Lower Owens River Project
2024 Annual Report

December 18, 2024

TABLE OF CONTENTS

Figures and Tables

ABBREVIATIONS, DEFINITIONS, AND MEMBERSHIP TABLE

1991 EIR	Final Environmental Impact Report regarding water from the Owens Valley to supply the second Los Angeles Aqueduct from 1970-1990, and from 1990 onward pursuant to the Water Agreement.
1997 MOU	1997 Memorandum of Understanding between the City of Los Angeles Department of Water and Power, the County of Inyo, the California Department of Fish and Game, the California State Lands Commission, the Sierra Club, the Owen Valley Committee and Carla Scheidlinger.
2004 EIR	Final Environmental Impact Report & Environmental Impact Statement Lower Owens River Project
2007 Stipulation & Order	2007 Stipulation and Order (Case number: S1CVCV01-29768) resolving issues with 2005 order "Orders Re: Defendants' Violations of Court Orders."
AF	Acre feet
BWMA	Blackrock Waterfowl Management Area
CAC	Inyo and Mono Counties Agricultural Commissioner's Office
CADF	California Department of Food and Agriculture
CEQA	California Environmental Quality Act
cfs	Cubic-feet-per-second
the County	Inyo County
DHA	Delta Habitat Area
EIR	Environmental Impact Report
ET	Evapotranspiration rate
FC	Flood Cycle associated with the Interim Plan for flooding BWMA
HIS	Habitat Indicator Species
ICWD	Inyo County Water Department
IP	Interim Plan. 5-year interim management plan for BWMA.
LAA	Los Angeles Aqueduct
LADWP	Los Angeles Department of Water & Power
LOR	Lower Owens River
LORP	Lower Owens River Project

MAMP	Lower Owens River Monitoring, Adaptative Management and Reporting Plan
MOU Parties	Los Angeles Department of Water and Power, Inyo County, California Department of Fish and Wildlife, California State Lands Commission, Sierra Club, Owens Valley Committee and Carla Scheidlinger.
OVC	Owens Valley Committee
RAS	Rapid Assessment Survey
RY	Runoff year accounts for peak stream flow and occurs from April 1st and ends the following March 31st.
SC	Sierra Club
SHF	Seasonal Habitat Flow
SLC	California State Lands Commission
Standing Committee	Comprised of elected and appointed officials from the City and County and provide direction to the Inyo/LA Technical Group.
Technical Group	Comprised of Inyo County and City staff who are directed by the Standing Committee.
Water Agreement	Agreement between the County of Inyo and the City of Los Angeles and its Department of Water and Power on a Long-Term Groundwater Management Plan for Owens Valley and Inyo County, administered by the Standing Committee and Technical Group
WY	Water year is a hydrological year that starts on October 1 and ends the following September 30.

Authored by:

The Los Angeles Department of Water and Power
http://www.ladwp.com/LORP

Inyo County Water Department
http://www.inyowater.org/projects/lorp/

EXECUTIVE SUMMARY

The 2024 Lower Owens River Project (LORP) Annual Report contains the results from the seventeenth year of monitoring along the river. Results contained in this report include hydrologic monitoring, water quality monitoring, adaptative management and associated monitoring.

Hydrologic Monitoring

The hydrologic monitoring section describes flow conditions in the LORP regarding attainment with the 2007 Stipulation & Order flow and reporting requirements and 1991 Environmental Impact Report (EIR) goals. For the 2023-24 water year (WY), Los Angeles Department of Water and Power (LADWP) was compliant with all the 2007 Stipulation & Order flow and reporting requirements. The mean flow to the Delta Habitat Area (DHA) was 39 cubic-feet-per-second (cfs). Implementation of the Interim Blackrock Waterfowl Management Area (BWMA) Plan continued. The Owens River Basin Runoff Forecast for the 2023-24 runoff year (RY) was 103% of normal, which, according to the 2004 EIR, called for a 14-day Seasonal Habitat Flow (SHF) with a peak release of 200 cfs. This section also describes flow measurement issues and includes commentary on flow losses and gains through the different reaches of the Lower Owens River (LOR).

Water Quality Monitoring

Water quality was manually monitored at 12 sites along the LOR from the Aqueduct Intake (north) to the Pumpback Station (south). Monitoring occurred from February to September 2024 and focused primarily on dissolved oxygen (DO) levels because of their critical importance to the fishery. There were no observed fish kills associated with depressed DO levels along the LOR in 2024. Temporal trends showed DO levels dropping to their lowest measured value in mid-July at Reinhackle Springs. Generally, starting at the Intake, DO concentrations declined in a downstream fashion to Reinhackle Springs and then increased downstream below the LOR Islands. DO levels were recovering at all sites by late summer. Additional parameters monitored were water temperature, specific conductance, and pH. Water temperature increased at all sites as the summer progressed, peaking around 76°F. Inversely, specific conductance generally decreased through the spring to early summer, then gradually increased or remained relatively stable into September. There was minimal variability in measured pH at all sites for the monitoring period.

LORP Adaptive Management Actions

Following the 2019 LORP Evaluation Report, LADWP and Inyo County Water Department (ICWD) identified a series of adaptive management actions to further improve the project. From late 2023 and mid-2024, LADWP and ICWD conducted work on the following: implementation of a five-year interim flow regime in the DHA and related monitoring, implementation of the BWMA Interim Management and Monitoring Plan, a tree recruitment assessment, and noxious species monitoring and treatment.

Delta Habitat Area Interim Flow Regime and Related Monitoring

Monitoring related to the adherence and effectiveness of the interim flows to the DHA was conducted for the 2023-24 RY. High flows associated with the runoff from the winter of 2023, coupled with Hurricane Hilary, flooded the DHA for the entirety of the growing season and renewed growth of aquatic vegetation. The longer-term impact of these high flows on the DHA will be reported in the 2025 annual report.

Blackrock Waterfowl Management Area Interim Management and Monitoring Plan

Both vegetation and avian surveys occurred in the BWMA in 2023-24 season. With respect to vegetation, monitoring demonstrated that despite the units being inundated for much of 2023, growth and expansion of aquatic vegetation was moderate. Additionally, there was a continual increase in ruderal vegetation species, relative to 2022, which are an important food source for waterfowl. Concerning the avian surveys, 67% of all birds identified were habitat indicator species (HIS). Relative to pre-Interim Plan conditions, surveys in 2023-24 demonstrated that all avian groups, except wading birds, were lower in total numbers. These lower numbers might be a function of the abundance of water on the landscape, not only in the Owens Valley, but all of California, following the historically large winter of 2023-24, which would have provided ample wetland habitat. Lastly, monitoring of avian numbers will continue in the 2024-25 season.

Tree Recruitment

To understand mechanisms that have permitted past and current riparian tree recruitment within the LORP riparian area, several proposed adaptive management actions were continued in 2024. Fieldwork was aimed at understanding topographic, hydrologic, edaphic, and biological conditions that allowed tree establishment both prior to (pre rewatering) and post LORP project initiation (post rewatering), to identify processes occurring within the context of the existing river state. To investigate whether plant competition along the bank and into the floodplain were inhibiting riparian tree recruitment a vegetation removal experiment was continued in 2024, which involved removing all vegetation along the bank to simulate the effects of high-flow events that might mechanically disturb and redistribute sediment, or wet bare soil. Removal experiments in 2024 did not yield any new recruits.

Inyo and Mono Counties Agricultural Commissioner’s Office and LADWP - Noxious Species Surveillance and Treatment

Monitoring and treatment of weeds within the LORP occurred in 2024, with Inyo and Mono Counties Agricultural Commissioner’s Office (CAC), treating pepperweed (*Lepidium latifolium*) populations. Lastly, LADWP focused exclusively on saltcedar (*Tamarix* sp.) treatment during the reporting period.

1.0 Introduction

The LORP is a large-scale habitat restoration project in Inyo County, California, being implemented through a joint effort by the LADWP and Inyo County (County). The LORP was identified in the 1991 EIR as mitigation for impacts related to groundwater pumping by LADWP from 1970 to 1990. The description of the project was augmented in a *1997 Memorandum of Understanding* (1997 MOU), signed by LADWP, Inyo County, California Department of Fish and Game (CDFG), California State Lands Commission (SLC), Sierra Club (SC), and the Owens Valley Committee (OVC). The MOU specifies the goal of the LORP, timeframe for development and implementation, and specific actions. It also provides certain minimum requirements for the LORP related to flows, locations of facilities, and habitat and biological species to be addressed.

The overall goal of the LORP, as stated in the MOU, is as follows:

> "*The goal of the LORP is the establishment of a healthy, functioning Lower Owens River riverine-riparian ecosystem, and the establishment of healthy, functioning ecosystems in the other physical features of the LORP, for the benefit of biodiversity and Threatened and Endangered Species, while providing for the continuation of sustainable uses including recreation, livestock grazing, agriculture and other activities*."

The LORP implementation included release of water from the Los Angeles Aqueduct (LAA) to the LOR, flooding of up to approximately 500 acres depending on the WY forecast in the BWMA, enhancement of the DHA, maintenance of several Off-River Lakes and Ponds, modifications to land management practices, and construction of new facilities including a pumpback station to capture a portion of the water released to the river.

The LORP was evaluated under the *California Environmental Quality Act* (CEQA) resulting in the completion and certification of the 2004 LORP EIR.

1.1 Monitoring and Reporting Responsibility

Section 2.10.4 of the 2004 LORP EIR states the County and LADWP will prepare an annual report that includes data, analysis, and recommendations. Specific monitoring procedures are described in the Lower Owens River Monitoring, Adaptative Management and Reporting Plan (MAMP) (Ecosystem Sciences, 2008), with a fifteen-year monitoring period post-implementation of the project (through 2022). Monitoring under the MAMP was complete in 2022; results and synthesis were provided in LADWP and the County's 2022 LORP Annual Report.

This LORP Annual Report describes monitoring, analysis, and recommendations for the LORP based on data collected in late 2023 through mid-2024. Although monitoring under the MAMP is complete, the MOU requires the County and LADWP to provide annual reports describing the environmental conditions of the LORP including any monitoring, analyses, and recommendations for adaptive management. Hydrologic monitoring for the project will continue per the 2007 Stipulation and Order and therefore will continue to be reported annually. Additionally, LADWP and the County are presently implementing a series of Adaptive Management measures and will continue to report on those accordingly. This report also provides a summary of water quality monitoring that occurred in 2024.

The 2007 Stipulation & Order requires a draft of the annual report be provided to the public and representatives of the Parties identified in the MOU. The 2007 Stipulation & Order states in Section L:

> "*LADWP and the County will release to the public and to the representatives of the Parties identified in the MOU a draft of the annual report described in Section 2.10.4 of the LORP EIR. The County and LADWP shall conduct a public meeting on the information contained in the draft report. The draft report will be released at least 15 calendar days in advance of the meeting. The public and the Parties will have the opportunity to offer comments on the draft report at the meeting and to submit written comments within a 15-calendar day period following the meeting. Following consideration of the comments submitted the Technical Group will conduct the meeting described in Section 2.10.4 of the EIR*."

The development of this LORP Annual Report is a collaborative effort between the ICWD and LADWP. Personnel from these entities participated in different sections of the report writing, data collection, and analysis. For this report, Sections 1.0 Introduction and 2.0 Hydrologic Monitoring were authored by LADWP, Section 3.0 Water Quality Monitoring was authored by ICWD, Section 4.0 Adaptive Management was co-authored by LADWP and the CAC.

The annual report is available to download from both the LADWP website: http://www.ladwp.com/LORP, and the ICWD website: https://www.inyowater.org/projects/lorp.

This document fulfills the reporting requirements for the LORP Annual Report for 2024.

1.2 References

Ecosystem Sciences. 2008. *Lower Owens River Project – Monitoring, Adaptative Management and Reporting Plan*. Report prepared for Los Angeles Department of Water and Power. 522p.

2.0 HYDROLOGIC MONITORING

2.1 River Flows

On July 12, 2007, a Court Stipulation & Order was issued requiring the LADWP to meet specific flow requirements for the LORP. The flow requirements are listed below:

1. Minimum of 40 cfs released from the Intake at all times.
2. None of the in-river measuring stations have a 15-day running average of less than 35 cfs.
3. The mean daily flow at each of the in-river measuring stations must equal or exceed 40 cfs on at least three individual days out of any continuous 15 day period.
4. The 15-day running average of the in-river flow measuring stations is no less than 40 cfs.

On July 14, 2009, six of the ten original temporary in-river measuring stations were taken out-of-service, while the Below LORP Intake, Mazourka Canyon Road, Reinhackle Springs, and Pumpback Stations remained in service.

The flow data graphs show the LADWP was in compliance with the Stipulation & Order, from October 2023 through September 2024, for the four in-river stations (see Appendix 2).

2.2 Web Posting Requirements

The Stipulation & Order also outlined web posting requirements for the LORP data. LADWP has met all the posting requirements for the daily reports, monthly reports, and real time data.

Daily reports listing the flows for the LORP, BWMA wetted acreage, and Off-River Lakes and Ponds depths are posted each day on the Web at <http://www.ladwp.com> under News and Media → Reports → Los Angeles Aqueduct Conditions Reports → LORP Flow Reports.

Monthly reports summarizing each month and listing all raw data for the month are posted to the Web at <http://www.ladwp.com> under News and Media → Reports → Los Angeles Aqueduct Conditions Reports → LORP Monthly Reports.

Real time data showing flows at Below LORP Intake, Owens River at Mazourka Canyon Road, Owens River at Reinhackle Springs, and Pumpback Station are posted to the Web at <http://www.ladwp.com> under News and Media → Reports → Los Angeles Aqueduct Conditions Reports → Real Time Data and click on the 'Lower Owens River

Project' link. The real time data are preliminary that may contain inaccuracies attributable to equipment issues or other environmental factors and is subject to change after data processing for quality assurance and control.

2.3 Measurement Issues

LORP in-river flows at Mazourka and Reinhackle gaging stations are measured using *Sontek* SW acoustic flow meters (the Intake and Pumpback stations use a combination of other measuring devices, see below for description). The acoustic flow-meters are located in the main channel of the LORP and are mounted on the bottom of concrete flumes at these stations. These devices are generally accurate, and final records for these stations generally fall within normal water measurement standards of +/- 10%.

The *Sontek* meters' measurement accuracy is affected by factors that influence river stage and flow velocity, including vegetation growth and sediment build up. To account for these environmental changes, LADWP manually meters flows at these stations to check the accuracy of the *Sontek* meters at least once per month. Each time current metering is performed, a 'shift' is applied to the station to account for the difference in flow determined by the current metering. If a fundamental change in the flow curve is observed, then a new index is created from the current metering data and downloaded to the meter. To maintain flow measurement accuracy, all meters on the LORP are calibrated at least once per month following the 2007 Stipulation & Order.

A commentary on each station along the LORP is as follows:

<u>Below LORP Intake</u>

Measurement Device: Langemann Gate

The Langemann Gate regulates and records the flow rate at the Intake. This has had good accuracy and reliability provided the gate does not become submerged, which occurs on rare occasions when flow reaches approximately 250 cfs. To measure flows during periods of submergence, LADWP conducts daily current meterings at the Intake, utilizing acoustic doppler current profiling equipment for measurement accuracy.

LORP at Mazourka Canyon Road

Measurement Devices: *Sontek* SW Meter

The station utilizes a single *Sontek* SW flow meter in a concrete measuring section, and flow measurement accuracy has been excellent.

LORP at Reinhackle Springs

Measurement Device: *Sontek* SW Meter

The station utilizes a single *Sontek* SW flow meter in a concrete measuring section, and measurement accuracy has been excellent.

LORP at Pumpback Station

Measurement Devices: Pumpback Station Discharge Meter, Langemann Gate, Weir

Flow at the Pumpback Station is calculated by adding the Pumpback Station flow, Langemann Gate Release to Delta flow, and Weir to Delta flow. In most flow conditions these stations have proven to be accurate. However, during the higher flows, the Weir and/or the Langemann Gate can become submerged, thus lowering the measuring accuracy of the submerged device.

2.4 Flows to the Delta Habitat Area

Based upon a review of the flow to Brine Pool and flow to Delta data, and after filtering out unintended spillage at the Pumpback Station to average a flow of 6 to 9 cfs, planned flows to the Delta were set to the following approximate schedule (per the LORP EIR, section 2.4):

- October 1 to November 30 4 cfs
- December 1 to February 28 3 cfs
- March 1 to April 30 4 cfs
- May 1 to September 30 7.5 cfs

Additionally, pulse flows were scheduled to be released to the Delta (LORP EIR, section 2.4):

- Period 1: March - April 10 days at 25 cfs
- Period 2: June - July 10 days at 20 cfs
- Period 3: September 10 days at 25 cfs
- Period 4: November - December 5 days at 30 cfs

Through adaptive management efforts, a new Delta flow schedule was implemented in April 2020 for a 5-year trial period. This interim schedule incorporates base and pulse flows into one schedule:

- October 1 to October 15 — 11 cfs
- October 16 to October 31 — 8 cfs
- November 1 to November 30 — 7 cfs
- December 1 to February 28 — 6 cfs
- March 1 to March 31 — 10 cfs
- April 1 to May 15 — 13 cfs
- May 16 to August 31 — 3 cfs
- September 1 to September 30 — 11 cfs

Figure 2-1 below shows actual Langemann flow released to the Delta for the 2023-24 WY along with the interim flow schedule. Figure 2-2 below shows total releases (Langemann and Weir) to the Delta for the 2023-24 WY, which resulted in an average daily flow of 39 cfs. Due to residual effects of the 2022-23 Owens River Basin Runoff conditions and other unintended flows, total releases to the Delta from October 2023 through April 2024 exceeded planned flows as specified in the interim schedule.

Unintended flows are released to the Delta when the total river flow at Pumpback Station exceeds the maximum allowed flowrate of the Pumpback Station due to natural (example: rainstorms) or operational (example: pump/Langemann maintenance or SHF) causes. Flows over the weir are generally unintended flows while flows over the Langemann Gate are scheduled flows.

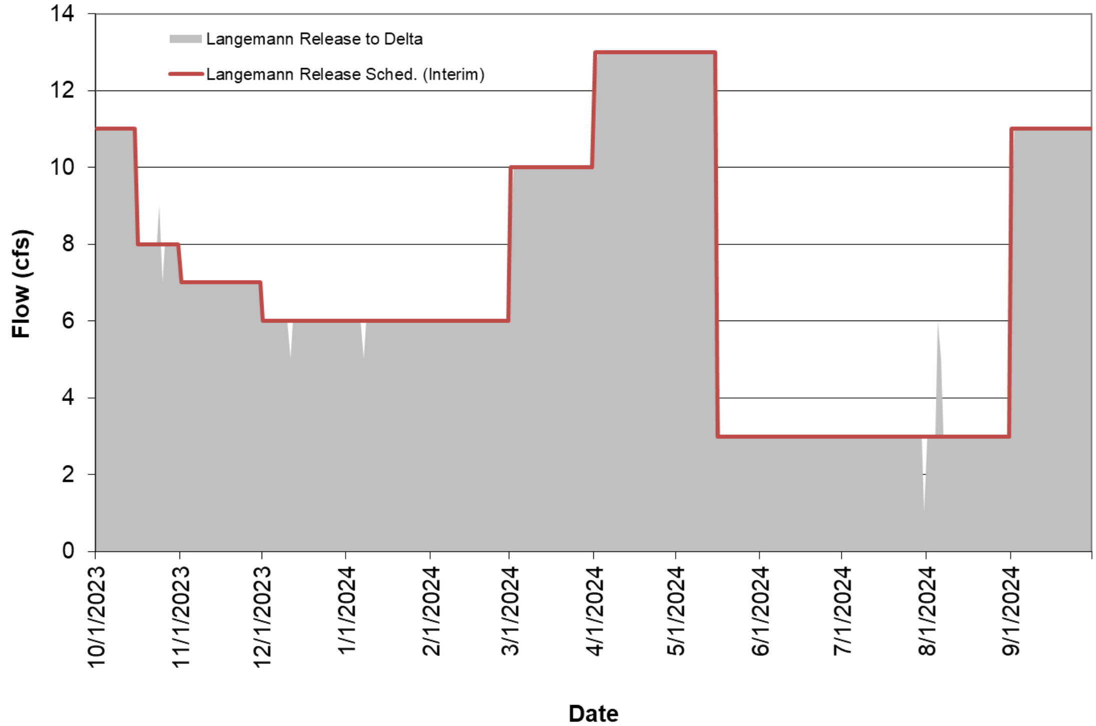


Figure 2-1. Langemann Release to Delta

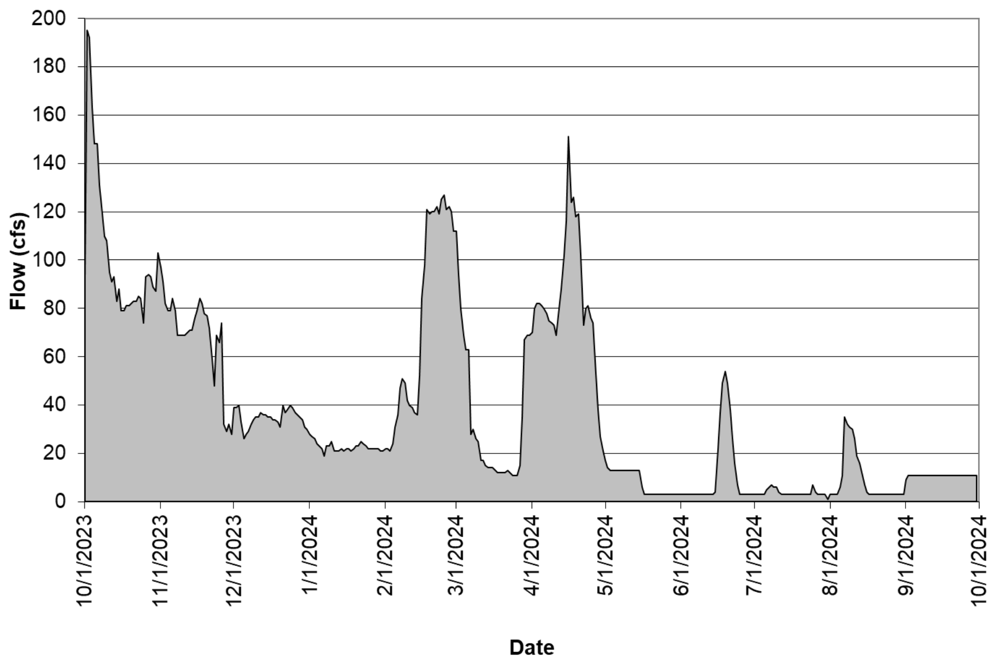


Figure 2-2. Langemann and Weir Release to Delta.

Off-River Lakes and Ponds

The BWMA and Off-River Lakes and Ponds Hydrologic Data Reporting Plan requires the Upper Twin Lake, Lower Twin Lake, and Goose Lake to be maintained between 1.5 and 3.0 feet on their respective staff gauges, and for Billy Lake to be maintained full (i.e., at an elevation that maintains outflow from the lake). Staff gages measured between 2.02 and 3.33 feet stage height for the 2023-24 WY (Figure 2-3).

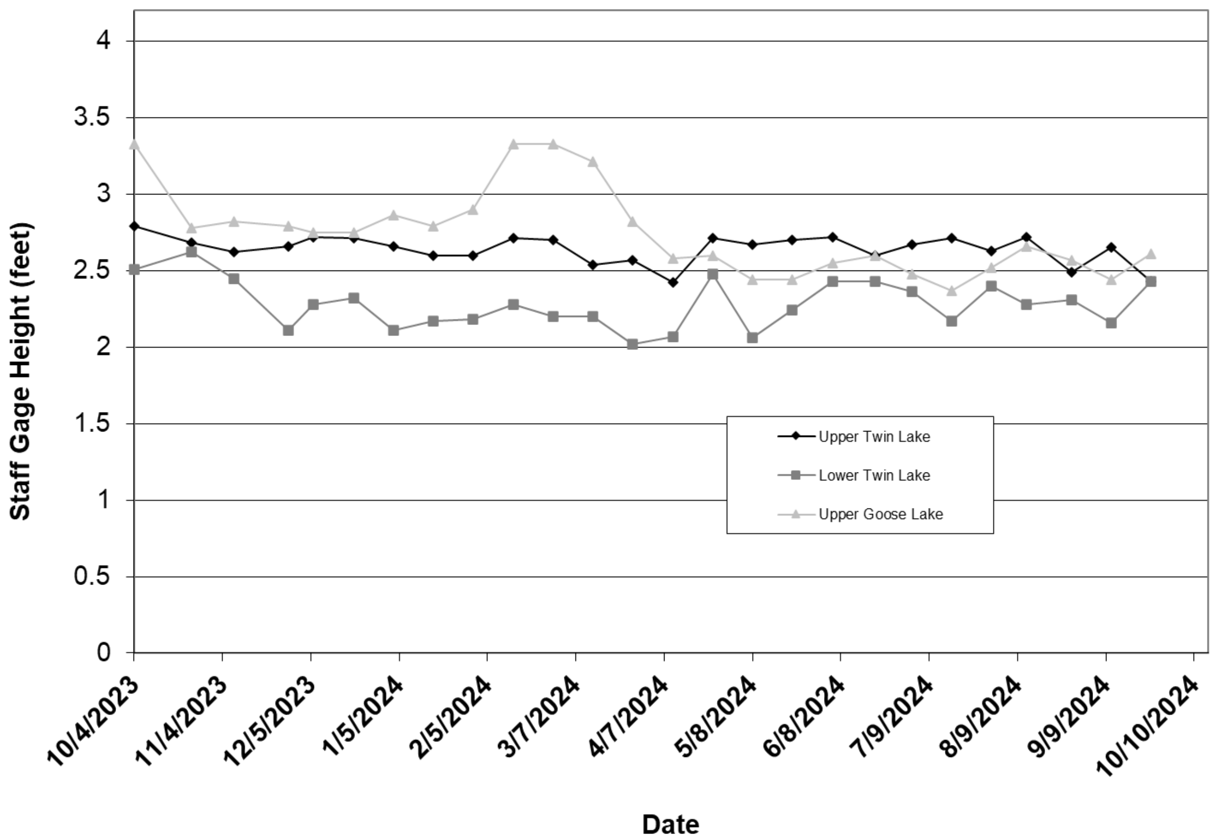


Figure 2-3. Off-River Lakes and Ponds Staff Gages.

Billy Lake

Due to the topography of Billy Lake in relation to the Billy Lake Return station, whenever the Billy Lake Return station is showing flow, Billy Lake is full. The LADWP maintains Billy Lake by monitoring the Billy Lake Return station, which had a daily average flow of 1.2 cfs for the year (see Table 2-1 and Hydrologic Appendix 2).

Table 2-1. LORP Flows – WY 2023-24

Station Name	Average Flow (cfs)	Maximum Flow (cfs)	Minimum Flow (cfs)
Below River Intake	82	225	42
Blackrock Return Ditch	1.3	3.9	0.5
Goose Lake Return	0	0	0
Billy Lake Return	1.2	3.4	0.4
Mazourka Canyon Road	86	225	49
Locust Ditch Return	0	6	0
Georges Ditch Return	3	10	0
Reinhackle Springs	85	197	38
Alabama Gates Return	0	31	0
At Pumpback Station	80	223	34
Pump Station Return to LAA/OL	42	48	0
Langemann Gate to Delta	7	13	1
Weir to Delta	32	184	0

Thibaut Pond

Thibaut Pond is contained completely within the Thibaut Unit of the BWMA. Each day the Thibaut Pond acreage is posted to the web in the LORP daily reports.

2.5 Blackrock Waterfowl Management Area

The BWMA is operated on the RY schedule, which differs from the schedule of the other components of the LORP included in Chapter 2, which are operated on the WY schedule. Flows for the BWMA are set based upon previous data relationships between inflows to an area and the resulting wetted acreage measurements during each of the four seasons based on evapotranspiration (ET) rates.

The seasons are defined as:

Spring	April 16 – May 31
Summer	June 1 – August 15
Fall	August 16 – October 15
Winter	October 16 – April 15

Up until the end of the 2012-13 RY, wetted acreage measurements were collected eight times per year, once in the middle of each season and once at the end of each season. Starting with the 2013-14 RY, only the middle of each season measurements have been collected. The end-of-season measurements were discontinued because they added little information compared to the middle-of-season measurements and required extensive personnel resources for taking the measurements. Measurements are performed by using GPS and walking the perimeter of the wetted edges of the waterfowl area and through satellite image processing.

With the adoption of the five-year Interim Management and Monitoring Plan, starting in 2021, measurements are only to be collected for the Fall and Winter seasons when flows occur. No flows are released in the Spring and Summer season. The target wetted acreage is 500 acres, based on the average of measurements taken on or around November 1 and March 1. If wetted acreages results were higher or lower than the target, releases in future years would be adjusted accordingly to better hit the target number.

The Interim Management and Monitoring Plan was affected by 2023 runoff conditions. The typical Spring and Summer dry out did not occur. Therefore, releases and acreages from this year will not be used to calibrate releases in future years.

Table 2-1. BWMA Wetted Acreage

	Winterton Unit				**Thibaut Unit**		
ET Season	**Read Date**	**Wetted Acreage**	**Average Inflow** (cfs)	**ET Season**	**Read Date**	**Wetted Acreage**	**Average Inflow** (cfs)
Fall ‘23	10/31/2023	127	4.2	Fall ‘23	11/7/2023	742	*8**
Winter ‘23-‘24	2/25/2024	288	1.8	Winter ‘23-‘24	2/25/2024	663	*3**
Fall ‘24			*2.5*	Fall ‘24			*7.5*
				**Estimated average inflow*			
	Drew Unit				**Waggoner Unit**		
ET Season	**Read Date**	**Wetted Acreage**	**Average Inflow** (cfs)	**ET Season**	**Read Date**	**Wetted Acreage**	**Average Inflow** (cfs)
Fall ‘23	N/A	N/A	OFF	Fall ‘23	11/1/2023	322	3.0
Winter ‘23-‘24	N/A	N/A	OFF	Winter ‘23-‘24	2/25/2024	311	2.3
Fall ‘24	N/A	N/A	OFF	Fall ‘24			*7.5*

Notes:
No flows are released during the Spring and Summer.
Measurements before 4/1/23 count towards the 2022-23 RY acreage goal.
Measurements after 4/1/23 count towards the 2023-24 RY acreage goal.

2.6 BWMA Results for April 2023 to March 2024

In accordance with the Interim Management and Monitoring Plan, the waterfowl wetted acreage target was 500 acres.

On September 15, 2023, the Fall 2023 season began with flows being sent out to Thibaut, Winterton, and Waggoner Units. Wetted acreage surveys completed for the Fall 2023 season measured a total of 1,191 acres. Thibaut measured 742 acres, Winterton 127 acres, and Waggoner 322 acres.

On November 1, 2023, flows to those three units were adjusted for the Winter season. On February 25, 2024, ICWD, using remote sensing analysis, estimated the spring wetted acreages of the Thibaut, Winterton, and Waggoner Units combined to exceed 500 total acres for the Winter 2023-24 season.

On March 1, 2024, flows to Thibaut, Winterton, and Waggoner Units were turned off.

The average waterfowl wetted acreage for the 2023-24 RY was estimated to exceed 500 acres.

As mentioned previously, due to residual affects the 2023 runoff and high precipitation conditions, these wetted acreage results will not be factored into calculations of future BWMA releases.

2.6.1 BWMA Results for April 2024 to March 2025

In accordance with the Interim Management and Monitoring Plan, the waterfowl wetted acreage goal was 500 acres.

On September 15, 2023, flows for the Fall 2024 season were set. Flow to Thibaut Unit was set to 7.5 cfs, Winterton Unit was set to 2.5 cfs, and Waggoner Unit was set to 7.5 cfs.

Wetted acreage surveys completed for the Fall 2024 season measured a total of 509 acres. Thibaut measured 226 acres, Winterton measured 138 acres, and Waggoner measured 145 acres. Acreages are associated with conditions on November 3 and 6, 2024.

On November18, 2024 flooded acreage has increased to 566 acres according to satellite imagery. The acreage updates are posted for cloud-free Sentinel satellite-imagery throughout the flooding cycle and can be found at the following address: https://inyo-gov.github.io/flooded-acreage/.

The spring wetted acreage measurement will take place in early March 2025; the average totals of the Fall and Spring measurements will be the recorded wetted acreage for the WY.

2.7 Assessment of River Flow Gains and Losses

This section describes river flow gains and losses for all reaches in the LOR from the LORP Intake to the Pumpback Station during WY 2024. The reaches referred to in this report indicate areas of river between specified permanent gaging stations. This analysis is an attempt at understanding flow losses and gains in the LOR so that estimates of future water requirements can be made.

2.7.1 River Flow Loss or Gain by Month and Year

Flow losses or gains can vary over time as presented in Table 2-3. ET falls during late fall and winter and increases during the spring and summer plant growing seasons. Thus, the river can lose water to ET during certain periods of the year and maintain or gain water during other periods of the year. December through March are winter periods with low ET that result in gains from increased flows from water stored in the shallow aquifer where groundwater levels are higher than adjacent river levels. Other incoming winter water sources such as local intermittent runoff from precipitation also result in flow increases.

Table 2-3. Average Monthly River Flow Losses/Gains From the Intake to the Pumpback Station during the 2023-24 WY

	Month	Flow (cfs)	Acre-Feet-Per-Day
2023	OCT	+10	+19
	NOV	+42	+83
	DEC	+24	+48
2024	JAN	+15	+29
	FEB	+19	+37
	MAR	+30	+60
	APR	+9	+17
	MAY	-2	-5
	JUN	-39	-77
	JUL	-34	-68
	AUG	-37	-73
	SEP	-25	-50
	AVG MONTH	**+1 cfs**	**+2 AcFt**

For the entire river, the overall gain or loss is calculated by subtracting Pumpback Station outflow from inflows at the Intake and augmentation spillgates. Inflows from the Intake were 59,259 acre feet (AF), inflows from augmentation spillgates were 4,191 AF, and outflows from the Pumpback Station were 58,347 AF. An additional 5,663 AF was released from the LORP through the McIver Canal and Eclipse Ditch as part of water spreading activities. This yields a total gain of 560 AF for the year, a daily average of approximately 0.8 cfs between the Intake and the Pumpback Station. Water gain during the 2023-24 WY represents less than 1% of the total released flow from the Intake and augmentation spillgates into the river channel.

2.7.2 Flow Loss or Gain by River Reach during the Winter Period

From December 2023 to March 2024, an average flow of 60 cfs was released into the LOR from the Intake. An additional 5.5 cfs was provided from augmentation ditches for a total accumulated release of 66 cfs. The average flow reaching the Pumpback Station was 87 cfs, an increase of 22 cfs during the period. Typically, during the winter ET is low and any "make water" coming into the river is additive.

The river reach from the Intake to the Mazourka Canyon Road gaging station gained an average of 7 cfs, Mazourka Canyon Road to the Reinhackle gaging station gained 9 cfs, and Reinhackle to the Pumpback Station gained 6 cfs (see Table 2-4).

Table 2-4. Winter Flow Losses/Gains, December 2023 to March 2024

Recording Station	Average Flow (cfs)	Gain or Loss (cfs)	Accumulative (cfs)
Intake	60	N/A	N/A
Mazourka	69	+7	+7
Reinhackle	81	+9	+16
Pumpback	87	+6	+22

Note: All numbers are rounded to the nearest whole value.
Calculations include augmentation and return flows in appropriate reaches, see Appendix 2 for all flows.

2.7.3 Flow Loss or Gain by River Reach during the Summer Period

During the summer period of June 2024 to September 2024, an average flow of 80 cfs was released into the LOR from the Intake. An additional 4 cfs was provided from augmentation ditches as well as 1 cfs from Alabama Gates, for a total accumulated release of 85 cfs. The effects of ET are observed during the summer period by a high total flow loss (-34) between the Intake and the Pumpback Station. The largest flow losses occurred in the Reinhackle to Pumpstation reach (-19 cfs) (see Table 2-5).

Table 2-5. Summer Flow Losses/Gains, June 2024 to September 2024

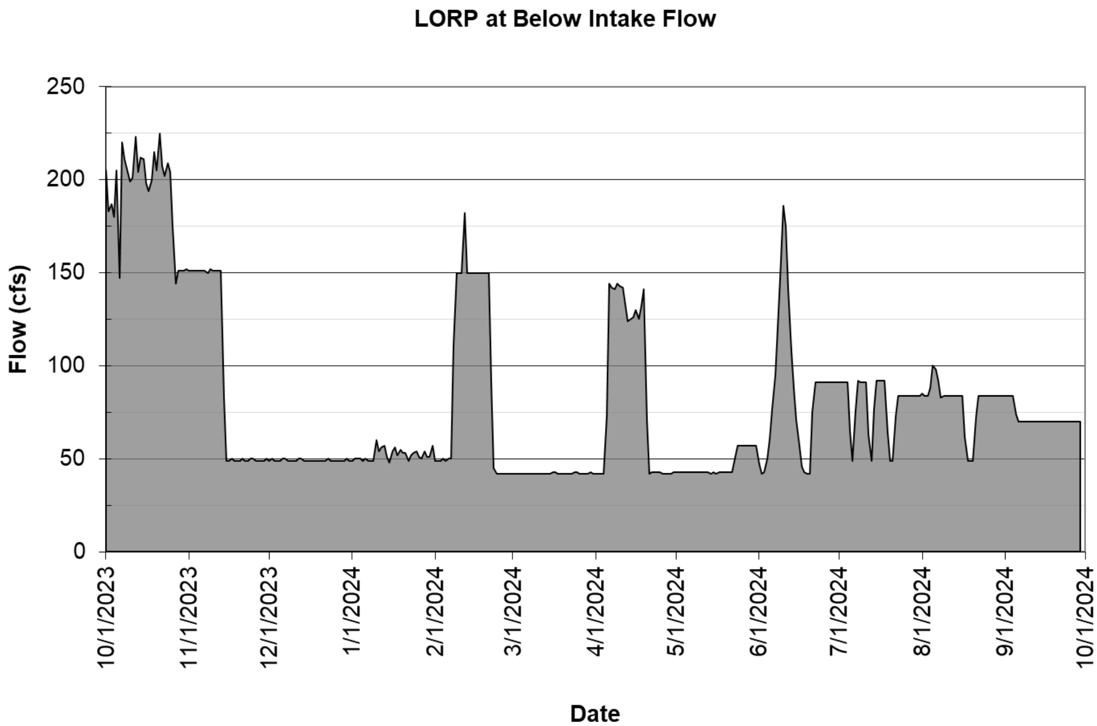
Recording Station	Average Flow (cfs)	Gain or Loss (cfs)	Accumulative (cfs)
Intake	80	N/A	N/A
Mazourka	79	-3	-3
Reinhackle	69	-12	-15
Pumpback	51	-19	-34

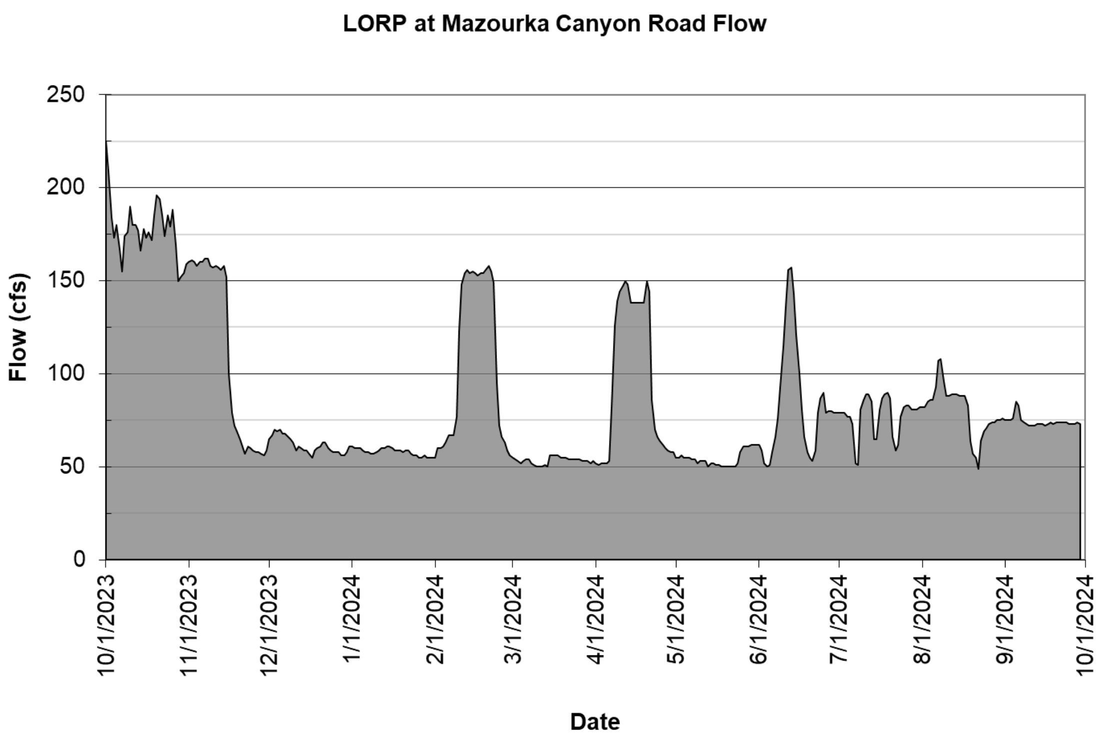
Note: All numbers are rounded to the nearest whole value.
Calculations include augmentation and return flows in appropriate reaches, see Appendix 2 for all flows.

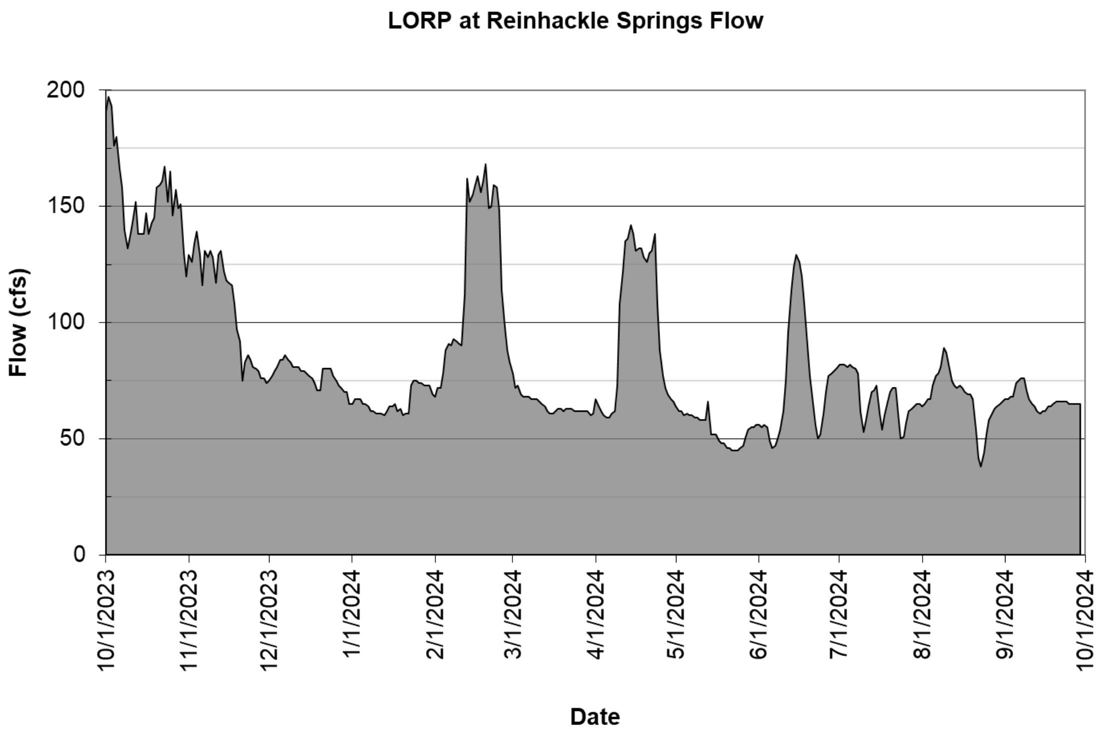
2.8 Seasonal Habitat Flow

The Owens River Basin Runoff Forecast for the 2023-2024 RY was 103% of normal, which, according to the 2004 EIR, calls for a 14-day SHF with a peak release of 200 cfs. Flows from LORP Intake were ramped up, over a period of seven days, to a peak of 200 cfs on June 10, 2024, before ramping back down over another seven days. Daily flow rates from the LORP Intake are provided in Appendix 2.

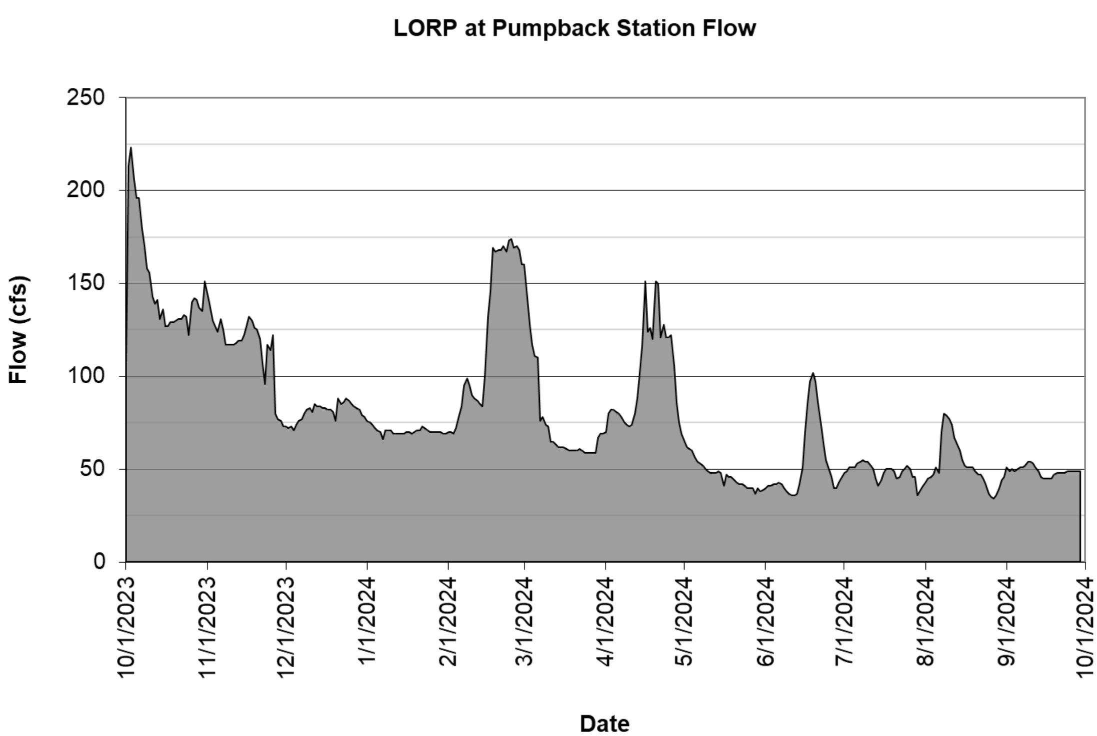
2.9 Appendix 1. LOR Hydrographs







LORP at Reinhackle Springs Flow
Flow (cfs)
200
150
100
50
0
10/1/2023
11/1/2023
12/1/2023
1/1/2024
2/1/2024
3/1/2024
4/1/2024
5/1/2024
6/1/2024
7/1/2024
8/1/2024
9/1/2024
10/1/2024
Date



LORP at Pumpback Station Flow
Flow (cfs)
250
200
150
100
50
0
10/1/2023
11/1/2023
12/1/2023
1/1/2024
2/1/2024
3/1/2024
4/1/2024
5/1/2024
6/1/2024
7/1/2024
8/1/2024
9/1/2024
10/1/2024
Date

2.10 Appendix 2. Tabular LORP Daily Flows

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
10/1/2023	205.0	1.0	0.0	0.4	225.0	0.5	3.3	191.0	0.0	108.0	14.0	11.0	83.0	182.3
10/2/2023	183.0	1.0	0.0	0.4	209.0	0.5	4.7	197.0	0.0	213.0	18.0	11.0	184.0	200.5
10/3/2023	187.0	1.0	0.0	0.6	184.0	0.5	4.8	193.0	0.0	223.0	31.0	11.0	181.0	196.8
10/4/2023	180.0	1.0	0.0	0.7	173.0	0.5	4.9	176.0	0.0	206.0	43.0	11.0	152.0	183.8
10/5/2023	205.0	1.0	0.0	0.8	180.0	0.4	4.8	180.0	0.0	196.0	48.0	11.0	137.0	190.3
10/6/2023	147.0	1.0	0.0	0.7	167.0	0.4	4.9	166.0	0.0	196.0	48.0	11.0	137.0	169.0
10/7/2023	220.0	1.0	0.0	0.7	155.0	0.4	5.0	158.0	0.0	179.0	48.0	11.0	120.0	178.0
10/8/2023	211.0	1.0	0.0	0.7	174.0	0.4	5.1	140.0	0.0	170.0	48.0	11.0	111.0	173.8
10/9/2023	204.0	1.0	0.0	0.7	176.0	0.4	5.3	132.0	0.0	158.0	48.0	11.0	99.0	167.5
10/10/2023	199.0	1.0	0.0	0.7	190.0	0.4	5.5	137.0	0.0	156.0	48.0	11.0	97.0	170.5
10/11/2023	201.0	1.0	0.0	0.7	180.0	0.3	5.7	143.0	0.0	143.0	48.0	11.0	84.0	166.8
10/12/2023	223.0	1.0	0.0	0.7	180.0	0.3	5.9	152.0	0.0	139.0	48.0	11.0	80.0	173.5
10/13/2023	204.0	1.0	0.0	0.6	177.0	0.3	6.1	138.0	0.0	141.0	48.0	11.0	82.0	165.0
10/14/2023	212.0	1.0	0.0	0.6	166.0	0.3	6.3	138.0	0.0	131.0	48.0	11.0	72.0	161.8
10/15/2023	211.0	1.0	0.0	0.6	178.0	0.3	6.5	138.0	0.0	136.0	48.0	11.0	77.0	165.8
10/16/2023	198.0	1.0	0.0	0.6	173.0	0.3	6.7	147.0	0.0	127.0	48.0	8.0	71.0	161.3
10/17/2023	194.0	1.0	0.0	0.6	176.0	0.2	6.9	138.0	0.0	127.0	48.0	8.0	71.0	158.8
10/18/2023	200.0	1.0	0.0	0.6	172.0	0.2	7.1	143.0	0.0	129.0	48.0	8.0	73.0	161.0
10/19/2023	215.0	1.0	0.0	0.6	185.0	0.2	7.2	145.0	0.0	129.0	48.0	8.0	73.0	168.5
10/20/2023	205.0	1.0	0.0	0.6	196.0	0.2	7.4	158.0	0.0	130.0	48.0	8.0	74.0	172.3
10/21/2023	225.0	1.0	0.0	0.5	194.0	0.2	7.6	159.0	0.0	131.0	48.0	8.0	75.0	177.3
10/22/2023	207.0	1.0	0.0	0.5	185.0	0.2	7.8	161.0	0.0	131.0	48.0	8.0	75.0	171.0
10/23/2023	202.0	1.0	0.0	0.5	174.0	0.1	8.0	167.0	0.0	133.0	48.0	8.0	77.0	169.0
10/24/2023	209.0	1.0	0.0	0.5	185.0	0.1	8.2	152.0	0.0	132.0	48.0	9.0	75.0	169.5
10/25/2023	204.0	1.0	0.0	0.5	179.0	0.1	8.4	165.0	0.0	122.0	48.0	7.0	67.0	167.5
10/26/2023	175.0	1.1	0.0	0.5	188.0	0.1	8.6	146.0	0.0	140.0	47.0	8.0	85.0	162.3
10/27/2023	144.0	1.8	0.0	1.7	169.0	0.1	9.4	157.0	0.0	142.0	48.0	8.0	86.0	153.0
10/28/2023	151.0	1.9	0.0	1.6	150.0	0.0	9.4	149.0	0.0	141.0	48.0	8.0	85.0	147.8
10/29/2023	151.0	1.8	0.0	1.3	152.0	0.0	9.3	151.0	0.0	137.0	48.0	8.0	81.0	147.8
10/30/2023	151.0	1.9	0.0	1.3	154.0	0.0	8.8	130.0	0.0	135.0	48.0	8.0	79.0	142.5
10/31/2023	152.0	1.8	0.0	1.2	159.0	0.1	8.4	120.0	0.0	151.0	48.0	8.0	95.0	145.5
Notes:	These measurements are not on the main channel of the Ow ens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langemann Gate to Delta	Weir to Delta	In Channel Average Flow
11/1/2023	151.0	2.2	0.0	1.2	160.0	0.1	8.6	129.0	0.0	145.0	48.0	7.0	90.0	146.3
11/2/2023	151.0	2.5	0.0	1.2	161.0	0.0	8.8	126.0	0.0	139.0	48.0	7.0	84.0	144.3
11/3/2023	151.0	2.8	0.0	1.2	160.0	0.0	8.9	134.0	0.0	130.0	48.0	7.0	75.0	143.8
11/4/2023	151.0	2.6	0.0	1.2	158.0	0.0	9.2	139.0	0.0	127.0	48.0	7.0	72.0	143.8
11/5/2023	151.0	1.9	0.0	1.2	160.0	0.1	9.3	129.0	0.0	124.0	45.0	7.0	72.0	141.0
11/6/2023	151.0	1.8	0.0	1.3	160.0	0.1	9.6	116.0	0.0	131.0	47.0	7.0	77.0	139.5
11/7/2023	151.0	1.8	0.0	1.2	162.0	0.1	9.9	131.0	0.0	125.0	46.0	7.0	72.0	142.3
11/8/2023	150.0	2.1	0.0	1.2	162.0	0.0	10.0	128.0	0.0	117.0	48.0	7.0	62.0	139.3
11/9/2023	152.0	2.0	0.0	1.2	158.0	0.0	9.9	131.0	0.0	117.0	48.0	7.0	62.0	139.5
11/10/2023	151.0	1.9	0.0	1.2	157.0	0.0	9.8	128.0	0.0	117.0	48.0	7.0	62.0	138.3
11/11/2023	151.0	1.9	0.0	1.2	158.0	0.0	9.6	117.0	0.0	117.0	48.0	7.0	62.0	135.8
11/12/2023	151.0	1.8	0.0	1.2	157.0	0.0	9.5	129.0	0.0	118.0	48.0	7.0	63.0	138.8
11/13/2023	151.0	1.8	0.0	1.2	156.0	0.0	9.3	131.0	0.0	119.0	48.0	7.0	64.0	139.3
11/14/2023	83.0	1.7	0.0	1.2	158.0	0.0	9.2	122.0	0.0	119.0	48.0	7.0	64.0	120.5
11/15/2023	49.0	1.7	0.0	1.1	152.0	0.0	9.0	118.0	0.0	122.0	46.0	7.0	69.0	110.3
11/16/2023	49.0	1.6	0.0	1.1	100.0	0.0	8.9	117.0	0.0	127.0	48.0	7.0	72.0	98.3
11/17/2023	50.0	1.5	0.0	1.1	79.0	0.0	8.7	116.0	0.0	132.0	48.0	7.0	77.0	94.3
11/18/2023	49.0	1.5	0.0	1.1	72.0	0.0	8.6	108.0	0.0	130.0	48.0	7.0	75.0	89.8
11/19/2023	49.0	1.4	0.0	1.1	69.0	0.0	8.4	97.0	0.0	126.0	48.0	7.0	71.0	85.3
11/20/2023	49.0	1.4	0.0	1.1	65.0	0.0	8.3	92.0	0.0	125.0	48.0	7.0	70.0	82.8
11/21/2023	50.0	1.3	0.0	1.1	61.0	0.0	8.2	75.0	0.0	120.0	48.0	7.0	65.0	76.5
11/22/2023	49.0	1.3	0.0	1.1	57.0	0.0	8.0	83.0	0.0	107.0	48.0	7.0	52.0	74.0
11/23/2023	49.0	1.2	0.0	1.0	61.0	0.0	7.9	86.0	0.0	96.0	48.0	7.0	41.0	73.0
11/24/2023	50.0	1.2	0.0	1.0	60.0	0.0	7.7	84.0	0.0	117.0	48.0	7.0	62.0	77.8
11/25/2023	50.0	1.1	0.0	1.0	59.0	0.0	7.6	81.0	0.0	114.0	48.0	7.0	59.0	76.0
11/26/2023	49.0	1.0	0.0	1.0	58.0	0.0	7.4	80.0	0.0	122.0	48.0	7.0	67.0	77.3
11/27/2023	49.0	1.0	0.0	1.0	58.0	0.0	7.3	79.0	0.0	80.0	48.0	7.0	25.0	66.5
11/28/2023	49.0	0.9	0.0	1.0	57.0	0.0	7.1	76.0	0.0	77.0	48.0	7.0	22.0	64.8
11/29/2023	49.0	0.9	0.0	1.0	56.0	0.0	7.0	76.0	0.0	76.0	44.0	7.0	25.0	64.3
11/30/2023	50.0	0.8	0.0	1.0	59.0	0.0	6.8	74.0	0.0	73.0	45.0	7.0	21.0	64.0

Notes: These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
12/1/2023	49.0	0.8	0.0	0.9	65.0	0.0	6.7	75.0	0.0	73.0	34.0	6.0	33.0	65.5
12/2/2023	50.0	0.7	0.0	0.9	67.0	0.0	6.5	77.0	0.0	72.0	33.0	6.0	33.0	66.5
12/3/2023	49.0	0.6	0.0	0.9	70.0	0.0	6.4	79.0	0.0	73.0	33.0	6.0	34.0	67.8
12/4/2023	49.0	0.6	0.0	0.9	69.0	0.0	6.2	81.0	0.0	71.0	38.0	6.0	27.0	67.5
12/5/2023	49.0	0.5	0.0	0.9	70.0	0.0	6.1	84.0	0.0	74.0	48.0	6.0	20.0	69.3
12/6/2023	50.0	0.5	0.0	0.9	68.0	0.0	6.1	84.0	0.0	76.0	48.0	6.0	22.0	69.5
12/7/2023	50.0	1.7	0.0	0.8	68.0	0.0	6.0	86.0	0.0	77.0	48.0	6.0	23.0	70.3
12/8/2023	49.0	3.9	0.0	0.9	66.0	0.0	6.1	84.0	0.0	80.0	48.0	6.0	26.0	69.8
12/9/2023	49.0	3.4	0.0	1.0	65.0	0.0	6.4	83.0	0.0	82.0	48.0	6.0	28.0	69.8
12/10/2023	49.0	2.6	0.0	1.2	63.0	0.0	6.4	81.0	0.0	83.0	48.0	6.0	29.0	69.0
12/11/2023	49.0	2.2	0.0	1.2	59.0	0.0	6.6	81.0	0.0	81.0	46.0	5.0	30.0	67.5
12/12/2023	50.0	2.1	0.0	1.1	61.0	0.0	6.8	81.0	0.0	85.0	48.0	6.0	31.0	69.3
12/13/2023	50.0	1.5	0.0	1.2	60.0	0.0	7.3	79.0	0.0	84.0	48.0	6.0	30.0	68.3
12/14/2023	49.0	1.1	0.0	1.2	59.0	0.0	6.0	79.0	0.0	84.0	48.0	6.0	30.0	67.8
12/15/2023	49.0	0.8	0.0	1.2	59.0	0.0	3.6	78.0	0.0	83.0	48.0	6.0	29.0	67.3
12/16/2023	49.0	1.7	0.0	1.2	57.0	0.0	3.6	77.0	0.0	83.0	48.0	6.0	29.0	66.5
12/17/2023	49.0	2.3	0.0	1.2	55.0	0.0	3.5	76.0	0.0	82.0	48.0	6.0	28.0	65.5
12/18/2023	49.0	1.1	0.0	1.1	59.0	0.0	3.4	74.0	0.0	82.0	48.0	6.0	28.0	66.0
12/19/2023	49.0	2.2	0.0	1.1	60.0	0.0	3.1	71.0	0.0	81.0	48.0	6.0	27.0	65.3
12/20/2023	49.0	3.3	0.0	1.1	61.0	0.0	2.8	71.0	0.0	76.0	45.0	6.0	25.0	64.3
12/21/2023	49.0	2.7	0.0	1.3	63.0	0.1	4.1	80.0	0.0	88.0	48.0	6.0	34.0	70.0
12/22/2023	49.0	1.7	0.0	1.2	63.0	0.1	6.6	80.0	0.0	85.0	48.0	6.0	31.0	69.3
12/23/2023	50.0	1.3	0.0	1.2	60.0	0.1	4.8	80.0	0.0	86.0	48.0	6.0	32.0	69.0
12/24/2023	49.0	1.1	0.0	1.3	59.0	0.1	3.8	80.0	0.0	88.0	48.0	6.0	34.0	69.0
12/25/2023	49.0	1.3	0.0	1.3	58.0	0.1	3.0	77.0	0.0	87.0	48.0	6.0	33.0	67.8
12/26/2023	49.0	2.0	0.0	1.3	58.0	0.1	2.7	75.0	0.0	85.0	48.0	6.0	31.0	66.8
12/27/2023	49.0	1.8	0.0	1.3	58.0	0.1	2.5	73.0	0.0	84.0	48.0	6.0	30.0	66.0
12/28/2023	49.0	1.4	0.0	1.3	56.0	0.0	1.9	72.0	0.0	83.0	48.0	6.0	29.0	65.0
12/29/2023	49.0	1.3	0.0	1.3	56.0	0.1	2.1	70.0	0.0	82.0	48.0	6.0	28.0	64.3
12/30/2023	50.0	1.3	0.0	1.4	58.0	0.1	1.9	70.0	0.0	79.0	48.0	6.0	25.0	64.3
12/31/2023	49.0	1.3	0.0	1.4	61.0	0.1	1.8	65.0	0.0	78.0	48.0	6.0	24.0	63.3

Notes: These measurements are not on the main channel of the Ow ens River, therefore highlighted columns are not included in average calculations.

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
1/1/2024	49.0	1.3	0.0	1.4	61.0	0.1	1.8	65.0	0.0	76.0	48.0	6.0	22.0	62.8
1/2/2024	50.0	1.2	0.0	1.4	60.0	0.1	1.9	67.0	0.0	75.0	48.0	6.0	21.0	63.0
1/3/2024	50.0	1.1	0.0	1.6	60.0	0.0	2.3	67.0	0.0	74.0	48.0	6.0	20.0	62.8
1/4/2024	50.0	1.1	0.0	1.6	60.0	0.0	2.2	67.0	0.0	72.0	48.0	6.0	18.0	62.3
1/5/2024	49.0	1.0	0.0	1.8	59.0	0.0	1.3	65.0	0.0	71.0	48.0	6.0	17.0	61.0
1/6/2024	50.0	0.8	0.0	1.4	58.0	0.0	1.4	65.0	0.0	70.0	48.0	6.0	16.0	60.8
1/7/2024	49.0	1.0	0.0	1.2	58.0	0.0	1.2	64.0	0.0	66.0	47.0	5.0	14.0	59.3
1/8/2024	49.0	1.7	0.0	1.3	57.0	0.0	1.0	62.0	0.0	71.0	48.0	6.0	17.0	59.8
1/9/2024	49.0	1.7	0.0	1.9	57.0	0.0	1.0	62.0	0.0	71.0	48.0	6.0	17.0	59.8
1/10/2024	60.0	1.5	0.0	1.8	58.0	0.0	0.9	61.0	0.0	71.0	46.0	6.0	19.0	62.5
1/11/2024	54.0	1.4	0.0	1.4	59.0	0.1	0.9	61.0	0.0	69.0	48.0	6.0	15.0	60.8
1/12/2024	56.0	1.3	0.0	1.4	60.0	0.1	0.9	61.0	0.0	69.0	48.0	6.0	15.0	61.5
1/13/2024	57.0	1.5	0.0	1.3	60.0	0.2	0.9	60.0	0.0	69.0	48.0	6.0	15.0	61.5
1/14/2024	51.0	1.6	0.0	0.9	61.0	0.3	0.9	62.0	0.0	69.0	47.0	6.0	16.0	60.8
1/15/2024	48.0	1.3	0.0	1.7	61.0	0.2	0.9	64.0	0.0	69.0	48.0	6.0	15.0	60.5
1/16/2024	54.0	1.1	0.0	1.4	60.0	0.3	0.9	64.0	0.0	70.0	48.0	6.0	16.0	62.0
1/17/2024	56.0	1.3	0.0	1.4	59.0	0.1	0.9	65.0	0.0	70.0	48.0	6.0	16.0	62.5
1/18/2024	52.0	1.1	0.0	1.4	59.0	0.0	1.0	62.0	0.0	69.0	48.0	6.0	15.0	60.5
1/19/2024	55.0	1.0	0.0	1.4	59.0	0.0	1.0	63.0	0.0	70.0	48.0	6.0	16.0	61.8
1/20/2024	53.0	1.1	0.0	1.4	58.0	0.0	1.1	60.0	0.0	71.0	48.0	6.0	17.0	60.5
1/21/2024	53.0	1.2	0.0	1.4	59.0	0.0	1.1	61.0	0.0	71.0	48.0	6.0	17.0	61.0
1/22/2024	49.0	1.2	0.0	1.4	59.0	0.1	1.1	61.0	0.0	73.0	48.0	6.0	19.0	60.5
1/23/2024	52.0	1.2	0.0	1.4	57.0	0.1	1.3	73.0	0.0	72.0	48.0	6.0	18.0	63.5
1/24/2024	53.0	1.2	0.0	1.6	56.0	0.1	1.3	75.0	0.0	71.0	48.0	6.0	17.0	63.8
1/25/2024	54.0	1.2	0.0	1.6	56.0	0.1	1.2	75.0	0.0	70.0	48.0	6.0	16.0	63.8
1/26/2024	51.0	1.1	0.0	1.5	55.0	0.0	1.1	74.0	0.0	70.0	48.0	6.0	16.0	62.5
1/27/2024	50.0	1.1	0.0	1.5	55.0	0.0	1.0	74.0	0.0	70.0	48.0	6.0	16.0	62.3
1/28/2024	54.0	1.1	0.0	1.5	56.0	0.1	0.9	73.0	0.0	70.0	48.0	6.0	16.0	63.3
1/29/2024	51.0	1.1	0.0	1.4	55.0	0.1	0.9	73.0	0.0	70.0	48.0	6.0	16.0	62.3
1/30/2024	51.0	1.1	0.0	1.5	55.0	0.1	0.9	73.0	0.0	69.0	48.0	6.0	15.0	62.0
1/31/2024	57.0	1.1	0.0	1.5	55.0	0.1	0.8	69.0	0.0	69.0	48.0	6.0	15.0	62.5
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
2/1/2024	49.0	1.2	0.0	1.4	55.0	0.1	0.8	68.0	0.0	70.0	48.0	6.0	16.0	60.5
2/2/2024	49.0	1.2	0.0	1.4	60.0	0.1	0.7	72.0	0.0	70.0	48.0	6.0	16.0	62.8
2/3/2024	49.0	1.2	0.0	1.4	60.0	0.1	0.7	72.0	0.0	69.0	48.0	6.0	15.0	62.5
2/4/2024	50.0	1.3	0.0	1.5	61.0	0.1	1.2	78.0	0.0	72.0	48.0	6.0	18.0	65.3
2/5/2024	49.0	1.3	0.0	1.6	63.0	0.1	5.7	88.0	0.0	79.0	48.0	6.0	25.0	69.8
2/6/2024	50.0	1.5	0.0	1.6	67.0	2.2	6.9	91.0	0.0	84.0	48.0	6.0	30.0	73.0
2/7/2024	50.0	1.4	0.0	1.6	67.0	4.6	6.3	90.0	0.0	95.0	48.0	6.0	41.0	75.5
2/8/2024	111.0	1.3	0.0	1.7	67.0	4.1	4.2	93.0	0.0	99.0	48.0	6.0	45.0	92.5
2/9/2024	150.0	1.4	0.0	1.7	77.0	3.3	2.3	92.0	0.0	95.0	46.0	6.0	43.0	103.5
2/10/2024	150.0	1.4	0.0	1.5	123.0	2.5	1.5	91.0	0.0	90.0	48.0	6.0	36.0	113.5
2/11/2024	150.0	1.3	0.0	1.6	148.0	1.8	1.1	90.0	0.0	88.0	48.0	6.0	34.0	119.0
2/12/2024	182.0	1.3	0.0	1.6	154.0	1.7	1.4	112.0	0.0	87.0	48.0	6.0	33.0	133.8
2/13/2024	150.0	1.3	0.0	1.5	156.0	1.5	1.8	162.0	0.0	85.0	48.0	6.0	31.0	138.3
2/14/2024	150.0	1.3	0.0	1.5	154.0	1.5	1.9	152.0	0.0	84.0	48.0	6.0	30.0	135.0
2/15/2024	150.0	1.3	0.0	1.4	155.0	1.5	2.0	155.0	0.0	100.0	48.0	6.0	46.0	140.0
2/16/2024	150.0	1.2	0.0	1.4	154.0	1.4	2.0	159.0	0.0	132.0	48.0	6.0	78.0	148.8
2/17/2024	150.0	1.2	0.0	1.4	153.0	1.4	2.0	163.0	0.0	146.0	48.0	6.0	92.0	153.0
2/18/2024	150.0	1.2	0.0	1.4	154.0	1.4	2.0	156.0	0.0	169.0	48.0	6.0	115.0	157.3
2/19/2024	150.0	1.2	0.0	1.3	154.0	1.5	1.9	161.0	0.0	167.0	48.0	6.0	113.0	158.0
2/20/2024	150.0	1.2	0.0	1.3	156.0	1.7	2.3	168.0	0.0	168.0	48.0	6.0	114.0	160.5
2/21/2024	150.0	1.5	0.0	1.0	158.0	1.8	2.4	149.0	0.0	168.0	48.0	6.0	114.0	156.3
2/22/2024	91.0	1.5	0.0	1.1	155.0	1.7	2.2	150.0	0.0	170.0	48.0	6.0	116.0	141.5
2/23/2024	45.0	1.1	0.0	1.5	149.0	1.5	2.2	159.0	0.0	167.0	48.0	6.0	113.0	130.0
2/24/2024	42.0	1.8	0.0	1.6	95.0	1.5	2.1	158.0	0.0	173.0	48.0	6.0	119.0	117.0
2/25/2024	42.0	1.6	0.0	2.6	72.0	1.4	1.6	148.0	0.0	174.0	47.0	6.0	121.0	109.0
2/26/2024	42.0	1.3	0.0	3.4	66.0	1.4	0.9	114.0	0.0	169.0	48.0	6.0	115.0	97.8
2/27/2024	42.0	1.1	0.0	3.2	63.0	1.2	0.7	98.0	0.0	170.0	48.0	6.0	116.0	93.3
2/28/2024	42.0	1.1	0.0	2.1	59.0	1.1	0.7	88.0	0.0	168.0	48.0	6.0	114.0	89.3
2/29/2024	42.0	1.1	0.0	1.4	56.0	1.1	0.9	83.0	0.0	160.0	48.0	6.0	106.0	85.3

Notes: These measurements are not on the main channel of the Ow ens River, therefore highlighted columns are not included in average calculations.

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
3/1/2024	42.0	0.7	0.0	1.6	55.0	1.1	0.6	78.0	0.0	160.0	48.0	8.0	104.0	83.8
3/2/2024	42.0	0.6	0.0	1.7	54.0	0.9	0.5	72.0	0.0	142.0	48.0	10.0	84.0	77.5
3/3/2024	42.0	0.8	0.0	1.5	53.0	0.9	0.7	73.0	0.0	128.0	48.0	10.0	70.0	74.0
3/4/2024	42.0	1.2	0.0	1.4	52.0	0.7	0.6	69.0	0.0	117.0	48.0	10.0	59.0	70.0
3/5/2024	42.0	2.6	0.0	1.9	53.0	0.7	0.6	68.0	0.0	111.0	48.0	10.0	53.0	68.5
3/6/2024	42.0	3.4	0.0	1.5	54.0	0.9	0.6	68.0	0.0	110.0	47.0	10.0	53.0	68.5
3/7/2024	42.0	2.5	0.0	1.4	54.0	0.9	0.7	68.0	0.0	76.0	48.0	10.0	18.0	60.0
3/8/2024	42.0	1.3	0.0	1.4	52.0	0.8	0.7	67.0	0.0	78.0	48.0	10.0	20.0	59.8
3/9/2024	42.0	1.8	0.0	1.4	51.0	0.7	0.7	67.0	0.0	74.0	48.0	10.0	16.0	58.5
3/10/2024	42.0	1.6	0.0	1.3	50.0	0.7	0.7	67.0	0.0	73.0	48.0	10.0	15.0	58.0
3/11/2024	42.0	1.9	0.0	1.1	50.0	0.8	0.7	66.0	0.0	65.0	48.0	10.0	7.0	55.8
3/12/2024	42.0	1.9	0.0	0.9	50.0	0.8	0.7	65.0	0.0	65.0	48.0	10.0	7.0	55.5
3/13/2024	42.0	1.5	0.0	1.2	51.0	0.7	0.7	64.0	0.0	63.0	48.0	10.0	5.0	55.0
3/14/2024	42.0	1.9	0.0	1.0	50.0	0.6	0.7	62.0	0.0	62.0	48.0	10.0	4.0	54.0
3/15/2024	42.0	1.4	0.0	1.0	56.0	0.7	0.6	61.0	0.0	62.0	48.0	10.0	4.0	55.3
3/16/2024	43.0	1.3	0.0	1.0	56.0	0.7	0.6	61.0	0.0	62.0	48.0	10.0	4.0	55.5
3/17/2024	43.0	1.1	0.0	1.1	56.0	0.7	0.6	62.0	0.0	61.0	48.0	10.0	3.0	55.5
3/18/2024	42.0	1.2	0.0	1.2	56.0	0.7	0.7	63.0	0.0	60.0	48.0	10.0	2.0	55.3
3/19/2024	42.0	1.2	0.0	1.4	55.0	0.6	0.7	63.0	0.0	60.0	48.0	10.0	2.0	55.0
3/20/2024	42.0	1.1	0.0	1.2	55.0	0.6	0.8	62.0	0.0	60.0	48.0	10.0	2.0	54.8
3/21/2024	42.0	1.1	0.0	1.3	55.0	0.5	0.8	63.0	0.0	60.0	48.0	10.0	2.0	55.0
3/22/2024	42.0	1.1	0.0	1.2	54.0	0.5	0.8	63.0	0.0	61.0	48.0	10.0	3.0	55.0
3/23/2024	42.0	1.4	0.0	1.1	54.0	0.5	0.8	63.0	0.0	60.0	48.0	10.0	2.0	54.8
3/24/2024	43.0	2.0	0.0	1.4	54.0	0.5	0.8	62.0	0.0	59.0	48.0	10.0	1.0	54.5
3/25/2024	43.0	1.2	0.0	1.1	54.0	0.5	0.7	62.0	0.0	59.0	48.0	10.0	1.0	54.5
3/26/2024	42.0	1.1	0.0	1.4	54.0	0.8	0.8	62.0	0.0	59.0	48.0	10.0	1.0	54.3
3/27/2024	42.0	1.2	0.0	1.2	53.0	1.2	0.8	62.0	0.0	59.0	44.0	10.0	5.0	54.0
3/28/2024	42.0	1.2	0.0	1.1	53.0	0.9	0.9	62.0	0.0	59.0	24.0	10.0	25.0	54.0
3/29/2024	42.0	1.1	0.0	1.0	53.0	0.5	0.9	62.0	0.0	67.0	0.0	10.0	57.0	56.0
3/30/2024	43.0	1.0	0.0	1.0	52.0	0.6	0.8	60.0	0.0	69.0	0.0	10.0	59.0	56.0
3/31/2024	42.0	0.8	0.0	1.2	53.0	0.4	0.8	61.0	0.0	69.0	0.0	10.0	59.0	56.3
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
4/1/2024	42.0	1.1	0.0	1.4	52.0	0.1	0.8	67.0	0.0	70.0	0.0	12.0	58.0	57.8
4/2/2024	42.0	1.2	0.0	1.4	51.0	0.1	0.8	64.0	0.0	80.0	0.0	13.0	67.0	59.3
4/3/2024	42.0	1.1	0.0	1.4	52.0	0.1	0.8	62.0	0.0	82.0	0.0	13.0	69.0	59.5
4/4/2024	42.0	1.1	0.0	1.4	52.0	0.1	0.7	60.0	0.0	82.0	0.0	13.0	69.0	59.0
4/5/2024	73.0	1.0	0.0	1.3	52.0	0.1	0.7	59.0	0.0	81.0	0.0	13.0	68.0	66.3
4/6/2024	144.0	1.2	0.0	1.1	53.0	0.1	0.9	59.0	0.0	80.0	0.0	13.0	67.0	84.0
4/7/2024	142.0	1.2	0.0	1.5	82.0	0.1	1.4	61.0	0.0	78.0	0.0	13.0	65.0	90.8
4/8/2024	141.0	1.0	0.0	1.4	126.0	0.1	1.2	62.0	0.0	75.0	0.0	13.0	62.0	101.0
4/9/2024	144.0	1.0	0.0	1.4	139.0	0.1	1.3	73.0	0.0	74.0	0.0	13.0	61.0	107.5
4/10/2024	143.0	0.6	0.0	1.3	144.0	0.1	1.6	108.0	0.0	73.0	0.0	13.0	60.0	117.0
4/11/2024	142.0	0.9	0.0	1.3	147.0	0.1	1.8	122.0	0.0	74.0	5.0	13.0	56.0	121.3
4/12/2024	133.0	1.6	0.0	1.1	150.0	0.1	1.8	135.0	0.0	80.0	0.0	13.0	67.0	124.5
4/13/2024	124.0	1.9	0.0	1.1	148.0	0.1	1.9	136.0	0.0	88.0	0.0	13.0	75.0	124.0
4/14/2024	125.0	1.9	0.0	1.3	138.0	0.0	2.0	142.0	0.0	102.0	0.0	13.0	89.0	126.8
4/15/2024	126.0	1.6	0.0	1.0	138.0	0.0	1.8	138.0	0.0	116.0	0.0	13.0	103.0	129.5
4/16/2024	130.0	1.6	0.0	1.3	138.0	0.0	1.8	131.0	0.0	151.0	0.0	13.0	138.0	137.5
4/17/2024	125.0	1.3	0.0	1.5	138.0	0.0	1.6	132.0	0.0	124.0	0.0	13.0	111.0	129.8
4/18/2024	132.0	1.0	0.0	1.4	138.0	0.0	1.6	132.0	0.0	126.0	0.0	13.0	113.0	132.0
4/19/2024	141.0	1.6	0.0	1.5	138.0	0.0	1.5	128.0	0.0	120.0	2.0	13.0	105.0	131.8
4/20/2024	71.0	1.3	0.0	1.3	150.0	0.0	1.5	126.0	0.0	151.0	32.0	13.0	106.0	124.5
4/21/2024	42.0	1.0	0.0	1.4	144.0	0.0	1.6	130.0	0.0	150.0	48.0	13.0	89.0	116.5
4/22/2024	43.0	1.6	0.0	1.5	86.0	0.0	1.6	131.0	0.0	121.0	48.0	13.0	60.0	95.3
4/23/2024	43.0	2.2	0.0	1.0	70.0	0.0	1.3	138.0	0.0	128.0	48.0	13.0	67.0	94.8
4/24/2024	43.0	1.5	0.0	0.9	66.0	0.0	1.1	108.0	0.0	121.0	40.0	13.0	68.0	84.5
4/25/2024	43.0	1.2	0.0	1.4	64.0	0.0	0.7	88.0	0.0	121.0	45.0	13.0	63.0	79.0
4/26/2024	42.0	1.9	0.0	1.3	62.0	0.0	0.6	77.0	0.0	122.0	48.0	13.0	61.0	75.8
4/27/2024	42.0	2.9	0.0	1.2	60.0	0.0	0.6	72.0	0.0	106.0	48.0	13.0	45.0	70.0
4/28/2024	42.0	1.7	0.0	1.4	59.0	0.0	0.6	69.0	0.0	86.0	48.0	13.0	25.0	64.0
4/29/2024	42.0	1.2	0.0	1.3	58.0	0.0	0.6	67.0	0.0	75.0	48.0	13.0	14.0	60.5
4/30/2024	43.0	1.0	0.0	1.7	58.0	0.0	0.6	66.0	0.0	69.0	48.0	13.0	8.0	59.0

Notes: These measurements are not on the main channel of the Ow ens River, therefore highlighted columns are not included in average calculations.

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
5/1/2024	43.0	1.1	0.0	1.1	55.0	0.0	0.6	64.0	0.0	65.0	48.0	13.0	4.0	56.8
5/2/2024	43.0	1.7	0.0	1.3	55.0	0.0	0.5	62.0	0.0	62.0	48.0	13.0	1.0	55.5
5/3/2024	43.0	1.1	0.0	1.1	56.0	0.0	0.5	62.0	0.0	61.0	48.0	13.0	0.0	55.5
5/4/2024	43.0	1.3	0.0	0.9	55.0	0.0	0.4	60.0	0.0	60.0	47.0	13.0	0.0	54.5
5/5/2024	43.0	1.7	0.0	0.9	55.0	0.0	0.4	61.0	0.0	56.0	43.0	13.0	0.0	53.8
5/6/2024	43.0	1.3	0.0	1.1	55.0	0.0	0.4	60.0	0.0	54.0	41.0	13.0	0.0	53.0
5/7/2024	43.0	1.1	0.0	1.2	54.0	0.0	0.7	60.0	0.0	53.0	40.0	13.0	0.0	52.5
5/8/2024	43.0	1.0	0.0	1.1	54.0	0.0	0.9	59.0	0.0	52.0	39.0	13.0	0.0	52.0
5/9/2024	43.0	1.4	0.0	1.2	52.0	0.0	0.8	59.0	0.0	50.0	37.0	13.0	0.0	51.0
5/10/2024	43.0	1.1	0.0	1.2	53.0	0.0	0.4	58.0	0.0	49.0	36.0	13.0	0.0	50.8
5/11/2024	43.0	0.8	0.0	0.9	53.0	0.0	0.6	58.0	0.0	48.0	35.0	13.0	0.0	50.5
5/12/2024	43.0	1.2	0.0	1.1	53.0	0.0	1.0	58.0	0.0	48.0	35.0	13.0	0.0	50.5
5/13/2024	43.0	1.2	0.0	1.0	50.0	0.0	0.8	66.0	0.0	48.0	35.0	13.0	0.0	51.8
5/14/2024	42.0	1.5	0.0	1.2	52.0	0.0	0.6	52.0	0.0	49.0	36.0	13.0	0.0	48.8
5/15/2024	43.0	1.5	0.0	1.3	52.0	0.0	0.5	52.0	0.0	48.0	35.0	13.0	0.0	48.8
5/16/2024	42.0	1.4	0.0	1.2	51.0	0.0	0.2	52.0	0.0	41.0	35.0	6.0	0.0	46.5
5/17/2024	43.0	1.3	0.0	1.2	51.0	0.0	0.4	49.0	0.0	47.0	44.0	3.0	0.0	47.5
5/18/2024	43.0	1.3	0.0	1.0	50.0	0.0	0.9	48.0	0.0	46.0	43.0	3.0	0.0	46.8
5/19/2024	43.0	1.3	0.0	0.9	50.0	0.0	1.3	48.0	0.0	46.0	43.0	3.0	0.0	46.8
5/20/2024	43.0	1.3	0.0	1.0	50.0	0.0	0.6	46.0	0.0	44.0	41.0	3.0	0.0	45.8
5/21/2024	43.0	1.2	0.0	1.4	50.0	0.0	1.1	46.0	0.0	43.0	40.0	3.0	0.0	45.5
5/22/2024	43.0	1.1	0.0	1.4	50.0	0.0	0.9	45.0	0.0	42.0	39.0	3.0	0.0	45.0
5/23/2024	51.0	1.1	0.0	1.4	50.0	0.0	0.6	45.0	0.0	42.0	39.0	3.0	0.0	47.0
5/24/2024	57.0	1.0	0.0	1.2	52.0	0.0	0.6	45.0	0.0	41.0	38.0	3.0	0.0	48.8
5/25/2024	57.0	1.0	0.0	1.1	58.0	0.0	0.7	46.0	0.0	40.0	37.0	3.0	0.0	50.3
5/26/2024	57.0	1.0	0.0	1.1	61.0	0.0	0.5	47.0	0.0	40.0	37.0	3.0	0.0	51.3
5/27/2024	57.0	1.0	0.0	1.0	61.0	0.0	0.5	51.0	0.0	40.0	37.0	3.0	0.0	52.3
5/28/2024	57.0	1.0	0.0	1.0	61.0	0.0	0.8	54.0	0.0	37.0	34.0	3.0	0.0	52.3
5/29/2024	57.0	1.0	0.0	1.3	62.0	0.0	0.7	55.0	0.0	40.0	37.0	3.0	0.0	53.5
5/30/2024	57.0	1.1	0.0	1.2	62.0	0.0	1.0	55.0	0.0	38.0	35.0	3.0	0.0	53.0
5/31/2024	57.0	1.3	0.0	1.2	62.0	0.0	1.2	56.0	0.0	39.0	36.0	3.0	0.0	53.5
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langemann Gate to Delta	Weir to Delta	In Channel Average Flow
6/1/2024	47.0	1.3	0.0	1.1	62.0	0.0	0.7	56.0	0.0	40.0	37.0	3.0	0.0	51.3
6/2/2024	42.0	1.3	0.0	1.1	59.0	0.0	0.5	55.0	0.0	41.0	38.0	3.0	0.0	49.3
6/3/2024	43.0	1.1	0.0	0.9	52.0	0.0	0.6	56.0	0.0	41.0	38.0	3.0	0.0	48.0
6/4/2024	50.0	0.8	0.0	1.1	50.0	0.0	0.8	55.0	0.0	42.0	39.0	3.0	0.0	49.3
6/5/2024	61.0	1.0	0.0	1.1	51.0	0.0	0.6	49.0	0.0	42.0	39.0	3.0	0.0	50.8
6/6/2024	77.0	1.0	0.0	1.0	58.0	0.0	0.5	46.0	0.0	43.0	40.0	3.0	0.0	56.0
6/7/2024	95.0	1.1	0.0	0.9	66.0	0.0	0.6	47.0	0.0	42.0	39.0	3.0	0.0	62.5
6/8/2024	121.0	1.8	0.0	1.0	76.0	0.0	0.5	50.0	0.0	40.0	37.0	3.0	0.0	71.8
6/9/2024	147.0	1.4	0.0	0.8	93.0	0.0	0.8	54.0	0.0	38.0	35.0	3.0	0.0	83.0
6/10/2024	186.0	1.3	0.0	0.8	115.0	2.2	3.6	62.0	0.0	37.0	34.0	3.0	0.0	100.0
6/11/2024	175.0	1.1	0.0	1.1	136.0	4.4	5.6	75.0	0.0	36.0	33.0	3.0	0.0	105.5
6/12/2024	141.0	0.9	0.0	1.0	156.0	4.4	5.6	96.0	0.0	36.0	33.0	3.0	0.0	107.3
6/13/2024	108.0	0.8	0.0	0.8	157.0	4.5	5.6	114.0	0.0	37.0	34.0	3.0	0.0	104.0
6/14/2024	88.0	1.0	0.0	0.9	143.0	4.4	5.8	124.0	0.0	42.0	39.0	3.0	0.0	99.3
6/15/2024	71.0	0.8	0.0	0.9	121.0	4.3	7.5	129.0	0.0	51.0	47.0	3.0	1.0	93.0
6/16/2024	57.0	1.0	0.0	0.9	100.0	5.6	8.7	126.0	0.0	70.0	48.0	3.0	19.0	88.3
6/17/2024	46.0	1.3	0.0	0.8	81.0	5.7	8.1	120.0	0.0	85.0	48.0	3.0	34.0	83.0
6/18/2024	43.0	1.2	0.0	0.8	66.0	4.9	7.2	108.0	0.0	97.0	48.0	3.0	46.0	78.5
6/19/2024	42.0	1.2	0.0	0.9	58.0	4.6	5.5	90.0	0.0	102.0	48.0	3.0	51.0	73.0
6/20/2024	42.0	1.2	0.0	1.0	55.0	4.5	5.4	77.0	0.0	97.0	48.0	3.0	46.0	67.8
6/21/2024	75.0	1.2	0.0	1.4	53.0	1.7	3.0	68.0	0.0	86.0	48.0	3.0	35.0	70.5
6/22/2024	91.0	1.2	0.0	1.5	59.0	0.0	0.7	56.0	0.0	74.0	48.0	3.0	23.0	70.0
6/23/2024	91.0	1.2	0.0	1.2	79.0	0.0	0.5	50.0	0.0	64.0	48.0	3.0	13.0	71.0
6/24/2024	91.0	1.2	0.0	0.8	87.0	0.0	0.5	52.0	0.0	55.0	48.0	3.0	4.0	71.3
6/25/2024	91.0	1.2	0.0	1.1	90.0	0.0	0.6	61.0	0.0	51.0	48.0	3.0	0.0	73.3
6/26/2024	91.0	1.1	0.0	1.0	79.0	0.0	0.7	70.0	0.0	46.0	43.0	3.0	0.0	71.5
6/27/2024	91.0	1.1	0.0	1.1	80.0	0.0	1.0	77.0	0.0	40.0	37.0	3.0	0.0	72.0
6/28/2024	91.0	1.0	0.0	1.1	80.0	0.0	0.4	78.0	0.0	40.0	37.0	3.0	0.0	72.3
6/29/2024	91.0	1.2	0.0	0.9	79.0	0.0	0.2	79.0	0.0	43.0	40.0	3.0	0.0	73.0
6/30/2024	91.0	1.2	0.0	1.2	79.0	0.0	0.6	80.0	0.0	46.0	43.0	3.0	0.0	74.0
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman Gate to Delta	Weir to Delta	In Channel Average Flow
7/1/2024	91.0	1.2	0.0	1.0	79.0	0.0	1.5	82.0	0.0	48.0	45.0	3.0	0.0	75.0
7/2/2024	91.0	1.2	0.0	1.0	79.0	0.0	1.2	82.0	0.0	49.0	46.0	3.0	0.0	75.3
7/3/2024	91.0	1.2	0.0	0.9	79.0	0.0	0.9	82.0	0.0	51.0	48.0	3.0	0.0	75.8
7/4/2024	91.0	1.1	0.0	1.2	77.0	0.0	0.8	81.0	0.0	51.0	48.0	3.0	0.0	75.0
7/5/2024	65.0	1.1	0.0	1.2	77.0	0.0	0.3	82.0	0.0	51.0	48.0	3.0	0.0	68.8
7/6/2024	49.0	1.1	0.0	1.1	73.0	0.0	0.3	81.0	0.0	53.0	48.0	3.0	2.0	64.0
7/7/2024	76.0	1.2	0.0	1.1	52.0	0.0	0.8	80.0	0.0	54.0	48.0	3.0	3.0	65.5
7/8/2024	92.0	1.3	0.0	1.0	51.0	0.0	0.5	78.0	0.0	55.0	48.0	3.0	4.0	69.0
7/9/2024	91.0	1.2	0.0	1.1	81.0	0.0	0.2	62.0	0.0	54.0	48.0	3.0	3.0	72.0
7/10/2024	91.0	1.2	0.0	0.8	86.0	0.0	0.3	53.0	0.0	54.0	48.0	3.0	3.0	71.0
7/11/2024	91.0	1.2	0.0	1.0	89.0	0.0	0.3	58.0	0.0	52.0	48.0	3.0	1.0	72.5
7/12/2024	63.0	1.2	0.0	0.8	89.0	0.0	0.7	64.0	0.0	50.0	47.0	3.0	0.0	66.5
7/13/2024	49.0	1.2	0.0	1.1	85.0	0.0	1.4	70.0	0.0	45.0	42.0	3.0	0.0	62.3
7/14/2024	77.0	1.3	0.0	1.0	65.0	0.0	1.5	71.0	0.0	41.0	38.0	3.0	0.0	63.5
7/15/2024	92.0	1.4	0.0	0.8	65.0	0.0	3.6	73.0	0.0	44.0	41.0	3.0	0.0	68.5
7/16/2024	92.0	1.3	0.0	1.0	81.0	0.0	1.9	61.0	0.0	48.0	45.0	3.0	0.0	70.5
7/17/2024	92.0	1.2	0.0	1.1	87.0	0.0	1.6	54.0	0.0	50.0	47.0	3.0	0.0	70.8
7/18/2024	92.0	1.2	0.0	1.3	89.0	0.0	1.0	60.0	0.0	50.0	47.0	3.0	0.0	72.8
7/19/2024	64.0	1.2	0.0	1.0	90.0	0.0	0.8	66.0	0.0	50.0	47.0	3.0	0.0	67.5
7/20/2024	49.0	1.1	0.0	0.9	87.0	0.0	0.6	70.0	0.0	49.0	46.0	3.0	0.0	63.8
7/21/2024	49.0	1.1	0.0	1.1	66.0	0.0	0.5	72.0	0.0	45.0	42.0	3.0	0.0	58.0
7/22/2024	73.0	1.0	0.0	1.0	59.0	0.0	0.4	72.0	0.0	46.0	43.0	3.0	0.0	62.5
7/23/2024	84.0	1.3	0.0	1.0	62.0	0.0	0.4	61.0	0.0	49.0	46.0	3.0	0.0	64.0
7/24/2024	84.0	1.4	0.0	0.7	77.0	0.0	0.8	50.0	0.0	50.0	47.0	3.0	0.0	65.3
7/25/2024	84.0	1.3	0.0	0.8	82.0	0.0	0.5	51.0	0.0	52.0	45.0	3.0	4.0	67.3
7/26/2024	84.0	1.3	0.0	0.7	83.0	0.0	0.9	57.0	0.0	50.0	46.0	3.0	1.0	68.5
7/27/2024	84.0	1.2	0.0	0.8	83.0	0.0	0.6	62.0	0.0	46.0	43.0	3.0	0.0	68.8
7/28/2024	84.0	1.1	0.0	1.1	81.0	0.0	0.4	63.0	0.0	46.0	43.0	3.0	0.0	68.5
7/29/2024	84.0	1.2	0.0	1.5	81.0	0.0	0.6	64.0	0.0	36.0	33.0	3.0	0.0	66.3
7/30/2024	84.0	1.3	0.0	1.3	81.0	0.0	1.3	65.0	0.0	39.0	36.0	3.0	0.0	67.3
7/31/2024	84.0	1.3	0.0	0.9	82.0	0.0	0.9	65.0	0.0	41.0	40.0	1.0	0.0	68.0
Notes:	These measurements are not on the main channel of the Ow ens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
8/1/2024	85.0	1.3	0.0	0.7	82.0	0.0	0.8	64.0	0.0	43.0	40.0	3.0	0.0	68.5
8/2/2024	84.0	1.3	0.0	1.0	82.0	0.0	0.8	65.0	0.0	45.0	42.0	3.0	0.0	69.0
8/3/2024	84.0	1.2	0.0	1.3	85.0	0.0	0.7	67.0	0.0	46.0	43.0	3.0	0.0	70.5
8/4/2024	88.0	1.3	0.0	1.4	86.0	0.0	3.2	67.0	0.0	47.0	44.0	3.0	0.0	72.0
8/5/2024	100.0	1.1	0.0	1.0	86.0	0.0	7.8	73.0	24.7	51.0	45.0	6.0	0.0	77.5
8/6/2024	98.0	1.3	0.0	1.2	93.0	0.0	8.2	77.0	31.0	48.0	37.0	5.0	6.0	79.0
8/7/2024	92.0	1.4	0.0	1.1	107.0	0.0	8.1	78.0	28.3	70.0	35.0	3.0	32.0	86.8
8/8/2024	83.0	1.5	0.0	0.6	108.0	0.0	8.1	81.0	22.6	80.0	48.0	3.0	29.0	88.0
8/9/2024	84.0	1.7	0.0	0.5	96.0	0.0	6.3	89.0	6.0	79.0	48.0	3.0	28.0	87.0
8/10/2024	84.0	1.7	0.0	0.6	88.0	0.0	0.3	87.0	0.0	77.0	47.0	3.0	27.0	84.0
8/11/2024	84.0	1.4	0.0	1.0	88.0	0.0	0.3	82.0	0.0	74.0	48.0	3.0	23.0	82.0
8/12/2024	84.0	1.2	0.0	1.1	89.0	0.0	0.3	75.0	0.0	67.0	48.0	3.0	16.0	78.8
8/13/2024	84.0	1.2	0.0	1.4	89.0	0.0	0.9	73.0	0.0	64.0	48.0	3.0	13.0	77.5
8/14/2024	84.0	1.2	0.0	1.5	89.0	0.0	0.6	72.0	0.0	60.0	48.0	3.0	9.0	76.3
8/15/2024	84.0	1.2	0.0	1.4	88.0	0.0	0.4	73.0	0.0	55.0	48.0	3.0	4.0	75.0
8/16/2024	84.0	1.1	0.0	1.2	88.0	0.0	0.4	72.0	0.0	52.0	48.0	3.0	1.0	74.0
8/17/2024	62.0	1.2	0.0	1.3	88.0	0.0	0.3	70.0	0.0	51.0	48.0	3.0	0.0	67.8
8/18/2024	49.0	1.1	0.0	1.2	83.0	0.0	0.2	69.0	0.0	51.0	48.0	3.0	0.0	63.0
8/19/2024	49.0	1.0	0.0	1.1	64.0	0.0	0.1	69.0	0.0	51.0	48.0	3.0	0.0	58.3
8/20/2024	49.0	1.1	0.0	1.1	57.0	0.0	0.1	67.0	0.0	49.0	46.0	3.0	0.0	55.5
8/21/2024	72.0	1.3	0.0	1.1	55.0	0.0	0.1	54.0	0.0	47.0	44.0	3.0	0.0	57.0
8/22/2024	84.0	1.2	0.0	1.1	49.0	0.0	0.1	42.0	0.0	47.0	44.0	3.0	0.0	55.5
8/23/2024	84.0	1.2	0.0	0.7	64.0	0.0	0.1	38.0	0.0	45.0	42.0	3.0	0.0	57.8
8/24/2024	84.0	1.2	0.0	0.9	69.0	0.0	0.8	44.0	0.0	42.0	39.0	3.0	0.0	59.8
8/25/2024	84.0	1.1	0.0	1.2	71.0	0.0	0.7	52.0	0.0	37.0	34.0	3.0	0.0	61.0
8/26/2024	84.0	1.3	0.0	1.3	73.0	0.0	0.7	58.0	0.0	35.0	32.0	3.0	0.0	62.5
8/27/2024	84.0	1.2	0.0	1.4	74.0	0.0	0.6	61.0	0.0	34.0	31.0	3.0	0.0	63.3
8/28/2024	84.0	1.2	0.0	1.4	74.0	0.0	0.5	63.0	0.0	36.0	33.0	3.0	0.0	64.3
8/29/2024	84.0	1.3	0.0	1.4	75.0	0.0	0.4	64.0	0.0	40.0	37.0	3.0	0.0	65.8
8/30/2024	84.0	1.4	0.0	1.4	75.0	0.0	0.4	65.0	0.0	44.0	41.0	3.0	0.0	67.0
8/31/2024	84.0	1.3	0.0	1.4	76.0	0.0	0.3	66.0	0.0	46.0	43.0	3.0	0.0	68.0
Notes:	These measurements are not on the main channel of the Ow ens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
9/1/2024	84.0	1.2	0.0	1.4	75.0	0.0	0.3	67.0	0.0	51.0	42.0	9.0	0.0	69.3
9/2/2024	84.0	1.2	0.0	1.2	75.0	0.0	0.1	67.0	0.0	49.0	38.0	11.0	0.0	68.8
9/3/2024	84.0	1.1	0.0	1.3	75.0	0.0	0.1	68.0	0.0	50.0	39.0	11.0	0.0	69.3
9/4/2024	84.0	1.0	0.0	1.2	76.0	0.0	0.2	68.0	0.0	49.0	38.0	11.0	0.0	69.3
9/5/2024	74.0	1.0	0.0	1.1	85.0	0.0	0.3	74.0	0.0	50.0	39.0	11.0	0.0	70.8
9/6/2024	70.0	1.2	0.0	1.2	83.0	0.0	0.3	75.0	0.0	51.0	40.0	11.0	0.0	69.8
9/7/2024	70.0	1.1	0.0	1.1	75.0	0.0	0.4	76.0	0.0	51.0	40.0	11.0	0.0	68.0
9/8/2024	70.0	1.1	0.0	0.8	74.0	0.0	0.3	76.0	0.0	52.0	41.0	11.0	0.0	68.0
9/9/2024	70.0	1.1	0.0	1.0	73.0	0.0	0.4	71.0	0.0	54.0	43.0	11.0	0.0	67.0
9/10/2024	70.0	1.1	0.0	1.0	72.0	0.0	1.1	67.0	0.0	54.0	43.0	11.0	0.0	65.8
9/11/2024	70.0	1.2	0.0	0.9	72.0	0.0	1.0	65.0	0.0	53.0	42.0	11.0	0.0	65.0
9/12/2024	70.0	2.0	0.0	1.1	72.0	0.0	0.8	64.0	0.0	51.0	40.0	11.0	0.0	64.3
9/13/2024	70.0	1.4	0.0	0.7	73.0	0.0	0.3	62.0	0.0	49.0	38.0	11.0	0.0	63.5
9/14/2024	70.0	1.3	0.0	1.0	73.0	0.0	0.2	61.0	0.0	46.0	35.0	11.0	0.0	62.5
9/15/2024	70.0	1.1	0.0	1.1	73.0	0.0	0.1	62.0	0.0	45.0	34.0	11.0	0.0	62.5
9/16/2024	70.0	1.0	0.0	1.1	72.0	0.0	0.4	62.0	0.0	45.0	34.0	11.0	0.0	62.3
9/17/2024	70.0	0.9	0.0	1.1	73.0	0.0	0.9	64.0	0.0	45.0	34.0	11.0	0.0	63.0
9/18/2024	70.0	1.0	0.0	1.2	74.0	0.0	0.3	64.0	0.0	45.0	34.0	11.0	0.0	63.3
9/19/2024	70.0	1.3	0.0	1.2	73.0	0.0	0.1	65.0	0.0	47.0	36.0	11.0	0.0	63.8
9/20/2024	70.0	1.0	0.0	1.2	74.0	0.0	0.4	66.0	0.0	48.0	37.0	11.0	0.0	64.5
9/21/2024	70.0	1.2	0.0	1.2	74.0	0.0	0.2	66.0	0.0	48.0	37.0	11.0	0.0	64.5
9/22/2024	70.0	1.3	0.0	1.1	74.0	0.0	0.2	66.0	0.0	48.0	37.0	11.0	0.0	64.5
9/23/2024	70.0	1.2	0.0	1.4	74.0	0.0	0.1	66.0	0.0	48.0	37.0	11.0	0.0	64.5
9/24/2024	70.0	1.2	0.0	1.3	74.0	0.0	0.1	66.0	0.0	49.0	38.0	11.0	0.0	64.8
9/25/2024	70.0	1.1	0.0	1.2	73.0	0.0	0.1	65.0	0.0	49.0	38.0	11.0	0.0	64.3
9/26/2024	70.0	1.0	0.0	1.0	73.0	0.0	0.0	65.0	0.0	49.0	38.0	11.0	0.0	64.3
9/27/2024	70.0	1.0	0.0	1.0	73.0	0.0	0.0	65.0	0.0	49.0	38.0	11.0	0.0	64.3
9/28/2024	70.0	1.0	0.0	1.0	74.0	0.0	0.0	65.0	0.0	49.0	38.0	11.0	0.0	64.5
9/29/2024	70.0	1.0	0.0	1.0	73.0	0.0	0.0	65.0	0.0	49.0	38.0	11.0	0.0	64.3
9/30/2024	70.0	1.0	0.0	1.0	73.0	0.0	0.0	65.0	0.0	49.0	38.0	11.0	0.0	64.3
Notes:	These measurements are not on the main channel of the Ow ens River, therefore highlighted columns are not included in average calculations.													

3.0 Water Quality Monitoring

3.1 Introduction

There is tradeoff in flow management of the LORP – implementing a spring flow aimed at cottonwood (*Populus* sp.) and willow (*Salix* sp.) recruitment, in June, can create lethally low DO levels for fish. The degree to which antecedent flows and consequent sediment transport interact with temperature and biological oxygen demand of the system during pulse flows has historically been monitored periodically, mostly in years where SHF's were released. In recent years, ICWD staff have more frequently collected manual water quality measurements in the LOR (and off-river Billy Lake) and continued the empirical record in 2024 by collecting these data with a focus on the higher flows from February through the June SHF ramped release. An *In-Situ AquaTROLL 400* multi-parameter probe was used to collect instantaneous water temperature (Temp), DO, specific conductivity (Sp Cond), and pH measurements at 12 sites on the LOR, from the Aqueduct Intake to the Pumpback Station (Figure 3-1). The primary objective, as in past years, of this limited field campaign was to observe changes in DO levels coupled with LOR flows and to document whether DO levels were lowered to ranges that produce fish stress or mortality.

As documented and discussed in previous LORP Annual Report water quality sections (2008, 2009, 2010, 2014, 2015, 2017, 2019, & 2023), changes in flow can mobilize sediments, increasing biologic oxygen demand from aerobic microbial decomposition of suspended sediments and release of hydrogen sulfide from disturbed channel-bed muck. This increased biological oxygen demand, especially during periods of elevated water temperature, can lower DO levels in the water column to critical levels. Fish stress and mortality have been observed in previous years (e.g., 2010, 2014, & 2017) when DO levels fell below 1 mg/L.

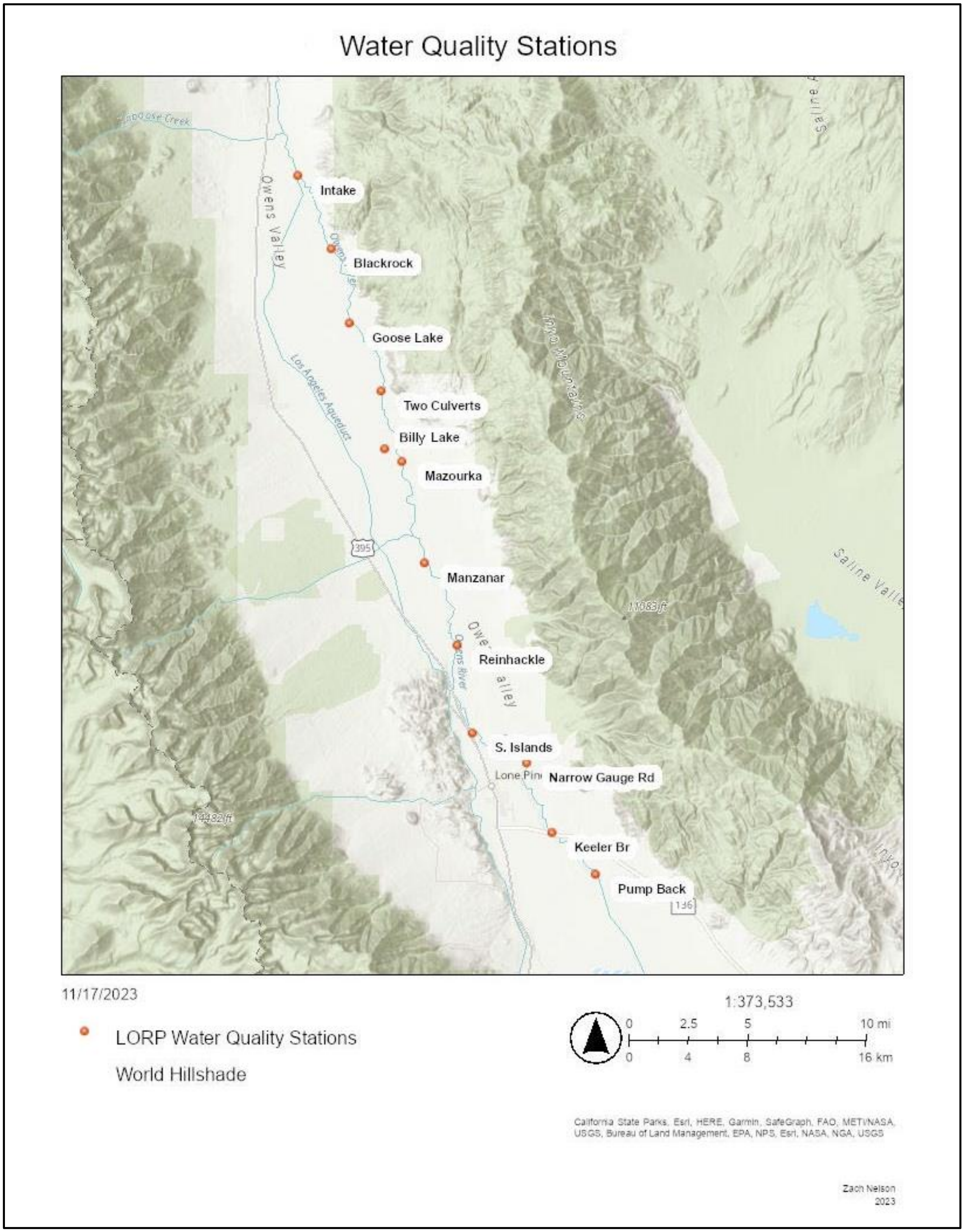
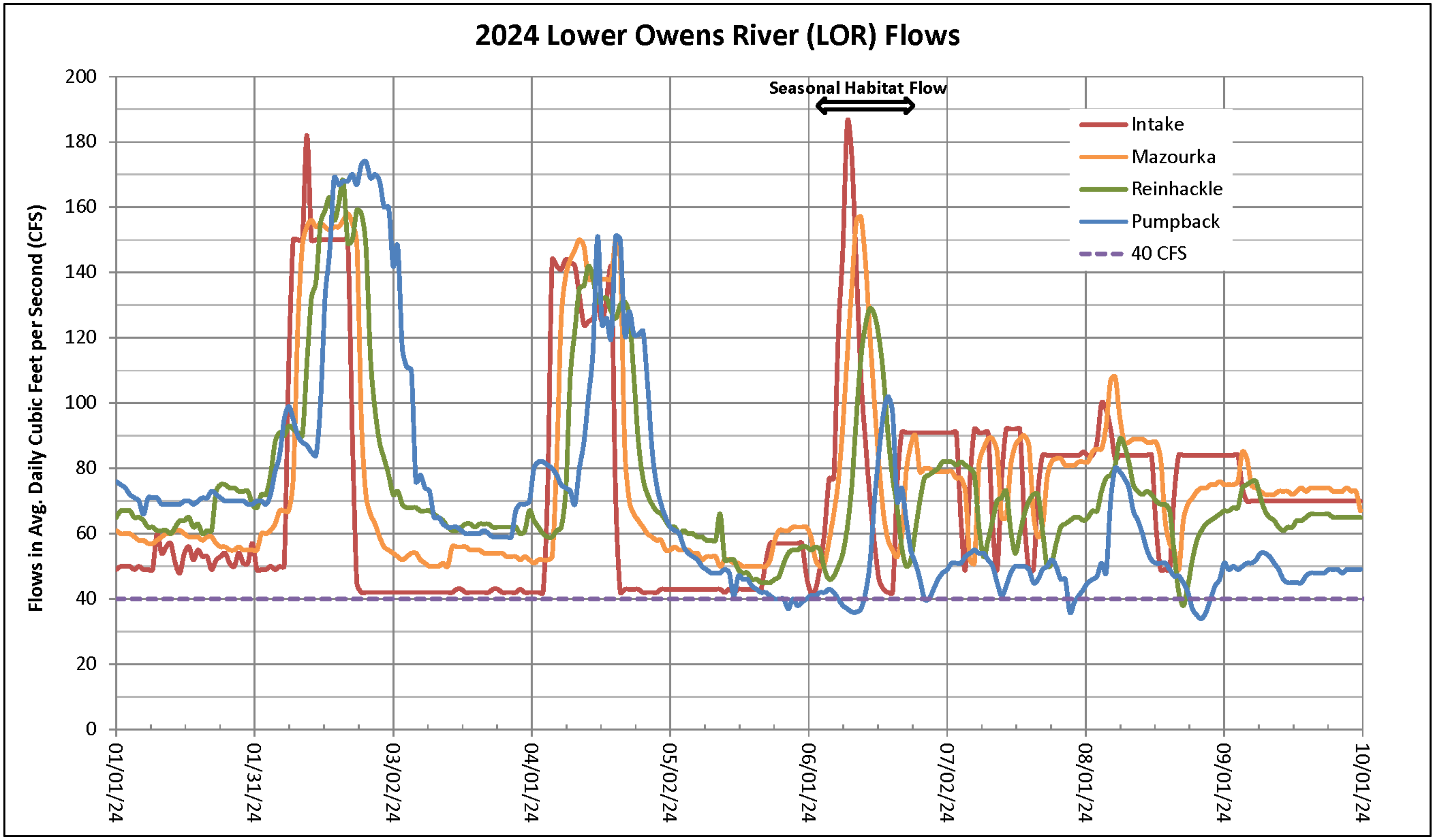


Figure 3-1. 2024 Water quality measuring stations on LOR.

3.2 Results and Discussion

There were three relatively distinct peaks in flow in the LOR during the 2023-24 runoff season: February, April, and June (Figure 3-2). The peak in June is the SHF ramped release. Gauged average daily flow did not exceed 190 cfs during the period of record from January through September 2024.



Data source: LADWP Daily LORP Flow Reports. https://www.ladwp.com/who-we-are/water-system/los-angeles-aqueduct/la-aqueduct-conditions-reports/lorp-flow-reports

Figure 3-2. LOR Flow from January through September 2024.

In June 2024, the SHF was conducted with a maximum average daily flow of 186 cfs at the Aqueduct Intake (Figure 3-3). Note that a maximum release of approximately 200 cfs was sustained for over 24 hours but spanned two days from June 10 to June 11, so the average daily flow shown on Figure 3-3 does not accurately depict the instantaneous target peak flow rate that was achieved. A maximum average daily flow of 102 cfs arrived at the Pumpback Station on June 19. The black dashed curve on the figure shows the planned release ramped flow rates at the Intake. The actual flows released at the Intake generally conformed to the planned flow rates.

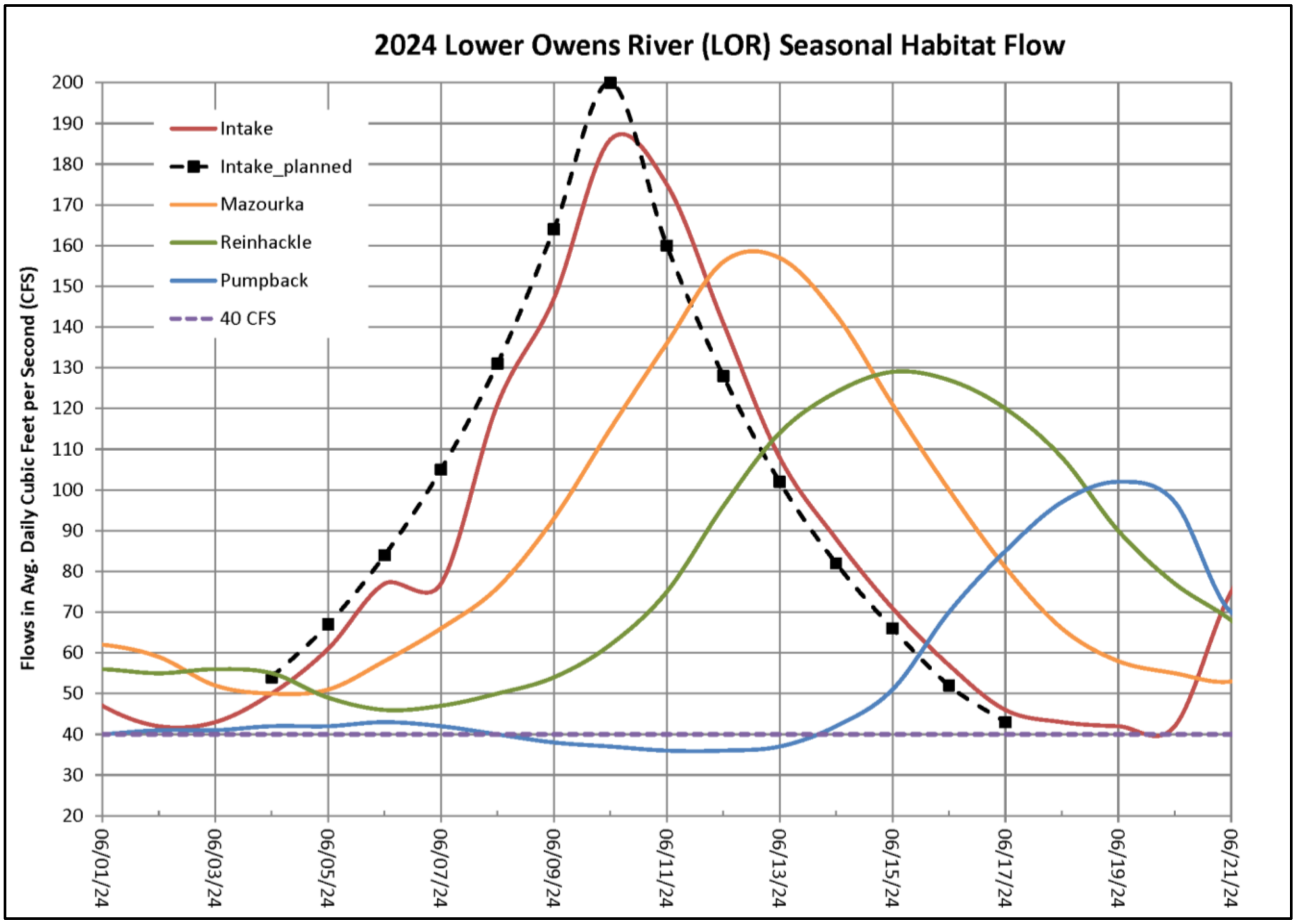


Figure 3-3. 2024 LOR SHF.

Water temperature and DO exhibited fluctuations related to flows. Measured water temperature from February through September ranged 48 to 76 degrees Fahrenheit (°F). Dissolved oxygen levels in the LOR ranged from around 9 mg/L at the LOR Intake in late February to 1.8 mg/L at Reinhackle Springs in mid-July.

Evidence of fish stress in correlation with low DO measurements was observed at several sites on the LOR in 2023 (historic wet year and high flows) but was not observed in 2024. No fish kills within the LOR were observed by ICWD staff or known to be reported in 2024.

Figures 3-4 through 3-7 show flow (cfs) versus DO (mg/L) and pH (top graph in the set) and temperature (°F) and specific conductance (µS/cm; bottom graph in the set) for: the Intake, Mazourka Bridge, Reinhackle Springs, and Keeler Bridge, respectively. Although 12 sites along the LOR were measured, these four sites best represent the trends in measured parameters observed during the 2024 measurement season; discussion is therefore limited to these sites. These data are available upon request to ICWD.

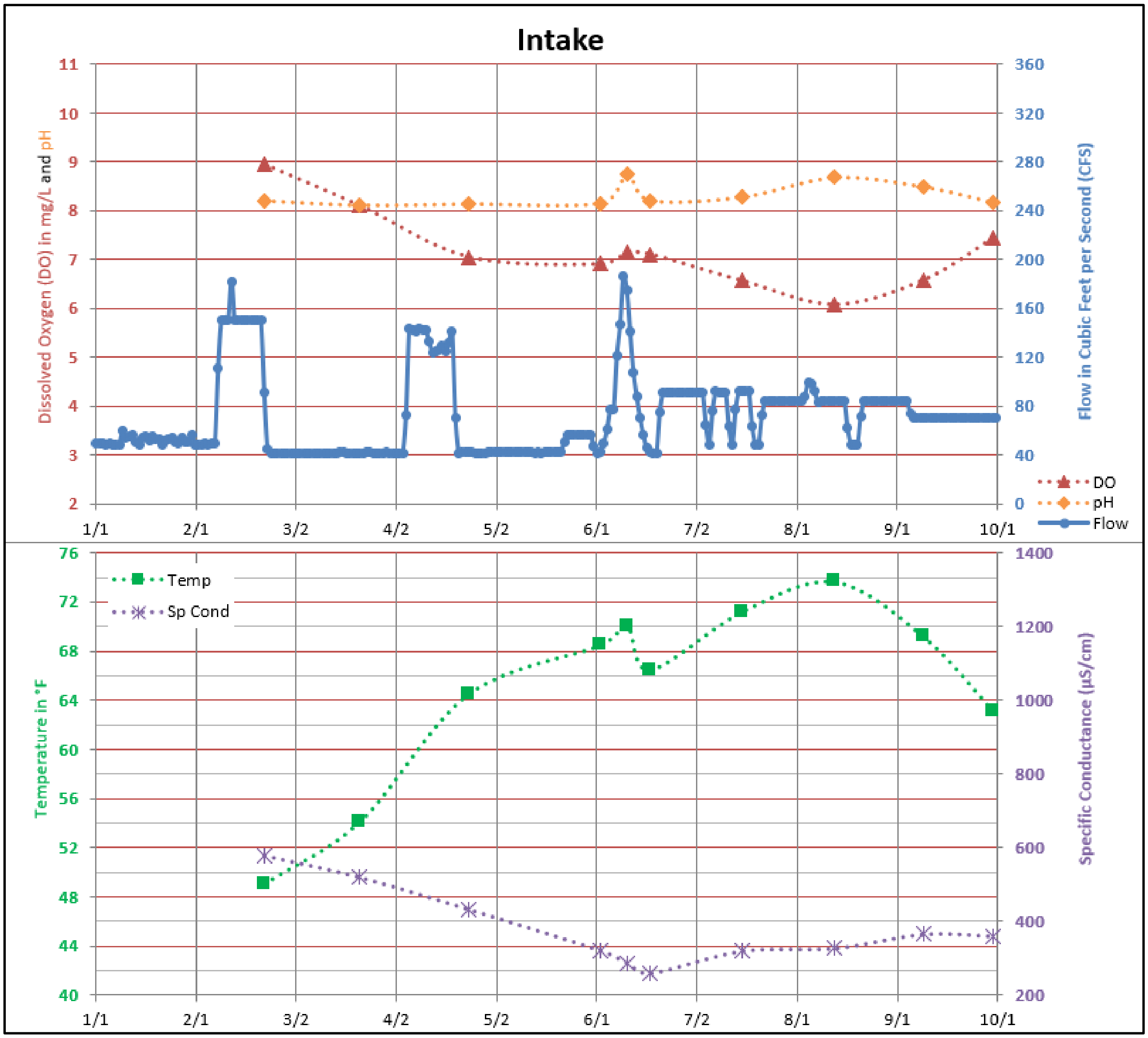


Figure 3-4. 2024 LOR at the Aqueduct Intake. Flow with DO, pH, Temperature and Specific Conductance measured water quality parameters.

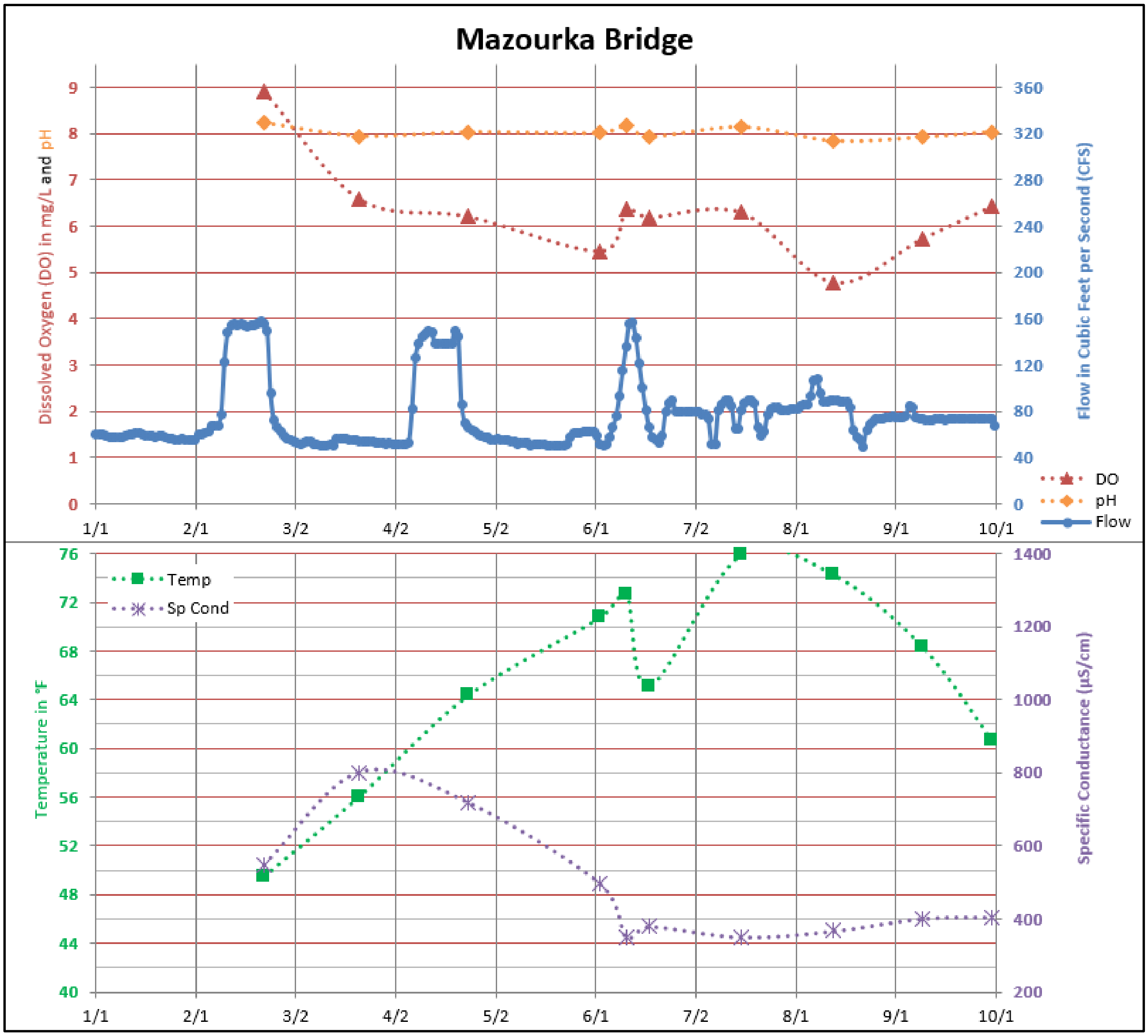


Figure 3-5. 2024 LOR at Mazourka Bridge. Flow with DO, pH, Temperature and Specific Conductance measured water quality parameters.

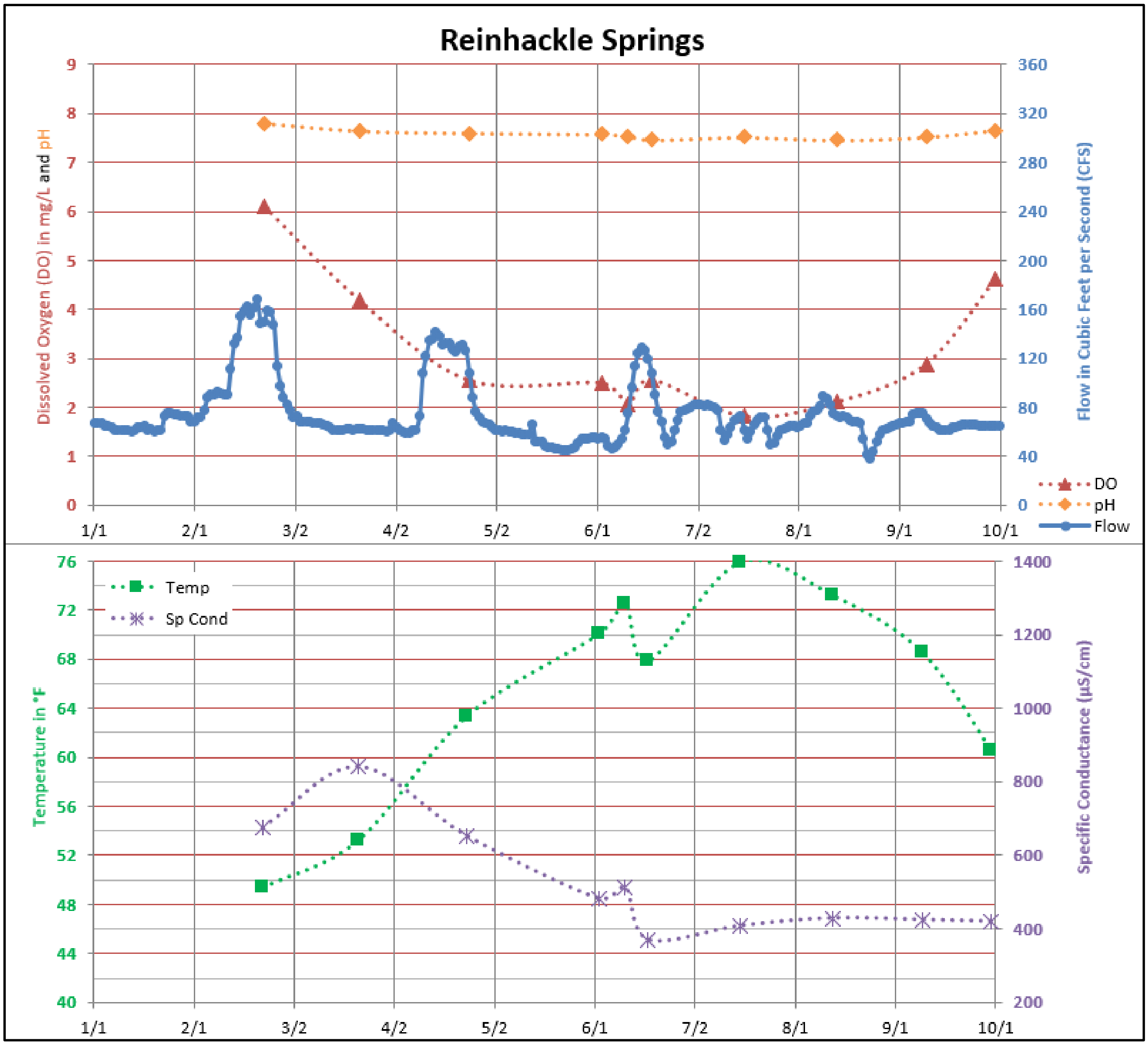


Figure 3-6. 2024 LOR at Reinhackle Springs. Flow with DO, pH, Temperature and Specific Conductance measured water quality parameters.

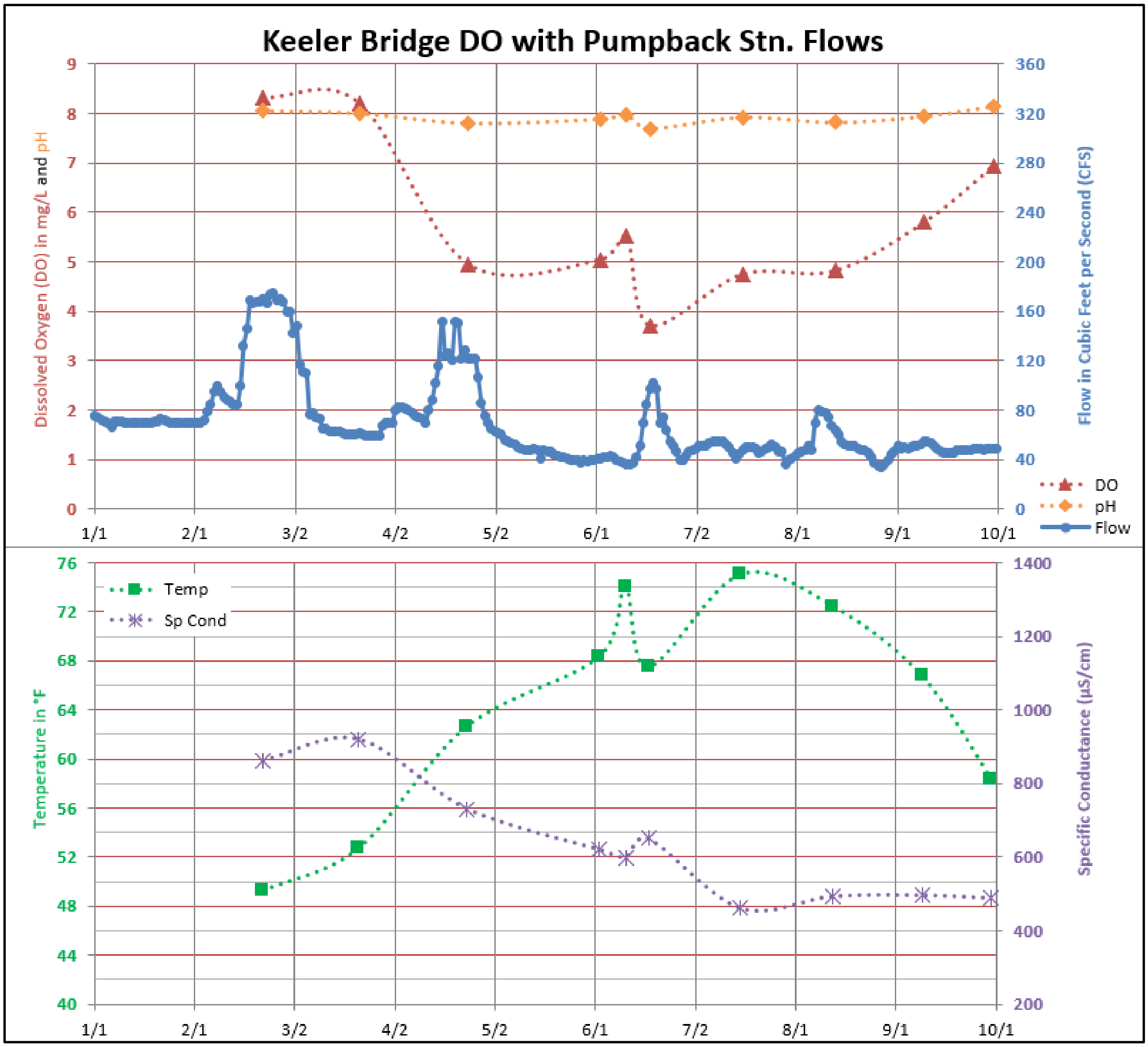


Figure 3-7. 2024 LOR DO, pH, Temperature and Specific Conductance measured water quality parameters at Keeler Bridge with downstream Pumpback Station flow.

DO levels measured within the LOR during the 2024 runoff season were generally higher than those measured in 2023, which was a historic wet year with corresponding much higher flows. A general inverse relationship between temperature and DO was observed, with increasing temperature correlating with decreasing DO. DO remained relatively low (but not depleted) for most of the summer season in the LOR, with a general trend of decreasing DO with increasing distance south from the Intake to Reinhackle Springs (Figures 3-4 through 3-6). Downstream of Reinhackle, DO measurements trended upward with distance towards Keeler Bridge and the Pumpback Station (Figure 3-7).

Across all LOR measurement sites in 2024, initial decreases in DO correspond most closely to increasing spring water temperatures and to a lesser extent early peaking of flow. Peak summer flows occurred at different times for each monitoring site, with flows peaking earlier at upstream sites and later at downstream sites as the pulses moved through the system. At the monitoring site with the lowest measured DO (Reinhackle), DO remained below 3 mg/L from late April through early September (Figure 3-7). Reinhackle (located upstream of the LOR Islands) represents a mid-LOR low in DO, increasing with distance upstream to the Intake and downstream towards Keeler Bridge.

Additional parameters measured at each site include pH and specific conductivity. Measured pH generally fluctuated within a narrow range at each site from 7.5 to 8.8. Measurements of pH indicate the acidity (below 7) or alkalinity (above 7) of the water. Shifts in pH can impact aquatic organisms by altering the solubility of chemicals which can change the nutrient balance in a waterway. Specific conductivity ranged from 260 µS/cm to 950 µS/cm, and generally decreased through the spring to early summer, then gradually increased or remained relatively stable into September (Figures 3-4 through 3-7). A notable specific conductivity decrease occurred in correlation to the June SHF. Note that specific conductance is an indication of total dissolved solids (TDS) but cannot be directly calculated from these data. Specific conductance values of 500 and 1,000 µS/cm approximately correspond to TDS values of 325 and 650 mg/L, respectively.

Quality assurance measures included daily calibration checks for specific conductivity and pH. DO field measurements were bracketed at the beginning and end of each field day with a relative control water sample to assess sensor drift throughout the day. Observed drift from the start to end of field days was minor to not detectible.

3.3 References

LADWP and County of Inyo. 2008. Lower Owens River Project 2008 Annual Report. Los Angeles Department of Water and Power, Bishop, CA & Inyo County Water Department, Independence, CA. 299 p https://www.inyowater.org/wp-content/uploads/legacy/LORP/DOCUMENTS/2008LORPAnnualReport.pdf

LADWP and County of Inyo. 2009. Lower Owens River Project 2009 Annual Report. Los Angeles Department of Water and Power, Bishop, CA & Inyo County Water Department, Independence, CA. 882 p https://www.inyowater.org/wp-content/uploads/legacy/LORP/DOCUMENTS/2009LORPAnnualReport.pdf

LADWP and County of Inyo. 2010. Lower Owens River Project 2010 Annual Report. Los Angeles Department of Water and Power, Bishop, CA & Inyo County Water Department, Independence, CA. 598 p https://www.inyowater.org/wp-content/uploads/legacy/LORP/DOCUMENTS/2010LORPAnnualReport.pdf

LADWP and County of Inyo. 2014. Lower Owens River Project 2014 Annual Report. Los Angeles Department of Water and Power, Bishop, CA & Inyo County Water Department, Independence, CA. 376 p https://www.inyowater.org/wp-content/uploads/2021/06/2014-LORP-Final-Annual-Report.pdf

LADWP and County of Inyo. 2015. Lower Owens River Project 2015 Annual Report. Los Angeles Department of Water and Power, Bishop, CA & Inyo County Water Department, Independence, CA. 418 p https://www.inyowater.org/wp-content/uploads/2017/02/Lower-Owens-River-Project-2015-Final-Annual-Report-1.pdf

LADWP and County of Inyo. 2017. Lower Owens River Project 2017 Annual Report. Los Angeles Department of Water and Power, Bishop, CA & Inyo County Water Department, Independence, CA. 266 p https://www.inyowater.org/wp-content/uploads/2018/12/FINAL-2017-Lower-Owens-River-Project-Annual-Report.pdf

LADWP and County of Inyo. 2019. Lower Owens River Project 2019 Annual Report. Los Angeles Department of Water and Power, Bishop, CA & Inyo County Water Department, Independence, CA. 290 p https://www.inyowater.org/wp-content/uploads/2020/05/2019-Final-LORP-Annual-Report.pdf

LADWP and County of Inyo. 2023. Lower Owens River Project 2013 Annual Report. Los Angeles Department of Water and Power, Bishop, CA & Inyo County Water Department, Independence, CA. 197 p https://www.inyowater.org/wp-content/uploads/2024/04/2023_FINAL_LORP_ANNUAL_REPORT.pdf

4.0 Adaptive Management

The LORP was implemented in 2006 by the LADWP and is managed jointly by the LADWP and the County. Nearing the end of the LORP's prescribed 15-year monitoring program, the LADWP and the County conducted a comprehensive evaluation of the project in 2019 to assess its status with respect to the goals and requirements defined by the guiding legal documents. Through this evaluation, a series of adaptive management actions were identified and are being pursued. In 2024, the LADWP and the County conducted the following:

- Continued implementation of a 5-year interim flow regime in the DHA and related monitoring.
- Continued implementation of a 5-year interim flow regime in the BWMA and related monitoring.
- Continuation of a tree recruitment assessment.
- Continuation of a noxious species survey and treatment.

A summary of these efforts is provided below. No new adaptive management was proposed for 2024, as the above items are multi-year commitments.

4.1 DHA Interim Flow Regime and Related Monitoring

4.1.1 Introduction

According to MOU, the goal of the DHA is to "*enhance and maintain approximately 325 acres of existing habitat consisting of riparian areas and ponds suitable for shorebirds, waterfowl, and other animals and to establish and maintain new habitat consisting of riparian areas and ponds suitable for shorebirds, waterfowl, and other animals within the Owens River Delta Habitat Area. Diverse natural habitats will be created and maintained through flow and land management, to the extent feasible, consistent with the needs of the "habitat indicator species" for the Owens River Delta Habitat Area. These habitats will be as self-sustaining as possible*."

However, it was found that stream discharges into the DHA during the growing season, as originally prescribed, promoted growth and expansion of emergent vegetation and the subsequent loss of open-water habitat. As an adaptive management effort, an interim plan (IP) that reduced summer stream flow, to induce hydrological stress of the emergent vegetation was developed to reverse this trend and provide open water and meadow habitat for HIS and other wildlife associated with the LORP.

4.1.2 Methodology

Stream Flow

Flow releases to the DHA were monitored following methods described in the Hydrologic Monitoring section of this report (Section 2.0). The scheduled interim flows to the DHA are released through a Langemann gate at the Pumpback station. Flows that exceed the capacity of the gate flow uncontrolled to the DHA and occur when flows in the Owens River exceed the capacity of the Pumpback Station, such as during precipitation events, SHF's, or during power outages. Average-daily flows for the 2023-24 RY, were compared to the interim-flow schedule to evaluate adherence to the prescribed flows.

Effectiveness of Adaptive Management Flows

The effectiveness of the interim flows was evaluated using the following three criteria:

1) Did the summer minimum baseflow result in drying and hydrologic stress of emergent vegetation in the DHA?
2) Did the minimum summer base flow maintain water in permanent ponds serving as "control points"?
3) Did the interim flows produce flooding of existing, seasonal ponds serving as "control points" from September through early May?

For criterion 1, aerial photos of the DHA were analyzed to determine if the interim flows were qualitatively inducing hydrologic stress among emergent vegetation. For criterion 2, the persistence of small permanent ponds through the 2023 summer period were documented from aerial photos. Similarly, these aerial photographs were also used to determine the creation of seasonal ponds associated with criterion 3.

4.1.3 Results and Discussion

For 2023-24 RY, actual daily mean flows were, for much of the period, one to two orders of magnitude higher than the prescribed flows (Figure 4-1). The average daily mean flow for the entire RY was 145 cfs and equated to 26,804 AF being delivered to the DHA. The higher flows were the result of the unprecedented winter of 2022-23 and the resultant runoff along with Hurricane Hilary, which resulted in peak daily-mean flow of 1,120 cfs on August 23, 2023.

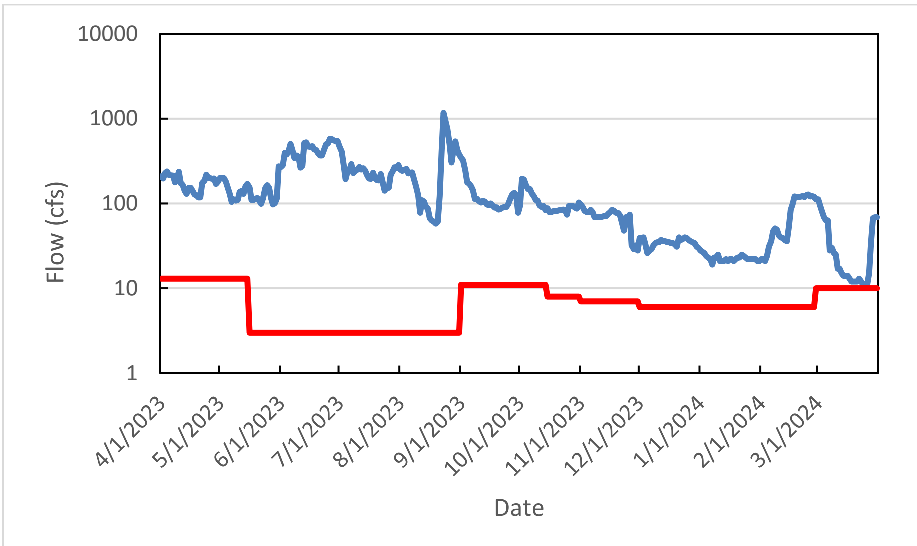


Figure 4-1. Actual daily mean flow (blue) to the DHA verses prescribed daily mean flow (red) in 2023-24 RY (y-axis is in log-scale).

Effectiveness of Adaptive Management Flow Regime

Criterion 1: Did the summer minimum baseflow result in drying and hydrologic stress of emergent vegetation in the DHA?

Because of the amplified runoff, much of the DHA was inundated for the growing season, which renewed growth of emergent vegetation (Figure 4-2). Conditions of emergent vegetation will be reviewed in 2025 with a return to the prescribed flows in the 2024 growing season.

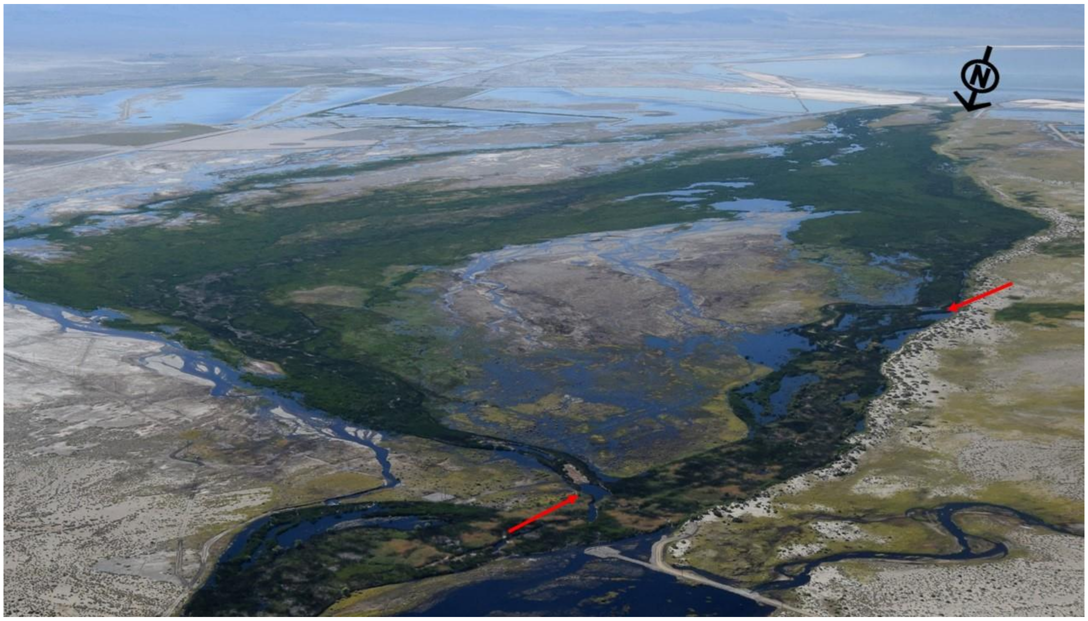


Figure 4-2. July 06, 2023, aerial image of DHA showing extent of inundation and response of vegetation. Red arrows denote ponds 1 and 2, from left to right, respectively.

Criterion 2: Did the minimum summer base flow maintain water in permanent ponds serving as "control points"?

The location of permanent ponds 1 and 2 that are to be monitored during the summer base flow conditions are shown in Figure 4-3. Both ponds were present in summer (Figure 4-2), and criterion 2 was met, but again, these were atypical conditions.

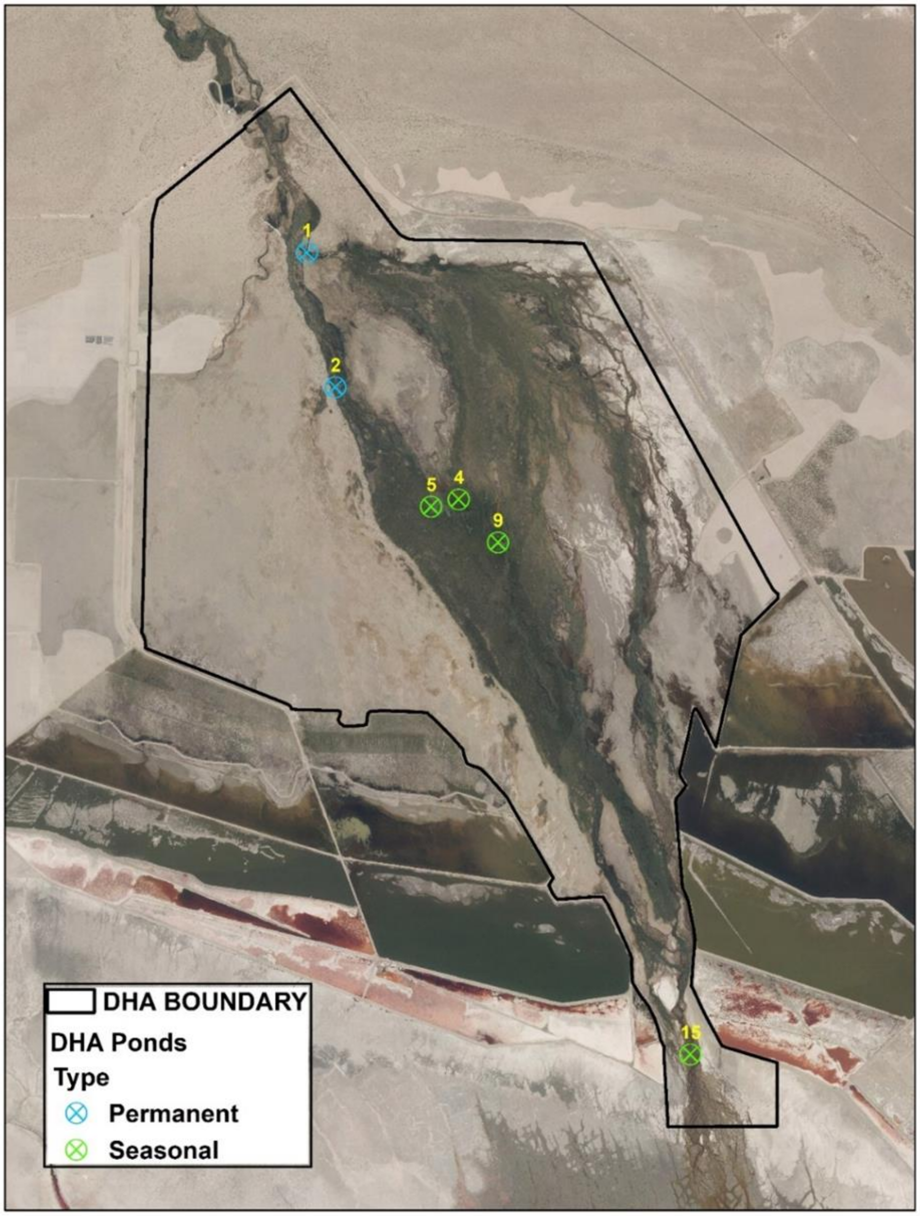


Figure 4-3. Locations of both permanent and seasonal ponds.

> *Criterion 3: Did the interim flows produce flooding of existing, seasonal ponds serving as "control points" from September through early May?*

The high flows of 2023-24 RY produced the seasonal ponds, in late September, as indicated by Figures 4-4 and 4-5 and therefore Criterion 3 was met.

Figure 4-4. September 26, 2023, aerial Image of DHA. Red arrows denote location of ponds 4, 5, and 9, from left to right, respectively.

Figure 4-5. September 19, 2023, aerial image of DHA. Red arrow denotes seasonal pond 15.

4.1.4 Conclusion

Two of the three evaluation criteria were met in 2023, with the first criterion compromised because of high flows from runoff associated with the historic winter snowpack of 2022-23 and Hurricane Hilary. For criteria 2 and 3, the permeant and seasonal ponds, respectively, were present although the hydrological conditions were atypical. Resumption of the adaptive management flows for the DHA and monitoring in 2024 will allow an evaluation of the lasting effects of the 2023-24 high flows on both the emergent vegetation and ponds.

Lastly, 2024, is year five and the last year of IP for the DHA. The continuation of the IP, or a derivative, is contingent on agreement between LADWP, the County and the MOU party members.

4.2 BWMA Interim Management and Monitoring

4.2.1 Background

The BWMA is managed in accordance with the goals and provisions stated in the 1997 MOU, which states: "*The goal is to maintain this waterfowl habitat area to provide the opportunity for the establishment of resident and migratory waterfowl populations as described in the EIR and to provide habitat for other native species. Diverse natural habitats will be created and maintained through flow and land management, to the extent feasible, consistent with the needs of the "habitat indicator species" for the Blackrock Waterfowl Habitat Area. These habitats will be as self-sustaining as possible",* Further the MOU describes management prescriptions: "*Approximately 500 acres of the habitat area will be flooded at any given time in a year when the runoff to the Owens River watershed is forecasted to be average or above average. In years when the runoff is forecasted to be less than average, the water supply to the area will be reduced in general proportion to the forecasted runoff in the watershed. (The runoff forecast for each year will be DWP's runoff year forecast for the Owens River Basin, which is based upon the results of its annual April 1 snow survey of the watershed.) Even in the driest years, available water will be used in the most efficient manner to maintain the habitat. The Wildlife and Wetlands Management Plan element of the LORP Plan will recommend the water supply to be made available under various runoff conditions and will recommend how to best use the available water in dry years. The amount of acreage to be flooded in years when the runoff is forecasted to be less than average will be set by the Standing Committee based upon the recommendations of the Wildlife and Wetlands Management Plan and in consultation with DFG."*

Historically, this year-round flooding has resulted in considerable growth of emergent vegetation -cattails (*Typha* sp.) and bulrush (*Scheoenoplectus* sp.), which has resulted in a loss of open-water habitat and a subsequent decline in water bird use. Consequently, LADWP and the County adopted a seasonal flooding regime that would improve habitat conditions for both shore and waterbird species (LADWP & ICWD, 2020). Specifically, this new regime ends year-round flooding and instead provides flooding that is outside the growing season of at least 500 acres of the BWMA each year from fall to mid-spring, with a complete drying in the summer months. This approach is intended to increase both habitat quality and productivity by *1)* controlling the growth of emergent vegetation (by drying out the units) to maintain open water habitat, and *2)* implementing moist soil management to enhance forage for indicator species (LADWP & ICWD, 2021).

LADWP and the County finalized the new flooding regime in an IP in April 2021, following consultation with the MOU Parties. The Inyo/Los Angeles Standing Committee set the BWMA flooded acreage in accordance with the IP at its June 22, 2023, meeting. The IP was implemented as adaptive management for a period of 5 years (ending April 2026), at which point the success of the project would be reviewed and recommendations for long-term management developed.

The IP states that both vegetation and birds will be monitored annually to assess the effectiveness of the new flooding scheme. The following sections detail these results.

4.3 Vegetation Monitoring

One of the goals of seasonal drawdowns in the BWMA units is to create moist soil conditions to support early seral vegetation. This vegetation directly provides food for birds, but also supports invertebrates that may be a food source too.

To gain a better understanding of the plant composition in each of the basins, vegetation sampling on winter flooded sub-units in the BWMA was conducted in August both in 2022 and 2024. The objective was to capture the dominant plant communities that emerged following the drawdown of the active units beginning in March of the same year. All the units in the BWMA project area were flooded beginning in the fall of 2022 per the IP. With the above average precipitation and snowpack of 2023, the units remained flooded for the entire spring and summer of 2023, continuing into the 2023-24 flood cycle for the BWMA. Water releases into the units finally ended March 1, 2024. The extensive flooding and resulting high water table prolonged the drying of the units in 2024. Because all units were flooded during the summer of 2023, there was no vegetation sampling for that year. Vegetation sampling resumed in 2024, occurring between July 29 and August 1. The units that will be flooded beginning September 15, 2024, are: Thibaut, Waggoner, and the West Winterton. This will be the first time the West Winterton will be activated during the IP.

4.3.1 Methodology

At least one transect was located in each sub-basin, which are nested inside East Winterton, Waggoner, and Thibaut. Fourteen of the original 16 transects were read in 2024; the two transects located in East Winterton were excluded because this unit will not be inundated in fall 2024 (Figure 4-6).

Methodology consisted of photo points at the 0m to the 100m and back from the 100m point to the 0m. The Dry-Weight-Rank (DWR) sampling method was applied inside a 40cm-by-40cm quadrat frame, placed every meter along a 100m tape. A total of 100 quadrats were sampled at each transect. The DWR method requires the observer to assign ranks for the three heaviest plant species using an ocular estimate of relative dry weight of the species (Bureau of Land Management, 1996). This method can generate a rapid estimate of production based on species composition. This method does not generate an estimate of pounds/acre of plant material but can provide a general depiction of which species contribute the largest amount of biomass across a given area (Friedel *et al*., 1988).

Line point intercept was also used to estimate cover along the same tape. The first live cover hit at each meter was recorded. If no cover was intercepted then the ground cover hit was recorded as soil, litter, or rock. These actual cover results will help interpret the DWR results which are based on the relative contribution by species to the total given weight in each quadrat. Typically cover values over-represent plants with lower biomass and underrepresent species that produce high amounts of biomass.

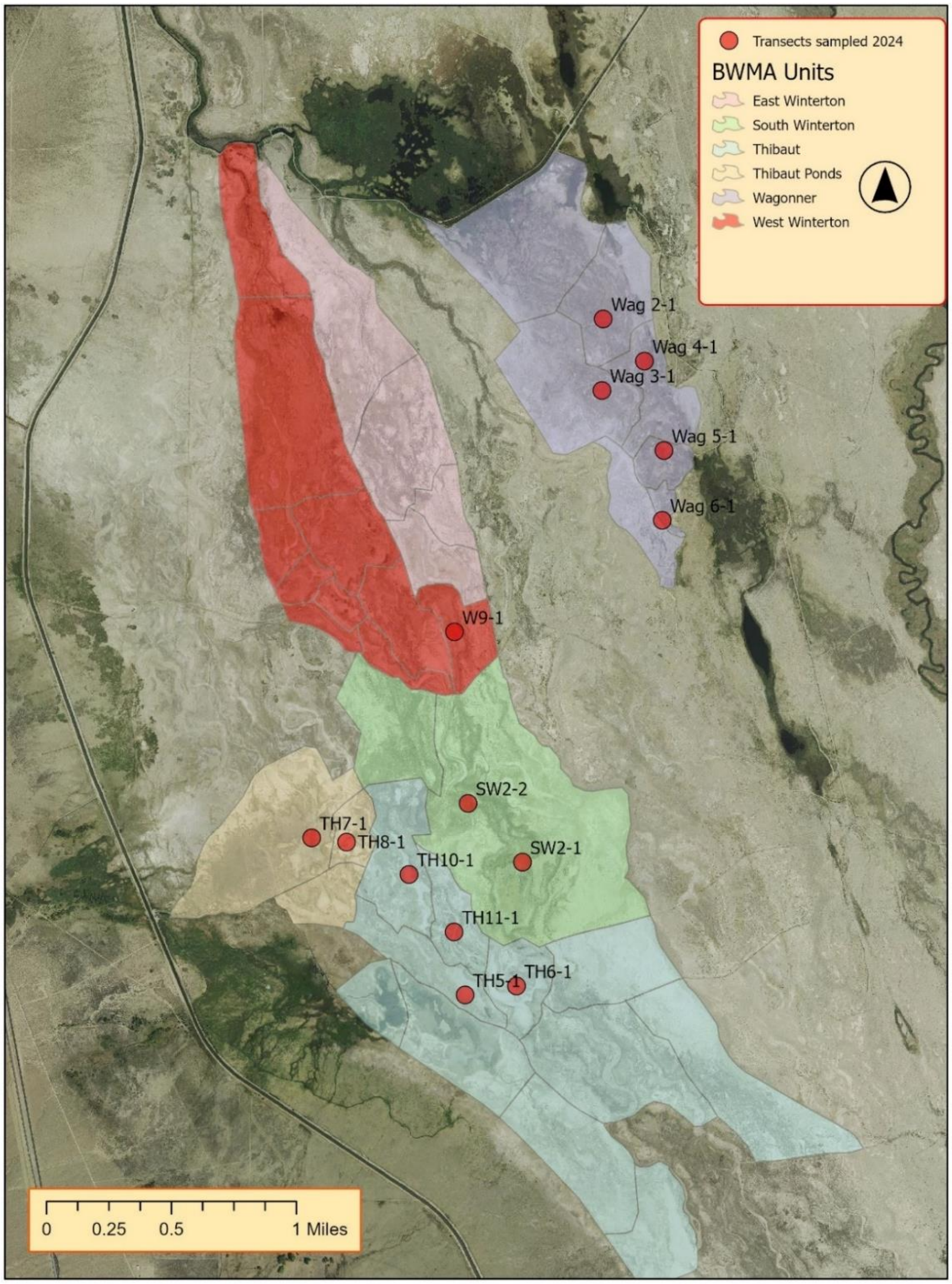


Figure 4-6. Location of units and vegetation transects in the BWMA project area.

4.3.2 Results

Live cover

Sampling for live cover in the five Waggoner subbasins ranged between 64%-80%. The single transect that was sampled in the East Winterton unit (W9-1) had a live cover value of 73%. Live cover values ranged between 23%-68% in the eight Thibaut subbasins which included the two South Winterton transects.

Species Composition

Species composition by weight (DWR) varied widely between units and among basins within the same unit (Table 4-1). In 2024, spreading alkali weed (*Cressa truxillensis)* was the dominant plant across all basins at 38% cover, followed by alkali mallow (*Malvella leprosa*) at 34% (Table 4-1).

Forage plants

In 2022, smartweed (*Polygonum* sp.) was only observed on TH7-1 with 2% relative species composition by weight on the same transect; while in 2024, relative composition by weight was 4% averaged across five transects spread throughout the three active units (Table 4-1). The emergence of swamp timothy (*Crypsis schoenoides*) was observed on four Thibaut sub-basin transects with a range between 4%-30% in 2022. In 2024, this annual grass was spread across additional units on eight transects vs five transects in 2022. Cover by weight increased from 1% to 3% averaged across all transects (Table 4-1). Based on observation in 2024, swamp timothy was in abundance at higher elevations on the Thibaut Unit (locations where drying down occurred earlier) and suggest this grass has a better chance to establish when units are drawn down earlier in the season (mid-May vs mid-June).

Table 4.1. Average composition for plants by weight, for all sub-basins in Thibaut, Waggoner, and East Winterton that were flooded in 2021-22 and 2023-24

		Forage value (*F*) Habitat value (*H*)	Percent composition by weight	
Common Name	**Scientific Name**		**2022**	**2023**
Triangle orache	*Atriplex prostrata*	*F*	13%	*t*
Tumbling saltweed	*Atriplex rosea*	*H*	14%	28%
Nevada saltbush	*Atriplex torreyii*	*n/a*	0%	1%
Wedgescale saltbush	*Atriplex truncata*	*H*	12%	3%
Fivehorn smotherweed	*Bassia hyssopifolia*	*n/a*	16%	3%
Sedge	*Carex sp.*	*F*	26%	2%
Canadian horseweed	*Conyza canadensis*	*n/a*	9%	*t*
Saltmarsh bird's beak	*Cordylanthus maritimus*	*H*	15%	0%
Swamp timothy	*Crypsis schoenoides*	*F*	1%	3%
Spreading alkali weed	*Cressa truxillensis*	*H*	11%	38%
Saltgrass	*Distichlis spicata*	*F*	5%	19%
Squirreltail	*Elymus elymoides*	*H*	*t*	3%
American licorice	*Glycyrrhiza lepidota*	*n/a*	1%	1%
Common sunflower	*Helianthus annuus*	*F*	9%	1%
Salt heliotrope	*Heliotropium curassavicum*	*H*	3%	1%
Mountain rush	*Juncus arcticus*	*H*	2%	3%
Perennial pepperweed	*Lepidium latifolium*	*n/a*	2%	*t*
Beardless wildrye	*Leymus triticoides*	*F*	*t*	1%
Alkali mallow	*Malvella leprosa*	*H*	7%	34%
Scratchgrass	*Muhlenbergia asperifolia*	*H*	8%	*t*
Common reed	*Phragmites australis*	*H*	*t*	22%
Inyo phacelia	*Phacelia inyoensis*	*H*	2%	13%
Oval-leaf knotweed	*Polygonum arenastrum*	*H*	0%	12%
Smartweed	*Polygonum* sp.	*H*	2%	4%
Annual rabbitsfoot grass	*Polypogon monspeliensis*	*F*	6%	*t*
Willow dock	*Rumex salicifolius*	*H*	2%	2%
Hardstem bulrush	*Schoenoplectus acutus*	*F/H*	10%	16%
Verrucose seapurslane	*Sesuvium verrucosum*	*H*	10%	2%
Alkali sacaton	*Sporobolus airoides*	*F*	1%	16%
Annual saltmarsh aster	*Symphyotrichum subulatum*	*H*	5%	8%
Broadleaf cattail	*Typha latifolia*	*F/H*	0%	19%
Rough cocklebur	*Xanthium strumarium*	*n/a*	1%	10%

t= trace (*<1% cover*)

Undesirable vegetation
Despite the extensive moisture in all units, fivehorn smotherweed (*Bassia hyssopifolia*) was less abundant in 2024 than 2022 (Table 4-1). This may be explained by the extended drawdown period that lasted past the winter/early spring's precipitation events. Because of 2023's slow draw down, viable substrate for germination was still under water into the late spring. Observations elsewhere in the LORP support that fivehorn smotherweed production was very high, contrary to what was observed in BWMA.

The estimated dry-weight of cattail (*Typha latifolia*) and hardstem bulrush (*Schoenoplectus acutus*) increased in 2024; with the former increasing from 0% to 19% and the latter from 10% to 16% (Table 4-1). Common reed (*Phragmites australis*) increased from trace amounts in 2022 to 22% by weight in 2024 (Table 4-1). It should be noted that the increase in cover values tended to be lower than the increases in production estimates (Table 4-2). Figure 4-7 shows the spatial expansion of reedgrass, cattail, and bulrush between 2022 and 2024 and Figures 4-8 through 4-10 visually depict these conditions; this result highlights the importance of why the BWMA should not be flooded through the growing season.

These increases in emergent vegetation were expected to occur as a result of the summer flooding in 2023; however, when assessed across an entire sub-unit the increases are not enough to warrant immediate treatment in the units.

Table 4-2. Percent live cover for three emergent species in 2022 and 2024.

Species	**2022**	**2024**
Cattail (*Typha latifolia*)	0%	10%
Bulrush (*Schoenoplectus acutus*)	8%	16%
Common reed (*Phragmites australis*)	1%	16%

Perennial pepperweed (*Lepidium latifolium*) decreased to trace amounts from 2% in 2022 (Table 4-1). Accounts from the LADWP weed mitigation crew also reported lower abundance of pepperweed in the BWMA units in 2024 and is likely from the prolonged inundation of the basins which limited pepperweed growth.

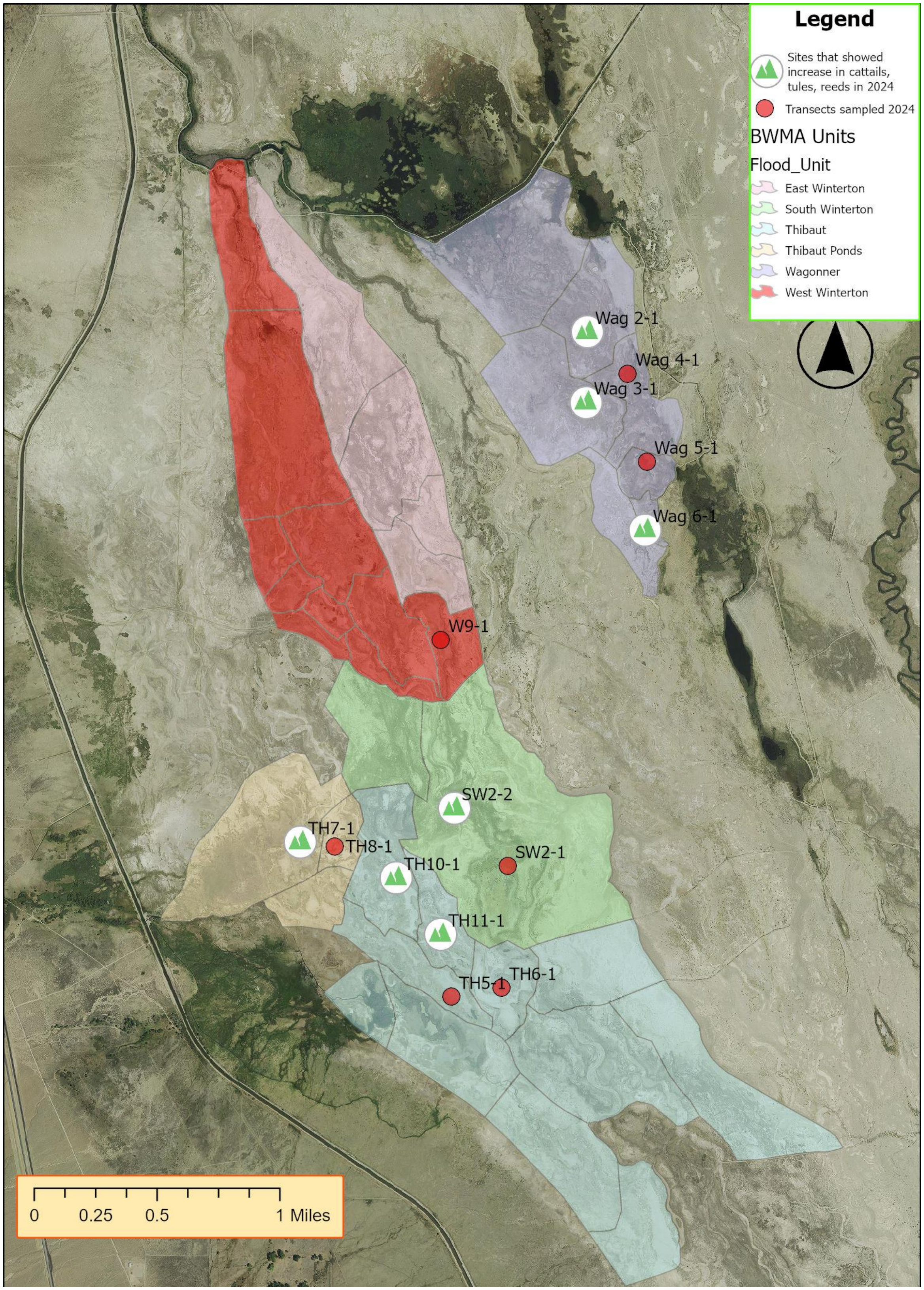


Figure 4-7. Locations in the BWMA that exhibited increases in cattail, tule, and common reedgrass.

WAG 2-1

2022

2024

WAG 3-1

2022

2024

Figure 4-8. Increases in hardstem bulrush in the Waggoner Unit.

TH7-1

2022 **2024**

TH10-1

2022 **2024**

Figure 4-9. Slight increase in hardstem bulrush on the Thibaut Unit on TH10-1. Note widespread smartweed in TH7-1 (Thibaut Pond area) in 2024.

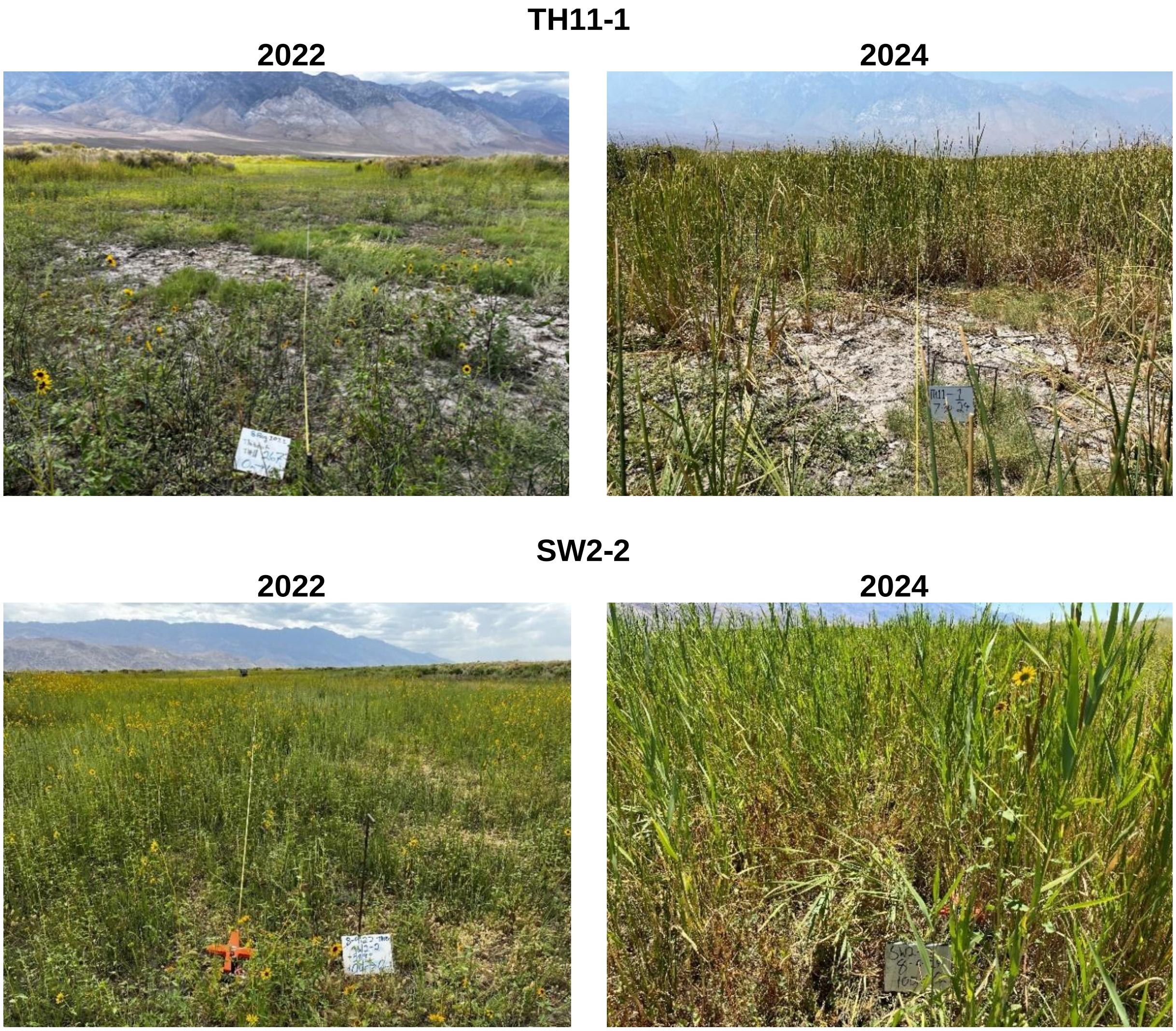


Figure 4-10. Increase in cattail and hardstem bull rush on TH11-1 and increase in common reedgrass on SW2-2.

4.3.3 Discussion

Much of the BWMA was flooded throughout the 2023 growing season. Historically, similar flooded conditions have led to the expansion of emergent vegetation and reduction in open water. In 2024, vegetation monitoring showed that emergent vegetation did expand in the units but not to the levels that warrant immediate attention as was the case prior to the IP when units had to either be burned or completely disced prior to use (Table 4-1). This monitoring also demonstrated that early seral species (smartweed and swamp timothy), which are favored by waterfowl, were relatively unimpacted by the previous year's flooded conditions. The level of production of these species between 2022 and 2024 was nearly unchanged at 8% versus 10% (Table 4-1). Lastly, vegetation monitoring will occur in summer of 2025 and will include new transects in West Winterton to monitor response to the recent activation of the unit.

4.3.4 Recommendations

In August of 2024, LADWP mowed approximately 100 acres in the West Winterton Unit in preparation for flooding. Next summer as an adaptive measure LADWP would like to continue mowing across all three units, in smaller areas, where encroachment has increased. However, we do not anticipate further expansion of cattail, bulrush, or reedgrass provided we are able to apply adequate draw down in units during the summer of 2025. The final recommendation is to reintroduce burning of units as part of the site preparation, especially after units have been flooded during the growing season. Discing was originally implemented to reset units back to mineral soil; however, the practice contributes to the spread of pepperweed.

4.3.5 References

Bureau of Land Management. 1996. Sampling vegetation attributes. Interagency Technical Reference, BLM/RS/ST-96/002+1730. pp. 50-54.

Friedel, M.H., Chewings, V.H., and G.N. Bastin. 1988. The use of comparative yield and dry-weight rank techniques for monitoring arid rangelands. Journal of Range Management 41:430-434.

LADWP and County of Inyo. 2020. Lower Owens River Project 2020 Annual Report. Los Angeles Department of Water and Power, Bishop, CA *&* Inyo County Water Department, Independence, CA. pp. 155.

LADWP and County of Inyo. 2021. Lower Owens River Project 2020 Annual Report. Los Angeles Department of Water and Power, Bishop, CA *&* Inyo County Water Department, Independence, CA. pp. 269.

4.3.6 Appendix 1. List of all species observed during BWMA vegetation monitoring, August 2024.

COMMON NAME	SPECIES	CODE
Yerba mansa	*Anemopsis californica*	ANCA10
Western pearly everlasting	*Anaphalis margaritacea*	ANMA
Triangle orache	*Atriplex prostrata*	ATPR
Tumbling saltweed	*Atriplex rosea*	ATRO
Torrey's saltbush	*Atriplex torreyi*	ATTO
Wedgescale saltbush	*Atriplex truncata*	ATTR
Fivehorn smotherweed	*Bassia hyssopifolia*	BAHY
Sedge	*Carex sp.*	CAREX
Hians goosefoot	*Chenopodium hians*	CHHI
Canadian horseweed	*Conyza canadensis*	COCA5
Saltmarsh bird's beak	*Cordylanthus maritimus ssp. canescens*	COMAC
Swamp timothy	*Crypsis schoenoides*	CRSC
Spreading alkaliweed	*Cressa truxillensis*	CRTR5
Dodder	*Cuscuta sp.*	CUSCU
Durango roots	*Datisca glomerata*	DAGL2
Saltgrass	*Distichlis spicata*	DISP
Squirreltail	*Elymus elymmoides*	ELEL5
Rubber rabbitbrush	*Ericameria nauseosa*	ERNA10
American licorice	*Glycyrrhiza lepidota*	GLLE3
Curlycup gumweed	*Grindelia squarrosa*	GRSQ
Common sunflower	*Helianthus annuus*	HEAN3
Salt heliotrope	*Heliotropium curassavicum*	HECU3
Foxtail barley	*Hordeum jubatum*	HOJU
Arctic rush	*Juncus arcticus*	JUAR2
Coulter's horseweed	*Laennecia coulteri*	LACO13
Broadleaved pepperweed	*Lepidium latifolium*	LELA2
Beardless wildrye	*Leymus triticoides*	LETR5
Birdsfoot treefoil	*Lotus corniculatus*	LOCO6
Alkali mallow	*Malvella leprosa*	MALE3
Sweetclover	*Melilotus officinalis*	MEOF
Scratchgrass	*Muhlenbergia asperifolia*	MUAS
Witchgrass	*Panicum capillare*	PACA6
Common reed	*Phragmites australis*	PHAU7
Inyo phacelia	*Phacelia inyoensis*	PHIN4
Oval-leaf knotweed	*Polygonum arenastrum*	POAR11
Smartweed	*Polygonum sp*	POLYG
Annual rabbitsfoot grass	*Polypogon monspeliensis*	POMO5

Appendix 1 (cont). List of all species observed during monitoring, August 2024.

COMMON NAME	SPECIES	CODE
Jersey cudweed	*Pseudognaphalium luteoalbum*	PSLU6
Willow dock	*Rumex salicifolius*	RUSA
Hardstem bulrush	*Schoenoplectus acutus*	SCAC3
Verrucose seapurslane	*Sesuvium verrucosum*	SEVE2
Eastern annual saltmarsh aster	*Symphyotrichum subulatum*	SYSU5
Saltcedar	*Tamarix ramosissima*	TARA
Rough cocklebur	*Xanthium strumarium*	XAST

4.4 Avian Surveys

4.4.1 Introduction

To evaluate the effectiveness of the IP on bird usage in the BWMA, avian surveys were conducted in fall, winter, and spring that coincided with late 2023 and early 2024. Surveys noted species and behavior to better understand how the wetlands are being utilized and to guide future management activities. Analysis consisted of temporal and spatial trends relative to pre-LORP, LORP, and conditions associated with the IP.

4.4.2 Methodologies

Avian Surveys

The BWMA units/subunits were surveyed nine times between October 2023 and April 2024 to evaluate use by HIS. Three units were surveyed: Thibaut, Waggoner, and Winterton. Within the units there are four survey routes: East Winterton, South Winterton, Waggoner, and Thibaut. Surveys took place over 2 to 3 days, using 2 to 3 surveyors, and all surveys were done from the ground; as opposed to aerial flights.

Each survey was assigned to a specific "Seasonal Survey" period corresponding to the survey periods and the coding used for all prior avian data (Table 4-3). For example, under prior management, flooding of the units/subunits was all year round, and "Fall" surveys started the first week of August. Under the IP, water releases are not initiated until mid-September. As a result of this change, the "Fall 1" and "Fall 2" surveys are not conducted since these would occur prior to the initiation of releases each fall. The first survey conducted during the 2023-24 season, which was the third Flood Cycle (FC) under the IP, is equivalent to "Fall 3" under the previous management scheme.

Under the IP, eight seasonal surveys were scheduled; however, a total of nine have been conducted due to the addition of an early spring survey in mid-March. LADWP and County staff recommended adding the mid-March survey since water would be turned off to the units/subunits on March 1, and it was uncertain how long the water would remain in each unit. Surveys show that a considerable amount of water is still present as are birds.

Surveys were conducted as area counts with observers walking the edge of flooded areas in a manner that would allow a complete view of each subbasin within the unit/subunit being surveyed. Surveys began within 30 minutes of local sunrise and were generally completed within 4 to 5 hours. Avian numbers and activities were recorded for each subbasin.
During each survey, all bird species and number of individuals encountered were recorded. Creating and maintaining diverse natural habitats is an overarching objective of the LORP, and keeping track of all bird species and number of individuals during surveys helps in describing the overall bird diversity and use of the BWMA.

Analysis focuses on the BWMA HIS, which include: all waterfowl, wading birds, shorebirds, rails, Northern Harrier (*Circus hudsonius*), and Marsh Wren (*Cistothorus palustris*). The resident, migratory, and wintering Waterfowl Group includes all species in the Family Anatidae including geese, swans, and ducks. The Wading Birds Group includes species in the Family Ardeidae (egrets and herons), and Threskiornithidae (i.e., Whitefaced Ibis). The Shorebird Group includes all species in the Order Charadriiformes, exclusive of gulls and terns (Family Laridae). The MOU also identified Least Bittern (*Ixobrychus exilis*) (a wading bird) and Northern Harrier, both California Species of Special Concern, as HIS. The rail species expected to occur in the BWMA are Virginia Rail (*Rallus limicola*), Sora (*Porzana carolina*), and American Coot (*Fulica americana*). Marsh Wren is the only songbird species that is designated as a HIS. For all bird species encountered, behaviors were documented such as foraging, perching, calling, locomotion, flying over (not using habitat), and flushing. The location of HIS individuals was mapped in the field using *ArcGIS Field Maps* to document the spatial distribution of waterbirds within subbasins.

Table 4-3. Dates of the BWMA Seasonal Avian Surveys by Survey Route

Seasonal Survey	Survey Dates	East Winterton Subunit	South Winterton Subunit	Thibaut Unit	Waggoner Unit
Fall 3	September 26 -28, 2023	X	X	X	X
Fall 4	October 11-12, 2023	X	X	X	X
Fall 5	October 31-November 2, 2023	X	X	X	X
Winter 1	December 12-14, 2023	X	X	X	X
Winter 2	January 16-17, 2024	X	X	X	X
Spring 1	March 12-13, 2024	X	X	X	X
Spring 2	March 26-28, 2024	X	X	X	X
Spring 3	April 9-11, 2024	X	X	X	X
Spring 4	April 24-26, 2024	X	X	X	X

4.4.3 Data Summary

Species Composition
The total number of bird species and individuals (HIS and non-HIS) encountered over the nine surveys was summed for the entire BWMA and by unit/subunit surveyed. The BWMA HIS totals (number of species and individuals) were also calculated and compared across units/subunits. Individuals unidentified to species (e.g., unidentified dabbling duck, or unidentified swallow) were not included in the species count but were included in total individual counts.

Seasonal Patterns of Abundance
The number of HIS individuals were totaled for all units/subunits for each of the nine seasonal surveys to describe the seasonal use patterns of the BWMA.

Spatial Distribution
The spatial distribution of HIS was evaluated by looking at the percentage of HIS individuals observed in each subbasin and across the BWMA. For each subbasin, the total number of HIS individuals was divided by the total for each unit/subunit. For example, the total number of HIS individuals in the SW1 subbasin, of the Thibaut Unit, was divided by the total number of HIS individuals in the entirety of the Thibaut Unit. For the BWMA, percentage was calculated using the total number of HIS individuals per unit/subunit and dividing that by the total number of HIS individuals observed in the BWMA over the entire survey season. These two percentages demonstrate the value of each subbasin within each unit/subunit, and each unit/subunit within the BWMA.

Comparison to Previous Years
To allow comparison of data from previous years, all existing BWMA avian data were filtered by unit, subunit, and seasonal survey.

To compare data during the IP, surveys included in the analysis were those from the Waggoner Unit, Thibaut Unit, and Winterton Unit. The time periods corresponded to the seasonal surveys which are: Fall 3, Fall 4, Fall 5, Winter 1, Winter 2, Spring 1, Spring 2, Spring 3, and Spring 4.

To compare data from the IP (FC1 2021-22; FC2 2022-23; FC3 2023-24) to pre-LORP conditions (encompassing data from years 2002-03) and LORP (years 2009-17) is more complicated. As the spring seasonal surveys have typically started the last week of March, there are no prior mid-March (Spring 1) survey data in the BWMA, except for data from FC1. In addition, the East Winterton Subunit had not been flooded prior to implementing the IP, therefore there are no data prior to these flooding cycles. For this comparison, the average number of HIS was calculated per survey due to differences in the total number of surveys conducted in each period. The Spring 1 survey data were removed from the FC because there were no surveys conducted during that period prior to the IP.

It is important to note that the number of surveys within the Pre-Project and Pre-IP periods was variable and not as extensive as it is now.

4.4.4 Results

Table 4-4 shows the percentage of HIS individuals in each unit and across the BWMA. This value is used to demonstrate the importance of each subbasin within a unit as well as across the BWMA.

Table 4-4. Percentage of HIS Individuals in Each Unit/Subunit and BWMA

Unit/Subunit Name	Subbasin	Total HIS Individuals	Total HIS per Unit	% HIS in Unit	% HIS in BWMA
Thibaut	SW1	96		1	
Thibaut	SW2	1514		21	
Thibaut	TH10	2067		29	
Thibaut	TH11	228		3	
Thibaut	TH5	1440		20	
Thibaut	TH6	1463		20	
Thibaut	TH7	72		1	
Thibaut	TH8	221		3	
Thibaut	TH9	78		1	
			7179		38
East Winterton	W11	688		27	
East Winterton	W12	11		0	
East Winterton	W13	591		23	
East Winterton	W14	114		4	
East Winterton	W9	1148		45	
			2552		13
Waggoner	WAG1	118		1	
Waggoner	WAG2	2243		24	
Waggoner	WAG3	2633		28	
Waggoner	WAG4	2501		27	
Waggoner	WAG5	1001		11	
Waggoner	WAG6	264		3	
Waggoner	WAG7	605		6	
			9365		49
BWMA Total		19096			100

Waggoner Unit

The Waggoner Unit has a total of 7 subbasins (Figure 4-11) and had 49% of the total HIS observations throughout the BWMA (Table 4-4).

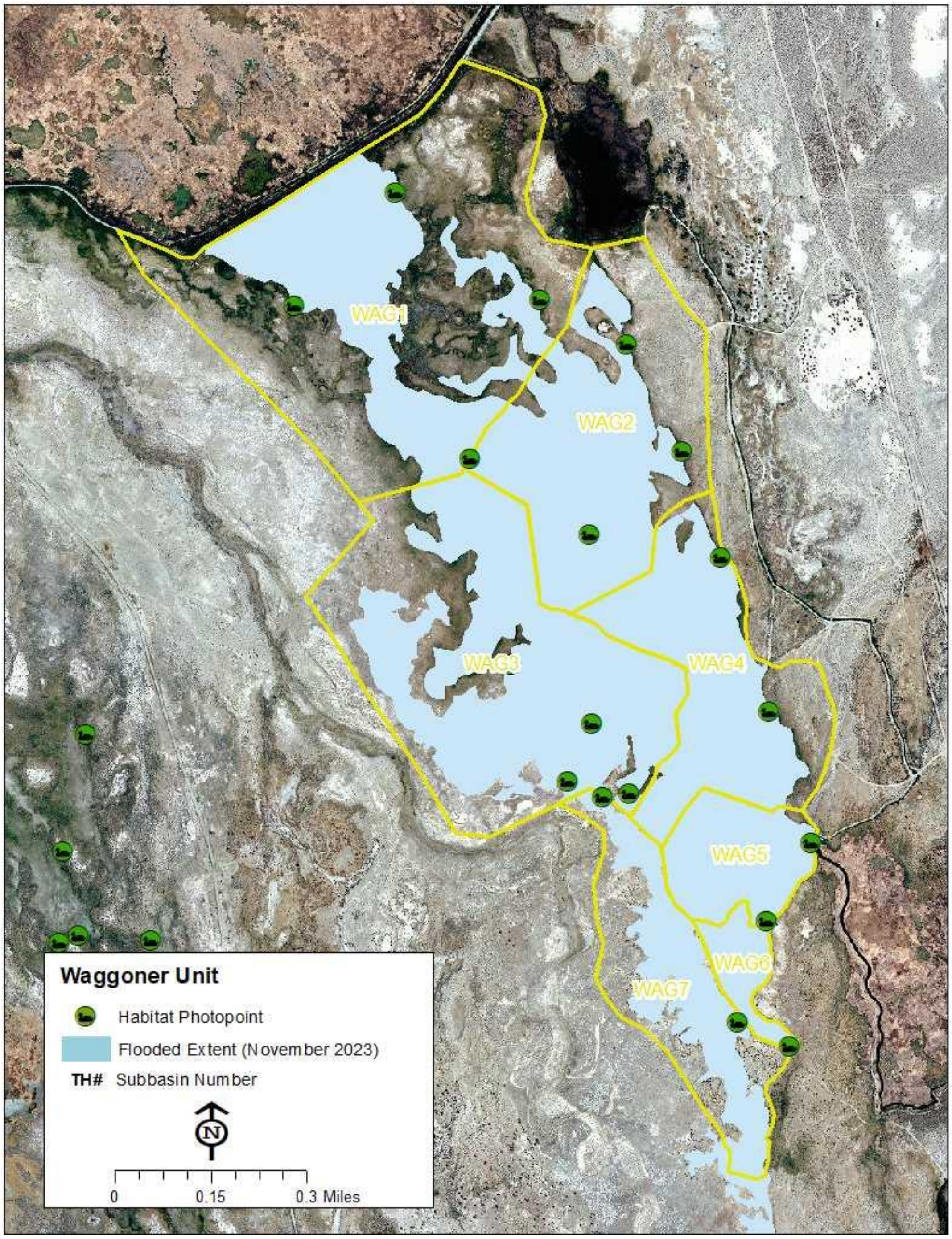


Figure 4-11. Waggoner Unit subbasins.

Thibaut Unit

The Thibaut Unit, which includes the South Winterton Subunit, has a total of 9 subbasins (Figure 4-12) and 38% of the HIS observations in the BWMA (Table 4-4).

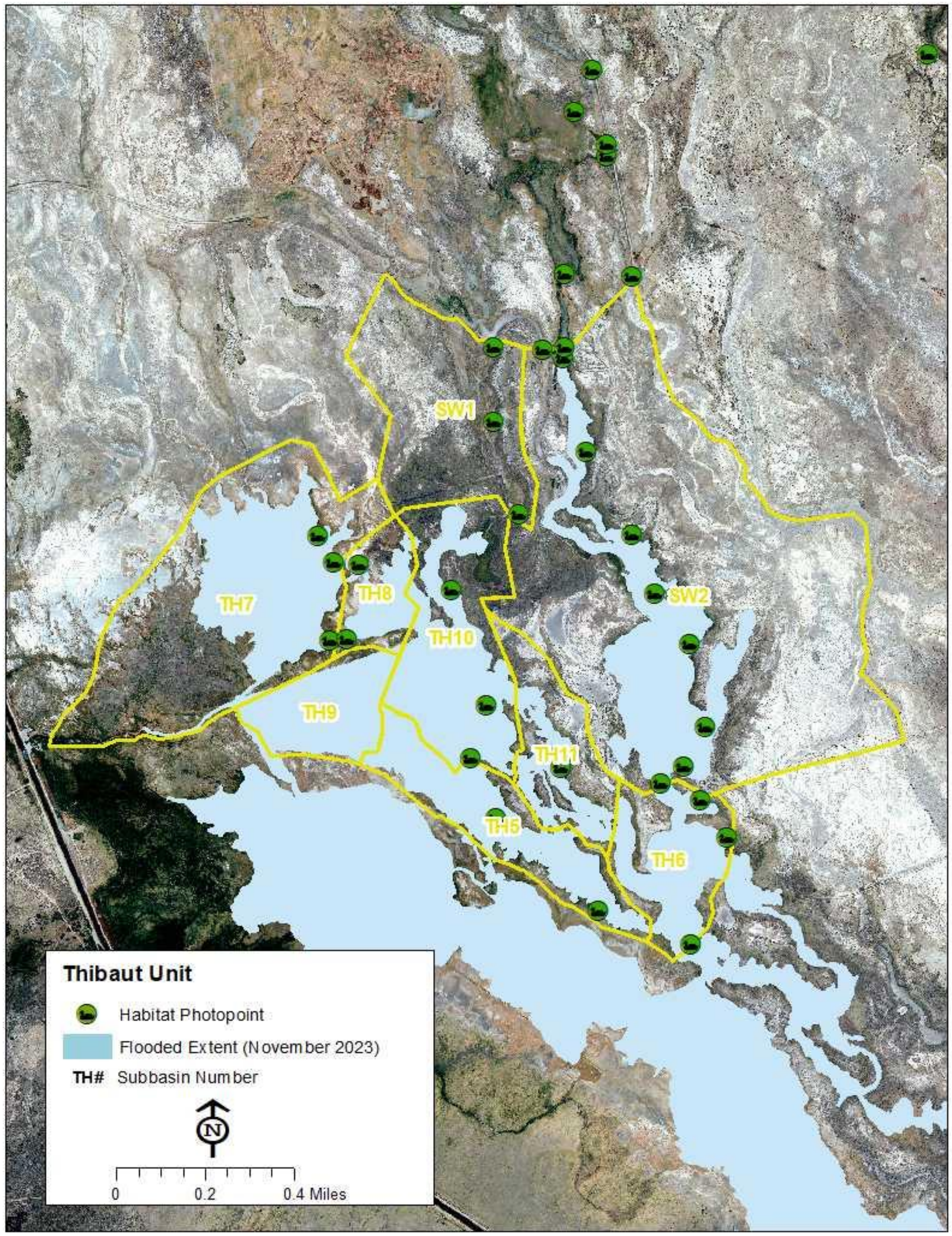


Figure 4-12. Thibaut Unit Subbasins.

East Winterton Subunit

The East Winterton subunit has 5 subbasins (Figure 4-13. and had 13% of the HIS observations in the BWMA (Table 4-4).

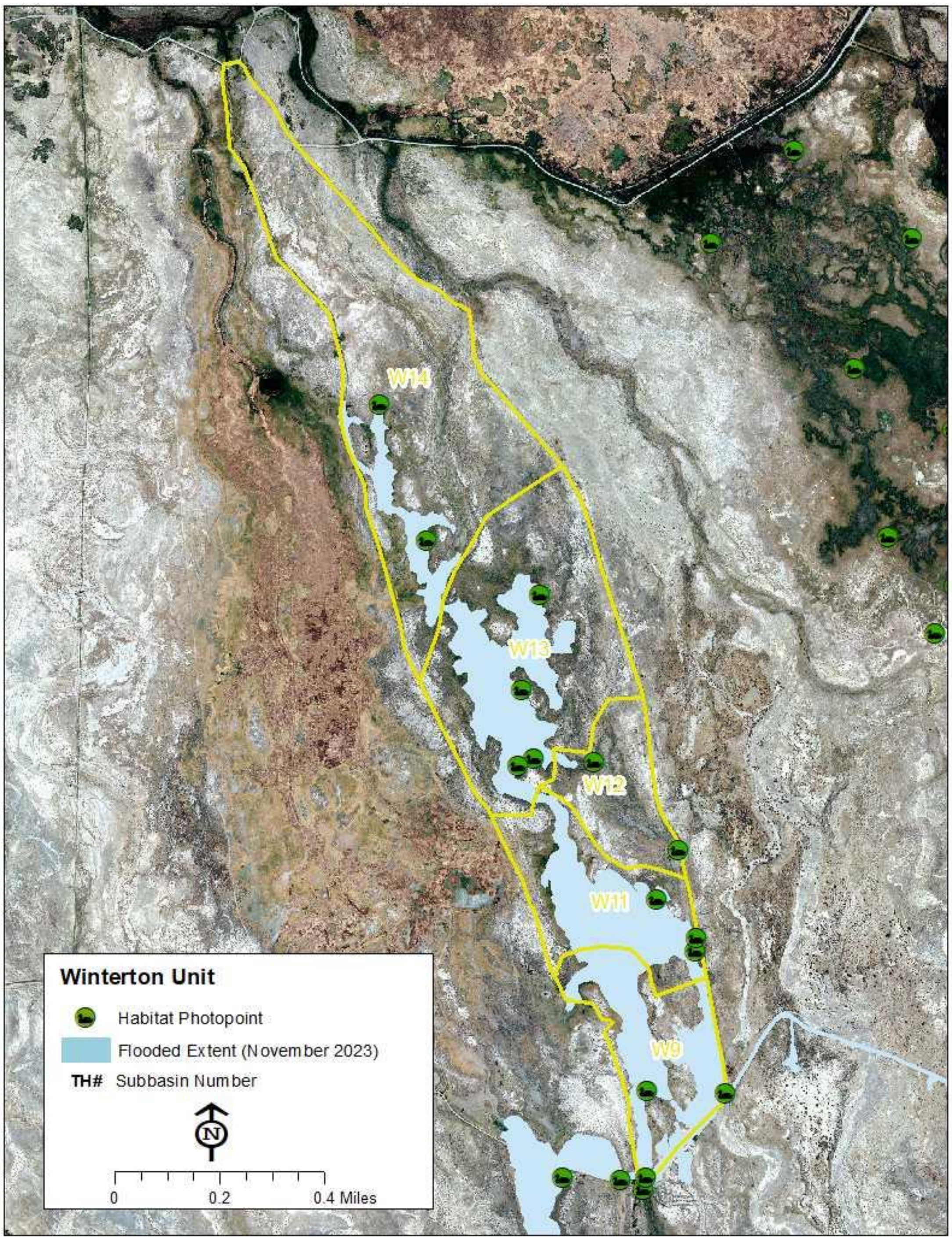


Figure 4-13. East Winterton subbasins.

General Habitat Conditions

Because of the above average precipitation and snowpack of 2023, the units/subunits were flooded for the entire spring and summer of 2023 continuing into FC3. Water releases into the BWMA ended March 1, 2024. The prolonged flooding resulted in a higher water table that prevented the drying of the units in 2024. The southern portion of the Thibaut Unit was the last to dry up, which was in the middle of June 2024.

BWMA Avian Species Composition

At total of 108 bird species and 28,543 individuals (HIS and non-HIS) were detected in the BWMA during FC3 (Table 4-5). The Thibaut and Waggoner Units had a similar number of species detected. The Winterton Unit had the lowest species richness (Table 4-5).

A total of 19,096 of individuals observed were HIS, comprising 67% of all birds (HIS and non-HIS) recorded (Table 4-6). The Waggoner Unit supported the highest number of HIS individuals (9,365) and the Winterton Unit the fewest (2,552). Waterfowl were the most abundant HIS Group. The total number of individuals in the Waterfowl Group represented 47% of all the HIS individuals observed. The number of individuals in the Rail Group represented 31% of all the HIS individuals observed (99% of rails were American Coot). The Wading Birds and Shorebirds Group together represented 21% of all HIS individuals encountered. The number of Northern Harrier and Marsh Wren together represented 1.2% of all the HIS individuals observed.

Table 4-5. Bird Species and Number by Unit/Subunit for FC3 (2023-24). HIS are in red text.

English Name	Scientific Name	Thibaut	Waggoner	Winterton	Total
American Avocet	*Recurvirostra americana*	30	23	15	68
American Bittern	*Botaurus lentiginosus*	6	3	3	12
American Coot	*Fulica americana*	1777	3239	815	5831
American Kestrel	*Falco sparverius*	2	2		4
American Pipit	*Anthus rubescens*	45	64	71	180
American Robin	*Turdus migratorius*		1		1
American White Pelican	*Pelecanus erythrorhynchos*	147	754	2	903
American Wigeon	*Mareca americana*	119	11	62	192
Barn Swallow	*Hirundo rustica*	201	637	30	868
Bell's Sparrow	*Artemisiospiza belli*	3			3
Belted Kingfisher	*Megaceryle alcyon*		2		2
Bewick's Wren	*Thryomanes bewickii*	2			2
Black Phoebe	*Sayornis nigricans*			1	1
Black-billed Magpie	*Pica hudsonia*		3		3
Black-crowned Night-Heron	*Nycticorax nycticorax*	167	86	2	255
Black-necked Stilt	*Himantopus mexicanus*	5	2	3	10
Blue-winged Teal	*Spatula discors*	6	63		69
Bonaparte's Gull	*Chroicocephalus philadelphia*	2			2
Brewer's Blackbird	*Euphagus cyanocephalus*	3	10	28	41
Brewer's Sparrow	*Spizella breweri*	13			13
Brown-headed Cowbird	*Molothrus ater*	1		45	46
Bufflehead	*Bucephala albeola*	30	298	68	396
Bushtit	*Psaltriparus minimus*		13		13
California Gull	*Larus californicus*	38		2	40
California Quail	*Callipepla californica*	35			35
Canada Goose	*Branta canadensis*	34	4	12	50
Canvasback	*Aythya valisineria*	3			3
Caspian Tern	*Hydroprogne caspia*	1			1
Chipping Sparrow	*Spizella passerina*	1			1
Cinnamon Teal	*Spatula cyanoptera*	653	396	103	1152
Clark's Grebe	*Aechmophorus clarkii*		1		1
Cliff Swallow	*Petrochelidon pyrrhonota*	12	93	4	109
Common Goldeneye	*Bucephala clangula*	1			1
Common Loon	*Gavia immer*		1		1
Common Merganser	*Mergus merganser*	22	1		23
Common Raven	*Corvus corax*	29	21	18	68
Common Yellowthroat	*Geothlypis trichas*	13	6		19
Cooper's Hawk	*Accipiter cooperii*		1		1

Table 4-5 (cont). Bird Species and Number by Unit/Subunit for FC3 (2023-24). HIS are in red text.

English Name	Scientific Name	Thibaut	Waggoner	Winterton	Total
Double-crested Cormorant	*Nannopterum auritum*	67	14	2	83
Eared Grebe	*Podiceps nigricollis*	6	17	3	26
Gadwall	*Mareca strepera*	533	541	88	1162
Great Blue Heron	*Ardea herodias*	82	62	12	156
Great Egret	*Ardea alba*	57	38	15	110
Greater White-fronted Goose	*Anser albifrons*		16		16
Greater Yellowlegs	*Tringa melanoleuca*	161	58	94	313
Great-tailed Grackle	*Quiscalus mexicanus*		11		11
Green-winged Teal	*Anas crecca*	1494	640	172	2306
Hooded Merganser	*Lophodytes cucullatus*	9	4		13
Horned Lark	*Eremophila alpestris*	15		1	16
Killdeer	*Charadrius vociferus*	69	10	7	86
Least Sandpiper	*Calidris minutilla*	104	8	42	154
LeConte's Thrasher	*Toxostoma lecontei*	2		1	3
Lesser Scaup	*Aythya affinis*	28	1	1	30
Lesser Yellowlegs	*Tringa flavipes*		5		5
Lincoln's Sparrow	*Melospiza lincolnii*	16	11	12	39
Loggerhead Shrike	*Lanius ludovicianus*	9	4	9	22
Long-billed Dowitcher	*Limnodromus scolopaceus*	43	342	112	497
Mallard	*Anas platyrhynchos*	433	555	191	1179
Marsh Wren	*Cistothorus palustris*	78	72	17	167
Merlin	*Falco columbarius*			1	1
Mourning Dove	*Zenaida macroura*		5	4	9
Northern Flicker	*Colaptes auratus*	1	6		7
Northern Harrier	*Circus hudsonius*	33	19	7	59
Northern Mockingbird	*Mimus polyglottos*	1	2		3
Northern Pintail	*Anas acuta*	18	19	17	54
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	5			5
Northern Shoveler	*Spatula clypeata*	128	974	15	1117
Orange-crowned Warbler	*Leiothlypis celata*	1			1
Osprey	*Pandion haliaetus*		10		10
Peregrine Falcon	*Falco peregrinus*	1	1		2
Pied-billed Grebe	*Podilymbus podiceps*	29	46	2	77
Prairie Falcon	*Falco mexicanus*	1			1
Red-breasted Nuthatch	*Sitta canadensis*		1		1
Redhead	*Aythya americana*	7	9		16
Red-necked Phalarope	*Phalaropus lobatus*			3	3
Red-winged Blackbird	*Agelaius phoeniceus*	1140	1909	950	3999
Ring-necked Duck	*Aythya collaris*	104	20		124
Ruddy Duck	*Oxyura jamaicensis*	102	632	81	815

Table 4-5 (cont). Bird Species and Number by Unit/Subunit for FC3 (2023-24). HIS are in red text.

English Name	Scientific Name	Thibaut	Waggoner	Winterton	Total
Sagebrush Sparrow	*Artemisiospiza nevadensis*	2			2
Savannah Sparrow	*Passerculus sandwichensis*	304	336	203	843
Say's Phoebe	*Sayornis saya*		1		1
Short-billed Dowitcher	*Limnodromus griseus*	6			6
Short-eared Owl	*Asio flammeus*	1			1
Snowy Egret	*Egretta thula*	13	37		50
Song Sparrow	*Melospiza melodia*	10	22	9	41
Sora	*Porzana carolina*		8		8
Spotted Sandpiper	*Actitis macularius*	1			1
Spotted Towhee	*Pipilo maculatus*	2		1	3
Tree Swallow	*Tachycineta bicolor*	16	276	71	363
Turkey Vulture	*Cathartes aura*		1		1
Unidentified Blackbird	*Icteridae (* gen,sp*)*	370		73	443
Unidentified Calidris sandpiper	*Calidris* sp.		12	11	23
Unidentified Dabbling Duck	*Anas* sp. Etc.	58	78	95	231
Unidentified Dowitcher	*Limnodromus* spp.		62		62
Unidentified Empidonax Flycatche	*Empidonax (* sp*)*		1		1
Unidentified Swallow	*Hirundidae (* gen, sp*)*	10			10
Vesper Sparrow	*Pooecetes gramineus*	5			5
Violet-green Swallow	*Tachycineta thalassina*	1	66	9	76
Virginia Rail	*Rallus limicola*	1	2		3
Western Grebe	*Aechmophorus occidentalis*	2	4		6
Western Meadowlark	*Sturnella neglecta*	157	156	109	422
Western Sandpiper	*Calidris mauri*	1	29		30
Whimbrel	*Numenius phaeopus*		1		1
White-crowned Sparrow	*Zonotrichia leucophrys*	91	54	50	195
White-faced Ibis	*Plegadis chihi*	760	979	488	2227
Wilson's Snipe	*Gallinago delicata*	3	6	1	10
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	144	144	3	291
Yellow-rumped Warbler	*Setophaga coronata*	19	49	1	69
Total Birds Recorded		**10155**	**14121**	**4267**	**28543**
Species Richness		**85**	**81**	**58**	**108**

The Waggoner Unit had the highest number of individuals in the Rail, Shorebirds, Wading Birds, and Waterfowl Groups during FC3 (Table 4-6). It had 18 of the 19 waterfowl species, with the highest number of individuals for three species: Bufflehead (298), Northern Shoveler (974), and Ruddy Duck (632). It also had the highest numbers of American Coot (3239), Long-billed Dowitcher (342), and White-faced Ibis (979).

The Thibaut Unit had the highest numbers of Cinnamon Teal (653) and Green-winged Teal (1494). It also had the highest number of Marsh Wren (78) and Northern Harrier (33) (Table 4-6).

The Winterton Unit had the lowest numbers of species and individuals, compared to the Waggoner and Thibaut Units (Table 4-6). It had the highest numbers of American Pipet (71), Brewer's Blackbird (28), and Brown-headed Cowbird (45) - all non-HIS species.

The most common Rail was American Coot (3,239), Shorebird was Long-billed Dowitcher (342), Wading Bird was White-faced Ibis (979), Waterfowl was Green-winged Teal (1,494). The highest number non-HIS species was Red-winged Blackbird (1,909) (Table 4-6).

The BWMA attracted an additional 63 non-HIS species, including large numbers of swallows, and migrating and overwintering blackbirds, sparrows and American White Pelican (Table 4-5).

Table 4-6. Bird Totals by Species Group and Unit/Subunit

Species Group	Thibaut	Waggoner	Winterton	BWMA Total
Marsh Wren	78	72	17	167
Northern Harrier	33	19	7	59
Rails	1778	3249	815	5842
Shorebirds	423	558	288	1269
Wading Birds	1085	1205	520	2810
Waterfowl	3782	4262	905	8949
Total HIS	**7179**	**9365**	**2552**	**19096**
Non HIS	2976	4756	1715	9447
Total All Bird Species	**10155**	**14121**	**4267**	**28543**

Seasonal Patterns of Abundance

HIS were observed using the BWMA throughout the flooding period (Figure 4-14). Northern Harrier and Marsh Wren were not included in the seasonal analysis because the IP is focused on creating and enhancing open water habitat and limiting the development of marsh, which is needed by these species. We will continue to report on these species and the BWMA will continue to provide habitat for them, but looking at their response to the adaptive management of the BWMA will not help us evaluate the success of the IP.

Overall, the trend in the number of HIS individuals varied by flood cycle (FC), as well as when the peak of HIS occurred in the BWMA. For FC1, the number of HIS individuals was relatively the same between Fall and Winter surveys, but then increased substantially in the Spring 1 survey, followed by a gradual decline over time. In FC1, the peak of HIS individuals was during the Spring 1 survey (4,099). For FC2, the number of HIS increased over the three fall surveys, then declined during the winter surveys. This was followed by an increase over the first three spring surveys, and then a decline by the spring 4 survey. In FC2, the peak was in Spring 3 (3,791), which is lower than the peak in FC1. For FC3, the peak was in the Fall 3 (3,099), followed by a decline in Fall 4

(879). There was an increase in Fall 5 (1,143) and Winter 1 (2,130) followed by a decline in Winter 2 (1,824). Spring 1 (2,945), Spring 2 (2,855), and Spring 3 (2,795) surveys saw relatively similar numbers followed by a decline in Spring 4 (1,200) (Figure 4-14).

Factors that might explain the trend seen in FC3 are the prolonged flooding and food availability. During FC3, there was a large amount of water across many different areas in the Owens Valley, including within the BWMA. This provided additional area for birds to reside, consequently spreading out individuals across the valley, reducing the concentration of individuals within the BWMA. Additionally, the BWMA was flooded through the summer, reducing the forage base generated during the previous summer. Without the planned water cycling suggested in the IP, including drying of the subunits/units, fall of FC3 is beginning to trend towards conditions observed before implementation of the IP when there was prolonged flooding through summer and into fall.

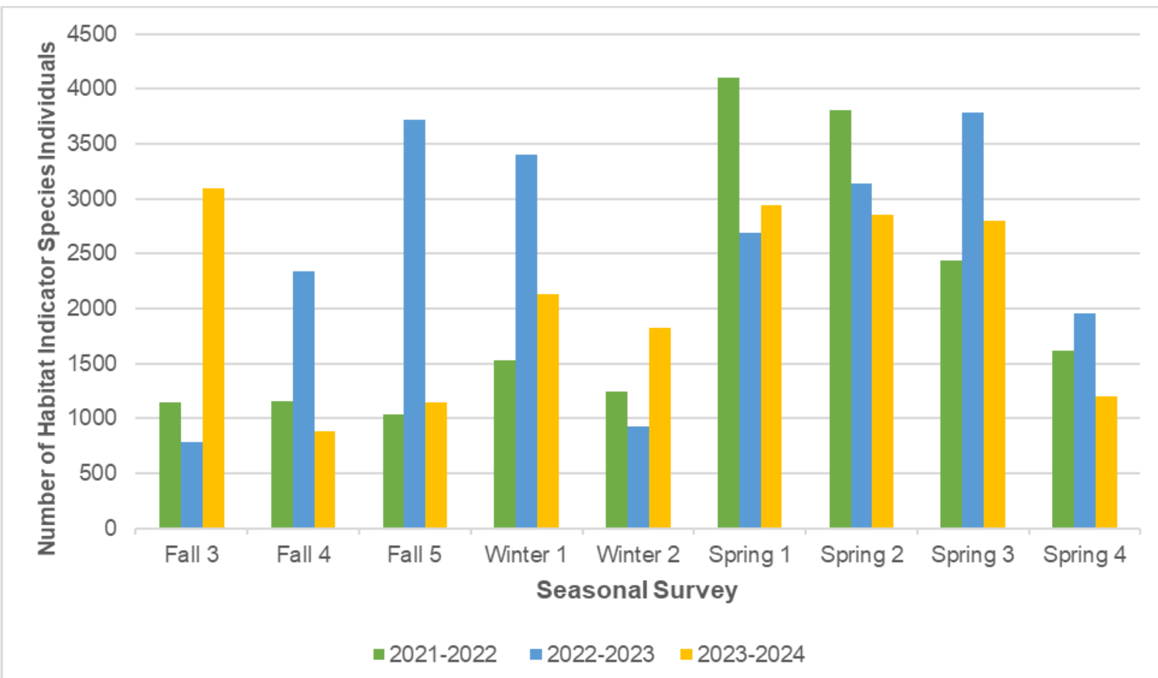


Figure 4-14. Seasonal Abundance of HIS for All Units/Subunits during FC1 (2021-22) and FC2 (2022-23) and FC3 (2023-24).

<u>Spatial Distribution</u>

Within each unit/subunit, individual subbasins varied in terms of their attractiveness (i.e., use) to waterbirds, and based on their size, the overall percentage of HIS individuals they supported (Figure 4-15). The Waggoner Unit consists of 6 managed subbasins. The WAG7 Subunit is surveyed but just receives overflow from the other subbasins.

During FC3, over 79% of HIS were observed in three subbasins within the Waggoner Unit: WAG2, WAG3, and WAG4.

The Thibaut Unit, which also consists of the South Winterton Subunit, contains four subbasins that made up 90% of the HIS observations during FC3: TH5, TH6, TH10, and SW2. The Winterton Unit, which consists of East Winterton, has been surveyed the last three years. East Winterton contains 5 subbasins: 14, 13, 12, 11, and 9. During FC3, Subbasin 9 made up 45% of the HIS observations (Figure 4-15.

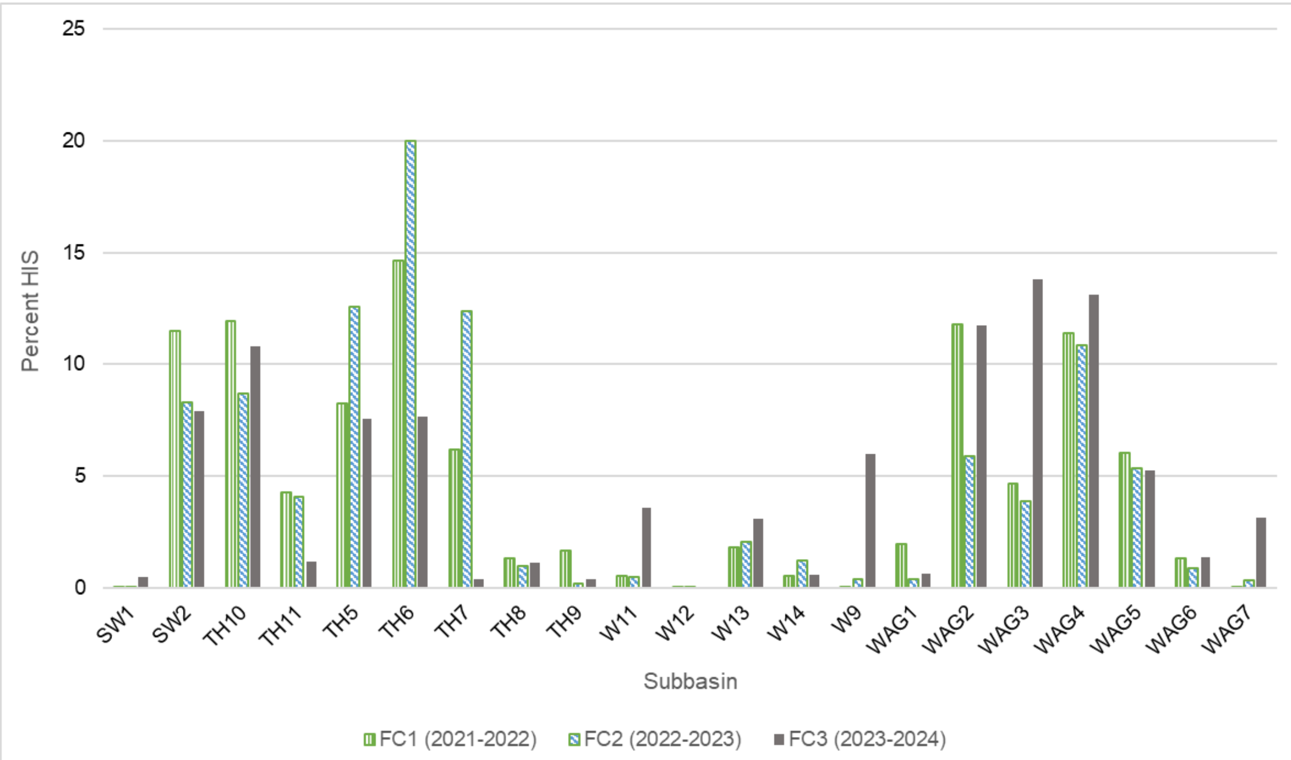


Figure 4-15. Percentage of HIS by subbasin.

<u>Comparison to Previous Years</u>

Overall, the average number of waterfowl, shorebirds, and rails observed per survey is higher during the IP versus pre LORP (i.e. pre-project) and pre-IP, with a few exceptions (Figure 4-16). For example, shorebirds, in FC2, the average number was down but there was not a drawdown of water, which may have limited habitat for that HIS. Wading birds only increased above pre-project and pre-IP levels in FC3. Marsh wren is higher in FC but lower than pre-IMP. This could be attributed to the amount of marsh habitat pre-IMP with year-round flooding. Looking at the FC, marsh has increased along with the average number of marsh wren. Northern harrier has always been low but are similar across all-time periods except FC2.

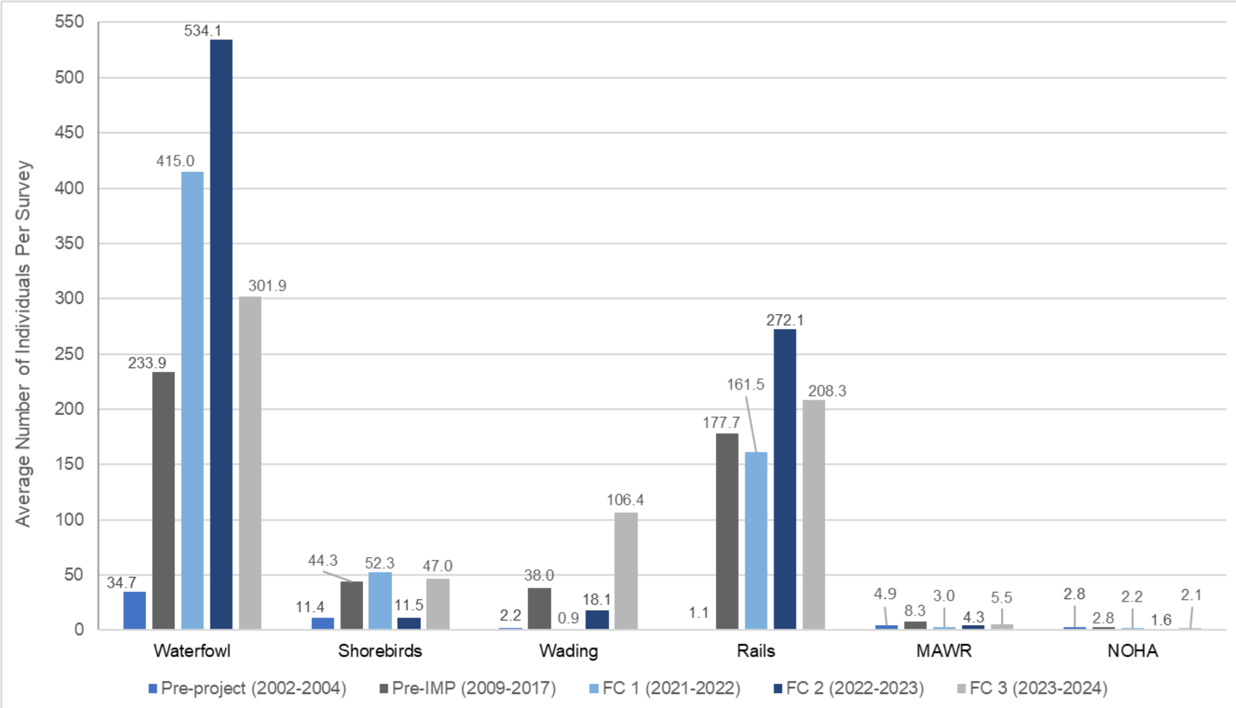


Figure 4-16. Average number of individuals in each HIS group per survey (MAWR = Marsh Wren, NOHA = Northern Harrier) for five time periods.

Comparison among the Last Three Flooding Cycles

Looking at the last three FC's (Figure 4-17), the average number of waterfowl dropped to its lowest level in FC3. The average number of shorebirds is similar between FC1 and FC3 and the average number of wading birds increased to its highest level in FC3. The average number of rails has remained high but was highest in FC2 followed by FC3. Finally, while always low, Marsh Wren were higher in FC3 and Northern Harrier were equal in FC1 and FC3. While the total number of birds observed in FC3 was lower than the previous two flooding cycles, FC3 had a slightly higher proportion of HIS overall (Figure 4-18).

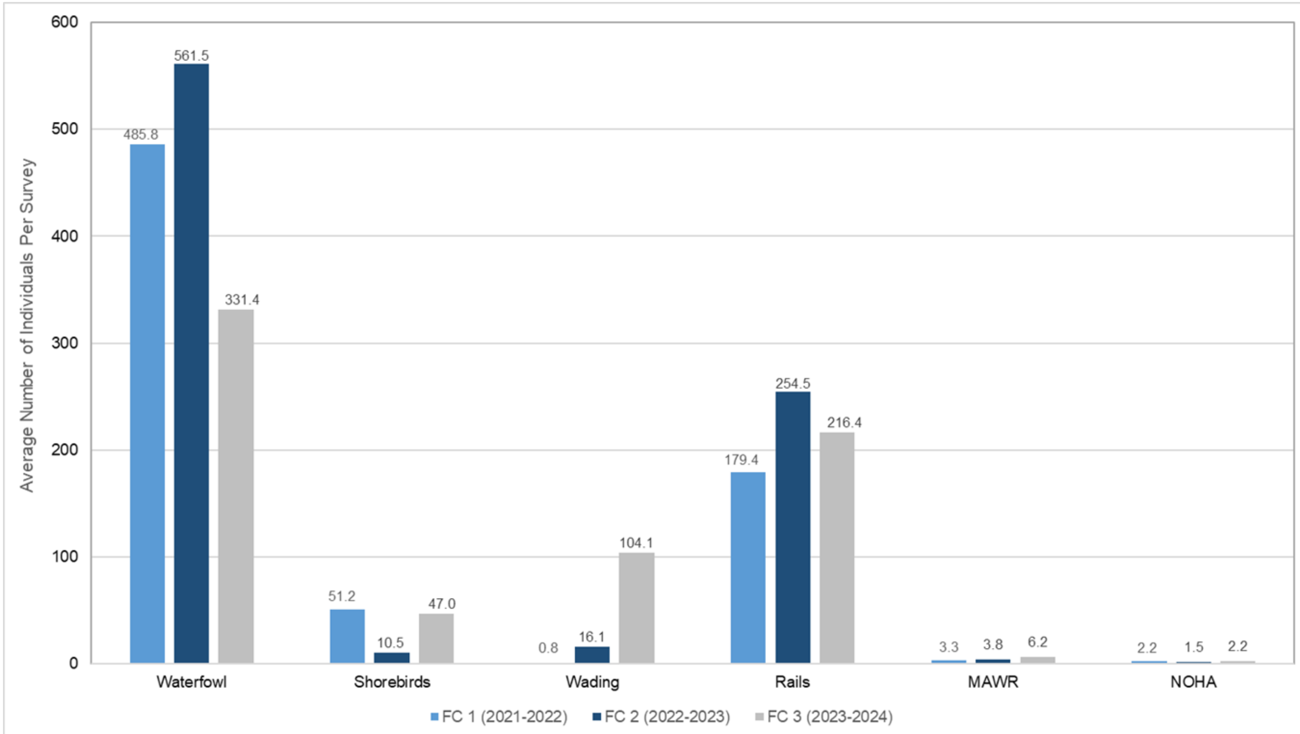


Figure 4-17. Average number of HIS individuals per FC1, FC2, and FC3.

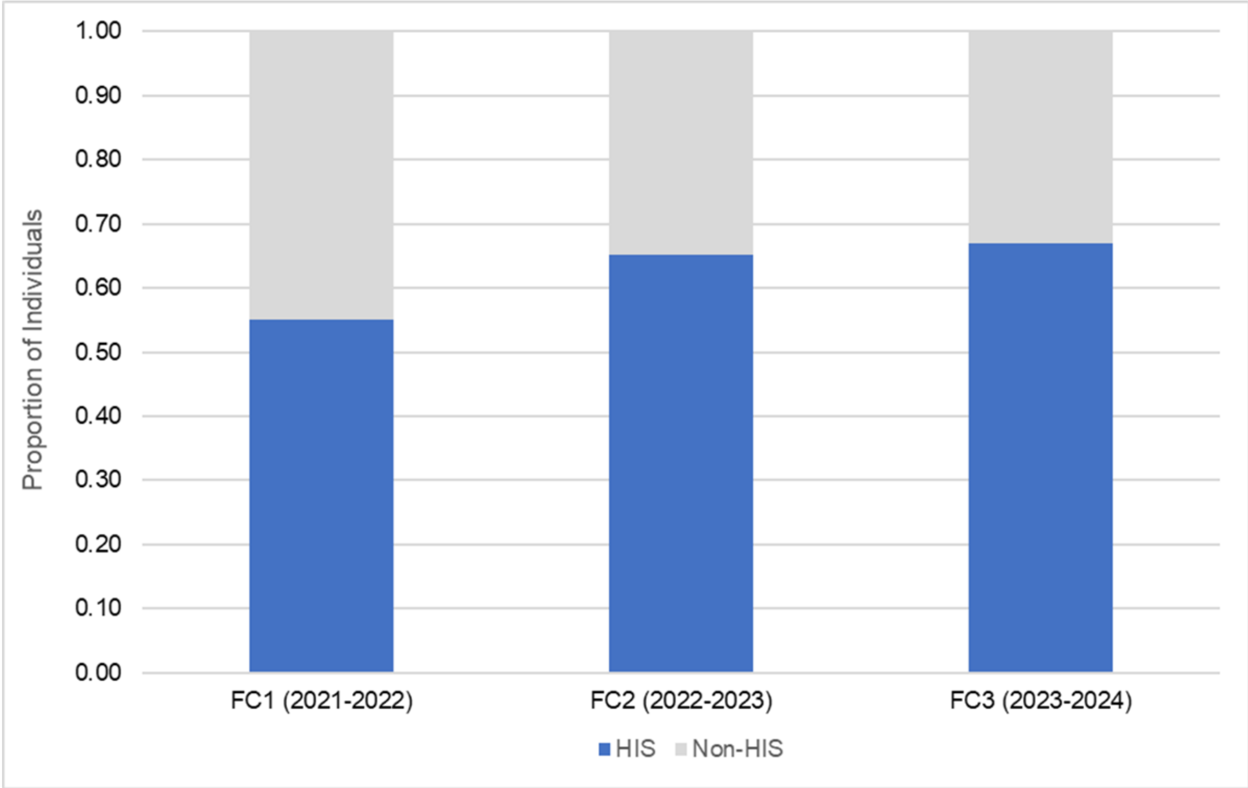


Figure 4-18. Proportion of individuals, HIS and non-HIS, for FC1, FC2, and FC3.

4.4.5 Discussion

Since implementation of the IP, there have been three FC's. The FC's have been effective at creating habitat and attracting HIS to the BWMA. During FC3, HIS were observed in the BWMA during each survey, and standing water remained in the subbasins through the end of spring migration. Subsquently, habitat was available fall, winter, and spring for migratory waterfowl, shorebirds, wading birds, and rails. During FC3, higher than normal spring runoff resulted in extensive flooding in the BWMA and reduced the forage base that was generated during the previous summer. Consequently, without the summer draw down and drying, the units are prone to the re-establishment of aquatic vegetation and the loss of open water habitat.

The Waterfowl and Rail HIS Groups have shown the best response to implementation of the IP compared to the prior management strategy of year-round flooding (Figure 4-16). Not only were the number of individuals in the Waterfowl and Rail HIS Groups higher, but their densities were much greater as compared to all previous years (Figure 4-17). The average number of individuals in the Shorebirds and Wading Birds HIS Groups has been more variable over time (Figure 4-16). In FC3, the average number of individuals in the Shorebirds HIS Group rebounded to FC1 levels and is above pre-IP levels. The Wading Birds HIS also rebounded to the highest level since implementation of the FC. The trends in the number of Marsh Wren and Northern Harrier have been more variable over time, and their numbers remain small compared to the other HIS Groups. This could be because the adaptive management strategy in the IP favors the creation of open water habitat while minimizing marsh habitat these two species depend upon.

4.4.6 Recommendations

We recommend continuing the avian survey program as implemented in FC1, FC2 and FC3, including the mid-March "Spring 1" survey that was added. During FC3, there was not a complete drawdown and reflood sequence. However, HIS appear to be responding positively within the BWMA during the IP versus pre-LORP (i.e. pre-project) and pre-IP. Continual monitoring will allow further understanding of the response of the HIS to adaptative management changes and the factors that influence abundance, timing, and spatial distribution

4.5 Tree Recruitment

4.5.1 Introduction

One of the purposes of the seasonal habitat flow is to *"…fulfill the wetting, seeding, and germination needs of riparian vegetation, particularly willow and cottonwood…*" (MOU, 1997), and thus develop and maintain riparian forest. The MOU also outlined one of the primary goals of the LORP as the enhancement of the riverine-riparian ecosystem to support habitat for avian indicator species, many of which have been documented as preferentially using the riparian forest vegetation type (LADWP and ICWD, 2022). The introduction of SHF's was expected to create conditions conducive to the recruitment of native riparian trees including black willow (*Salix gooddingii*), red willow (*Salix laevigata*), or Fremont cottonwood (*Populus fremontii*).

Three adaptive management actions were originally proposed in the 2020 LORP Annual Report (LADWP and ICWD, 2020) and subsequent 2020-21 LORP Workplan (LADWP and ICWD, 2021) to understand historic and current riparian tree recruitment within the project area. These actions included: *1)* characterizing conditions that allowed tree establishment under pre-project settings (prior to re-watering), *2)* identifying conditions that have permitted limited recruitment since project initiation (post re-watering), and *3)* ascertaining current biological processes that could limit tree germination or establishment. This report summarizes riparian tree recruitment assessment activities during the 2023-24 fiscal year on the LORP (ending on July 1, 2024).

4.5.2 Action Items

<u>Action Item 1: Historic Recruitment</u>

The first adaptive management recommendation, designed to understand historic or pre-project tree recruitment, was initiated during summer 2020 and continued in 2021 and 2022 with riparian vegetation (or Type D) transects located within LORP reaches 2, 3, 5, and 6. Riparian survey methods are described in detail in the 2020, 2021 and 2022 ICWD annual reports (*see:* Type D – Riparian Vegetation Monitoring Annual Status Report 2022, Appendix 1: Type D Monitoring Program and studies for the Long Term Water Agreement; ICWD 2020, 2021, 2022). Due to historic runoff and flooding in 2023, the only component of the Type D riparian monitoring project that occurred in summer 2023 was a continuation of tree coring for age estimates. Riparian monitoring and studies were continued in summer 2024 (into the 2024-25 fiscal year); a more comprehensive analysis will be presented in the 2025 or 2026 LORP Annual Report.

Action Item 2: Successful Recruitment Locations Post-implementation

The second adaptive management item recommended surveying successful tree recruitment locations post-LORP implementation. To understand the conditions that permitted riparian tree germination and establishment, a set of recruitment sites identified from the LORP Rapid Assessment Survey (RAS), which occurred 2008 – 2018, have been revisited. RAS recruitment sites, with surviving recruits, were sampled during three establishment periods: *i*) the initial project wet-up period from 2007-09, *ii*) high runoff years, and *iii*) low runoff years. During spring 2021-22, 35 sites were assessed using full survey techniques. At these locations several datasets were recorded along line-point transects including: *1)* the number of tree recruits (*Salix laevigata, Salix gooddingii,* & *Populus fremontii*) and their size (basal diameter and height), *2)* presence of co-occurring vegetation species, and *3)* ground substrate (e.g. bare soil, litter) (Figure 4-19). Local environmental conditions such as landform, tree topographic elevation relative to water surface, soil substrate, soil salinity, and patch size were also assessed (as identified in the LORP Work Plan 2020-21).

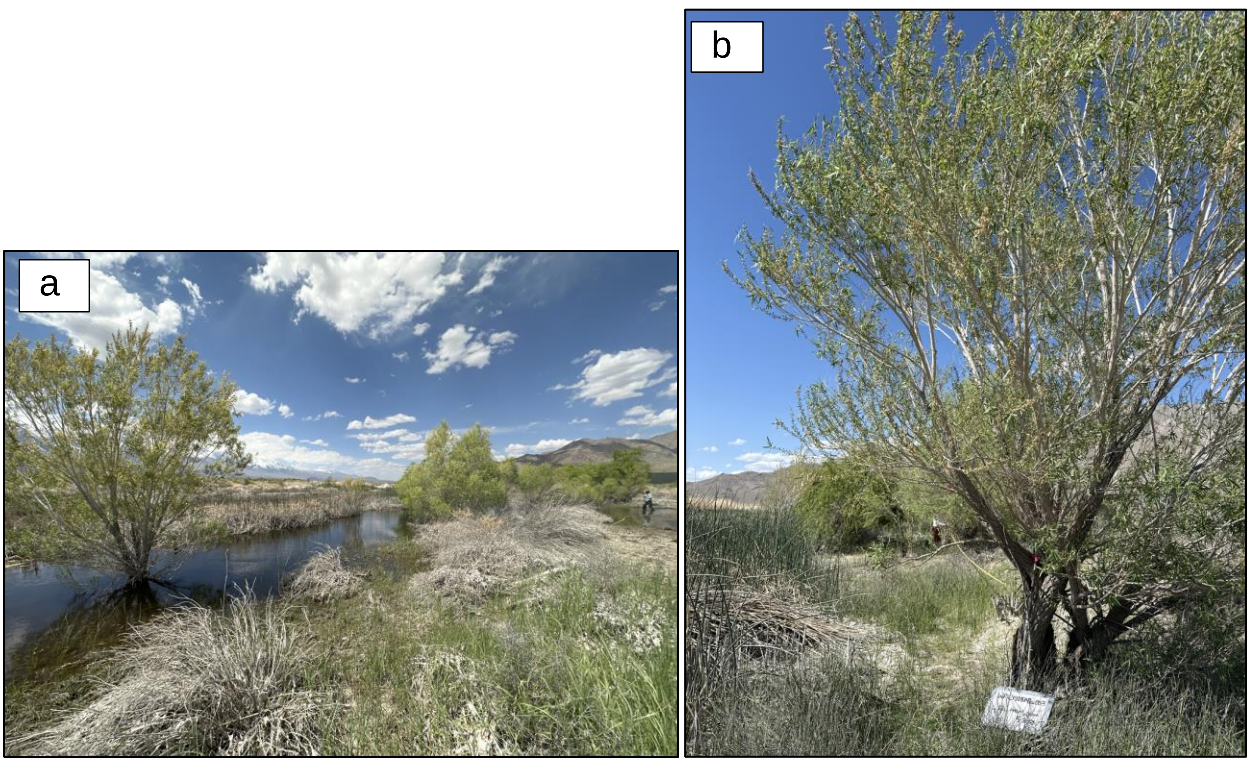


Figure 4-19. A woody recruitment site on the LORP identified during the RAS in 2014, and revisited *a)* in 2023 during high water, and *b)* in 2024 during vegetation sampling.

In spring 2024, the 16 RAS sites preliminarily sampled in 2023 were revisited to complete transect data collection due to inundation at the time of first visit. Two sites were added in 2024, for a total of 52 sites sampled between 2021 and 2024 (Figure 4-

20). It is expected that one more field season will be required to complete this dataset, which will include sampling RAS sites recorded during the initial project wet-up cycle from 2007-09, and from high and low runoff years.

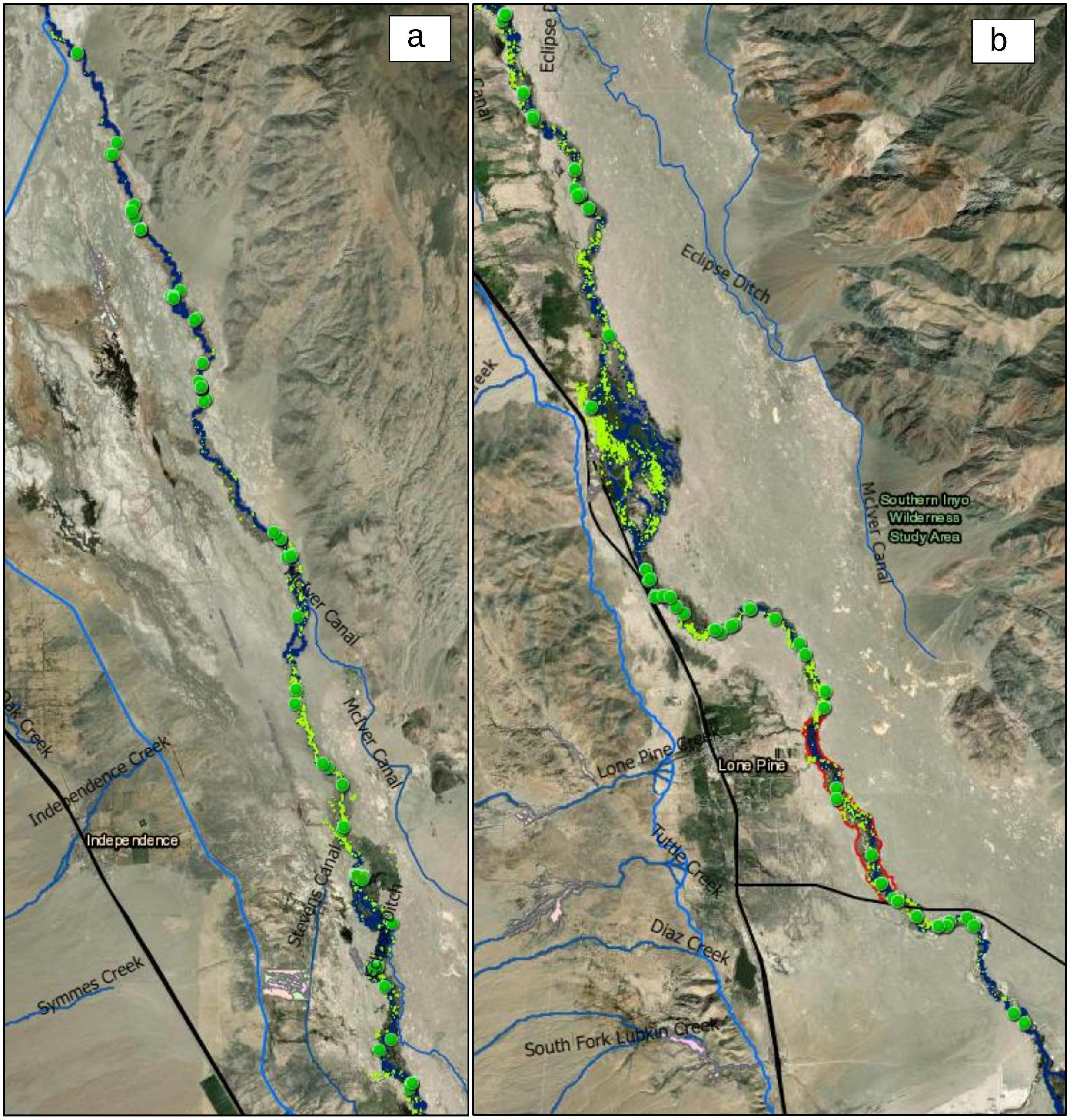


Figure 4-20. LORP tree recruitment locations (green dots) that have been revisited as part of the tree recruitment assessment. For reference, the Owens River is depicted in navy blue, and the Aqueduct and tributary creeks are shown in lighter shades of blue. Mature tree polygons are depicted in lime green. In a) the northern portion of the LORP from the intake to Manzanar Reward, and in b) the southern portion from Manzanar to the delta.

Action Item 3: Plant competition and Removals

Assessing the impact of plant competition on tree recruitment or survival was a final component of the tree recruitment assessment due to limited documented tree recruitment, particularly in the lower LORP reaches, 5 and 6. Riparian trees are disturbance adapted species and typically require mechanical disturbance or flood induced wetting of unvegetated, bare soils for successful establishment. However, such disturbance events or wetting of higher elevation floodplains, bare of vegetation, was not occurring regularly on the lower LORP reaches under MOU-prescribed SHF's. Neighboring plant species that established post implementation, under the paradigm of stable bank conditions, therefore could be crowding potential recruitment locations adjacent to the bank.

A second year above 100% of normal runoff resulted in a full SHF in 2024 of 200 cfs, allowing experimental vegetation removal. It was difficult to determine the best location to initiate removals because of the unpredictability of the gain in river stage and exact timing of peak flow; however, twelve removal sites were completed on LORP reaches 5 and 6. These reaches were chosen because little to no recruitment was recorded during the 20 years of the RAS, while greater recruitment was observed in the upper reaches (2 and 3). All vegetation was removed from a 1-m wide band 2-5 meters long and perpendicular to the channel (Figure 4-21); all removal sites were paired with a control plot.

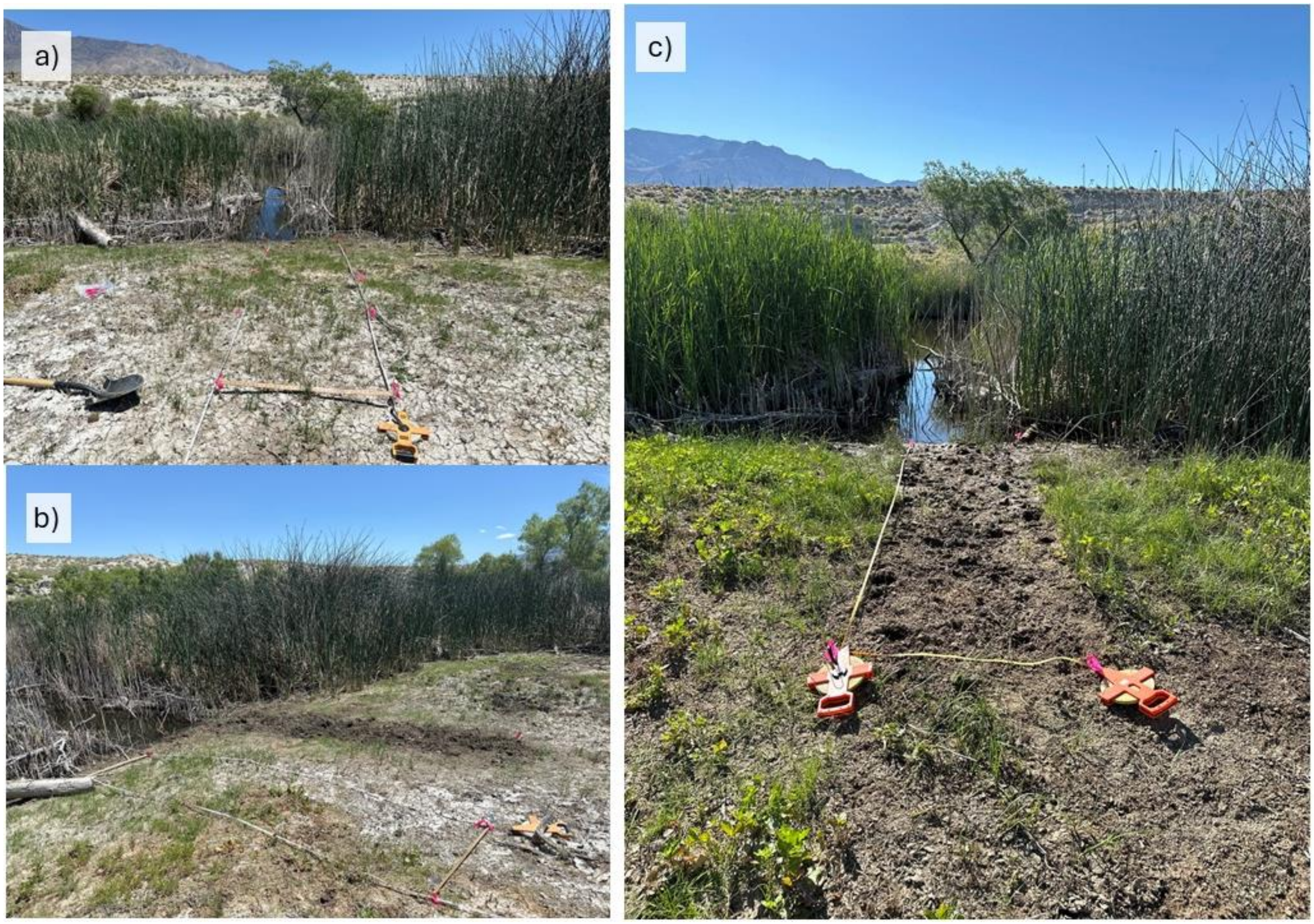


Figure 4-21. A plant removal site on the LORP in May-June 2024. Image *a)* depicts the site pre-removal, *b)* shows post-plant removal and the control plot, and *c)* depicts the site after high flows.

Unlike in 2023, this removal experiment did not yield any riparian tree seedlings on experimental or control plots. All sites were surveyed during the SHF, and the water line had risen laterally into the plot at 11 of 12 sites between 0.4 - 4.4 m (average 1.89 m). At only one site, the SHF did not cause a change in the river stage enough to wet either the removal or control plots. Given the plots were at least partially wetted during the SHF, the lack of recruitment could be due to the low habitat flow relative to the historic flows in 2023, or it could be due to other factors.

4.5.3 Future work

In spring 2025 we expect to continue environmental and biological assessments of known recruitment locations, and to possibly conduct a RAS in summer 2025 to evaluate tree recruitment that occurred in 2024, and was anecdotally recorded during the 2024 RAS (while surveying for 2023 tree recruitment). It is expected that a more thorough analysis of findings from riparian tree recruitment work will be presented in a subsequent (2025 or 2026) annual report as the field datasets are completed.

4.5.4 References

ICWD 2020. Type D - Riparian Vegetation Monitoring Annual Status Report 2020. County of Inyo, Independence, CA, 22 p https://www.inyowater.org/wp-content/uploads/2021/08/TypeD_AnnualReport_2020_08242021_FINAL.pdf

ICWD 2021. Type D - Riparian Vegetation Monitoring Annual Status Report 2021. County of Inyo, Independence, CA, 24 p https://www.inyowater.org/wp-content/uploads/2022/07/TypeD_AnnualReport_2021_Final.pdf

ICWD 2022. Type D - Riparian Vegetation Monitoring Annual Status Report 2022. County of Inyo, Independence, CA, 23 p https://www.inyowater.org/wp-content/uploads/2024/01/ICWD_TypeD_AnnualReport_2022-23.pdf

LADWP and County of Inyo. 2020. Lower Owens River Project 2020 Annual Report. Los Angeles Department of Water and Power, Bishop, CA & Inyo County Water Department, Independence, CA. 155 p https://www.inyowater.org/wp-content/uploads/2021/02/2020-FINAL-LORP-ANNUAL-REPORT-rev02.22.21.pdf

LADWP and County of Inyo. 2021. Lower Owens River Project Work Plan, Budget, and Schedule 2020-2021 Fiscal Year. Los Angeles Department of Water and Power, Bishop, CA & Inyo County Water Department, Independence, CA. 19 p https://www.inyowater.org/wp-content/uploads/2020/06/2020-21-LORP-Work-Plan-FINAL-FINAL-20200602-_IC_LA-2.pdf

LADWP and County of Inyo. 2022. Lower Owens River Project 2022 Annual Report. Los Angeles Department of Water and Power, Bishop, CA & Inyo County Water Department, Independence, CA. 867 p https://www.inyowater.org/wp-content/uploads/2023/09/2022-FINAL-LORP-ANNUAL-REPORT.pdf

Memorandum of Understanding (MOU). 1997. City of Los Angeles Department of Water and Power, the County of Inyo, the California Department of Fish and Game, the California State Lands Commission, the Sierra Club, and the Owens Valley Committee. 62 pp https://www.inyowater.org/documents/governing-documents/mou/

4.6 Noxious Weed Surveillance and Treatment

4.6.1 CAC Noxious Weed Treatment

The CAC treats weed infestations within the LORP project area in conjunction with the LADWP, and in coordination with the ICWD. Funds from all three agencies are used to support the effort. Target weeds for CAC management and control include California Department of Food and Agriculture (CDFA) designated noxious weeds with a significant focus on pepperweed (*Lepidium latifolium)*. Management of pepperweed is accomplished both by efforts to eradicate known weed populations within the large LORP area of more than 78,000 acres, as well as monitoring for pioneer populations.

Within the LORP, operations and maintenance activities, flooding, wildlife activity and cattle grazing, off road vehicles and other recreational uses all create disturbances and can carry and spread weeds. A significant source of weed contamination comes from outside the LORP boundary. The middle Owens River from the Pleasant Valley Dam to the LORP Intake contains large established populations of pepperweed that can be mobilized to contaminate the LOR and LORP area. To limit spread, CAC now treats areas of extensive pepperweed populations from Pleasant Valley to Warm Springs Road as grant funding permits, and LADWP is managing invasive weeds on city owned lands including along the Owens River from Warm Springs Road to the LORP intake. Protecting native habitat is the paramount goal of controlling weeds and maintaining a healthy native plant habitat that will support wildlife (including some threatened and endangered species), help reduce stream bank erosion, control dust, maintain healthy fire regimes, preserve the viability of open-space agriculture, and enhance recreational experiences.

2024 was a challenging year for invasive weed treatments within the LORP area. Following the record breaking 2022-23 winter snowpack and runoff, the 2023-24 snowpack and runoff was much lower. We saw similar impacts to this year in the years after the 2016-17 winter and runoff. With greater access to areas previously flooded in 2023, the 2024 treatments saw massive gains in pepperweed spread.

Treatments began in May, and visits to all previously known pepperweed sites were made as well as surveys of flooding areas from 2023. The lower water levels resulted in more of the project area being accessible and treatable. The total acreage treated within the project area was 17.8 acres. The treated acreage was the largest ever reported within the project area by nearly an acre. In 2021, 16.8 acres were treated. We expected these results following the flooding in 2023. Populations of pepperweed received a break from treatment during these high flow years that caused flooding due to limited treatments and spreading to previously un-infested areas. We expect to see similar or a slight increase in acreage next year before any significant decrease will be seen. Following the 2017 runoff we saw an explosion of pepperweed in 2018 (2019 was also a larger runoff year so those numbers were artificially skewed) – similar trends with runoff and large increases in treated areas were witnessed in both 2020 and 2021, with treated acres decreasing in 2022 following a decline in runoff, relative to previous years (Figure 4-22).

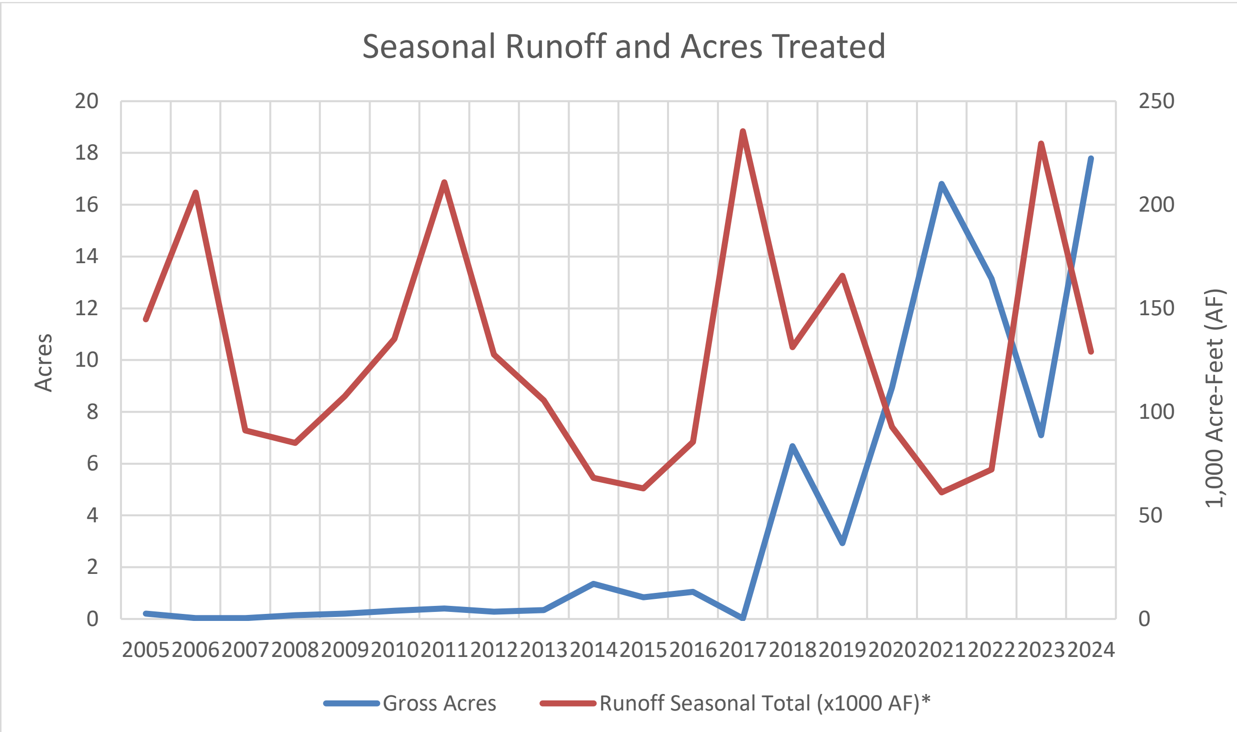


Figure 4-22. Annual acres of pepperweed treated in the LORP and Owen's Valley runoff from 2005 to 2024.

The most significant management difficulty continues to be maintaining adequate staffing for effective management of such a large site. Next season's activities should include more survey efforts since we expect to see similar, if not continued expansion in pepperweed populations.

4.6.2 LADWP Noxious Weed Treatment

Salt Cedar Treatment

Approximately 100 acres were canvassed for salt cedar (*Tamarisk sp*) treatment within the LORP in 2023-24 (Figure 4-23). During the 2023-24 season, salt cedar treatment efforts were focused on the Billy Lake site. Salt cedar at this site consisted of dense stands of various sizes from seedlings to mature trees with 10-inch diameter trunks. This required higher intensity mowing and sawing per unit area, which resulted in numerous piles of salt cedar slash having to be moved to appropriate locations for subsequent burning.

The 2023-24 control efforts consisted of cut stump treatment of larger diameter trees using a skid steer mounted turbo saw attachment, mowing of smaller diameter trees including saplings and seedlings, and hand cutting using chainsaws and pruners. *Garlon 4-Ultra* herbicide was applied to cut stumps using the turbo saw attachment, spray equipment mounted on side-by-side utility vehicles, and backpack sprayers.

A skid steer mounted grapple rake attachment was utilized to gather and consolidate substantial volumes of slash into piles for burning. Piles measuring approximately 10 ft. in diameter and 6 ft. tall were stacked in locations to be burned by CalFire.

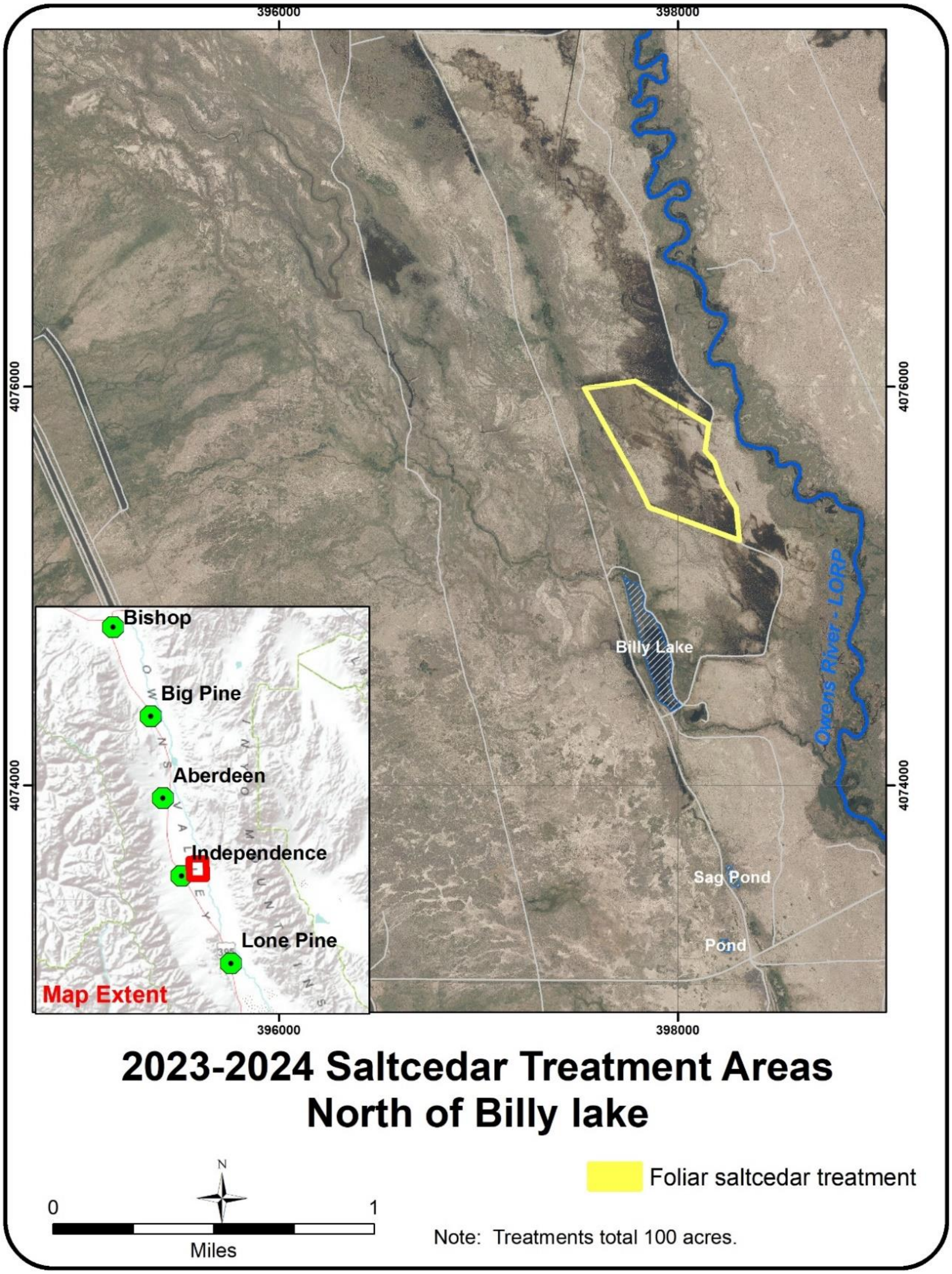


Figure 4-23. Saltcedar Treatment Area for 2023-24.

Pepperweed Treatment

No weed treatment occurred within the LORP during RY April 1, 2023, through March 31, 2024. Weed treatment after the historic RY of 2023 resumed in April of 2024 and will be reported in the 2025 Annual report.