cornelius, P.G., GEI Consultants Dani Hassan, PhD, GEI Consultants
cc:	Elizabeth Leeper Brian Mueller
Date:	May 02, 2023
Re:	Main Ditch Seepage Analysis GEI Project No. 2300685

1 Executive Summary

The El Dorado Irrigation District (EID or District) is seeking to transfer conserved water under one of its pre-1914 water rights, using water that was previously lost through evaporation and seepage from the earthen and unlined Upper Main Ditch (Main Ditch) and that is now conserved through a new piped conveyance.

Any proposed water transfer conveyed through Folsom Dam is subject to U.S. Bureau of Reclamation (Reclamation) review and approval for the conveyance of water through federal facilities via a Warren Act Contract with prospective buyer(s). In considering the District's pending request to transfer conserved water to Westlands Water District, Reclamation requested an analysis to estimate the amount of seepage losses from the Main Ditch that historically reached the South Fork of the American River (SFAR) prior to converting the Main Ditch to a piped conveyance. Reclamation indicated that the seepage water which previously reached the SFAR and is now conserved by the piped conveyance would not be available for transfer, as it would have been water that was historically available to downstream water users.

This Technical Memorandum (TM) uses the best available data and methodologies and a water balance approach to estimate the amount of Main Ditch seepage losses that reached the SFAR. The TM describes the water balance approach applied for the analysis and the primary variables and assumptions used to estimate seepage losses that reach the SFAR. In general, the water balance approach evaluates the amount of water moving through the local geological formations by considering recharge variables such as rainfall/snowfall and Main Ditch seepage losses, along with discharge variables such as evapotranspiration (ET) of the forest lands and outflow from the study area, such as surface flows to the perennial streams and subsurface outflow. The water balance assumes that any Main Ditch seepage losses that historically reached a perennial stream would also reach the SFAR. The water balance analysis revealed that the rainfall/snowfall associated with water year type was a primary factor in the amount of seepage losses reaching the SFAR, and therefore water year type would provide a reasonable means to estimate seepage losses under any particular year that could reach the SFAR under future transfer scenarios. The results of the technical analysis are summarized in Table ES-1.

Table ES-1. Percent of Seepage Losses Reaching the SFAR by Water Year Type Based on Water Deliveries to the Main Ditch and Seepage Losses for the 2010 to 2020 period.

Water Year Type	Percent of Seepage Losses Reaching the SFAR
WET	33%
AN	26%
BN	23%
DRY	12%
CD	6%

2 Introduction

2.1 Main Ditch

The District relies on surface water to meet its entire potable water demand, and one of the District's main surface water conveyance facilities historically was the Upper Main Ditch (Main Ditch), which, prior to 2022, was an unlined ditch located in the eastern region of the District.

The portion of the Main Ditch considered as part of this analysis is located between Forebay Reservoir and the District's Reservoir 1 WTP. The ditch is approximately three miles in length and 14 to 20 feet wide at bank-full width and up to five feet in depth. The Main Ditch historically delivered a maximum of 15,080 AFY of raw water supplies from the Forebay Reservoir to the District's Reservoir 1 WTP. The Main Ditch typically conveyed raw water supplies during the spring and summer months and was shut down for varying periods of time in the fall and winter months for maintenance. Because the Main Ditch was open and unlined, it was susceptible to losses due to evaporation and seepage.

The unlined Main Ditch conveyance was replaced with a 42-inch-diameter pipe conveyance in the spring of 2022. The objectives of the pipe replacement project included reducing water loss resulting from seepage and ET from the Main Ditch, thereby contributing to EID's overall water conservation efforts and supply reliability.

2.2 Analytical Objective and Approach

At the request of the District, GEI Consultants, Inc. (GEI) was contracted to develop a Water Balance Model and perform an assessment to estimate the historical disposition of the seepage losses from the Main Ditch that may have conveyed water to the SFAR. To develop the Water Balance Model, we included the primary recharge components comprised of rainfall/snowfall and Main Ditch seepage, and primary discharge components including ET to estimate the outflow from the study area. This TM presents estimates of the amount of seepage water per year that historically reached the SFAR. The TM also illustrates how water year type and associated rainfall/snowfall correlate with seepage flow from the Main Ditch into the SFAR.

Prior work completed by EID estimated average seepage losses of approximately 1,800 acre-feet per year (AFY) from the approximately three-mile-long Main Ditch during its annual operating period over the past decade. The unlined Main Ditch was replaced with a pipeline beginning with the 2022 operational period. Monthly data for water deliveries to the Main Ditch and seepage losses from the Main Ditch were analyzed for the 2010 to 2020 period, which includes three wet years, one above normal year, two below normal years, two dry years, and three critical dry years. Annual values for deliveries to the Main Ditch, and seepage losses from the Main Ditch vary by year type. The water year types for this analysis are based on the California Department of Water Resources' (DWR's) Bulletin 120 forecast of April through July unimpaired flow for the American River below Folsom Lake, which includes monthly forecasts of inflow based on snowpack at the start of each month beginning in February and extending through May. In the future when developing individual transfer proposals, the May Water Year Type designation can be used to determine the percent of seepage losses that would have historically reached the SFAR in that year.

Prior to replacing the Main Ditch with the pipeline conveyance, seepage losses from the Main Ditch entered the local groundwater reservoir with some of those losses eventually reaching the SFAR. The specific yield of the underlying groundwater reservoir is a primary variable used in estimating the amount of Main Ditch seepage that historically reached the SFAR. The groundwater reservoir is not designated as a groundwater basin by DWR, but groundwater does exist in the Mehrten Formation (MF) and the underlying metasedimentary (MS) rocks. The study area for the water balance includes the 4,925-acre area encompassing the Main Ditch between the El Dorado Forebay (Forebay) Reservoir and the Reservoir 1 Water Treatment Plant (WTP). The primary sources of recharge in the study area include precipitation in the form of rainfall/snowfall and seepage from the Main Ditch. The primary sources of discharge in the study area include ET of the forest lands, and outflow from the study area as surface flows to the perennial streams and subsurface outflow. The water balance utilizes the best available data and information for the study area regarding each of these topics.

3 Project Setting

Seepage losses from the Main Ditch were estimated in previous studies made available by EID. A review of prior reports provided insight into potential contributions to subsurface flow from canal seepage, rainfall/snowfall, and ET of the overlying vegetation. A summary of the available information pertinent to this study is described below.

3.1 Project Location and Study Area

The Main Ditch is located near the ridge line between the streams that are tributary to the SFAR to the north of the Main Ditch and Weber Creek to the south of the Main Ditch. The nearby streams include both ephemeral and perennial streams. The United States Geological Survey (USGS) defines these features as follows:

- **Perennial Stream –** A stream that normally always has water in its channel. A perennial stream receives water from a variety of sources, including groundwater discharge, precipitation, and runoff from surrounding areas.

- **Ephemeral Stream** – A stream or part of a stream that flows only in direct response to precipitation; it receives little or no water from springs, melting snow, or other sources; its channel is always above the water table.

As ephemeral streams only flow in response to precipitation events, they do not receive groundwater inputs. On the other hand, the flow of perennial streams continues during non-precipitation periods, supported by seepage from the surrounding geologic formations. Consequently, any water that exits the study area is expected to reach the perennial streams and after undergoing some losses eventually reach the SFAR.

The Main Ditch is not a natural stream with a naturally defined watershed. Therefore, for this seepage analysis, the watersheds of the nearby streams were used to define the study area. For the Water Balance Model, we defined the study area based on the boundaries where ephemeral streams within this area meet the perennial streams, which are tributaries to the SFAR. The analysis assumes that any Main Ditch seepage water, which historically reached these perennial streams, also reached the SFAR.

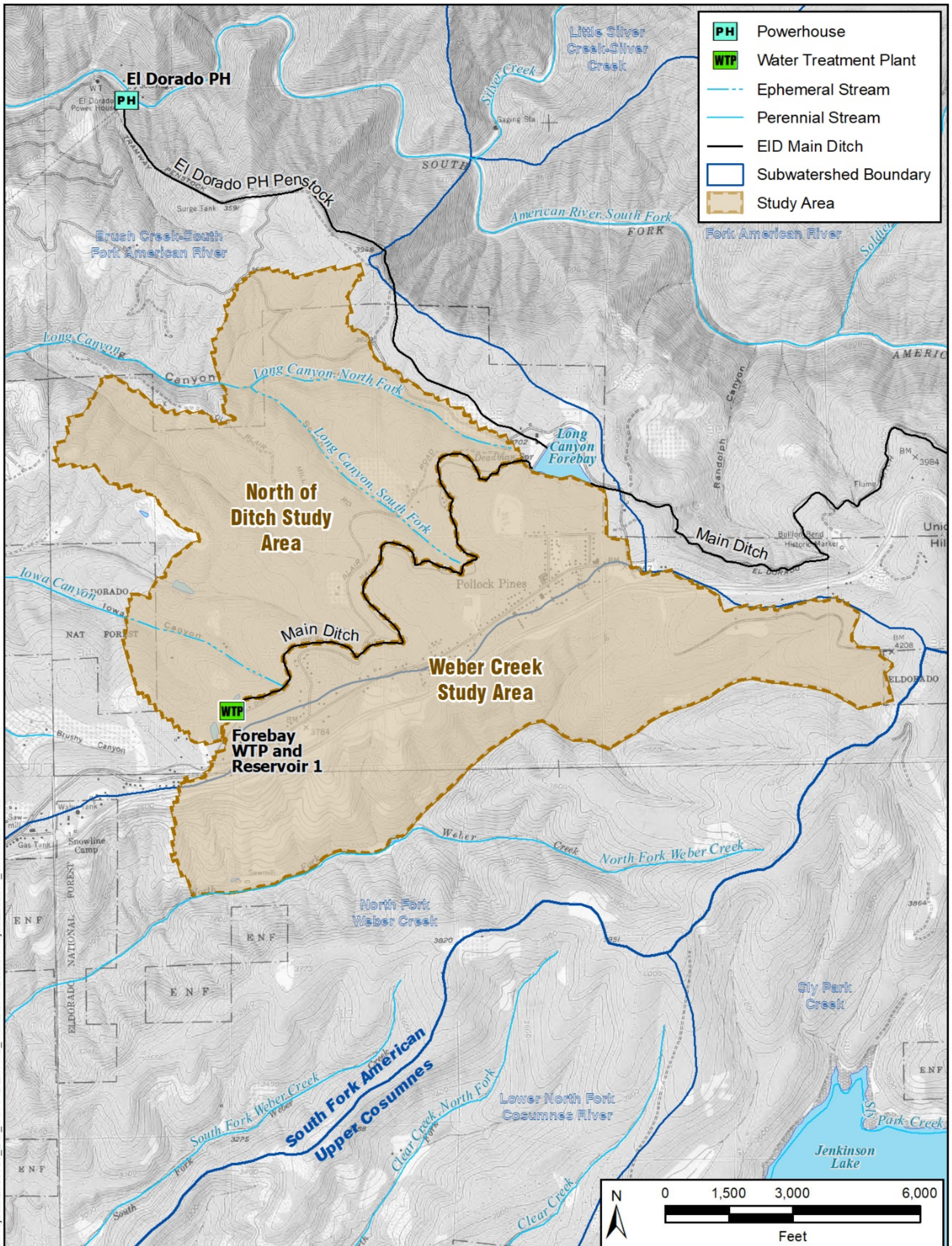
Watershed boundaries for the ephemeral streams were delineated using web-based application 'StreamStats' developed by the USGS. The StreamStats map-based user interface was used to obtain watershed characteristics for selected streams and their delineated drainage areas.

The study area is divided into the North of Ditch study area and the Weber Creek study area (Figure 1). The North of Ditch study area is located on the northern side of the Main Ditch. The SFAR is located at a distance ranging between 1.4 to 3.0 miles from the Main Ditch. In the North of Ditch study area there are two perennial streams located between SFAR and the Main Ditch: (1) South Fork of Long Canyon and (2) Iowa Canyon. These perennial streams drain into the SFAR. Adjacent to the Main Ditch, three ephemeral streams drain into the South Fork of Long Canyon and two ephemeral streams drain into Iowa Canyon. The transition point from ephemeral stream to perennial stream identified on the USGS quad sheet was used to define the extent of the North of Ditch study area as shown on Figure 1.

The Weber Creek study area is located on the southern side of the Main Ditch. In the Weber Creek study area, the North Fork Weber Creek and an unnamed ephemeral stream that flows into the North Fork Weber Creek define the southern boundary of the Weber Creek study area as shown on Figure 1. Ultimately, Weber Creek flows to the SFAR just upstream of Folsom Reservoir.

The study area totals 4,925 acres with 2,264 acres comprising the North of Ditch study area and 2,661 acres comprising the Weber Creek study area.

Figure 1. Project Location and Study Area



EID Main Canal Seepage Study El Dorado County, CA	GEI Consultants	PROJECT LOCATION
El Dorado Irrigation District		MAY 2023

Z:\Projects\2300685_EID_CONFIDENTIAL_MainDitchH2Oxfer\ProjectLocation_8x11.mxd RS
01-May-2023

3.2 Geology and Hydrology Description

A review of the study area's geologic and hydrologic characteristics was completed to support the assumptions and approach applied to the seepage analysis. These characteristics are summarized below. This information is needed to identify the potential range of parameters that need to be considered to support the seepage analysis and the rationale for selecting the values since there are limited localized data and information available. Where available, prior information was used to inform the selection of parameters.

3.2.1 Geologic Setting

The District's service area is located within the geomorphic province of the Sierra Nevada Mountain range, which is a northwest trending mountain range that extends for 400 miles in length and 40 to 100 miles in width. In a regional geomorphic context, the Sierra Nevada province is bounded by the Cascade Range to the north, by the Basin and Range Province on the east, the intersection of the Transverse Ranges and the Mohave Desert Provinces to the south, and the Great Valley Province to the west. Sierra Nevada bedrock consists of varied rock types and geological ages, from Paleozoic metamorphic to Holocene sedimentary and volcanic rock.

3.2.1.1 Mehrten Formation

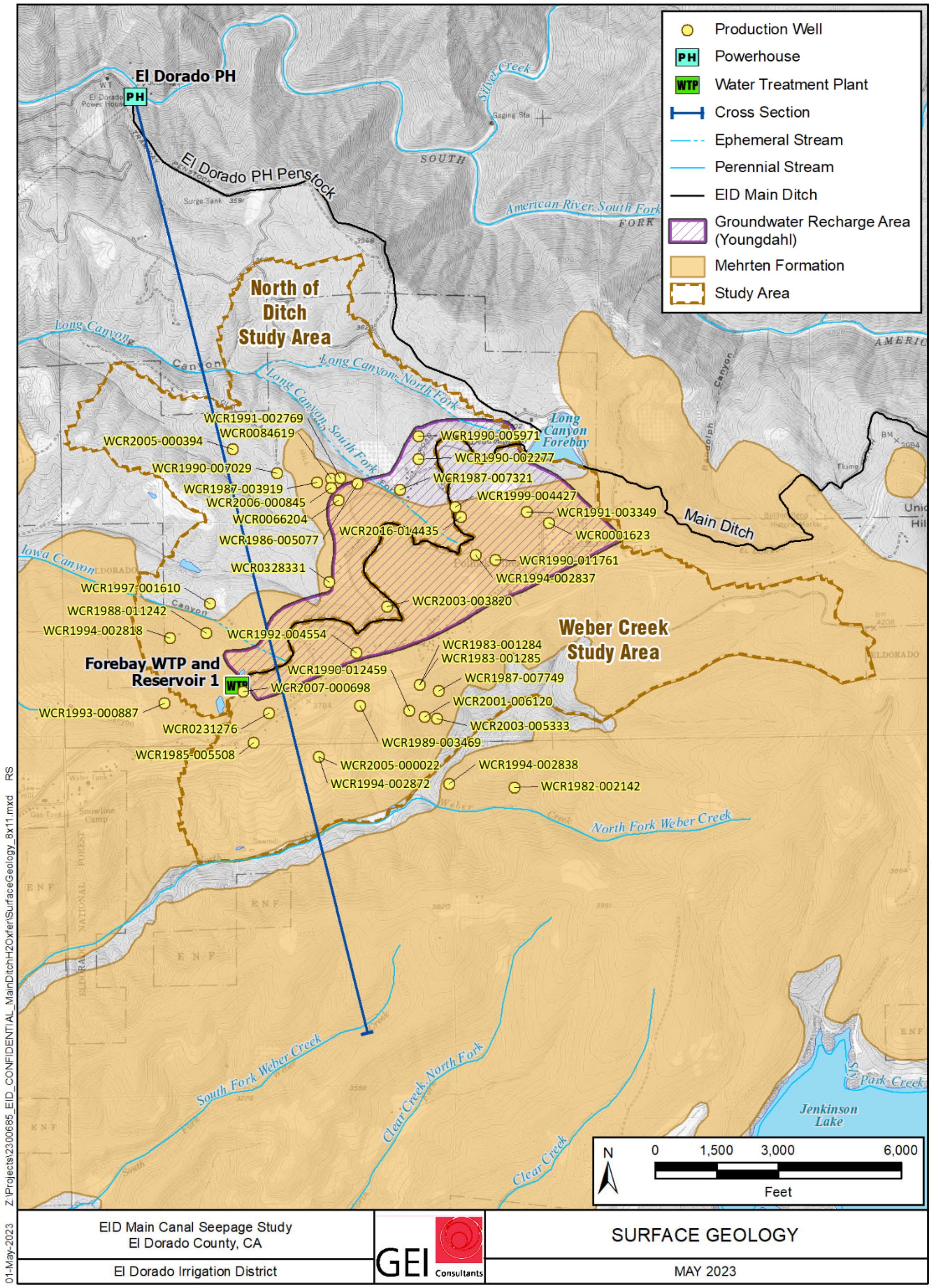
The Main Ditch is located partly on the Tertiary MF and partly on the undifferentiated Paleozoic metamorphic rocks as shown on Figure 2. While there are limited groundwater resources in this area and the District relies wholly on surface water to meet the region's municipal needs, there are a few private domestic wells for groundwater production. The locations of some of the well logs associated with these wells are shown on Figure 2. The MF can be identified from the metamorphic rocks in well logs and can range in thickness from less than 100 feet to about 300 feet thick. The thickness of the MF is highly variable resulting from the deposition of the MF upon the MS rock in the locally defined low-lying areas associated with creeks and valleys.

The specific yield of the water-bearing formations is a primary variable used in estimating the amount of Main Ditch seepage that historically reached the SFAR. The USGS defines specific yield as the ratio of the volume of water that a saturated rock or soil will yield by gravity to the total volume of the rock or soil. Specific yield is usually expressed as a percentage. The specific yield of the MF is highly variable and can range from 2 to 10 percent within the study area.

3.2.1.2 Metasedimentary Rocks

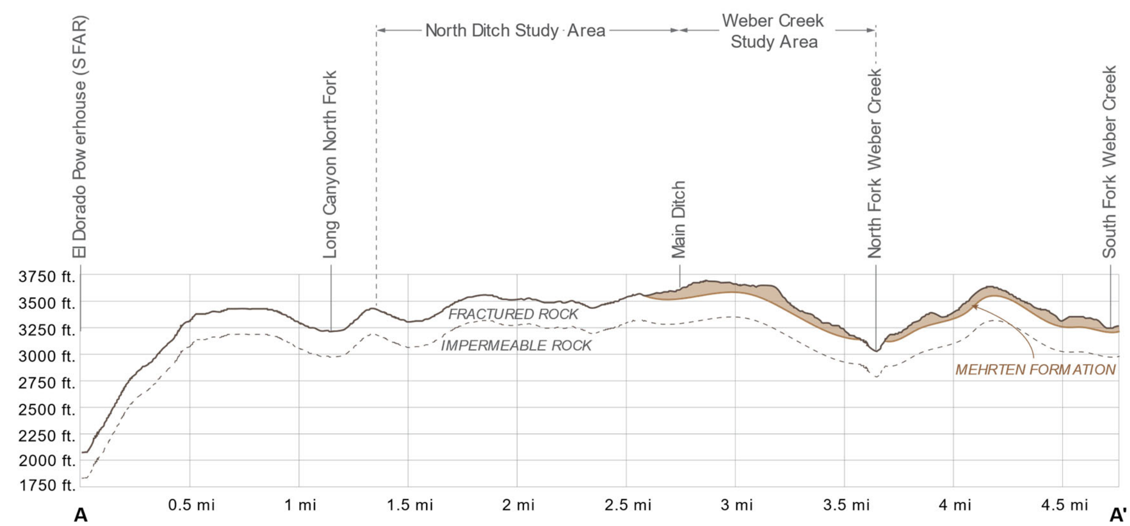
The geological foundation of the entire study area is composed of MS rock (hard rock), as reported by Youngdahl Consulting Group (2017). The approximate extent of this rock type is illustrated in Figure 3. The main source of groundwater in the study area is from fractures within these hard rock formations, as described by the USGS (USGS 1984). In the study area, the predominant flow of groundwater occurs through fractures in the hard rock, with the possibility of some water moving across the contact between thin layers of alluvium, colluvium, or decomposed granite. The thickness of these MS rocks varies between 200 and 250 feet, while their specific yields range from 1 to 3 percent.

Figure 2. Surface Geology



A geologic section line shown on Figure 2 extends from El Dorado Powerhouse located on the SFAR through the Main Ditch to Weber Creek. Figure 3 identifies the approximate extent of the MF overlying the MS rock along the representative geologic cross-section line. The objectives of this analysis are to define the water balance and its components including groundwater, which in this case is most appropriately represented as a uniform groundwater reservoir. The direction of seepage flow from the Main Ditch is a variable in the seepage estimation approach. The amount of seepage that flows to the north or south from the Main Ditch influences the impact on the groundwater storage reservoir, and therefore the amount of seepage that reaches the SFAR.

Figure 3. Schematic Geologic Section



3.2.2 Groundwater Setting

Groundwater provides a limited source of water for some private domestic uses in the area. While there are no groundwater basins in the study area, groundwater is still present in both the MF and the underlying MS rocks. The MF (upon which most of the Main Ditch is located) contains pervious zones that do supply groundwater during seasons of adequate rainfall/snowfall. The pervious zones function as a 'reservoir' for groundwater. As a result of the winter rains and snow melt, the groundwater reservoir is refilled during the winter and drained during the summer. In the Sierra Nevada region, local alluvial deposits may be developed for groundwater supply, but it is much more common for wells to be drilled in fractured rock. Fractured rock groundwater sources in the Sierra Nevada Mountain range are highly variable in terms of water quantity and quality. The primary mode of groundwater transport to a bedrock well is through contacts between lithologic units, as well as secondary porosity developed through fractures and faults, which can often be limited in aerial extent.

Groundwater availability in fractured rocks decreases as the depth below the ground surface increases, primarily due to the reduction in the number of joints and fractures at greater depths. The reduction becomes significant below a depth of 200 feet below the ground surface (USGS 1984). Figure 3 shows the representation of the fractured rocks overlying the impermeable rocks of the area. The groundwater system in the study area is recharged from rainfall and snowmelt as well as seepage losses from the

Main Ditch. A study carried out by the Youngdahl Consulting Group (2017) as part of the Main Ditch Piping Project Environmental Impact Report indicated that the possible contribution of Main Ditch seepage to well recharge was expected to be minimal and decline as distance from the ditch increased, provided all other influencing factors remained uniform (such as geology, soils, climate, etc.).

3.2.3 Hydrologic Setting

3.2.3.1 Precipitation

This analysis used the California Data Exchange Center's (CDEC) Pacific House (PCF) gage due to its proximity to the study area.

3.2.3.2 Evapotranspiration Rate and Volume

The influence of ET on the amount of Main Ditch seepage that reached the SFAR is a critical aspect to consider in the study area, which primarily contains dense vegetation. The ET reduces the available seepage water from the Main Ditch by depleting water from soil and plant surfaces, thereby impacting the volume of water that enters the SFAR through seepage. A positive correlation exists between higher rates of ET and lower quantities of seepage reaching the SFAR.

The CDEC-PCF does not offer ET data, and thus the most suitable alternative for the ET data is the California Irrigation Management Information System (CIMIS) Camino station, approximately six miles west of the study area. This analysis utilized reference evapotranspiration (ETo) data obtained from the CIMIS Camino station. ETo is the amount of evaporation (i.e., movement of water from soil to air) and transpiration (i.e., movement of water from root systems, through a plant, and exiting into the air as water vapor) from a grass surface that is well-watered.

Howes (2015) asserts that the ETo typically exceeds the actual ET of native vegetation. In the Sierra Foothills surrounding the study area at elevations between 3,000 and 4,000 feet, no other sources are available for actual ET data except for OpenET. OpenET utilizes various satellite-driven models to provide actual ET from 2016 onwards. Google Earth Engine was used to obtain mean actual ET data for the study area from OpenET.

To evaluate the accuracy of the reference ET from the Camino station, we compared it to the actual ET obtained from OpenET for the study area. Our analysis indicates that the mean annual actual ET of the study area (obtained from OpenET) is only about 70 percent of the reference ET (obtained from CIMIS-Camino) during the period from 2016 to 2022. Consequently, we assumed that the actual ET of the study area is 70 percent of the reference ET of the CIMIS Camino station and applied this factor to the entire time series (January 2009 to September 2020).

3.3 Main Ditch Operations and Seepage Losses

Tully and Young (2021) evaluated the Main Ditch seepage information from previous modeling studies and analyzed available data related to water losses from the Main Ditch, as documented in a Technical Memorandum (Tully memorandum) for the District. According to the Tully memorandum, the estimated total water loss from the Main Ditch can vary based on seasonal variations (see Table 1). Under low flow conditions (5 to 10 cubic feet per second (cfs)), the total water loss can range from 31 to 33 percent, while under high flow conditions (35.1-40 cfs), the total water loss can range from 11 to 12 percent. The quantity of seepage that contributed to groundwater recharge is unknown but would be less than the total seepage and would be dispersed along the entire ditch alignment.

According to the 1977 Environmental Assessment Report prepared by EID for the Main Canal Pipeline Project, seepage losses through the earth-lined ditch were estimated to contribute 1,260 AFY to the local groundwater (EID 1977).

Table 1. Seepage losses in the Main Ditch, Total Water Supplied, and a Percentage of Seepage Losses to the Total Water Supplied from Water Year 2010 to Water Year 2020.

	2010 AN	2011 WET	2012 DRY	2013 CD	2014 CD	2015 CD	2016 BN	2017 WET	2018 BN	2019 WET	2020 DRY
Seepage Losses from the Main Ditch (AF)											
Oct	0	0	0	0	0	0	0	0	0	0	0
Nov	0	0	0	0	0	0	0	0	0	0	0
Dec	0	0	0	0	0	0	0	0	0	0	0
Jan	156	139	0	157	102	0	0	0	0	0	0
Feb	151	112	122	194	145	0	0	0	0	0	0
Mar	177	154	145	223	142	136	0	0	109	0	0
Apr	179	198	145	256	194	220	0	0	187	0	0
May	222	265	231	241	232	226	172	0	229	185	133
Jun	205	256	262	240	242	257	240	198	241	239	294
Jul	221	222	203	248	251	207	228	204	204	257	382
Aug	229	221	204	221	245	266	205	269	248	258	261
Sep	222	216	263	239	232	193	199	197	201	146	224
Annual Loss	**1,762**	**1,783**	**1,575**	**2,019**	**1,785**	**1,505**	**1,044**	**868**	**1,419**	**1,085**	**1,294**
Total Water Supplied to the Main Ditch (AF)											
Total Supplied	**8,289**	**6,998**	**7,318**	**12,048**	**8,663**	**5,421**	**5,467**	**4,555**	**5,642**	**4,445**	**3,945**
Percent of Seepage Losses to Total Water Supplied											
Percentage	**21%**	**25%**	**22%**	**17%**	**21%**	**28%**	**19%**	**19%**	**25%**	**24%**	**33%**

Note: These data are derived from the Tully memorandum.

3.4 Water Year Classification

The seepage analysis presented here also illustrates how water year type and associated rainfall/snowfall correlate with the amount of Main Ditch seepage flow that historically reached the SFAR. EID employs water year categories specified in its Federal Energy Regulatory Commission license for the El Dorado Hydroelectric Project (FERC Project No. 184). The water year categories are based on DWR's Bulletin 120 forecast of April through July unimpaired flow for the American River below Folsom Lake, which are updated monthly from February to May, with the final water year type determined in May. The water year types used for FERC Project No. 184 operations are classified into five categories based on the following criteria:

Wet = exceeding 125 percent of the average

Above Normal (AN) = less than 125 percent but greater than or equal to 100 percent of average

Below Normal (BN) = less than 100 percent but greater than or equal to 75 percent of average

Dry = less than 75 percent but greater than or equal to 50 percent of average

Critically Dry (CD) = less than 50 percent of average

4 Project Assumptions and Seepage Estimation Approach

The primary variables that may affect the amount of seepage losses that flow to the SFAR are identified in Table 2, together with the key assumptions for the ranges of these variables, including the assumed value utilized for the evaluation and identified lower and upper limits for each variable. In general, this analysis utilizes a more "conservative" assumption for each variable, which likely tends to overestimate the amount of Main Ditch seepage flows reaching the SFAR.

Table 2. Key Variables and Assumptions on Value Ranges.

Variable	Assumed Value	Lower Limit	Upper Limit	References
Flow Direction of the Seepage Losses	60% of the seepage losses from the Main Ditch contribute to the North of Ditch study area; and 40% to the Weber Creek study area.	60% North, 40% South	100% North, 0% South	Uncertainty associated with subsurface ridge
Geological Formation Thickness	MF: 100 feet MS: 200 feet	MF: 100 feet MS: 200 feet	MF: 300 feet MS: 250 feet	DWR Well Logs USGS (1984)
Specific Yields	MF: 2%; MS: 1%	MF: 2% MS: 1%	MF: 10% MS: 3%	DWR (2011)
Actual ET	Actual ET (obtained from OpenET) is 70% of the reference ET (obtained from the CIMIS-Camino station).	Actual ET = 70% of the reference ET	Actual ET = 100% of the reference ET	A comparison of Camino stations reference ET with OpenET's actual ET
Ephemeral/ Perennial Stream Losses	5%	5%	27%	Constantz et al. (1994)

4.1 Estimation of the Main Ditch Seepage Flow to SFAR

The Main Ditch study area is divided into the North of Ditch and Weber Creek study areas. Two distinct geological formations, the MF and the MS, underlie the entire region. As per DWR well logs and USGS (1984), MF thickness estimates range from less than 100 to about 300 feet, while the water-bearing portion of the MS that underlies the area has a thickness between 200 and 250 feet. Assuming a conservative estimate of 100 feet for the thickness of the MF and 200 feet for the thickness of the MS rocks, along with a specific yield of 2 percent for the MF and 1 percent for the MS, the total storage capacity of groundwater in the study area is estimated to be 16,162 AF. The groundwater storage estimate is considered 'conservative' because the selection of the thickness of the water bearing units and the specific yield are on the low end of the potential range of values and result in a smaller groundwater storage reservoir. A smaller groundwater storage reservoir results in the greater potential for seepage flows from the Main Ditch to reach the SFAR.

The Water Balance Model was formulated using an eleven-year period (Oct 2009 to Sep 2020) incorporating historical inflow data (precipitation and Main Ditch seepage) and outflow data (ET) from the groundwater system. This simulation period was selected based on the available Main Ditch seepage data. There were three wet years (2011, 2017, 2019), one AN year (2010), two BN years (2016, 2018), two dry years (2012, 2020), and three CD years (2013, 2014, 2015) recorded during this period.

The water balance approach estimated the January 2009 groundwater storage initial condition for the study period. The study area experienced a period of significant dry conditions prior to January 2009, with 2007 characterized as critical dry, and 2008 and 2009 as dry water years. Accordingly, the groundwater storage in January 2009 was expected to be at a minimum level due to the prolonged drought. To account for this, we assumed that the groundwater storage at the start of the simulation was 30 percent full. The change in groundwater reservoir storage during the following months was calculated using inflows into and outflows from the groundwater systems. The primary inflows to the groundwater system include rainfall/snowfall and seepage from Main Ditch while the primary outflows include ET and subsurface outflows.

Information is not available to determine the division of Main Ditch seepage flows that go to the North of Ditch study area and the Weber Creek study area. As mentioned, the Main Ditch is located north of the ridge line that separates the North of Ditch study area and the Weber Creek study area. The simplifying assumption is that the water-bearing portion of the MS is at a constant depth beneath the ground surface, forming a ridge in the subsurface that divides the seepage to the North of Ditch study area and the Weber Creek study area. As a result, more of the Main Ditch seepage flows would go to the North of Ditch study area than the Weber Creek study area, but some seepage would still flow towards the Weber Creek study area. This study assumes 60 percent of the seepage losses from the Main Ditch contribute to the North of Ditch study area, while 40 percent contribute to the Weber Creek study area.

After meeting the actual ET demand, the surplus precipitation either flows into the local creeks and streams or infiltrates into the groundwater reservoir. Seepage from the Main Ditch fills any remaining groundwater storage capacity. Once the groundwater storage in the study area is full, the remaining seepage water from the Main Ditch will ultimately be routed to the SFAR, possibly in one or more forms, such as perennial surface streams, and subsurface flows. This seepage water may possibly undergo some degree of depletion resulting from losses (streams evaporation) before eventually ending up in SFAR. Evaporation from natural streams, stream-side evapotranspiration, and infiltration account for approximately 5 to 27 percent of flow loss (Constantz et al. 1994). We assume that 5 percent of the Main Ditch seepage water that reaches the perennial streams is lost on its way to the SFAR.

The key steps of the Water Balance Model simulations are summarized below.

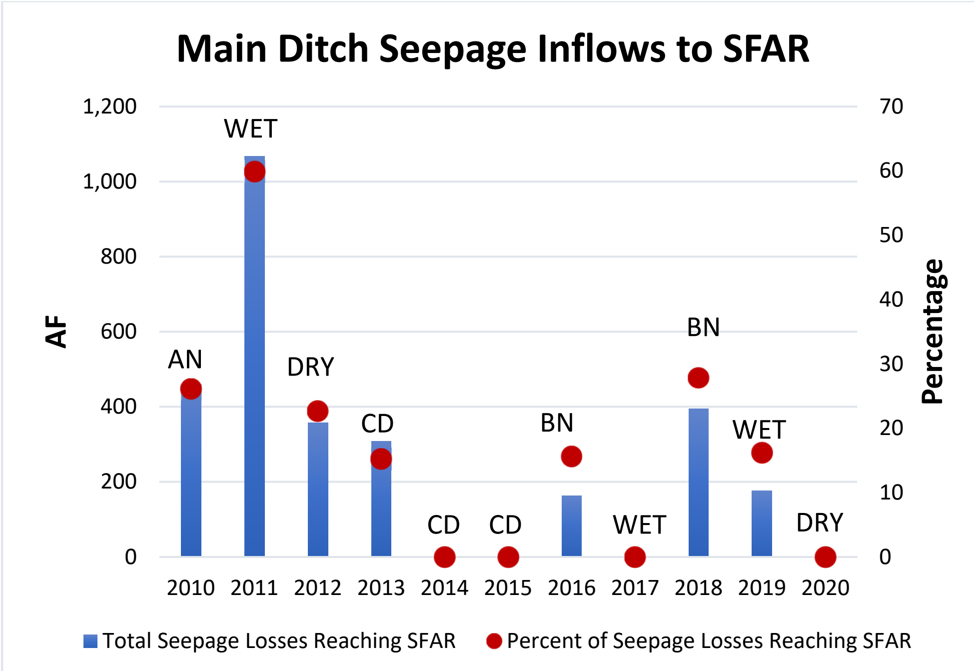
- The conservative assumptions in the analysis include a smaller amount of groundwater storage based on an estimated capacity of 16,162 AF (assuming a thickness of 100 feet for the MF, a thickness of 200 feet for the MS, a specific yield of 2 percent for the MF, and a specific yield of 1 percent for the MS). Additionally, 60 percent of the seepage water is assumed to flow to the north and 40 percent to the south, while the actual ET is assumed to be 70 percent of the ETo.
- The groundwater reservoir within the study area refilled to approximately 25 percent capacity during fall of 2008 based on the available precipitation and ET data. For purposes of our water balance, we used the initial groundwater storage capacity of 30 percent full in January 2009.
- The January 2009 to September 2009 period was included in simulation period but was not used in the water balance results summary because it does not represent a full water year.
- The changes in groundwater storage were evaluated on a monthly time step, including the various sources of recharge and discharge to the groundwater reservoir.
- Once the groundwater storage in the study area is full, the remaining seepage water from the Main Ditch ultimately leaves the study area.
- Any water that leaves the study area is assumed to flow into the SFAR after undergoing losses of approximately 5 percent.

5 Results and Conclusions

5.1 Main Ditch Seepage Inflow to SFAR During Different Water Year Types

In this section, the study's primary outcomes are summarized, with visual representations of the findings available in Figures 4 and 5 and Tables 3 and 4. Figure 4 illustrates the estimated Main Ditch seepage losses reaching the SFAR, estimated using the Water Balance Model. Using the data reported in the Tully memo on the total amount of seepage losses from the Main Ditch, a percentage of these losses reaching SFAR was calculated. The highest total Main Ditch seepage volume reaching the SFAR was estimated for Wet Year 2011 at 1,068 AF (Figure 4 & Table 3). Seepage at this highest level can be attributed to significant higher precipitation during the water year 2011. Seepage flow to SFAR was almost negligible during dry and critical dry years (Figure 4 & Table 3).

Figure 4. Historical Annual Seepage Inflows into and Percentage of Seepage Losses reaching SFAR.



Sections below present the summary of the mean annual Main Ditch seepage inflow to SFAR during the wet, AN, BN, dry, and CD year.

5.1.1 Wet Water Year

The mean water supplied to the Main Ditch during the wet years (2011, 2017, and 2019) was 5,333 AF (see Figure 5 and Table 4). The mean Main Ditch seepage losses were estimated as 1,245 AF (Table 3). As a result of losses and consumption, the mean annual Main Ditch seepage inflows to the SFAR during the wet years totaled 415 AF, which represents 8 percent of the total water supply to the Main Ditch and 33 percent of the seepage losses from the Main Ditch (see Table 4).

5.1.2 Above Normal Water Year

During the period from 2010 to 2020, only the year 2010 was observed as an AN year. During water year 2010, water supplied to the Main Ditch was recorded as 8,289 AF. The Main Ditch seepage losses were estimated as 1,762 AF (Table 3). As a result of losses and consumption, the mean Main Ditch annual seepage inflows to the SFAR during the AN year totaled 460 AF, which represents 6 percent of the total water supply to the Main Ditch and 26 percent of the seepage losses from the Main Ditch (see Table 4).

5.1.3 Below Normal Water Year

The mean water supplied to the Main Ditch during the BN years (2016 and 2018) was 5,555 AF (see Figure 5 & Table 4). During the BN years, the mean Main Ditch seepage losses were estimated as 1,232 AF. As a result of losses and consumption, the mean annual seepage inflows to the SFAR during the BN years totaled 279 AF. These losses represent 23 percent of the total Main Ditch seepage losses and 5 percent of the total mean water supplied during BN years (see Table 4).

5.1.4 Dry Water Year

The mean water supplied to the Main Ditch during the dry years (2012 and 2020) was 5,632 AF (see Figure 5 and Table 4). During the dry years, the mean Main Ditch seepage losses were estimated as 1,435 AF. As a result of losses and consumption, the mean annual Main Ditch seepage inflows to the SFAR during the dry years totaled 179 AF. These losses represent 12 percent of the total Main Ditch seepage losses and 3 percent of the total mean water supplied during these dry years (see Table 4).

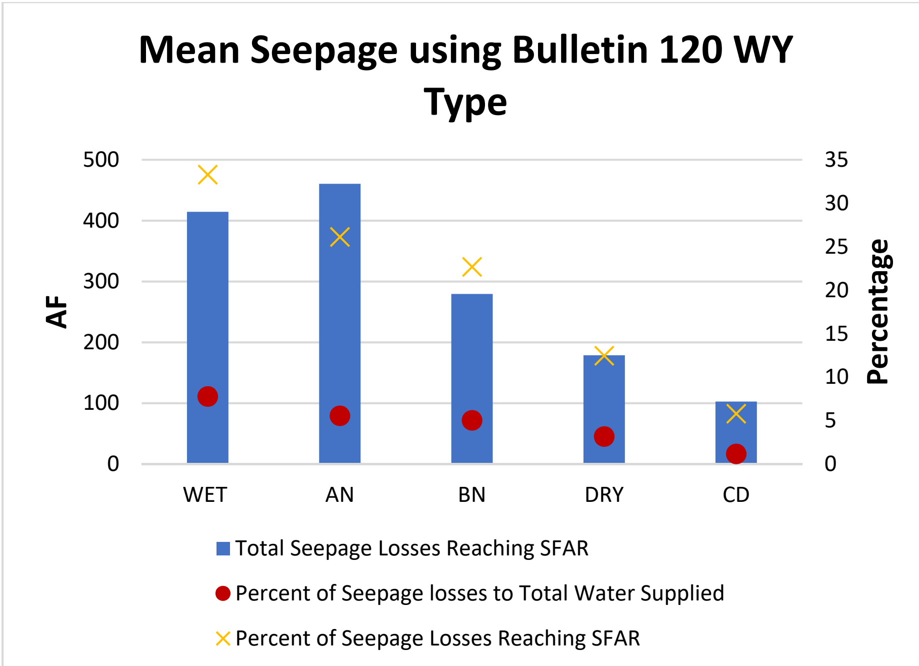
5.1.5 Critically Dry Water Year

The mean water supplied to the Main Ditch during the CD years (2013, 2014, 2015) was 8,711 AF (see Figure 5 and Table 4). During the CD years, the mean Main Ditch seepage losses were estimated as 1,770 AF.

It should be noted that the Main Ditch releases from the Forebay Reservoir were not contingent upon the type of water year. Typically, greater releases to the Main Ditch resulted in higher seepage losses. It is noteworthy that a higher amount of water supply was released to the Main Ditch during CD years to meet consumptive demands. Due to the higher water releases from the Main Ditch during CD years, seepage losses from the Main Ditch were also higher compared to other years.

On the other hand, the Main Ditch seepage losses reaching the SFAR depend on the precipitation deficit and the environmental water demand of the study area. As a result of precipitation deficits and unmet water demands, most of the seepage from the Main Ditch was consumed during the CD years and only 102 AF of seepage flowed into the SFAR (see Table 4). This represents 6 percent of the total Main Ditch seepage losses and 1 percent of the total mean water supplied during these CD years (see Table 4).

Figure 5. Mean Annual Main Ditch Seepage Inflows Reaching SFAR during the Wet, BN, Dry, and CD years.



Note: The percentage of Main Ditch seepage losses estimated to reach SFAR during AN years, as reported here, is based on a one-year observation.

Table 3. Main Ditch Seepage Losses and Amount of Seepage Losses Reaching SFAR during the 2010 to 2020 Period.

Bulletin 120 WY Type	Water Year	Water Supplied to Main Ditch	Main Ditch Seepage Losses	[1]GW Storage at the beginning of WY	Seepage Losses Reaching SFAR	Percent of Seepage Losses Reaching SFAR to Total Losses	[2]Percent of Seepage Losses Reaching SFAR to Water Supplied
AN	2010	8,289	1,762	3,990	460	26%	6%
WET	2011	6,998	1,783	7,218	1,068	60%	15%
DRY	2012	7,318	1,575	9,145	357	23%	5%
CD	2013	12,048	2,019	6,111	308	15%	3%
CD	2014	8,663	1,785	7,576	0	0%	0%
CD	2015	5,421	1,505	3,645	0	0%	0%
BN	2016	5,467	1,044	1,598	163	16%	3%
WET	2017	4,555	868	5,400	0	0%	0%
BN	2018	5,642	1,419	5,872	395	28%	7%
WET	2019	4,445	1,085	1,044	176	16%	4%
DRY	2020	3,945	1,294	2,008	0	0%	0%

Note:

[1] In January 2009, the groundwater storage capacity was assumed to be at 30% of full capacity. However, over the course of subsequent years, its level remained low. The primary reason for this phenomenon was the high ET demand during the dry season, i.e., between April and September when precipitation levels were minimal. As a result, the groundwater storage underwent significant depletion.

[2] Based on the data reported in the Tully memorandum of the total water supplied from the Forebay Reservoir to the Main Ditch, a percentage of seepage inflows was calculated.

Table 4. Average Seepage Losses Reaching SFAR using Bulletin 120 Water Year Types in AF during the 2010 to 2020 Period.

WY Type	Water Supplied to Main Ditch	Mean Main Ditch Seepage Losses	Seepage Losses Reaching SFAR	Percent of Seepage Losses Reaching SFAR	Percent of Seepage Losses to Water Supplied
WET	5,333	1,245	415	33%	8%
AN	8,289	1,762	460	26%	6%
BN	5,555	1,232	279	23%	5%
DRY	5,632	1,435	179	12%	3%
CD	8,711	1,770	103	6%	1%

5.2 Conclusions

The analysis used the best available and readily accessible data and information to estimate the approximate seepage losses that reached the SFAR from the Main Ditch. The complex nature of the physical setting and subsurface conditions as well as other factors affect the ability to simulate these complex conditions and the water balance approach is designed to cover the range of the most likely conditions. The water balance approach applied for this analysis considers the primary variables and includes a base set of conservative assumptions that may overestimate the amount of Main Ditch seepage that historically reached the SFAR.

The results of the water balance identified the Water Year Type and associated rainfall/snowfall as strongly correlated to the amount of Main Ditch seepage losses reaching the SFAR each year. In October, at the beginning of the water year, the groundwater reservoir is typically at its lowest after the summer months of no meaningful precipitation and a high ET demand. During the fall and winter, precipitation increases while ET decreases, causing the groundwater storage to increase. This continues until spring when most of the precipitation has occurred, and the months of highest ET have not yet started. At this time of year, the groundwater storage reservoir is reaching its highest storage volume. When the groundwater storage is full, discharges from the groundwater system occur in the form of discharge to streams and subsurface outflow.

Water deliveries to the Main Ditch are greatest during the April to September period. In wetter years, when the groundwater reservoir is full, seepage losses from the Main Ditch contribute to the discharges from the study area, and these flows are expected to reach the SFAR. In drier years, when the groundwater reservoir is not full, seepage losses from the Main Ditch flow into the groundwater reservoir. During the summer months of all water year types, the higher ET demand relies on groundwater in storage, reducing groundwater storage by September at the end of the water year.

The results suggest that during wet years 33 percent of the seepage losses from the Main Ditch were estimated to reach SFAR, 26 percent during the single AN year, 23 percent during BN years, 12 percent during dry years, and 6 percent during CD years.

References

California Department of Water Resources. 2011. Ground Water in Fractured Hard Rock. Retrieved from:

https://water.ca.gov/-/media/DWR-Website/Web-Pages/Water-Basics/Drought/Files/Publications-And-Reports/water_fact_1__2011.pdf

Constantz, J., Thomas, C.L. and Zellweger, G., 1994. Influence of diurnal variations in stream temperature on streamflow loss and groundwater recharge. Water resources research, 30(12), pp.3253-3264.

Daly, C., Halbleib, M., Smith, J.I., Gibson, W.P., Doggett, M.K., Taylor, G.H., Curtis, J., and Pasteris, P.A. 2008. Physiographically-sensitive mapping of temperature and precipitation across the conterminous United States. International Journal of Climatology, 28: 2031-2064. https://doi.org/10.1002/joc.1688

El Dorado Irrigation District (EID). 1977. Jones and Stokes Associates, Environmental Assessment of the El Dorado Canal Pipeline Project, August 19, 1977

Howes, D. J., Fox, P., & Hutton, P. H. 2015. Evapotranspiration from natural vegetation in the Central Valley of California: Monthly grass reference-based vegetation coefficients and the dual crop coefficient approach. Journal of Hydrologic Engineering, 20(10), 04015004.

Tully and Young. 2021. Updated Main Ditch Water Loss Analysis with 2020 Data, December 30, 2021.

United States Geological Survey, 1939. Water Supply Paper 780, Geology and Ground-Water Hydrology of the Mokelumne Area, California.

United States Geological Survey, 1984. Water-Resources Investigations Report 83-4262, Groundwater Conditions and Well Yields in Fractured Rocks, Southwestern Nevada County, California.

Youngdahl Consulting Group (Youngdahl). 2017. Groundwater Resources Impacts Analysis for El Dorado Irrigation District Upper Main Ditch Piping Project Pollock Pines, California.