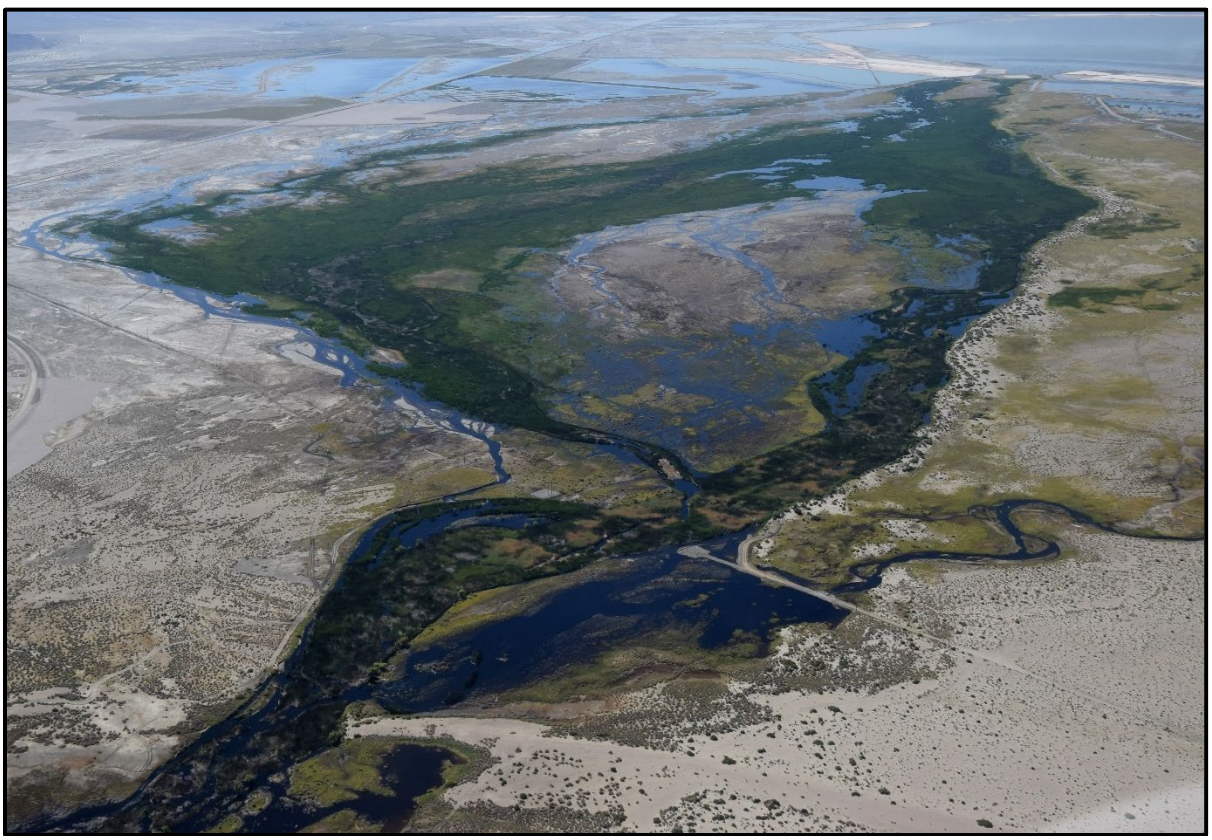
Lower Owens River Project
2023 Annual Report



March 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
CADFW	California Department of Fish and Wildlife (formerly California Department of Fish and Game)
CDFA	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
FC1	Flood cycle 1
FC2	Flood cycle 2
HIS	Habitat Indicator Species
ICWD	Inyo County Water Department
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.
NIR	Near-Infra-Red wavelengths used for remote sensing analysis
OVC	Owens Valley Committee
OVMAP	Owens Valley Mosquito Abatement Program
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.

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EXECUTIVE SUMMARY

The 2023 Lower Owens River Project (LORP) Annual Report contains the results from the sixteenth year of monitoring along the river. Results contained in this report include hydrologic monitoring, water quality monitoring, adaptative management and associated monitoring, and observations from Owens Valley Mosquito Abatement (OVMAP).

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 EIR goals. For the 2022-23 WY, LADWP was compliant with all the 2007 Stipulation & Order flow and reporting requirements. The mean flow to the Delta Habitat Area (DHA) was 141 cubic-feet-per-second (cfs). Implementation of the Interim Blackrock Waterfowl Management Area (BWMA) Plan continued. The Owens River Basin Runoff Forecast for the 2022-23 RY was 233% of normal, which, according to the 2004 EIR, calls for a 14-day Seasonal Habitat Flow (SHF) with a peak release of 200 cfs. As flows in the LORP were projected to be in excess of 200 cfs from late May through early August 2023, no SHF was scheduled in 2023. 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 that ranged from the Aqueduct Intake to the Pumpback station. Monitoring occurred from March to October 2023 and focused primarily on dissolved oxygen levels because of their critical importance to the fishery. Additional parameters monitored were water temperature, specific conductivity, and pH. Temporal trends showed dissolved oxygen levels dropping to their lowest values in late May, which was the onset of peak snowmelt runoff. Dissolved oxygen levels recovered at all sites as the summer progressed, except for the Reinhackle Springs site, which was depressed for the majority of this period. Relatedly, starting at the Intake, dissolved oxygen concentrations declined in a downstream fashion to Reinhackle Springs and then concentrations increased downstream. In terms of the other water quality parameters, water temperatures increased at all sites as the summer progressed and inversely, conductivity declined with time. There was minimal variability in pH at all sites for the monitoring period. Lastly, there were no observed fish kills associated with depressed dissolved oxygen levels along the LOR.

2023 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. During the 2022-2023 fiscal year, 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.

DHA Interim Flow Regime and Related Monitoring

Monitoring related to the adherence and effectiveness of the interim flows to the DHA was conducted for the 2022-23 RY and supports that the flows were effective at inducing hydrologic stress on emergent vegetation and flooding permanent and seasonal ponds. Additionally, large storm events in the latter portion of the RY resulted in sustained high flows to the DHA, which continued through the summer of 2023. The impact of these high flows on the DHA will be reported in the 2024 annual report as the water recedes and monitoring can occur. Lastly, recommendations are provided for potential vegetation management activities and additional monitoring to improve our understanding of how the DHA is responding to the interim flows and large-scale flood events.

BWMA Interim Management and Monitoring Plan

Implementation of the BWMA Interim Plan continued with the seasonal flooding in Flooding Cycle 2 (FC2). The seasonal flooding regime requires sustained flooding from fall through mid-spring, and a complete dry down during late spring, with a goal of a fixed 500 flooded acres of the BWMA. Habitat was available fall, winter, and spring for migratory waterfowl, shorebirds, wading birds and rails. Increases in the average number of birds per survey were observed for all indicator species groups except shorebirds and wading birds. The waterfowl and rail groups saw the best response and most increase in numbers as compared to the prior management strategy of year-round flooding. The average number of shorebird and wading birds has been more variable over time. The average number of shorebirds across all survey units was almost as low as pre-project conditions. The average number of wading birds across all survey units was highest in FC2, but at its lowest in Flood Cycle 1 (FC1). The trends in Marsh Wren and Northern Harrier have been more variable, and their numbers remain small compared to the other HIS Groups. The spring drawdown and summer drying maintained open water habitat from FC1 to FC2 and facilitated a robust and diverse growth of vegetation in the subbasins. However, above normal runoff and high precipitation conditions in the spring and summer of 2023 prevented the units from being dried out, leaving the units saturated instead of dry ahead of year 3 of the BWMA Interim Plan, scheduled for the 2023-24 WY. Anticipating the persistence of the above normal runoff and high precipitation conditions would compromise year 3 of the BWMA Interim Plan, LADWP, ICWD and the MOU parties will discuss modifying the schedule of the Interim Plan come the summer of 2024.

BWMA – Remote Sensing

Currently to ensure compliance with the 500-acre flooded extent of the BWMA, the entire wetted perimeter is mapped on foot, in both the fall and the spring. To replace these arduous and time-consuming field surveys, the effectiveness of using satellite images to map the flooded area of BWMA was evaluated. In particular, the use of near-infra-red (NIR) bands can differentiate between vegetation and water because of the distinct reflective values these features exhibit. Initial findings indicate the method is highly accurate in settings where there is a discrete topographic break between water and vegetation. However, in areas where shallow water is interspersed with vegetation the method is limited. Future work will focus on refining the methods in these problematic areas.

Tree Recruitment

To understand mechanisms that have permitted past and current riparian tree recruitment within the LORP riparian area, several adaptive management actions were proposed. Work to date includes fieldwork aimed at understanding topographic, hydrologic, edaphic, and biological conditions that allowed tree establishment both prior to and post project initiation, focused on identifying current processes that could limit tree germination or establishment. Removal experiments were trialed in 2023 and resulted in preliminary success; tree recruitment was observed at experimental sites.

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

Inyo and Mono Counties Agricultural Commissioner's Office (CAC) treated and documented pepperweed (*Lepidium latifolium*) populations along the LORP in 2023. However, flooded conditions along the river and staff shortages limited extensive treatment and mapping. It is anticipated that pepperweed populations will expand following the 2023 historic high flows, and increased surveillance and treatment will be required next year and beyond.

LADWP - Noxious Species Surveillance and Treatment

LADWP surveilled and treated salt cedar (*Tamarix spp*.) populations in the BWMA. Treatment focused on both previously treated and untreated populations. LADWP did not treat pepperweed in the LORP in 2023 due to flooded conditions and because of limited staff availability as LADWP addressed emergency runoff conditions.

Mosquito Abatement

The OVMAP performed surveillance and control of mosquito populations in the LORP from April through October 2023. The increase in flooding had the diametric effect of increasing mosquito population numbers, while limiting treatment access. Limited staffing of OVMAP also compounded the reduction in treatment.

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 Lower Owens River, 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 data, analysis, and recommendations for the LORP based on data collected during 2023. 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 data, the results of analyses, and recommendations for any 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 summaries of water quality monitoring and mosquito abatement activities that occurred in 2023. Although not required, these summaries are provided as additional information that could be of interest to project stakeholders.

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 ICWD, and Section 5.0 was authored by OVMAP.

The annual report will be available to download from the LADWP website link: http://www.ladwp.com/LORP.

This document fulfills the reporting requirements for the LORP Annual Report for 2023.

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 2022 through September 2023, for the four in-river stations (see Hydrologic Appendix 2).

2.1.1 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 About Us → Los Angeles Aqueduct → LA Aqueduct Conditions Reports → LORP Flow Reports and click on the 'List of LORP Flow Reports' link to access a list of PDFs summarizing the most current daily reports.

Monthly reports summarizing each month and listing all of the raw data for the month are posted to the Web at <http://www.ladwp.com> under About Us → Los Angeles Aqueduct → LA 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 About Us → Los Angeles Aqueduct → LA

Aqueduct Conditions Reports → Real Time Data and click on the 'Lower Owens River Project' link.

2.2 Measurement Issues

LORP in-river flows are measured using *Sontek* SW acoustic flow meters. Both of the *Sontek* SW meters located in the main channel of the LORP are mounted on the bottom of concrete sections. These devices are highly accurate, and final records for the LORP generally fall within normal water measurement standards of +/- 5%.

The *Sontek* meters' measurement accuracy is affected by factors that influence river stage and flow velocity, including vegetation growth and sediment build up. In order to account for these environmental changes, LADWP manually meters flows at all of the stations along the LORP 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 take into account 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 of the meters on the LORP are calibrated at least once per month following the 2007 Stipulation & Order.

A commentary on each station along the LORP 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 very good accuracy and reliability as long as the gate does not become submerged (submergence may be possible at higher flows such as when the seasonal habitat flows are released). Because of this infrequent submergence of the Langemann Gate, a *WaterLOG* H-450XL (bubbler) was installed as a backup to measure flow and is not affected by the high seasonal habitat releases. After a few years of attempting to apply a rating curve to the level measured by the bubbler, it has been determined that the large fluctuations in stage as conditions in the river channel go through seasonal cycles are too large and unpredictable to sustain an accurate measurement using the bubbler. As such, the bubbler has been abandoned, and LADWP will no longer use the bubbler as a backup device to measure flow at the Intake.

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.

Due to record high Owens River Basin Runoff conditions, flows in the LORP at times exceeded the measurement capacity of the LORP stations during the 2022-23 RY. In order to accurately measure the high flows, LADWP conducted daily current meterings of flows at the stations. Results of the daily current meterings were recorded as the 24-hour average flow for each respective station.

2.3 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, the 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

Due to record high Owens River Basin Runoff conditions, flows released to the Delta exceeded flows specified in the interim schedule. The releases for the 2022-23 WY resulted in a daily average flow of 141 cfs to the Delta.

Examples of unintended flows are when rainstorms cause river flows to exceed the maximum allowed flowrate of the Pumpback Station or when pump outages occur at the Pumpback Station. Flows over the weir are generally unintended flows and flows over the Langemann Gate are scheduled flows.

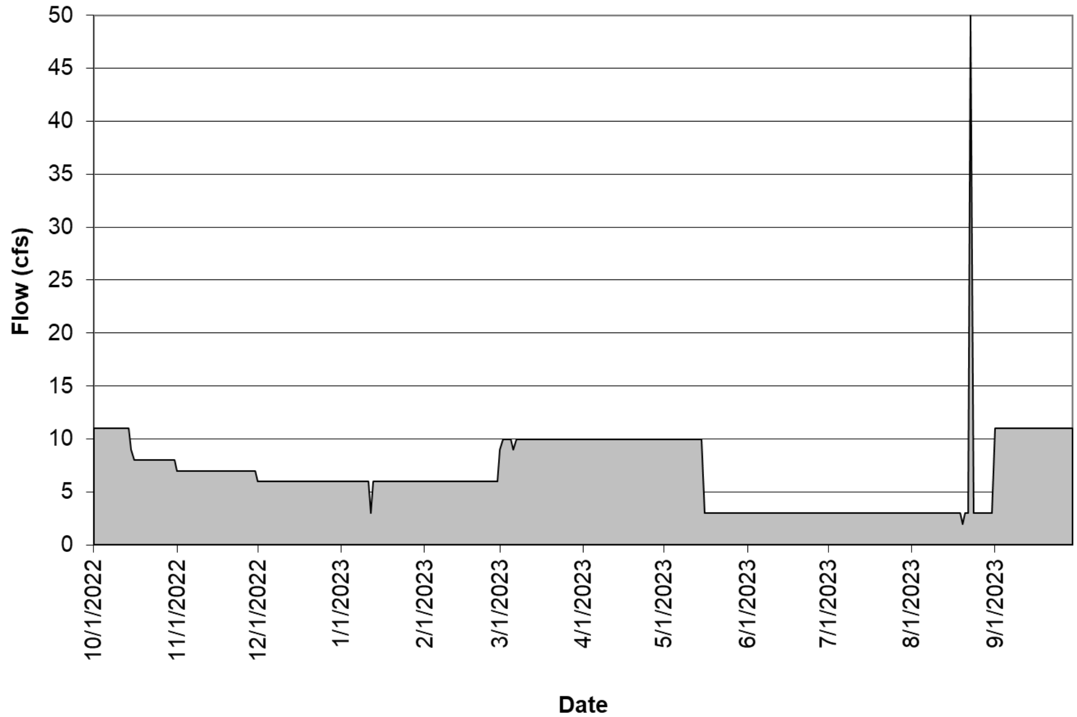


Figure 2-1. Langemann Release to Delta.

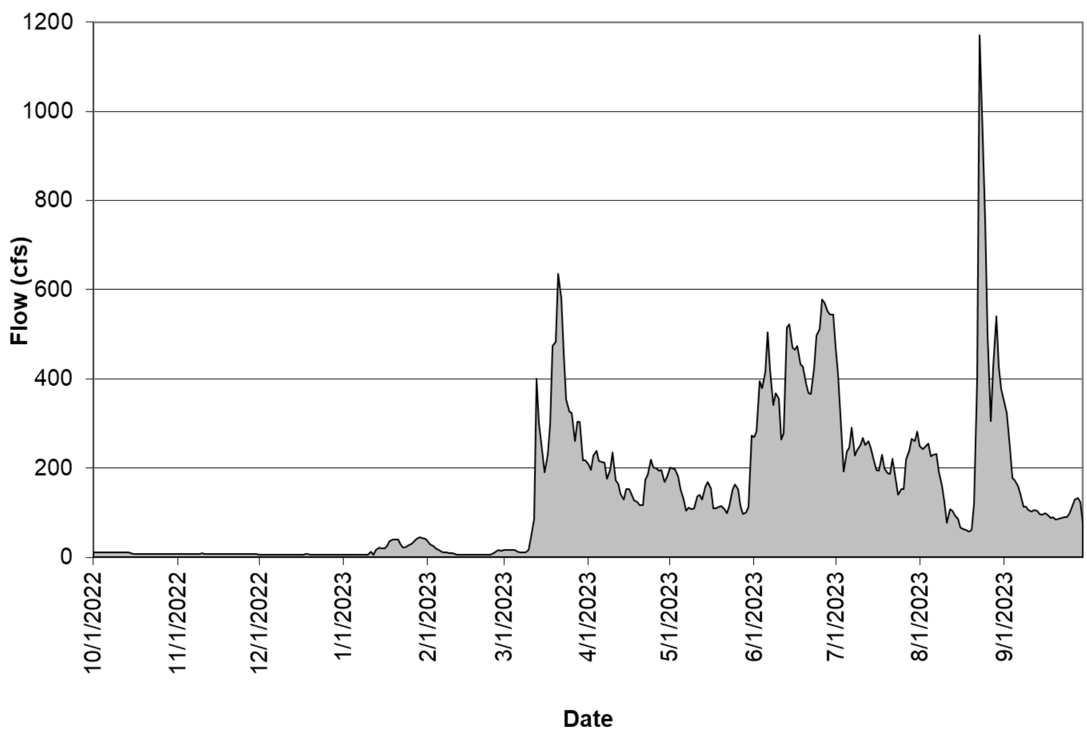


Figure 2-2. Langemann and Weir Release to Delta.

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 1.86 and 4.04 feet stage height for the 2022-23 WY (Figure 2-3). Above normal runoff and high precipitation conditions caused Upper and Lower Twin Lakes to exceed staff gauge levels of 3.0 feet at times during 2023.

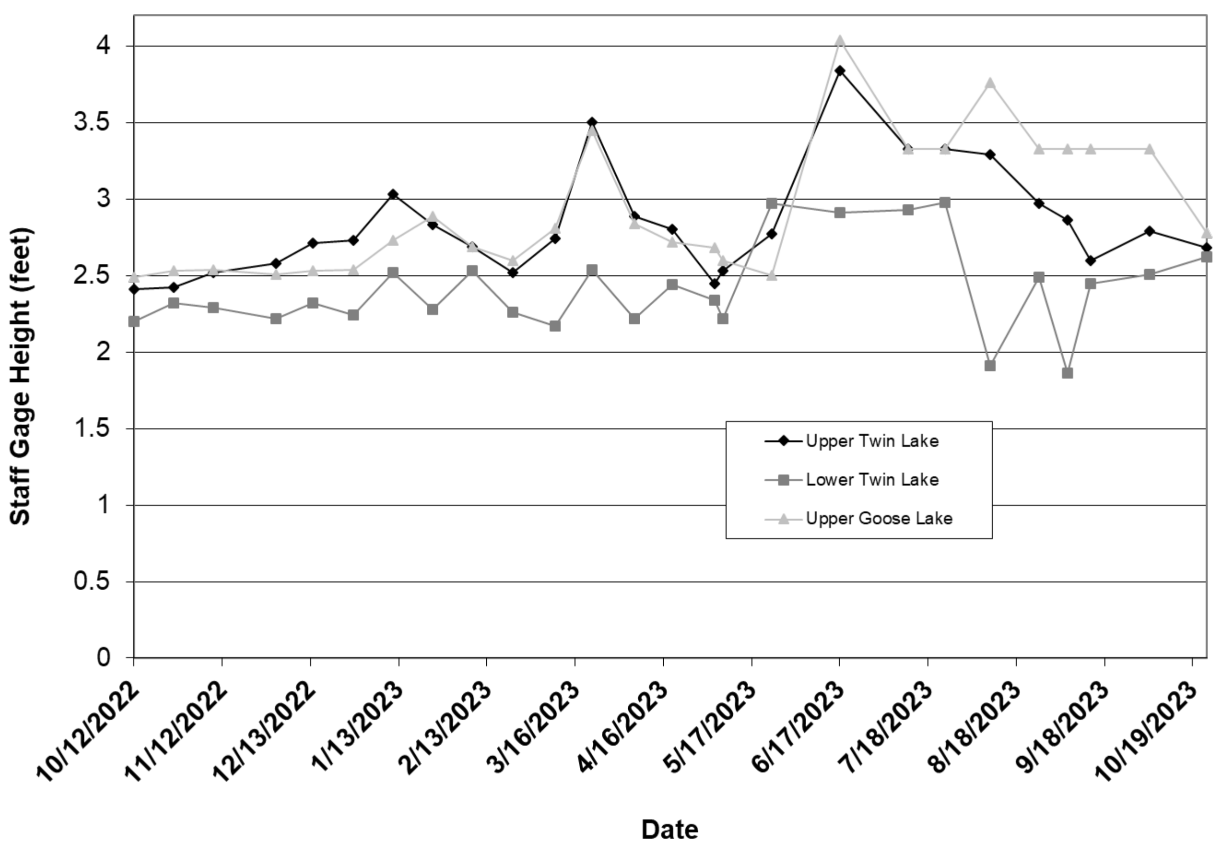


Figure 2-3. Off-River Lakes and Ponds Staff Gages.

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 minimum daily average flow of 2.4 cfs for the year (see Table 2-1, and Hydrologic Appendix 2).

Table 2-1. LORP Flows – WY 2022-23

Station Name	Average Flow (cfs)	Maximum Flow (cfs)	Minimum Flow (cfs)
Below River Intake	169	767	41
Blackrock Return Ditch	1.2	4.2	0.5
Goose Lake Return	0	0	0
Billy Lake Return	2.4	14.8	0.6
Mazourka Canyon Road	152	647	46
Locust Ditch Return	4	18	0
Georges Ditch Return	4	15	0
Reinhackle Springs	149	646	41
Alabama Gates Return	25	945	0
At Pumpback Station	176	1170	41
Pump Station	45	48	0
Langemann Gate to Delta	7	50	2
Weir to Delta	144	1120	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.

2.4 Blackrock Waterfowl Management Area

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 very 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.

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.

Table 2-2. BWMA Wetted Acreage

Winterton Unit

ET Season	Read Date	Wetted Acreage	Average Inflow
Fall '22	11/2/2022	79	5.5
Winter '22-'23	February 2023	100+	1.8
Fall '23	10/31/23	127	3

Thibaut Unit

ET Season	Read Date	Wetted Acreage	Average Inflow
Fall '22	11/1/2022	234	8.2
Winter '22-'23	February 2023	200+	2.6
Fall '23	11/7/23	742	8

Drew Unit

ET Season	Read Date	Wetted Acreage	Average Inflow
Fall '22	N/A	N/A	OFF
Winter '22-'23	N/A	N/A	OFF
Fall '23	N/A	N/A	OFF

Waggoner Unit

ET Season	Read Date	Wetted Acreage	Average Inflow
Fall '22	10/31/2022	159	7.6
Winter '22-'23	February 2023	200+	2.8
Fall '23	11/1/23	322	3

Notes:
No flows are released during the Spring and Summer.
Measurements before 4/1/22 count towards the 2021-22 RY acreage goal.
Measurements after 4/1/22 count towards the 2022-23 RY acreage goal.

2.4.1 BWMA Results for April 2022 to March 2023

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

On September 15, 2022, flows for the fall season were set. Flow to Thibaut Unit was set to 8.3 cfs. Flow to Winterton Unit was set to 5 cfs. Flow to Waggoner Unit was set to 8.2 cfs.

Wetted acreage surveys completed for the Fall 2022 season measured a total of 472 acres. Thibaut measured 234 acres on November 1, Winterton measured 79 acres on November 2, and Waggoner measured 159 acres on October 31.

On November 2, 2022, flows for the winter season were set. Flow to Thibaut Unit was set to 2.6 cfs. Flow to Winterton Unit was set to 1.9 cfs. Flow to Waggoner Unit was set to 2.7 cfs.

In February 2023, ICWD, using remote sensing analysis, estimated the spring wetted acreages of the Thibaut, Winterton, and Waggoner Units combined to exceed 500 total acres.

On March 1, 2023, flows to Thibaut, Winterton, and Waggoner Units were set to 0 cfs.

The average waterfowl wetted acreage for the 2022-23 RY was estimated to exceed 500 acres.

2.4.2 BWMA Results for April 2023 to March 2024

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

On September 15, 2023, flow to Thibaut Unit was set to 8 cfs, Winterton Unit was set to 3 cfs, and Waggoner Unit was set to 3 cfs.

Wetted acreage surveys completed for the fall 2023 season measured a total of 1,191 acres. Thibaut measured 742 acres on November 7, 2023, Winterton measured 127 acres on October 31, 2023, and Waggoner measured 322 acres on November 1, 2023.

The spring wetted acreage measurement will take place in early March 2024; the average totals of the Fall and Spring measurements will be the recorded wetted acreage for the WY.

2.5 Assessment of River Flow Gains and Losses

This section describes river flow gains and losses for all reaches in the Lower Owens River from the LORP Intake to the Pumpback Station during WY 2023. 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 Lower Owens River so that estimates of future water requirements can be made.

2.5.1 River Flow Loss or Gain by Month and Year

Flow losses or gains can vary over time as presented in Table 2-3. ET rates fall sharply during late fall and winter and increase dramatically 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 2022-23 WY

	Month	Flow (cfs)	Acre-Feet-Per-Day
2022	OCT	-16	-32
	NOV	-1	-2
	DEC	-1	-1
2023	JAN	+2	+4
	FEB	+13	+26
	MAR	-72	-143
	APR	-10	-20
	MAY	-86	-171
	JUN	-10	-21
	JUL	+14	+27
	AUG	+1	+2
	SEP	-12	-23
	AVG MONTH	**-15 cfs**	**-30 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 122,693 acre feet (AF), inflows from augmentation spillgates were 26,651 AF, and outflows from the Pumpback Station were 127,253 AF. An additional 11,103 AF was released from the LORP through the McIver Canal and Eclipse Ditch as part of water spreading activities. This yields a total loss of 10,987 AF for the year, a daily average of approximately 15.2 cfs between the Intake and the Pumpback Station. Water loss during the 2022-23 WY represents about 7% of the total released flow from the Intake and augmentation spillgates into the river channel.

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

From December 2022 to March 2023, an average flow of 101 cfs was released into the Lower Owens River from the Intake. An additional 5 cfs was provided from augmentation ditches as well as 15 cfs from Alabama Gates, for a total accumulated release of 121 cfs. A combined daily average of 2.8 cfs was released out of the LORP through the McIver and Eclipse Ditches. The average flow reaching the PumpbackStation was 104 cfs, a decrease of 14 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 lost an average of 13 cfs, Mazourka Canyon Road to the Reinhackle gaging station lost 1 cfs, and Reinhackle to the Pumpback Station lost 1 cfs (see Table 2-4).

Table 2-4. Winter Flow Losses/Gains, December 2022 to March 2023

Recording Station	Average Flow (cfs)	Gain or Loss (cfs)	Accumulative (cfs)
Intake	101	N/A	N/A
Mazourka	91	-13	-13
Reinhackle	90	-1	-13
Pumpback	104	-1	-14

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.

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

During the summer period of June 2023 to September 2023, an average flow of 278 cfs was released into the Lower Owens River from the Intake. An additional 16 cfs was provided from augmentation ditches as well as 59 cfs from Alabama Gates, for a total accumulated release of 353 cfs. Typically, the effects of ET are observed during the summer period by a high total flow loss between the Intake and the Pumpback Station. However, high precipitation conditions throughout the Owens Valley created high flows throughout the LORP with a minimal loss (-2 cfs) observed during the summer period. The largest flow losses occurred at Intake to Mazourka reach (-8 cfs) (see Table 2-5).

Table 2-5. Summer Flow Losses/Gains, June 2023 to September 2023

Recording Station	Average Flow (cfs)	Gain or Loss (cfs)	Accumulative (cfs)
Intake	278	N/A	N/A
Mazourka	254	-8	-8
Reinhackle	243	-4	-12
Pumpback	311	+10	-2

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.

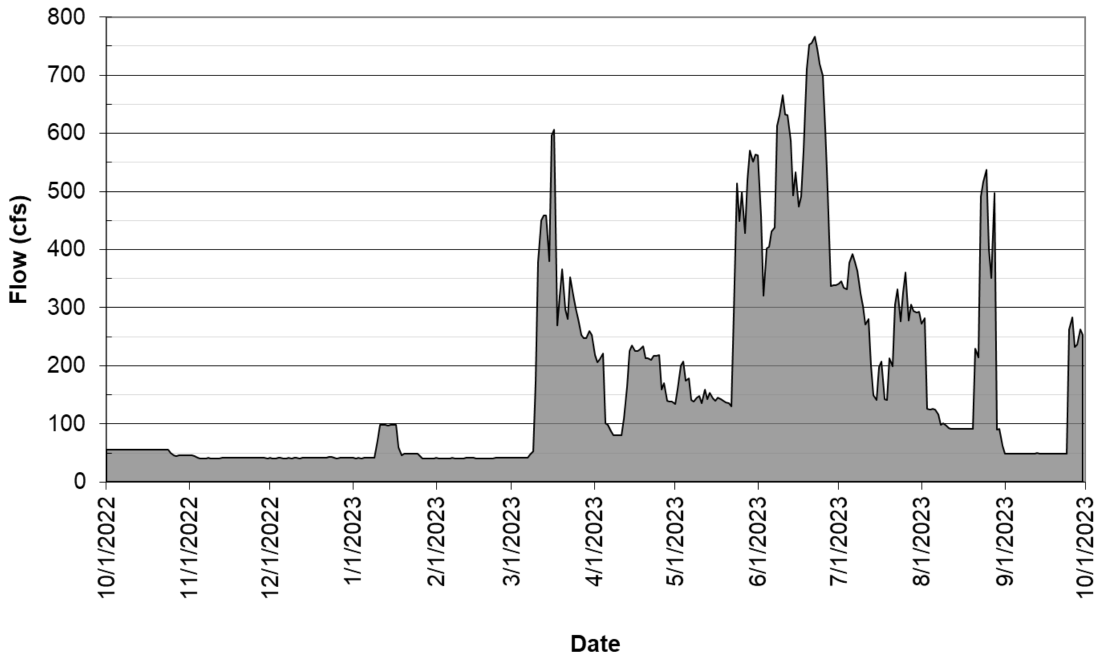
2.6 Seasonal Habitat Flow

The Owens River Basin Runoff Forecast for the 2022-2023 RY was 233% of normal, which, according to the 2004 EIR, calls for a 14-day SHF with a peak release of 200 cfs. As flows in the LORP were projected to be in excess of 200 cfs from late May through early August 2023, a SHF was not released in 2023. An average flow of 316 cfs was released from LORP Intake from May through August. Daily flow rates from the LORP Intake are provided in Appendix 2.

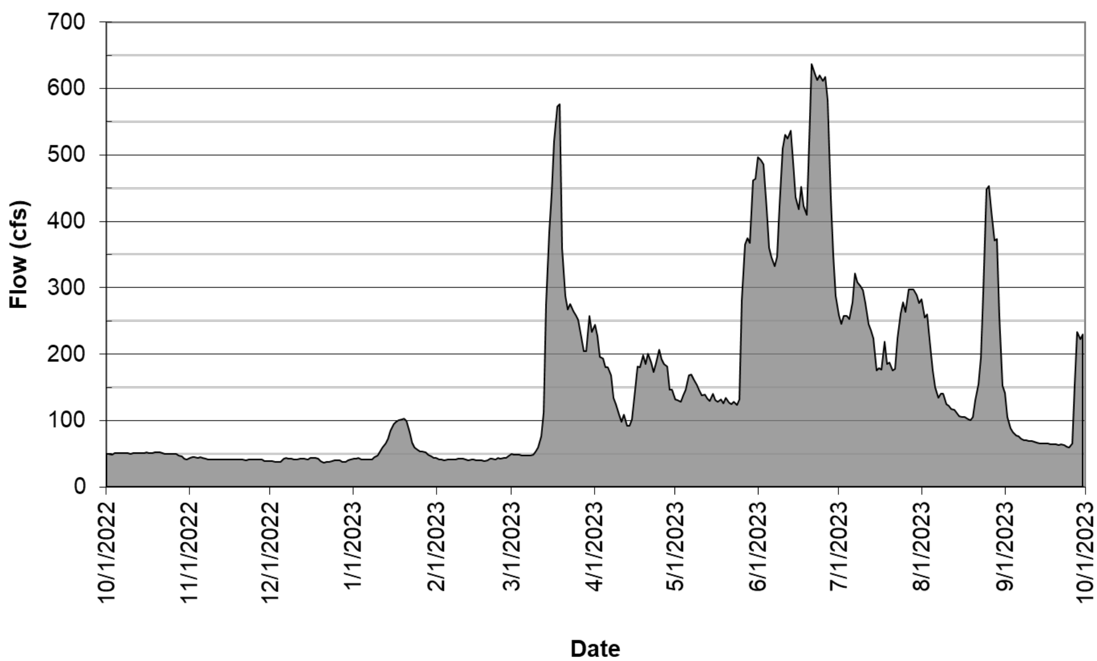
2.7 Appendices

Appendix 1. Hydrologic Monitoring Graphs

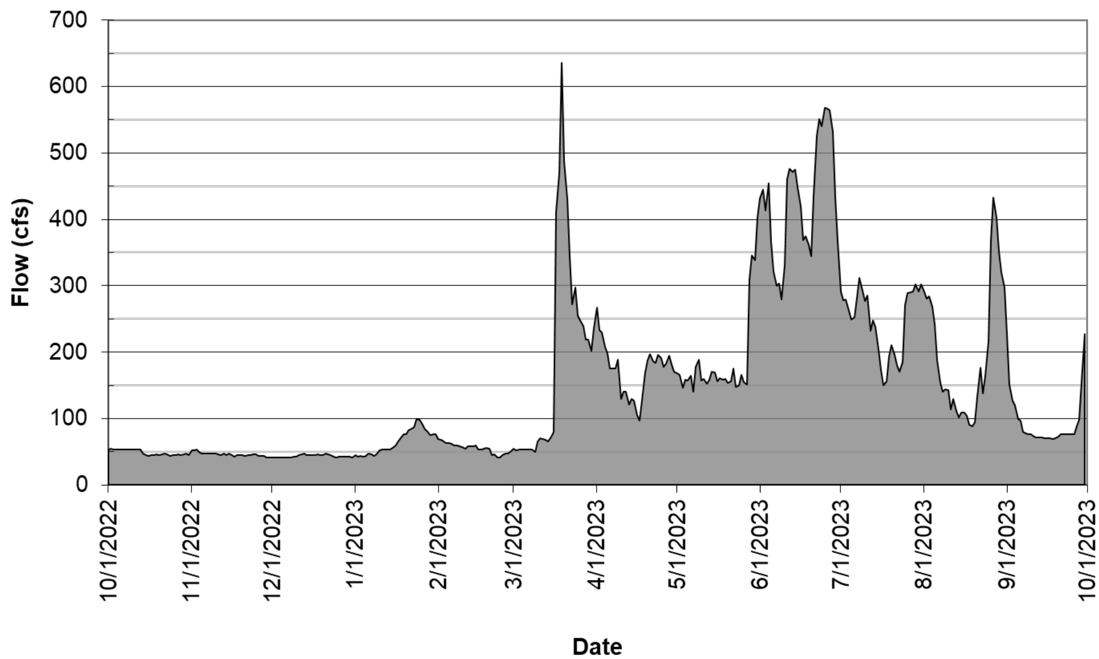
LORP at Below Intake Flow



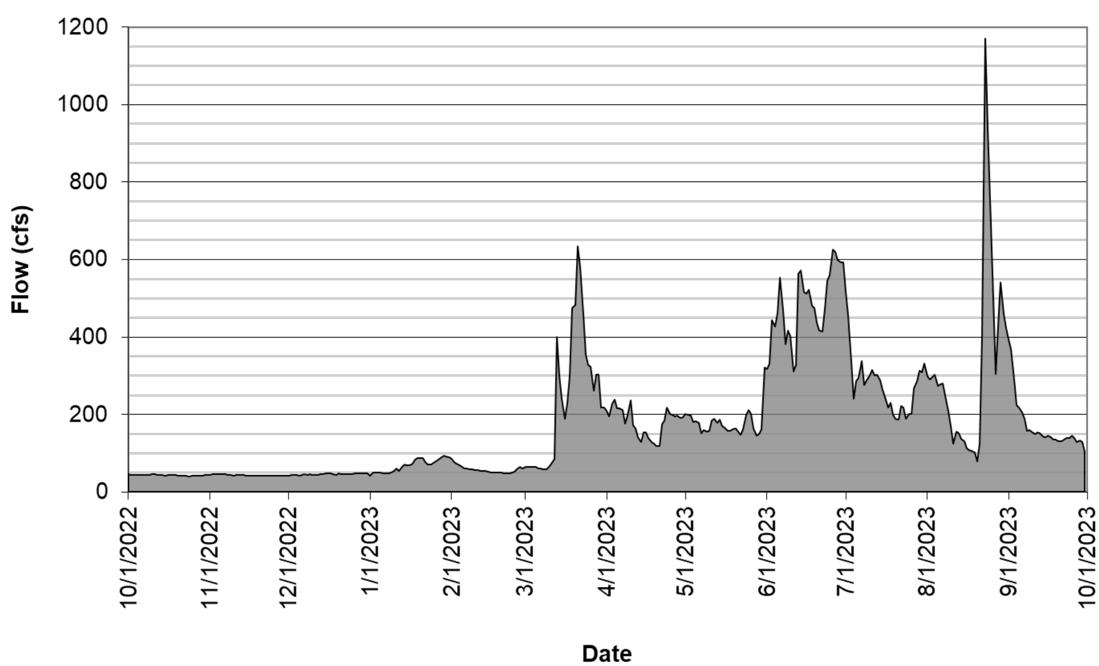
LORP at Mazourka Canyon Road Flow



LORP at Reinhackle Springs Flow



LORP at Pumpback Station Flow



Appendix 2. River Flow Tables

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
10/1/2022	56.0	1.1	0.0	1.1	50.0	0.0	9.6	54.0	0.0	46.0	35.0	11.0	0.0	51.5
10/2/2022	56.0	1.1	0.0	1.1	50.0	0.0	9.4	55.0	0.0	45.0	34.0	11.0	0.0	51.5
10/3/2022	56.0	1.1	0.0	1.1	49.0	0.0	9.3	54.0	0.0	45.0	34.0	11.0	0.0	51.0
10/4/2022	56.0	1.2	0.0	1.2	51.0	0.0	9.2	54.0	0.0	45.0	34.0	11.0	0.0	51.5
10/5/2022	56.0	1.2	0.0	1.1	51.0	0.0	9.5	53.0	0.0	44.0	33.0	11.0	0.0	51.0
10/6/2022	55.0	1.1	0.0	1.1	51.0	0.0	9.8	54.0	0.0	44.0	33.0	11.0	0.0	51.0
10/7/2022	56.0	1.1	0.0	1.0	51.0	0.0	9.7	54.0	0.0	44.0	33.0	11.0	0.0	51.3
10/8/2022	56.0	1.1	0.0	0.9	51.0	0.0	9.6	54.0	0.0	44.0	33.0	11.0	0.0	51.3
10/9/2022	56.0	1.1	0.0	0.8	51.0	0.0	9.1	54.0	0.0	45.0	34.0	11.0	0.0	51.5
10/10/2022	56.0	1.1	0.0	0.8	50.0	0.0	8.9	54.0	0.0	46.0	35.0	11.0	0.0	51.5
10/11/2022	56.0	1.2	0.0	1.0	51.0	0.0	8.9	54.0	0.0	46.0	35.0	11.0	0.0	51.8
10/12/2022	55.0	1.1	0.0	1.1	51.0	0.0	9.0	54.0	0.0	45.0	34.0	11.0	0.0	51.3
10/13/2022	56.0	1.1	0.0	1.1	51.0	0.0	5.1	53.0	0.0	45.0	34.0	11.0	0.0	51.3
10/14/2022	55.0	1.1	0.0	1.1	51.0	0.0	0.7	48.0	0.0	45.0	34.0	11.0	0.0	49.8
10/15/2022	56.0	1.2	0.0	1.1	51.0	0.0	0.2	45.0	0.0	43.0	34.0	9.0	0.0	48.8
10/16/2022	55.0	1.3	0.0	1.1	52.0	0.0	0.1	44.0	0.0	44.0	36.0	8.0	0.0	48.8
10/17/2022	56.0	1.2	0.0	1.1	51.0	0.0	0.3	45.0	0.0	45.0	37.0	8.0	0.0	49.3
10/18/2022	56.0	1.1	0.0	1.1	51.0	0.0	0.3	45.0	0.0	45.0	37.0	8.0	0.0	49.3
10/19/2022	56.0	1.0	0.0	1.1	52.0	0.0	0.2	46.0	0.0	44.0	36.0	8.0	0.0	49.5
10/20/2022	55.0	1.0	0.0	1.1	52.0	0.0	0.2	45.0	0.0	43.0	35.0	8.0	0.0	48.8
10/21/2022	56.0	1.1	0.0	1.1	52.0	0.0	0.1	46.0	0.0	42.0	34.0	8.0	0.0	49.0
10/22/2022	56.0	1.2	0.0	1.2	51.0	0.0	0.2	47.0	0.0	42.0	34.0	8.0	0.0	49.0
10/23/2022	56.0	1.2	0.0	1.3	50.0	0.0	0.2	46.0	0.0	42.0	34.0	8.0	0.0	48.5
10/24/2022	56.0	1.2	0.0	1.3	50.0	0.0	0.4	44.0	0.0	41.0	33.0	8.0	0.0	47.8
10/25/2022	50.0	1.2	0.0	1.4	50.0	0.0	0.4	45.0	0.0	42.0	34.0	8.0	0.0	46.8
10/26/2022	46.0	1.3	0.0	1.5	50.0	0.0	0.3	45.0	0.0	42.0	34.0	8.0	0.0	45.8
10/27/2022	45.0	1.2	0.0	1.4	50.0	0.0	0.2	46.0	0.0	43.0	35.0	8.0	0.0	46.0
10/28/2022	46.0	1.1	0.0	1.4	48.0	0.0	0.2	45.0	0.0	42.0	34.0	8.0	0.0	45.3
10/29/2022	46.0	1.1	0.0	1.4	46.0	0.0	0.2	46.0	0.0	42.0	34.0	8.0	0.0	45.0
10/30/2022	46.0	1.1	0.0	1.3	43.0	0.0	0.2	47.0	0.0	44.0	36.0	8.0	0.0	45.0
10/31/2022	46.0	1.2	0.0	1.3	42.0	0.0	0.2	45.0	0.0	44.0	36.0	8.0	0.0	44.3

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
11/1/2022	46.0	1.2	0.0	1.2	44.0	0.0	0.3	52.0	0.0	44.0	37.0	7.0	0.0	46.5
11/2/2022	46.0	1.2	0.0	1.2	45.0	0.0	0.2	52.0	0.0	46.0	39.0	7.0	0.0	47.3
11/3/2022	45.0	1.3	0.0	1.2	45.0	0.0	0.2	53.0	0.0	46.0	39.0	7.0	0.0	47.3
11/4/2022	42.0	1.2	0.0	1.2	44.0	0.0	0.1	49.0	0.0	46.0	39.0	7.0	0.0	45.3
11/5/2022	41.0	1.2	0.0	1.2	45.0	0.0	0.1	48.0	0.0	47.0	40.0	7.0	0.0	45.3
11/6/2022	41.0	1.2	0.0	1.2	44.0	0.0	0.3	48.0	0.0	47.0	40.0	7.0	0.0	45.0
11/7/2022	41.0	1.1	0.0	1.2	43.0	0.0	0.3	47.0	0.0	46.0	39.0	7.0	0.0	44.3
11/8/2022	42.0	1.1	0.0	1.2	42.0	0.0	0.1	47.0	0.0	45.0	38.0	7.0	0.0	44.0
11/9/2022	41.0	1.1	0.0	1.2	41.0	0.0	0.3	48.0	0.0	44.0	37.0	7.0	0.0	43.5
11/10/2022	41.0	1.1	0.0	1.2	41.0	0.0	0.3	47.0	0.0	43.0	34.0	7.0	2.0	43.0
11/11/2022	41.0	1.2	0.0	1.2	42.0	0.0	0.2	46.0	0.0	45.0	38.0	7.0	0.0	43.5
11/12/2022	41.0	1.2	0.0	1.2	42.0	0.0	0.2	45.0	0.0	44.0	37.0	7.0	0.0	43.0
11/13/2022	42.0	1.2	0.0	1.2	42.0	0.0	0.4	48.0	0.0	44.0	37.0	7.0	0.0	44.0
11/14/2022	42.0	1.2	0.0	1.2	41.0	0.0	0.4	45.0	0.0	44.0	37.0	7.0	0.0	43.0
11/15/2022	42.0	1.2	0.0	1.2	42.0	0.0	0.4	48.0	0.0	43.0	36.0	7.0	0.0	43.8
11/16/2022	42.0	1.3	0.0	1.2	42.0	0.0	0.3	45.0	0.0	43.0	36.0	7.0	0.0	43.0
11/17/2022	42.0	1.3	0.0	1.2	41.0	0.0	0.2	43.0	0.0	43.0	36.0	7.0	0.0	42.3
11/18/2022	42.0	1.3	0.0	1.1	42.0	0.0	0.2	45.0	0.0	42.0	35.0	7.0	0.0	42.8
11/19/2022	42.0	1.3	0.0	1.1	42.0	0.0	0.2	45.0	0.0	43.0	36.0	7.0	0.0	43.0
11/20/2022	42.0	1.3	0.0	1.2	41.0	0.0	0.2	45.0	0.0	43.0	36.0	7.0	0.0	42.8
11/21/2022	42.0	1.4	0.0	1.2	41.0	0.0	0.2	44.0	0.0	42.0	35.0	7.0	0.0	42.3
11/22/2022	42.0	1.4	0.0	1.2	40.0	0.0	0.2	45.0	0.0	42.0	35.0	7.0	0.0	42.3
11/23/2022	42.0	1.4	0.0	1.3	41.0	0.0	0.3	45.0	0.0	42.0	35.0	7.0	0.0	42.5
11/24/2022	42.0	1.4	0.0	1.3	42.0	0.0	0.4	46.0	0.0	42.0	35.0	7.0	0.0	43.0
11/25/2022	42.0	1.4	0.0	1.3	41.0	0.0	0.3	46.0	0.0	42.0	35.0	7.0	0.0	42.8
11/26/2022	42.0	1.4	0.0	1.3	41.0	0.0	0.4	44.0	0.0	42.0	35.0	7.0	0.0	42.3
11/27/2022	42.0	1.2	0.0	1.3	41.0	0.0	0.4	44.0	0.0	43.0	36.0	7.0	0.0	42.5
11/28/2022	42.0	1.2	0.0	1.2	41.0	0.0	0.3	44.0	0.0	43.0	36.0	7.0	0.0	42.5
11/29/2022	42.0	1.3	0.0	1.2	39.0	0.0	0.3	41.0	0.0	43.0	36.0	7.0	0.0	41.3
11/30/2022	41.0	1.3	0.0	1.2	39.0	0.0	0.3	41.0	0.0	43.0	36.0	7.0	0.0	41.0

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
12/1/2022	42.0	1.3	0.0	1.1	39.0	0.0	0.3	41.0	0.0	43.0	37.0	6.0	0.0	41.3
12/2/2022	41.0	1.3	0.0	1.1	39.0	0.0	0.3	41.0	0.0	44.0	38.0	6.0	0.0	41.3
12/3/2022	41.0	1.3	0.0	1.1	38.0	0.0	0.3	42.0	0.0	44.0	38.0	6.0	0.0	41.3
12/4/2022	42.0	1.3	0.0	1.1	38.0	0.0	0.4	41.0	0.0	44.0	38.0	6.0	0.0	41.3
12/5/2022	42.0	1.3	0.0	2.9	38.0	0.0	0.4	42.0	0.0	43.0	37.0	6.0	0.0	41.3
12/6/2022	41.0	1.3	0.0	5.6	43.0	0.0	0.5	41.0	0.0	45.0	39.0	6.0	0.0	42.5
12/7/2022	41.0	1.2	0.0	6.0	44.0	0.0	0.5	41.0	0.0	46.0	40.0	6.0	0.0	43.0
12/8/2022	42.0	1.2	0.0	6.1	43.0	0.0	0.5	41.0	0.0	45.0	39.0	6.0	0.0	42.8
12/9/2022	41.0	1.2	0.0	6.0	43.0	0.0	0.4	43.0	0.0	46.0	40.0	6.0	0.0	43.3
12/10/2022	42.0	1.2	0.0	6.0	41.0	0.0	0.5	43.0	0.0	45.0	39.0	6.0	0.0	42.8
12/11/2022	42.0	1.4	0.0	6.0	41.0	0.0	0.3	45.0	0.0	45.0	39.0	6.0	0.0	43.3
12/12/2022	41.0	1.3	0.0	6.2	43.0	0.0	0.2	46.0	0.0	45.0	39.0	6.0	0.0	43.8
12/13/2022	42.0	1.3	0.0	6.3	43.0	0.0	0.2	47.0	0.0	46.0	40.0	6.0	0.0	44.5
12/14/2022	42.0	1.3	0.0	6.2	43.0	0.0	0.2	45.0	0.0	46.0	40.0	6.0	0.0	44.0
12/15/2022	42.0	1.2	0.0	6.2	42.0	0.0	0.2	45.0	0.0	49.0	43.0	6.0	0.0	44.5
12/16/2022	42.0	1.2	0.0	6.2	44.0	0.0	0.2	45.0	0.0	49.0	43.0	6.0	0.0	45.0
12/17/2022	42.0	1.3	0.0	6.3	44.0	0.0	0.3	45.0	0.0	48.0	42.0	6.0	0.0	44.8
12/18/2022	42.0	1.3	0.0	6.3	44.0	0.0	0.3	46.0	0.0	47.0	40.0	6.0	1.0	44.8
12/19/2022	42.0	1.3	0.0	5.3	43.0	0.0	0.3	45.0	0.0	45.0	37.0	6.0	2.0	43.8
12/20/2022	42.0	1.3	0.0	2.1	39.0	0.0	0.3	45.0	0.0	49.0	43.0	6.0	0.0	43.8
12/21/2022	42.0	1.3	0.0	1.2	36.0	0.0	0.3	47.0	0.0	46.0	40.0	6.0	0.0	42.8
12/22/2022	42.0	1.4	0.0	1.2	38.0	0.0	0.2	46.0	0.0	46.0	40.0	6.0	0.0	43.0
12/23/2022	43.0	1.4	0.0	1.2	38.0	0.0	0.2	45.0	0.0	46.0	40.0	6.0	0.0	43.0
12/24/2022	43.0	1.3	0.0	1.2	39.0	0.0	0.2	43.0	0.0	46.0	40.0	6.0	0.0	42.8
12/25/2022	42.0	1.0	0.0	1.1	40.0	0.0	0.4	42.0	0.0	47.0	41.0	6.0	0.0	42.8
12/26/2022	41.0	0.9	0.0	1.1	40.0	0.0	0.5	43.0	0.0	48.0	42.0	6.0	0.0	43.0
12/27/2022	42.0	1.1	0.0	1.1	40.0	0.0	0.4	43.0	0.0	48.0	42.0	6.0	0.0	43.3
12/28/2022	42.0	1.0	0.0	1.1	38.0	0.0	0.4	43.0	0.0	48.0	42.0	6.0	0.0	42.8
12/29/2022	42.0	1.1	0.0	1.2	38.0	0.0	0.4	43.0	0.0	49.0	43.0	6.0	0.0	43.0
12/30/2022	42.0	1.0	0.0	1.2	40.0	0.0	0.4	43.0	0.0	48.0	42.0	6.0	0.0	43.3
12/31/2022	42.0	0.9	0.0	1.2	42.0	0.0	0.5	42.0	0.0	49.0	43.0	6.0	0.0	43.8
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
1/1/2023	42.0	0.9	0.0	1.2	43.0	0.0	0.4	45.0	0.0	43.0	37.0	6.0	0.0	43.3
1/2/2023	41.0	0.8	0.0	1.3	43.0	0.0	0.4	43.0	0.0	50.0	44.0	6.0	0.0	44.3
1/3/2023	42.0	0.7	0.0	1.3	44.0	0.0	0.4	44.0	0.0	50.0	44.0	6.0	0.0	45.0
1/4/2023	41.0	0.7	0.0	1.3	42.0	0.0	0.4	43.0	0.0	50.0	44.0	6.0	0.0	44.0
1/5/2023	42.0	1.0	0.0	1.3	41.0	0.0	0.4	44.0	0.0	50.0	44.0	6.0	0.0	44.3
1/6/2023	42.0	1.1	0.0	1.2	41.0	0.0	0.4	47.0	0.0	49.0	43.0	6.0	0.0	44.8
1/7/2023	42.0	1.3	0.0	1.2	41.0	0.0	0.4	46.0	0.0	48.0	42.0	6.0	0.0	44.3
1/8/2023	42.0	1.3	0.0	1.2	42.0	0.0	0.4	44.0	0.0	49.0	43.0	6.0	0.0	44.3
1/9/2023	42.0	1.7	0.0	1.4	45.0	0.0	0.7	46.0	0.0	51.0	45.0	6.0	0.0	46.0
1/10/2023	72.0	2.3	0.0	1.5	48.0	0.0	0.6	52.0	0.0	54.0	48.0	6.0	0.0	56.5
1/11/2023	98.0	2.4	0.0	1.4	54.0	0.0	0.4	53.0	0.0	61.0	48.0	6.0	7.0	66.5
1/12/2023	98.0	2.0	0.0	1.4	60.0	0.0	0.4	54.0	17.1	54.0	48.0	3.0	3.0	66.5
1/13/2023	98.0	1.9	0.0	1.3	65.0	0.0	0.4	53.0	40.6	65.0	48.0	6.0	11.0	70.3
1/14/2023	97.0	1.9	0.0	1.3	73.0	0.0	0.4	53.0	39.8	70.0	48.0	6.0	16.0	73.3
1/15/2023	98.0	2.0	0.0	1.2	85.0	0.0	0.3	56.0	37.9	69.0	48.0	6.0	15.0	77.0
1/16/2023	98.0	1.9	0.0	1.2	94.0	0.0	0.3	59.0	36.5	68.0	48.0	6.0	14.0	79.8
1/17/2023	98.0	1.8	0.0	1.2	98.0	0.0	0.5	65.0	14.1	74.0	48.0	6.0	20.0	83.8
1/18/2023	60.0	1.6	0.0	1.2	101.0	0.0	0.5	71.0	0.0	84.0	48.0	6.0	30.0	79.0
1/19/2023	46.0	1.4	0.0	1.2	102.0	0.0	0.6	77.0	0.0	88.0	48.0	6.0	34.0	78.3
1/20/2023	49.0	1.2	0.0	1.2	103.0	0.0	0.6	77.0	0.0	88.0	48.0	6.0	34.0	79.3
1/21/2023	49.0	1.1	0.0	1.1	99.0	0.0	0.5	82.0	0.0	88.0	48.0	6.0	34.0	79.5
1/22/2023	49.0	1.0	0.0	1.1	83.0	0.0	0.5	85.0	0.0	78.0	48.0	6.0	24.0	73.8
1/23/2023	49.0	1.1	0.0	1.1	67.0	0.0	0.4	87.0	0.0	70.0	48.0	6.0	16.0	68.3
1/24/2023	49.0	1.3	0.0	1.1	59.0	0.0	0.4	100.0	0.0	71.0	48.0	6.0	17.0	69.8
1/25/2023	49.0	1.1	0.0	1.0	56.0	0.0	0.4	98.0	0.0	75.0	48.0	6.0	21.0	69.5
1/26/2023	45.0	1.0	0.0	1.1	54.0	0.0	0.4	92.0	0.0	79.0	48.0	6.0	25.0	67.5
1/27/2023	41.0	1.1	0.0	1.2	53.0	0.0	0.3	85.0	0.0	84.0	48.0	6.0	30.0	65.8
1/28/2023	41.0	1.1	0.0	1.2	52.0	0.0	0.3	80.0	0.0	89.0	48.0	6.0	35.0	65.5
1/29/2023	41.0	1.1	0.0	1.2	49.0	0.0	0.3	75.0	0.0	93.0	48.0	6.0	39.0	64.5
1/30/2023	41.0	1.0	0.0	1.2	46.0	0.0	0.3	76.0	0.0	92.0	48.0	6.0	38.0	63.8
1/31/2023	41.0	1.0	0.0	1.2	44.0	0.0	0.3	76.0	0.0	90.0	48.0	6.0	36.0	62.8
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2/1/2023	42.0	1.0	0.0	1.1	44.0	0.0	0.3	69.0	0.0	85.0	48.0	6.0	31.0	60.0
2/2/2023	41.0	1.4	0.0	1.1	42.0	0.0	0.3	68.0	0.0	78.0	48.0	6.0	24.0	57.3
2/3/2023	41.0	1.4	0.0	1.1	41.0	0.0	0.6	65.0	0.0	74.0	48.0	6.0	20.0	55.3
2/4/2023	41.0	1.1	0.0	1.1	40.0	0.0	0.7	63.0	0.0	68.0	48.0	6.0	14.0	53.0
2/5/2023	41.0	0.9	0.0	1.2	41.0	0.0	0.7	63.0	0.0	64.0	48.0	6.0	10.0	52.3
2/6/2023	41.0	0.9	0.0	1.2	41.0	0.0	0.6	62.0	0.0	61.0	48.0	6.0	7.0	51.3
2/7/2023	42.0	1.5	0.0	1.8	41.0	0.0	0.6	59.0	0.0	60.0	48.0	6.0	6.0	50.5
2/8/2023	41.0	1.6	0.0	3.2	41.0	0.0	0.6	60.0	0.0	59.0	48.0	6.0	5.0	50.3
2/9/2023	41.0	1.6	0.0	4.2	43.0	0.0	0.6	58.0	0.0	58.0	48.0	6.0	4.0	50.0
2/10/2023	41.0	1.6	0.0	3.6	43.0	0.0	0.5	57.0	0.0	57.0	48.0	6.0	3.0	49.5
2/11/2023	41.0	1.6	0.0	3.0	43.0	0.0	0.5	55.0	0.0	56.0	48.0	6.0	2.0	48.8
2/12/2023	42.0	1.8	0.0	1.3	42.0	0.0	0.5	58.0	0.0	54.0	48.0	6.0	0.0	49.0
2/13/2023	42.0	1.9	0.0	0.7	40.0	0.0	0.6	58.0	0.0	54.0	48.0	6.0	0.0	48.5
2/14/2023	42.0	1.4	0.0	1.2	41.0	0.0	0.8	58.0	0.0	54.0	48.0	6.0	0.0	48.8
2/15/2023	42.0	1.2	0.0	1.6	41.0	0.0	0.7	60.0	0.0	53.0	47.0	6.0	0.0	49.0
2/16/2023	41.0	1.2	0.0	1.8	40.0	0.0	0.6	54.0	0.0	51.0	45.0	6.0	0.0	46.5
2/17/2023	41.0	1.3	0.0	1.7	40.0	0.0	0.8	54.0	0.0	51.0	45.0	6.0	0.0	46.5
2/18/2023	41.0	1.1	0.0	1.6	40.0	0.0	0.6	55.0	0.0	51.0	45.0	6.0	0.0	46.8
2/19/2023	41.0	1.1	0.0	1.6	39.0	0.0	0.6	56.0	0.0	50.0	44.0	6.0	0.0	46.5
2/20/2023	41.0	1.1	0.0	1.6	40.0	0.0	0.6	55.0	0.0	50.0	44.0	6.0	0.0	46.5
2/21/2023	41.0	1.3	0.0	1.5	43.0	0.0	0.5	45.0	0.0	49.0	43.0	6.0	0.0	44.5
2/22/2023	41.0	1.1	0.0	1.3	43.0	0.0	0.4	46.0	0.0	49.0	43.0	6.0	0.0	44.8
2/23/2023	42.0	1.0	0.0	1.2	42.0	0.0	0.3	42.0	0.0	49.0	43.0	6.0	0.0	43.8
2/24/2023	42.0	1.4	0.0	1.1	44.0	0.0	0.4	42.0	0.0	50.0	44.0	6.0	0.0	44.5
2/25/2023	42.0	1.4	0.0	1.2	43.0	0.0	0.5	45.0	0.0	52.0	42.0	6.0	4.0	45.5
2/26/2023	42.0	1.5	0.0	1.2	44.0	0.0	0.4	47.0	0.0	61.0	48.0	6.0	7.0	48.5
2/27/2023	42.0	1.5	0.0	1.2	44.0	0.0	0.3	48.0	0.0	64.0	48.0	6.0	10.0	49.5
2/28/2023	42.0	1.4	0.0	1.3	47.0	0.0	0.5	51.0	0.0	61.0	46.0	6.0	9.0	50.3
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3/1/2023	42.0	1.4	0.0	1.2	50.0	0.0	0.6	55.0	0.0	65.0	48.0	9.0	8.0	53.0
3/2/2023	42.0	1.2	0.0	1.2	49.0	0.0	0.5	52.0	0.0	65.0	48.0	10.0	7.0	52.0
3/3/2023	42.0	1.2	0.0	1.2	49.0	0.0	0.7	54.0	0.0	65.0	48.0	10.0	7.0	52.5
3/4/2023	42.0	1.3	0.0	1.2	49.0	0.0	0.6	54.0	0.0	65.0	48.0	10.0	7.0	52.5
3/5/2023	42.0	1.5	0.0	1.2	48.0	0.0	0.3	54.0	0.0	65.0	48.0	10.0	7.0	52.3
3/6/2023	42.0	2.4	0.0	1.2	48.0	0.0	0.2	54.0	0.0	61.0	48.0	9.0	4.0	51.3
3/7/2023	42.0	2.7	0.0	1.2	47.0	0.0	0.2	53.0	0.0	60.0	48.0	10.0	2.0	50.5
3/8/2023	48.0	1.6	0.0	1.2	48.0	0.0	0.3	54.0	0.0	59.0	48.0	10.0	1.0	52.3
3/9/2023	53.0	3.2	0.0	1.1	49.0	0.3	0.3	50.0	0.0	59.0	48.0	10.0	1.0	52.8
3/10/2023	173.0	2.8	0.0	1.5	53.0	1.2	0.2	66.0	100.0	64.0	48.0	10.0	6.0	89.0
3/11/2023	378.0	2.8	0.0	1.5	60.0	0.8	0.2	71.0	320.0	74.0	28.0	10.0	36.0	145.8
3/12/2023	450.0	2.8	0.0	5.9	77.0	0.6	0.1	69.0	317.5	86.0	0.0	10.0	76.0	170.5
3/13/2023	458.0	2.8	0.0	9.4	113.0	0.4	0.2	68.0	186.0	400.0	0.0	10.0	390.0	259.8
3/14/2023	458.0	2.8	0.0	9.9	276.0	0.3	0.2	66.0	226.5	300.0	0.0	10.0	290.0	275.0
3/15/2023	380.0	2.8	0.0	11.0	384.0	0.5	0.3	73.0	256.5	240.0	0.0	10.0	230.0	269.3
3/16/2023	597.0	2.8	0.0	10.9	442.0	0.5	4.2	80.0	185.0	190.0	0.0	10.0	180.0	327.3
3/17/2023	606.0	2.8	0.0	10.7	521.0	0.3	0.4	411.0	66.5	230.0	0.0	10.0	220.0	442.0
3/18/2023	270.0	2.8	0.0	10.1	573.0	0.3	0.3	470.0	0.0	300.0	0.0	10.0	290.0	403.3
3/19/2023	320.0	2.8	0.0	9.8	576.0	0.3	0.4	636.0	0.0	474.0	0.0	10.0	464.0	501.5
3/20/2023	366.0	2.8	0.0	9.6	359.0	0.2	0.4	487.0	0.0	483.0	0.0	10.0	473.0	423.8
3/21/2023	297.0	2.3	0.0	3.8	288.0	0.2	0.3	430.0	0.0	635.0	0.0	10.0	625.0	412.5
3/22/2023	280.0	1.6	0.0	1.8	267.0	2.2	5.7	345.0	0.0	580.0	0.0	10.0	570.0	368.0
3/23/2023	352.0	1.3	0.0	2.0	276.0	7.1	11.2	272.0	0.0	459.0	0.0	10.0	449.0	339.8
3/24/2023	320.0	1.3	0.0	2.0	265.0	6.9	10.8	297.0	0.0	354.0	0.0	10.0	344.0	309.0
3/25/2023	299.0	1.3	0.0	2.0	259.0	6.9	10.8	255.0	0.0	327.0	0.0	10.0	317.0	285.0
3/26/2023	280.0	1.3	0.0	2.0	251.0	7.2	9.5	248.0	0.0	323.0	0.0	10.0	313.0	275.5
3/27/2023	253.0	1.3	0.0	2.0	225.0	6.9	9.2	239.0	0.0	261.0	0.0	10.0	251.0	244.5
3/28/2023	248.0	1.3	0.0	2.0	205.0	6.1	9.7	219.0	0.0	303.0	0.0	10.0	293.0	243.8
3/29/2023	248.0	1.3	0.0	2.0	205.0	5.2	10.1	219.0	0.0	303.0	0.0	10.0	293.0	243.8
3/30/2023	260.0	1.3	0.0	1.9	258.0	5.7	10.1	202.0	0.0	218.0	0.0	10.0	208.0	234.5
3/31/2023	253.0	1.3	0.0	1.9	234.0	5.9	10.1	236.0	0.0	218.0	0.0	10.0	208.0	235.3
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4/1/2023	218.0	1.3	0.0	1.9	244.0	6.3	10.1	267.0	0.0	209.0	0.0	10.0	199.0	234.5
4/2/2023	206.0	1.3	0.0	1.8	227.0	6.3	9.4	234.0	0.0	196.0	0.0	10.0	186.0	215.8
4/3/2023	212.0	1.3	0.0	1.9	196.0	6.1	9.4	230.0	0.0	229.0	0.0	10.0	219.0	216.8
4/4/2023	221.0	1.3	0.0	1.8	194.0	6.1	9.8	208.0	0.0	239.0	0.0	10.0	229.0	215.5
4/5/2023	101.0	1.5	0.0	1.8	180.0	6.1	10.0	199.0	0.0	216.0	0.0	10.0	206.0	174.0
4/6/2023	98.0	1.7	0.0	1.7	180.0	6.0	10.0	175.0	0.0	215.0	0.0	10.0	205.0	167.0
4/7/2023	87.0	1.7	0.0	1.6	168.0	5.6	10.8	176.0	0.0	212.0	0.0	10.0	202.0	160.8
4/8/2023	80.0	1.7	0.0	1.4	134.0	5.4	10.8	176.0	0.0	177.0	0.0	10.0	167.0	141.8
4/9/2023	80.0	1.7	0.0	1.5	125.0	5.8	9.2	189.0	0.0	197.0	0.0	10.0	187.0	147.8
4/10/2023	80.0	1.7	0.0	1.5	109.0	5.9	9.3	130.0	0.0	236.0	0.0	10.0	226.0	138.8
4/11/2023	80.0	1.7	0.0	1.6	98.0	6.3	9.4	140.0	0.0	173.0	0.0	10.0	163.0	122.8
4/12/2023	110.0	1.7	0.0	1.7	109.0	6.6	10.1	140.0	0.0	165.0	0.0	10.0	155.0	131.0
4/13/2023	164.0	1.7	0.0	1.7	92.0	6.7	10.7	121.0	0.0	142.0	0.0	10.0	132.0	129.8
4/14/2023	226.0	1.7	0.0	1.5	92.0	6.8	10.9	129.0	0.0	130.0	0.0	10.0	120.0	144.3
4/15/2023	235.0	1.7	0.0	1.4	102.0	6.2	11.7	127.0	0.0	153.0	0.0	10.0	143.0	154.3
4/16/2023	226.0	1.7	0.0	1.5	147.0	6.6	10.5	106.0	0.0	153.0	0.0	10.0	143.0	158.0
4/17/2023	226.0	1.7	0.0	1.5	181.0	7.7	8.5	97.0	0.0	140.0	0.0	10.0	130.0	161.0
4/18/2023	228.0	1.6	0.0	1.5	180.0	6.6	7.9	127.0	0.0	128.0	0.0	10.0	118.0	165.8
4/19/2023	233.0	1.5	0.0	1.5	199.0	7.5	7.6	169.0	0.0	125.0	0.0	10.0	115.0	181.5
4/20/2023	213.0	1.4	0.0	1.5	185.0	7.1	8.1	188.0	0.0	118.0	0.0	10.0	108.0	176.0
4/21/2023	213.0	1.4	0.0	1.4	201.0	7.1	8.5	197.0	0.0	118.0	0.0	10.0	108.0	182.3
4/22/2023	210.0	1.4	0.0	1.4	187.0	7.3	8.5	186.0	0.0	174.0	0.0	10.0	164.0	189.3
4/23/2023	217.0	1.4	0.0	1.4	173.0	9.8	7.8	184.0	0.0	185.0	0.0	10.0	175.0	189.8
4/24/2023	217.0	1.4	0.0	1.4	186.0	10.0	7.8	196.0	0.0	219.0	0.0	10.0	209.0	204.5
4/25/2023	218.0	1.4	0.0	1.4	207.0	9.9	8.0	191.0	0.0	201.0	0.0	10.0	191.0	204.3
4/26/2023	159.0	1.4	0.0	1.4	192.0	9.2	8.2	178.0	0.0	199.0	0.0	10.0	189.0	182.0
4/27/2023	170.0	1.4	0.0	1.4	185.0	8.6	8.2	183.0	0.0	195.0	0.0	10.0	185.0	183.3
4/28/2023	140.0	1.4	0.0	1.4	182.0	8.8	8.2	195.0	0.0	197.0	0.0	10.0	187.0	178.5
4/29/2023	138.0	1.4	0.0	1.4	147.0	10.0	8.0	182.0	0.0	191.0	21.0	10.0	160.0	164.5
4/30/2023	139.0	1.4	0.0	1.4	147.0	9.7	7.8	171.0	0.0	194.0	14.0	10.0	170.0	162.8

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5/1/2023	134.0	1.4	0.0	1.3	132.0	11.8	7.7	168.0	0.0	201.0	0.0	10.0	191.0	158.8
5/2/2023	161.0	1.4	0.0	1.3	131.0	13.1	7.2	166.0	0.0	199.0	0.0	10.0	189.0	164.3
5/3/2023	200.0	1.4	0.0	1.4	128.0	10.2	7.3	147.0	0.0	198.0	0.0	10.0	188.0	168.3
5/4/2023	208.0	1.4	0.0	1.4	138.0	8.4	6.4	159.0	0.0	181.0	0.0	10.0	171.0	171.5
5/5/2023	175.0	1.4	0.0	1.4	146.0	8.4	8.3	157.0	0.0	182.0	29.0	10.0	143.0	165.0
5/6/2023	179.0	1.0	0.0	1.4	168.0	7.2	13.6	165.0	0.0	178.0	48.0	10.0	120.0	172.5
5/7/2023	141.0	0.5	0.0	1.4	170.0	7.9	14.5	140.0	0.0	152.0	48.0	10.0	94.0	150.8
5/8/2023	138.0	0.5	0.0	1.5	162.0	8.0	9.6	178.0	0.0	160.0	48.0	10.0	102.0	159.5
5/9/2023	146.0	0.5	0.0	1.8	154.0	7.2	10.5	189.0	0.0	156.0	48.0	10.0	98.0	161.3
5/10/2023	148.0	0.5	0.0	1.9	145.0	9.2	11.3	157.0	0.0	158.0	48.0	10.0	100.0	152.0
5/11/2023	135.0	0.5	0.0	1.9	138.0	8.4	11.3	160.0	0.0	185.0	48.0	10.0	127.0	154.5
5/12/2023	159.0	0.5	0.0	1.9	139.0	8.5	11.3	152.0	0.0	188.0	48.0	10.0	130.0	159.5
5/13/2023	143.0	0.5	0.0	1.8	133.0	9.1	11.3	159.0	0.0	178.0	48.0	10.0	120.0	153.3
5/14/2023	154.0	0.5	0.0	1.8	129.0	9.3	11.7	171.0	0.0	186.0	27.0	10.0	149.0	160.0
5/15/2023	144.0	0.5	0.0	1.7	140.0	9.1	12.0	169.0	0.0	170.0	0.0	10.0	160.0	155.8
5/16/2023	140.0	0.5	0.0	1.7	131.0	9.0	12.1	156.0	0.0	167.0	12.0	3.0	152.0	148.5
5/17/2023	146.0	0.5	0.0	1.7	128.0	9.3	11.5	161.0	0.0	158.0	48.0	3.0	107.0	148.3
5/18/2023	142.0	0.5	0.0	1.7	132.0	9.5	10.5	158.0	0.0	158.0	48.0	3.0	107.0	147.5
5/19/2023	140.0	0.5	0.0	1.7	126.0	9.6	10.6	160.0	12.5	162.0	48.0	3.0	111.0	147.0
5/20/2023	137.0	0.5	0.0	1.7	135.0	9.6	11.2	154.0	34.0	164.0	48.0	3.0	113.0	147.5
5/21/2023	136.0	0.5	0.0	1.7	127.0	10.5	12.2	156.0	46.5	156.0	48.0	3.0	105.0	143.8
5/22/2023	130.0	0.5	0.0	1.6	125.0	11.3	12.4	176.0	74.5	147.0	48.0	3.0	96.0	144.5
5/23/2023	290.0	0.5	0.0	1.6	128.0	11.7	12.2	148.0	49.5	163.0	48.0	3.0	112.0	182.3
5/24/2023	514.0	0.5	0.0	1.6	124.0	12.3	12.2	150.0	0.0	200.0	48.0	3.0	149.0	247.0
5/25/2023	449.0	0.5	0.0	1.6	132.0	12.1	10.6	166.0	0.0	212.0	48.0	3.0	161.0	239.8
5/26/2023	499.0	0.5	0.0	1.6	282.0	12.5	5.3	155.0	0.0	201.0	48.0	3.0	150.0	284.3
5/27/2023	428.0	0.5	0.0	1.6	365.0	12.4	4.6	151.0	0.0	164.0	48.0	3.0	113.0	277.0
5/28/2023	519.0	0.5	0.0	1.5	375.0	11.5	6.5	310.0	0.0	145.0	48.0	3.0	94.0	337.3
5/29/2023	571.0	0.5	0.0	1.5	367.0	11.4	3.7	346.0	0.0	149.0	48.0	3.0	98.0	358.3
5/30/2023	551.0	0.5	0.0	1.5	462.0	12.0	1.8	338.0	0.0	162.0	48.0	3.0	111.0	378.3
5/31/2023	563.0	0.5	0.0	1.4	464.0	11.7	3.9	402.0	0.0	321.0	48.0	3.0	270.0	437.5
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6/1/2023	562.0	0.5	0.0	1.6	497.0	11.6	8.3	431.0	0.0	318.0	48.0	3.0	267.0	452.0
6/2/2023	457.0	0.5	0.0	1.7	492.0	11.9	10.4	445.0	120.0	331.0	48.0	3.0	280.0	431.3
6/3/2023	320.0	0.5	0.0	1.6	486.0	12.4	10.0	413.0	177.5	444.0	48.0	3.0	393.0	415.8
6/4/2023	402.0	0.5	0.0	1.5	418.0	13.9	9.8	454.0	82.5	427.0	48.0	3.0	376.0	425.3
6/5/2023	405.0	0.5	0.0	1.6	360.0	15.8	9.7	366.0	44.0	463.0	48.0	3.0	412.0	398.5
6/6/2023	431.0	0.5	0.0	1.6	346.0	18.3	9.7	322.0	33.0	553.0	48.0	3.0	502.0	413.0
6/7/2023	438.0	0.5	0.0	1.6	333.0	17.5	7.8	300.0	14.0	469.0	48.0	3.0	418.0	385.0
6/8/2023	613.0	0.5	0.0	1.5	347.0	15.7	3.5	303.0	0.0	381.0	39.0	3.0	339.0	411.0
6/9/2023	631.0	0.5	0.0	1.5	423.0	11.9	2.5	279.0	0.0	416.0	48.0	3.0	365.0	437.3
6/10/2023	666.0	0.5	0.0	1.6	510.0	9.9	6.6	331.0	30.0	403.0	48.0	3.0	352.0	477.5
6/11/2023	633.0	0.5	0.0	1.6	530.0	8.7	9.7	460.0	60.0	312.0	48.0	3.0	261.0	483.8
6/12/2023	631.0	0.5	0.0	1.5	525.0	8.1	9.6	476.0	30.0	327.0	48.0	3.0	276.0	489.8
6/13/2023	587.0	0.5	0.0	1.5	537.0	7.8	9.2	471.0	0.0	564.0	48.0	3.0	513.0	539.8
6/14/2023	493.0	0.5	0.0	1.5	488.0	8.6	9.2	475.0	15.0	571.0	48.0	3.0	520.0	506.8
6/15/2023	533.0	0.5	0.0	1.5	436.0	7.5	9.2	449.0	30.0	517.0	46.0	3.0	468.0	483.8
6/16/2023	474.0	0.5	0.0	1.5	418.0	8.0	9.2	419.0	30.8	513.0	48.0	3.0	462.0	456.0
6/17/2023	492.0	0.5	0.0	1.5	452.0	9.1	9.2	369.0	39.9	522.0	48.0	3.0	471.0	458.8
6/18/2023	570.0	0.5	0.0	1.4	423.0	9.6	9.2	375.0	46.8	481.0	48.0	3.0	430.0	462.3
6/19/2023	711.0	0.5	0.0	1.3	410.0	10.1	9.1	361.0	45.1	475.0	48.0	3.0	424.0	489.3
6/20/2023	752.0	0.5	0.0	1.4	520.0	10.5	9.0	344.0	22.3	438.0	48.0	3.0	387.0	513.5
6/21/2023	755.0	0.5	0.0	1.5	637.0	10.5	7.8	435.0	0.0	417.0	48.0	3.0	366.0	561.0
6/22/2023	767.0	0.5	0.0	1.6	622.0	10.7	4.0	526.0	0.0	415.0	48.0	3.0	364.0	582.5
6/23/2023	746.0	0.5	0.0	1.6	613.0	10.3	1.4	551.0	0.0	472.0	48.0	3.0	421.0	595.5
6/24/2023	720.0	0.5	0.0	1.5	620.0	10.2	1.1	540.0	0.0	546.0	48.0	3.0	495.0	606.5
6/25/2023	699.0	0.5	0.0	1.4	611.0	9.8	1.0	568.0	0.0	560.0	48.0	3.0	509.0	609.5
6/26/2023	608.0	0.5	0.0	1.0	618.0	9.2	1.2	567.0	0.0	626.0	48.0	3.0	575.0	604.8
6/27/2023	501.0	0.5	0.0	1.1	582.0	8.5	1.2	564.0	0.0	619.0	48.0	3.0	568.0	566.5
6/28/2023	337.0	0.5	0.0	1.6	434.0	8.5	0.9	532.0	0.0	599.0	48.0	3.0	548.0	475.5
6/29/2023	339.0	0.5	0.0	1.6	349.0	8.4	1.0	434.0	0.0	593.0	48.0	3.0	542.0	428.8
6/30/2023	338.0	0.5	0.0	1.6	288.0	8.6	1.3	368.0	0.0	592.0	48.0	3.0	541.0	396.5
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7/1/2023	341.0	0.5	0.0	1.6	259.0	9.2	3.7	291.0	0.0	518.0	48.0	3.0	467.0	352.3
7/2/2023	346.0	0.5	0.0	1.7	246.0	9.4	8.0	278.0	0.0	457.0	48.0	3.0	406.0	331.8
7/3/2023	335.0	0.5	0.0	1.6	257.0	9.4	9.9	279.0	0.0	335.0	48.0	3.0	284.0	301.5
7/4/2023	332.0	0.5	0.0	3.7	257.0	9.1	9.5	262.0	0.0	241.0	48.0	3.0	190.0	273.0
7/5/2023	377.0	0.5	0.0	6.8	253.0	9.0	9.3	249.0	0.0	286.0	48.0	3.0	235.0	291.3
7/6/2023	393.0	0.5	0.0	10.2	278.0	9.2	9.3	253.0	0.0	294.0	48.0	3.0	243.0	304.5
7/7/2023	378.0	0.5	0.0	9.9	322.0	9.4	9.4	282.0	0.0	339.0	48.0	3.0	288.0	330.3
7/8/2023	363.0	0.5	0.0	7.1	308.0	9.5	9.4	312.0	0.0	276.0	48.0	3.0	225.0	314.8
7/9/2023	325.0	0.5	0.0	8.0	302.0	9.5	9.5	293.0	0.0	289.0	48.0	3.0	238.0	302.3
7/10/2023	303.0	0.5	0.0	8.1	296.0	9.7	9.8	277.0	0.0	300.0	48.0	3.0	249.0	294.0
7/11/2023	271.0	0.5	0.0	7.6	277.0	9.9	10.3	285.0	0.0	316.0	48.0	3.0	265.0	287.3
7/12/2023	280.0	0.5	0.0	6.7	245.0	9.9	10.9	232.0	0.0	300.0	48.0	3.0	249.0	264.3
7/13/2023	200.0	0.5	0.0	6.6	236.0	9.9	11.6	248.0	0.0	303.0	43.0	3.0	257.0	246.8
7/14/2023	149.0	0.5	0.0	6.6	224.0	10.0	12.1	238.0	0.0	289.0	44.0	3.0	242.0	225.0
7/15/2023	141.0	0.5	0.0	6.8	176.0	10.1	11.6	203.0	0.0	264.0	48.0	3.0	213.0	196.0
7/16/2023	198.0	0.5	0.0	6.9	179.0	10.2	10.7	173.0	0.0	245.0	48.0	3.0	194.0	198.8
7/17/2023	207.0	0.5	0.0	7.3	177.0	10.4	10.2	150.0	0.0	217.0	22.0	3.0	192.0	187.8
7/18/2023	142.0	0.5	0.0	9.1	219.0	10.7	10.1	156.0	12.5	230.0	0.0	3.0	227.0	186.8
7/19/2023	141.0	0.5	0.0	9.9	185.0	10.8	10.1	194.0	12.5	199.0	0.0	3.0	196.0	179.8
7/20/2023	213.0	0.5	0.0	9.7	187.0	11.2	10.0	210.0	0.0	189.0	0.0	3.0	186.0	199.8
7/21/2023	199.0	0.5	0.0	9.7	176.0	11.3	9.7	196.0	0.0	187.0	0.0	3.0	184.0	189.5
7/22/2023	305.0	0.5	0.0	9.6	178.0	11.2	9.4	180.0	0.0	222.0	0.0	3.0	219.0	221.3
7/23/2023	331.0	0.5	0.0	9.6	224.0	11.3	9.1	171.0	0.0	218.0	41.0	3.0	174.0	236.0
7/24/2023	277.0	0.5	0.0	9.7	261.0	11.4	9.1	185.0	0.0	189.0	48.0	3.0	138.0	228.0
7/25/2023	326.0	0.5	0.0	9.7	278.0	11.3	9.6	271.0	0.0	201.0	48.0	3.0	150.0	269.0
7/26/2023	361.0	0.5	0.0	9.9	264.0	11.2	10.5	289.0	0.0	201.0	48.0	3.0	150.0	278.8
7/27/2023	278.0	0.5	0.0	10.1	298.0	11.2	10.7	290.0	0.0	267.0	48.0	3.0	216.0	283.3
7/28/2023	306.0	0.5	0.0	13.5	297.0	11.1	10.6	291.0	0.0	287.0	48.0	3.0	236.0	295.3
7/29/2023	294.0	0.5	0.0	14.8	298.0	11.2	10.7	302.0	0.0	314.0	48.0	3.0	263.0	302.0
7/30/2023	291.0	0.5	0.0	12.6	289.0	11.3	10.8	292.0	0.0	309.0	48.0	3.0	258.0	295.3
7/31/2023	293.0	0.5	0.0	6.5	277.0	11.4	10.9	302.0	0.0	331.0	48.0	3.0	280.0	300.8
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8/1/2023	273.0	0.5	0.0	0.9	283.0	11.4	10.9	294.0	0.0	298.0	48.0	3.0	247.0	287.0
8/2/2023	282.0	0.6	0.0	1.0	255.0	11.5	10.9	281.0	0.0	291.0	48.0	3.0	240.0	277.3
8/3/2023	126.0	0.7	0.0	1.0	260.0	11.3	10.8	284.0	0.0	296.0	48.0	3.0	245.0	241.5
8/4/2023	124.0	0.7	0.0	0.8	211.0	9.3	10.8	269.0	0.0	303.0	48.0	3.0	252.0	226.8
8/5/2023	126.0	0.8	0.0	0.8	176.0	7.8	10.8	242.0	0.0	274.0	48.0	3.0	223.0	204.5
8/6/2023	125.0	0.9	0.0	0.6	150.0	7.3	10.7	188.0	0.0	279.0	48.0	3.0	228.0	185.5
8/7/2023	116.0	0.9	0.0	1.6	135.0	7.0	10.5	154.0	0.0	280.0	48.0	3.0	229.0	171.3
8/8/2023	98.0	1.0	0.0	4.1	141.0	6.9	10.3	141.0	0.0	239.0	47.0	3.0	189.0	154.8
8/9/2023	101.0	1.1	0.0	7.4	140.0	7.0	7.3	144.0	0.0	207.0	47.0	3.0	157.0	148.0
8/10/2023	97.0	1.2	0.0	1.0	125.0	4.6	2.3	143.0	0.0	171.0	47.0	3.0	121.0	134.0
8/11/2023	93.0	1.2	0.0	1.6	122.0	0.7	0.8	114.0	0.0	125.0	47.0	3.0	75.0	113.5
8/12/2023	92.0	1.3	0.0	1.6	118.0	0.6	1.4	129.0	0.0	156.0	47.0	3.0	106.0	123.8
8/13/2023	92.0	1.4	0.0	1.6	116.0	0.5	0.8	111.0	0.0	152.0	47.0	3.0	102.0	117.8
8/14/2023	92.0	1.4	0.0	0.9	111.0	0.4	0.1	102.0	0.0	138.0	46.0	3.0	89.0	110.8
8/15/2023	92.0	1.5	0.0	0.9	107.0	0.4	0.2	109.0	0.0	132.0	45.0	3.0	84.0	110.0
8/16/2023	92.0	1.6	0.0	1.0	106.0	0.3	0.6	109.0	0.0	112.0	45.0	3.0	64.0	104.8
8/17/2023	92.0	1.6	0.0	1.0	105.0	0.4	0.6	104.0	0.0	108.0	45.0	3.0	60.0	102.3
8/18/2023	92.0	1.7	0.0	3.2	103.0	0.4	0.4	91.0	0.0	106.0	45.0	3.0	58.0	98.0
8/19/2023	92.0	1.8	0.0	1.7	101.0	0.5	0.2	89.0	0.0	103.0	45.0	3.0	55.0	96.3
8/20/2023	91.0	1.8	0.0	2.4	106.0	0.8	0.1	95.0	500.0	79.0	18.0	2.0	59.0	92.8
8/21/2023	230.0	1.9	0.0	4.7	131.0	4.8	0.0	133.0	935.0	125.0	4.0	3.0	118.0	154.8
8/22/2023	214.0	2.0	0.0	1.6	155.0	2.7	0.2	177.0	750.0	403.0	0.0	3.0	400.0	237.3
8/23/2023	492.0	2.1	0.0	1.1	195.0	1.1	0.4	138.0	544.0	1170.0	0.0	50.0	1120.0	498.8
8/24/2023	517.0	2.1	0.0	0.9	294.0	0.7	0.3	165.0	277.5	940.0	0.0	3.0	937.0	479.0
8/25/2023	538.0	2.2	0.0	0.8	449.0	0.4	0.1	216.0	104.5	754.0	0.0	3.0	751.0	489.3
8/26/2023	400.0	2.3	0.0	1.4	453.0	0.3	0.3	368.0	108.5	500.0	0.0	3.0	497.0	430.3
8/27/2023	351.0	2.3	0.0	1.8	416.0	0.3	0.5	433.0	96.0	305.0	0.0	3.0	302.0	376.3
8/28/2023	497.0	2.4	0.0	1.8	371.0	0.3	0.4	402.0	90.5	428.0	0.0	3.0	425.0	424.5
8/29/2023	90.0	2.5	0.0	1.3	373.0	0.3	0.4	352.0	95.5	540.0	0.0	3.0	537.0	338.8
8/30/2023	92.0	2.5	0.0	0.8	258.0	0.4	0.8	321.0	97.0	460.0	33.0	3.0	424.0	282.8
8/31/2023	62.0	2.5	0.0	1.1	152.0	0.4	1.3	298.0	94.0	424.0	46.0	3.0	375.0	234.0
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
9/1/2023	49.0	2.5	0.0	1.7	142.0	0.3	1.3	228.0	88.5	393.0	46.0	11.0	336.0	203.0
9/2/2023	49.0	2.4	0.0	1.7	105.0	0.3	1.6	151.0	90.5	370.0	46.0	11.0	313.0	168.8
9/3/2023	49.0	2.4	0.0	2.2	88.0	0.3	2.1	127.0	107.0	290.0	46.0	11.0	233.0	138.5
9/4/2023	49.0	2.3	0.0	2.1	83.0	0.3	2.3	120.0	90.0	224.0	46.0	11.0	167.0	119.0
9/5/2023	49.0	2.3	0.0	2.0	78.0	0.4	2.4	100.0	74.0	218.0	46.0	11.0	161.0	111.3
9/6/2023	49.0	2.2	0.0	2.0	76.0	0.4	2.7	97.0	90.0	206.0	46.0	11.0	149.0	107.0
9/7/2023	49.0	2.2	0.0	2.0	73.0	0.4	2.9	80.0	106.5	189.0	46.0	11.0	132.0	97.8
9/8/2023	49.0	2.1	0.0	1.9	71.0	0.4	3.2	78.0	110.0	159.0	46.0	11.0	102.0	89.3
9/9/2023	49.0	2.1	0.0	1.7	70.0	0.4	3.4	77.0	95.0	160.0	46.0	11.0	103.0	89.0
9/10/2023	49.0	2.0	0.0	1.7	69.0	0.4	3.3	76.0	90.0	153.0	46.0	11.0	96.0	86.8
9/11/2023	49.0	2.0	0.0	1.7	69.0	0.4	3.2	73.0	91.5	149.0	46.0	11.0	92.0	85.0
9/12/2023	49.0	1.9	0.0	1.6	68.0	0.4	3.3	72.0	101.5	153.0	46.0	11.0	96.0	85.5
9/13/2023	50.0	1.9	0.0	1.6	67.0	0.3	3.4	72.0	113.0	151.0	46.0	11.0	94.0	85.0
9/14/2023	49.0	1.8	0.0	1.4	66.0	0.2	3.3	72.0	102.0	143.0	46.0	11.0	86.0	82.5
9/15/2023	49.0	1.8	0.0	1.6	66.0	0.3	3.1	71.0	91.0	141.0	45.0	11.0	85.0	81.8
9/16/2023	49.0	1.7	0.0	1.4	66.0	0.7	3.0	71.0	91.0	146.0	46.0	11.0	89.0	83.0
9/17/2023	49.0	1.7	0.0	1.2	65.0	1.2	3.1	70.0	83.5	141.0	46.0	11.0	84.0	81.3
9/18/2023	49.0	1.6	0.0	1.2	64.0	1.6	3.1	69.0	80.5	135.0	46.0	11.0	78.0	79.3
9/19/2023	49.0	1.6	0.0	1.4	64.0	1.8	3.3	71.0	91.0	136.0	46.0	11.0	79.0	80.0
9/20/2023	49.0	1.5	0.0	1.5	64.0	1.8	3.3	73.0	98.5	132.0	47.0	11.0	74.0	79.5
9/21/2023	49.0	1.5	0.0	1.2	63.0	2.0	3.0	76.0	91.5	131.0	45.0	11.0	75.0	79.8
9/22/2023	49.0	1.4	0.0	1.2	64.0	1.9	2.9	76.0	84.5	136.0	47.0	11.0	78.0	81.3
9/23/2023	49.0	1.4	0.0	1.2	63.0	1.8	2.5	77.0	81.5	139.0	48.0	11.0	80.0	82.0
9/24/2023	49.0	1.3	0.0	1.0	61.0	1.7	1.8	76.0	155.0	139.0	48.0	11.0	80.0	81.3
9/25/2023	262.0	1.3	0.0	0.6	60.0	1.5	6.6	76.0	165.0	146.0	48.0	11.0	87.0	136.0
9/26/2023	283.0	1.2	0.0	1.2	65.0	1.2	11.3	77.0	57.5	139.0	24.0	11.0	104.0	141.0
9/27/2023	232.0	1.2	0.0	1.1	155.0	0.8	7.0	88.0	15.0	129.0	0.0	11.0	118.0	151.0
9/28/2023	237.0	1.1	0.0	0.9	233.0	0.7	2.4	98.0	15.0	133.0	0.0	11.0	122.0	175.3
9/29/2023	262.0	1.1	0.0	0.7	223.0	0.7	1.5	173.0	27.5	130.0	5.0	11.0	114.0	197.0
9/30/2023	253.0	1.0	0.0	0.6	230.0	0.6	1.6	228.0	20.0	104.0	26.0	11.0	67.0	203.8
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

3.0 WATER QUALITY MONITORING

There is tradeoff in flow management of the LORP – implementing a spring flow aimed at cottonwood and willow recruitment in June can create lethally low dissolved oxygen levels for fish. The degree to which antecedent flows and consequent sediment transport interact with temperature and biological oxygen demand of the system during subsequent pulse flows has only been monitored periodically, mostly in years with seasonal habitat flows. To continue the empirical record, ICWD staff collected manual water quality measurements on the LOR during 2023 with a focus on the high flows from March to October. An In-Situ AquaTROLL 400 Multi-parameter probe was used to collect instantaneous water temperature (temp), dissolved oxygen (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 of this limited field campaign was to document changes in DO levels correlated with changes in LOR flows and to document whether DO levels were lowered to ranges that produce fish stress or mortality.

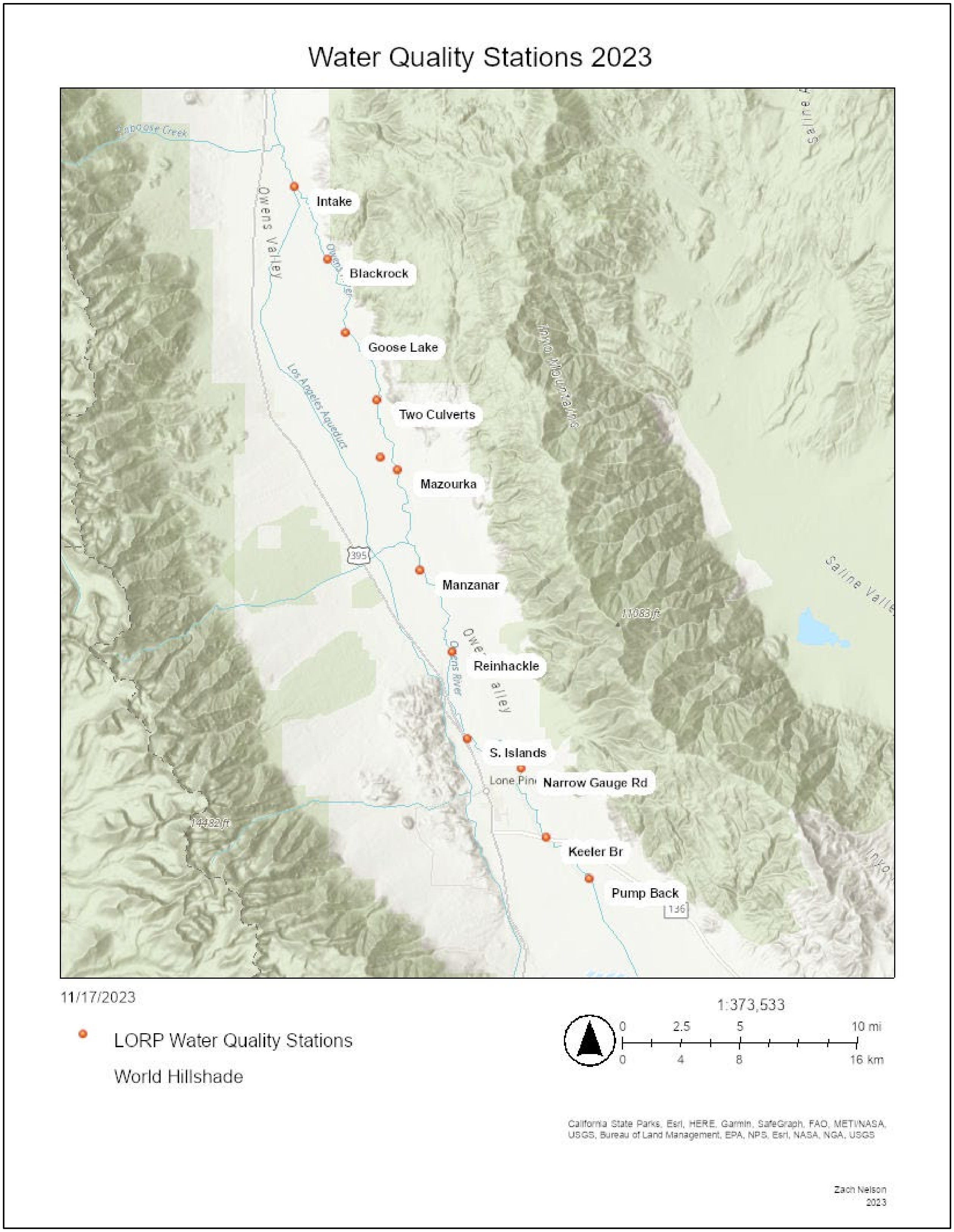


Figure 3-1. Water quality measuring stations on the Lower Owens River.

As documented and discussed in previous LORP Annual Report water quality sections (2008-10, 2014-15, 2017, 2019), 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.

From March through late August 2023, flow in the LOR remained high due to record wet winter precipitation and the remnants of Tropical Storm Hilary (August 20-21, 2023), with flows at the LOR Intake exceeding typical two-week seasonal habitat flow rates of 200 cfs for most of this time period. Three distinct peaks in flow occurred during the runoff season, measured at the LOR Intake: 606 daily average cfs (on March 17), 767 cfs (June 22), and 548 cfs (August 25). Several sub-peaks in flow occurred throughout the season between these main peaks, and average flows remained high during the entire runoff season (Figure 3-2).

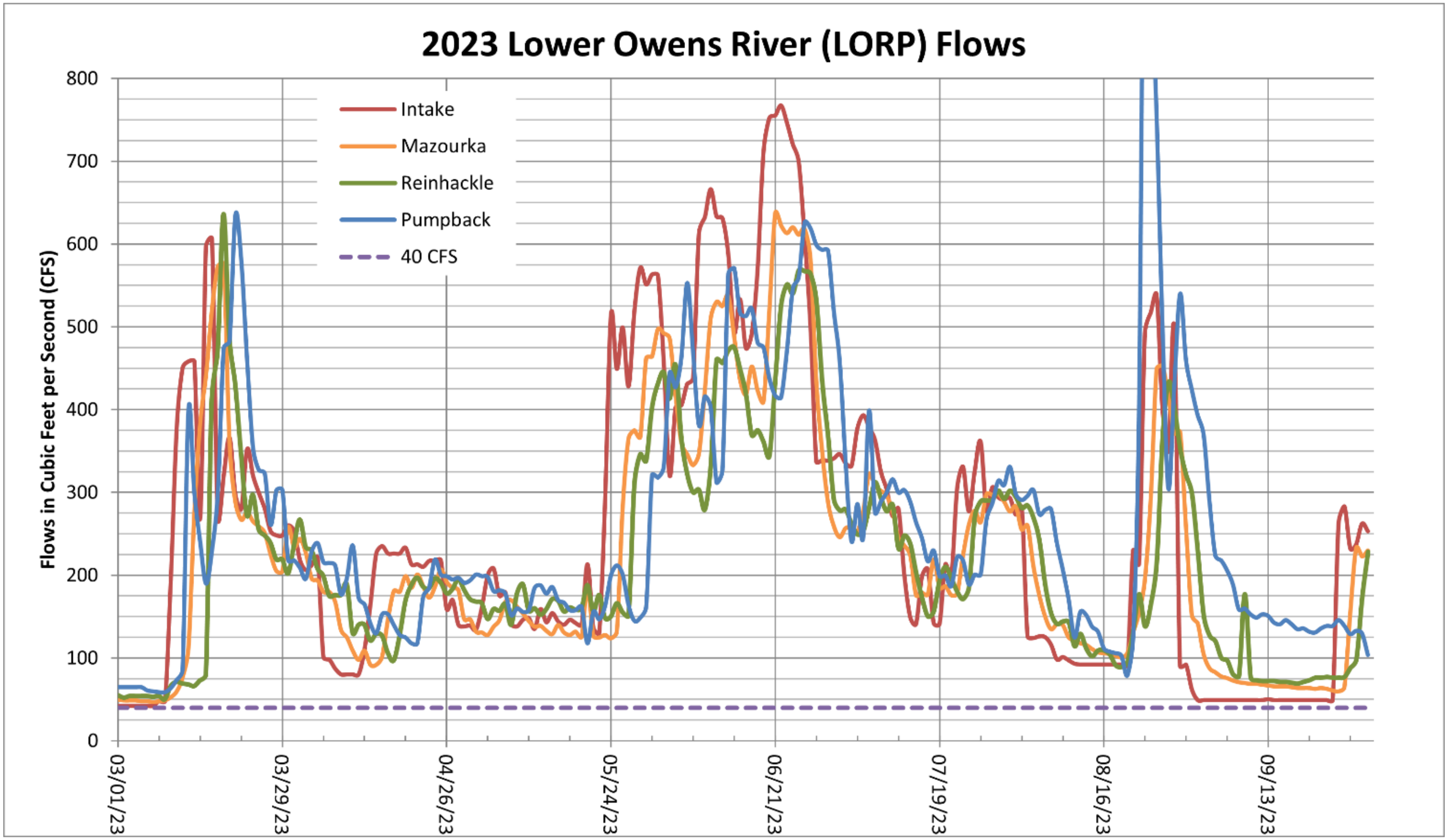


Figure 3-2. 2023 LOR March-September Flow. Data taken from LADWP LORP Daily Reports. August 24, 2023, Pumpback peak flow was 1170 cfs.

Water temperature and dissolved oxygen exhibited fluctuations related to flows. Water temperature during the sustained high flows from late May to mid-August ranged from 40 to 74 degrees Fahrenheit (F). Dissolved oxygen levels in the LOR ranged from more than 10 mg/L at the LOR Intake in mid-April to 0.0 mg/L at Reinhackle Springs in late May. Evidence of fish stress in correlation with low DO measurements was observed at several sites on the LOR. Observed behaviors indicative of fish stress included schooling, breaking the surface to gulp air, and lethargic swimming; such behavior was observed at Two Culverts, Manzanar, Reinhackle, and the Pumpback Station throughout May and June. However, no major fish kills within the LOR were observed or reported, though several fish kills were reported in the Off-River Lakes and Ponds (Upper and Lower Twin Lakes, Goose Lake, Billy Lake). During the June and July peak summer flows, water temperature ranged from 60 to 74 F and DO levels ranged from 7.0 mg/L at the LOR Intake to 0.0 mg/L at Reinhackle. Evidence of fish stress and mortality coincided with the lowest DO measurements. Figures 3-3 through 3-6 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. Although 12 sites along the LOR were measured, these four sites best represent the trends in measured parameters observed during the 2023 measurement season; discussion is therefore limited to these sites.

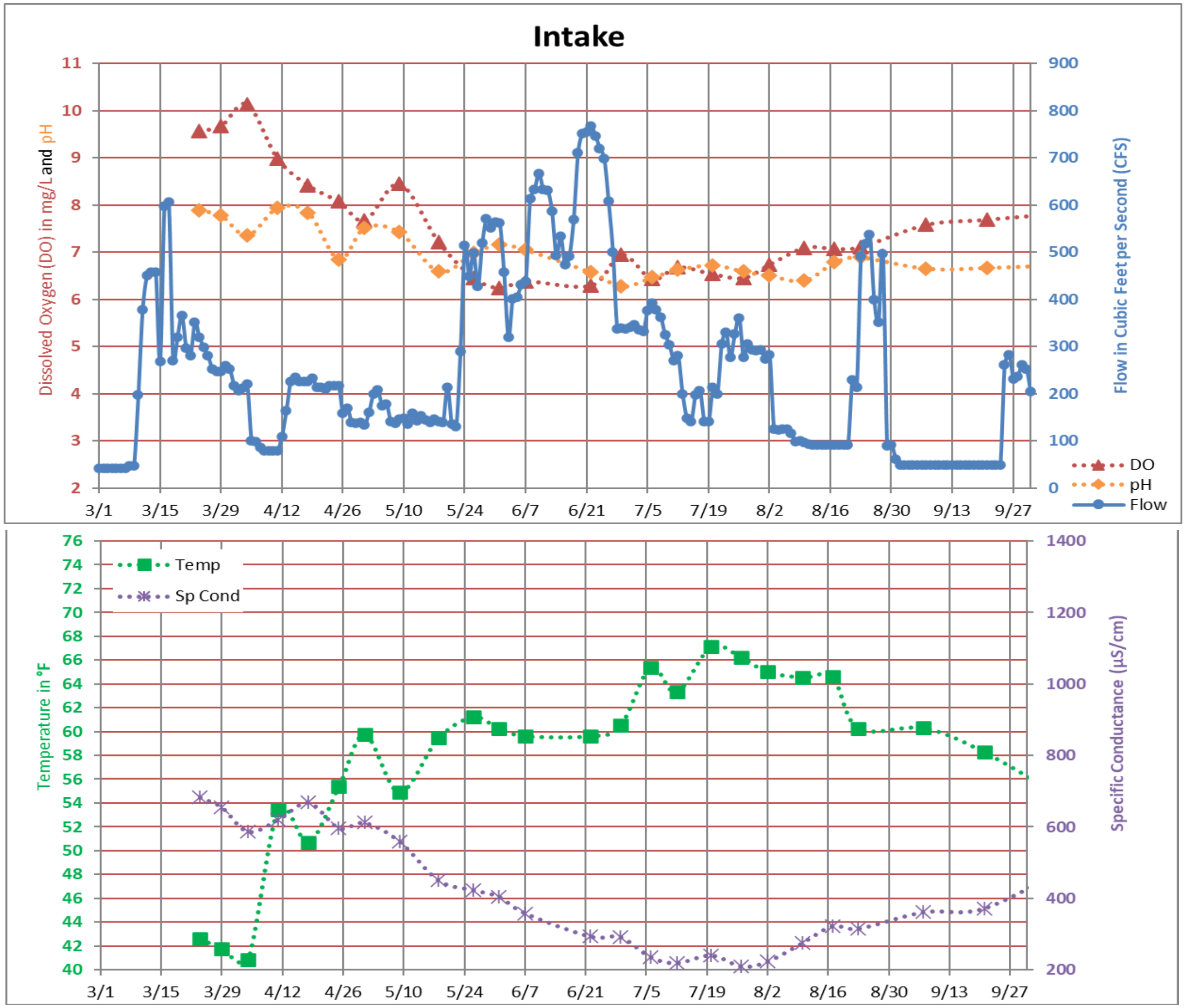


Figure 3-3. 2023 LOR Intake. LOR Flow with DO, pH, Temp, and Sp Cond at the LOR Intake.

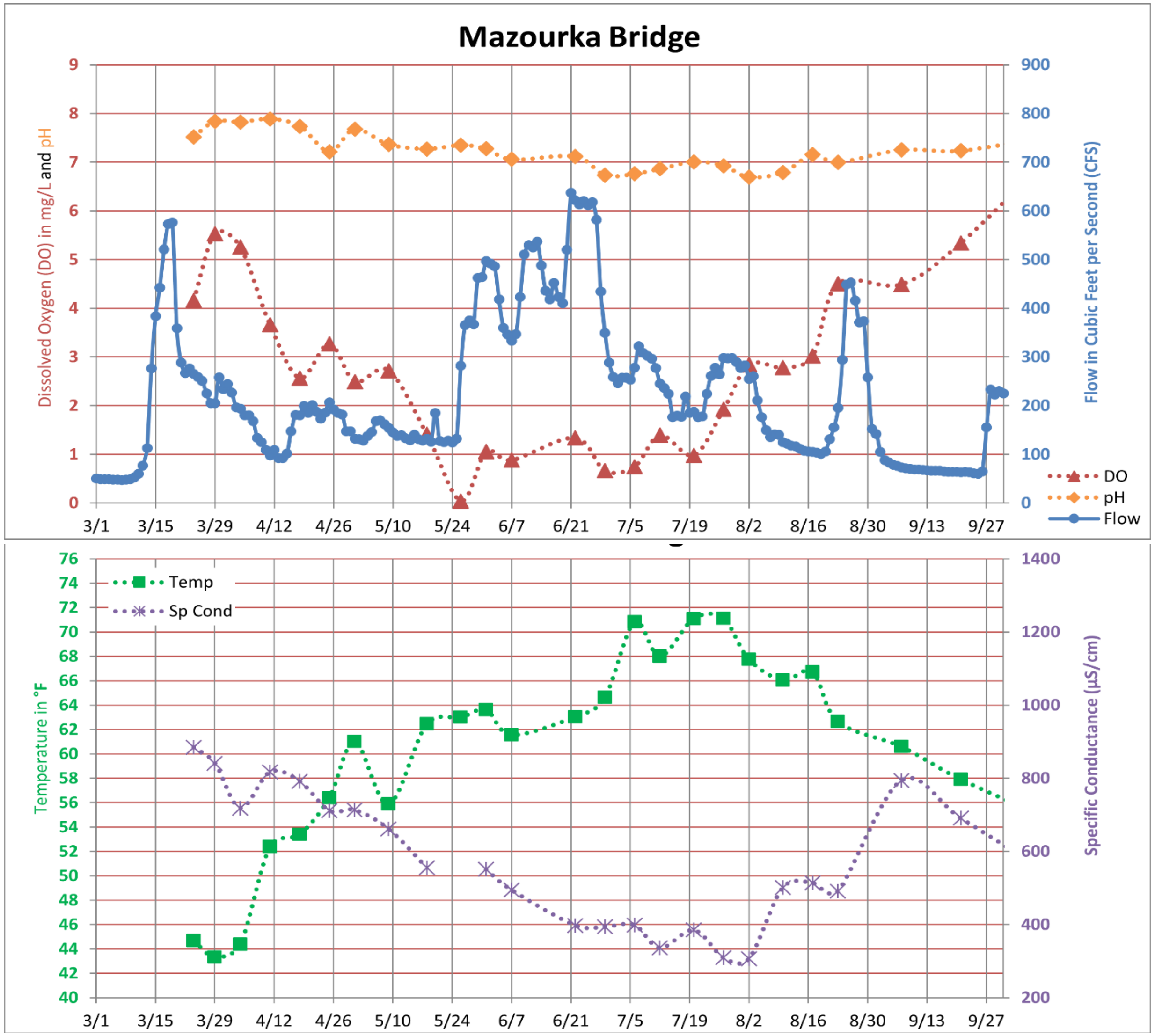


Figure 3-4. 2023 LOR Mazourka Bridge. LOR Flow with DO, pH, Temp, and Sp Cond at Mazourka Bridge.

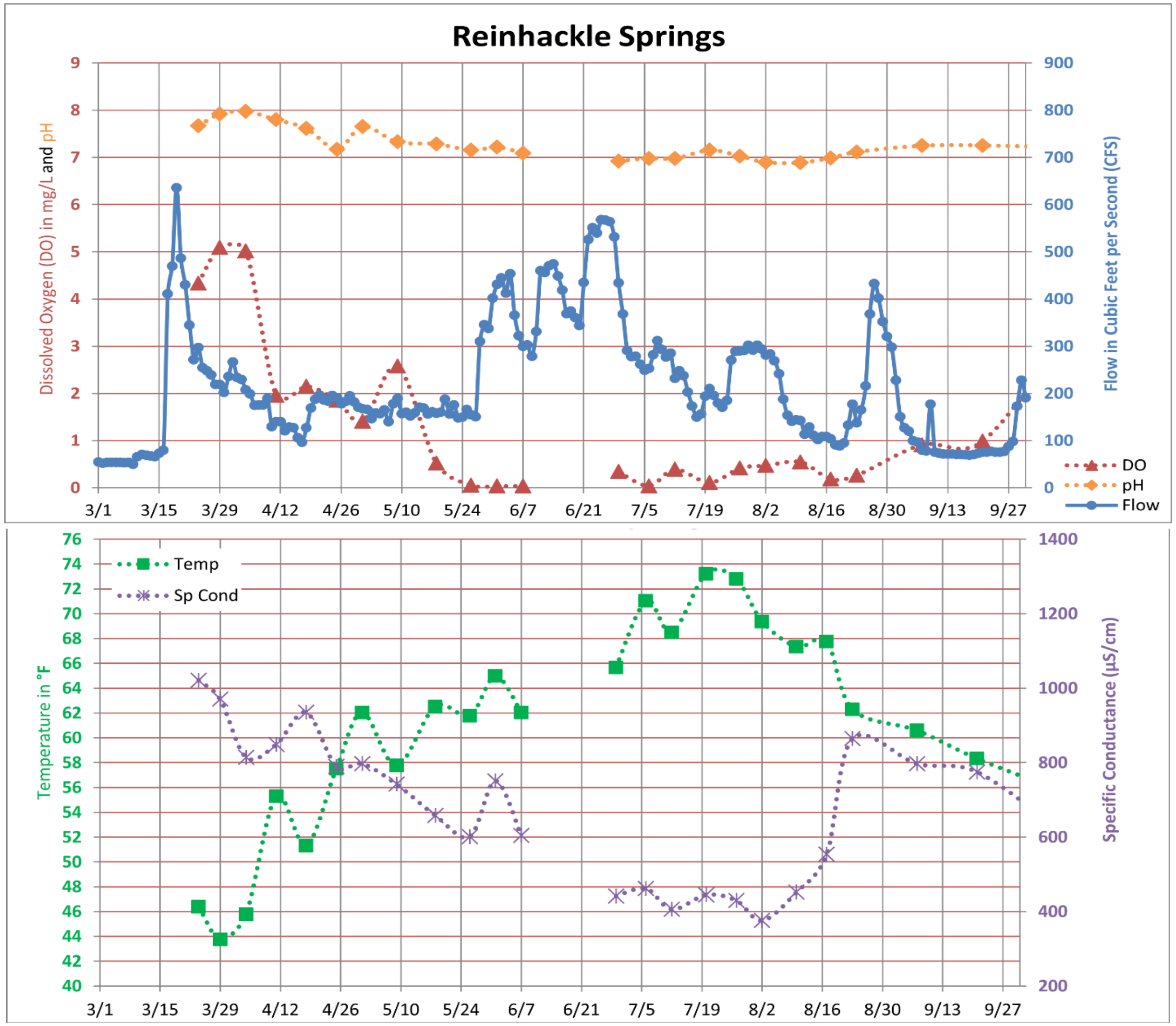


Figure 3-5. 2023 LOR Reinhackle Springs. LOR Flow with DO, pH, Temp, and Sp Cond at Reinhackle Springs. Gaps in water quality parameters indicate measurements missed due to site inaccessibility.

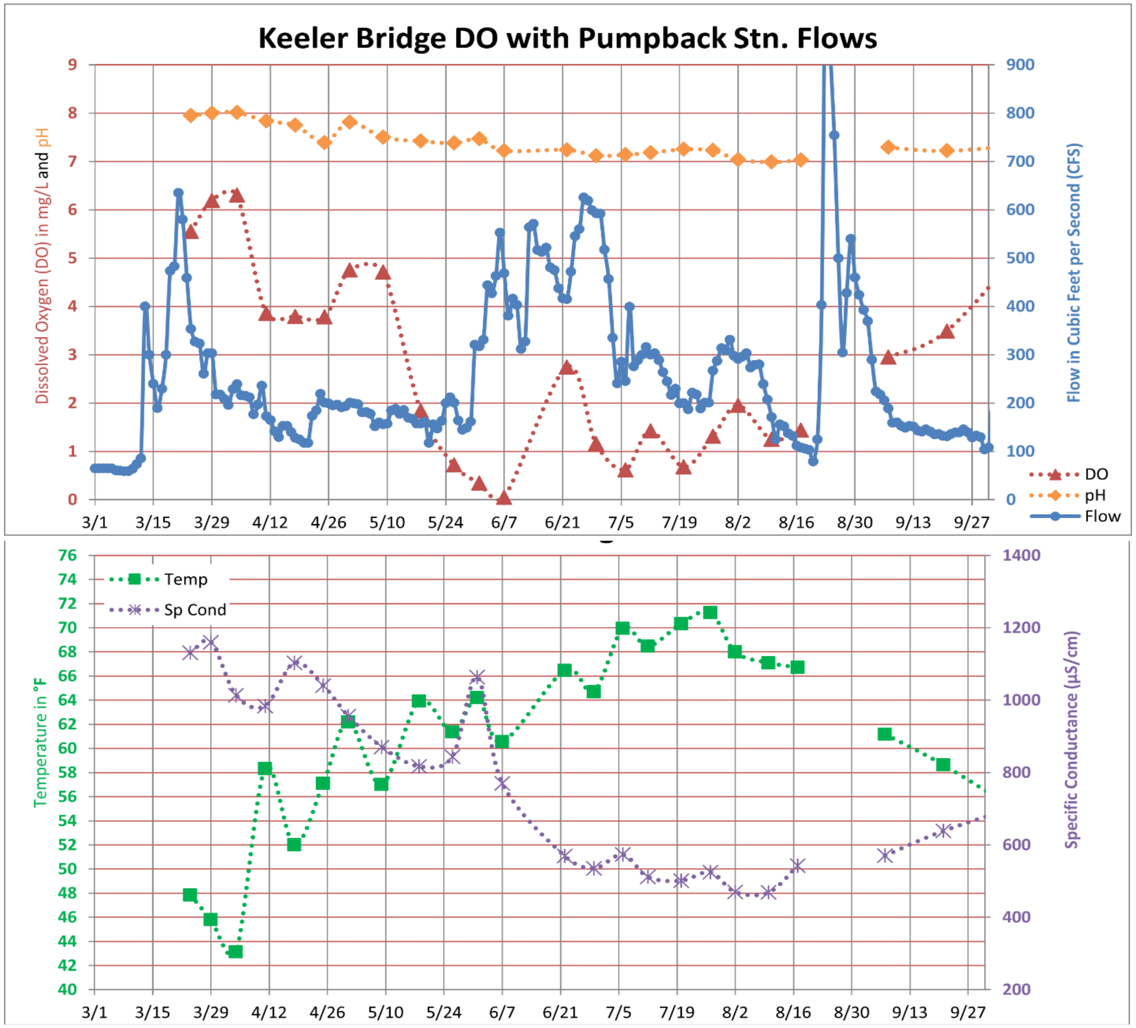


Figure 3-6. 2023 LOR Flow with DO and pH at Keeler Bridge. Minimum DO coincides with initial summer peaking of flow (June 7). Flow data are taken from the Pumpback Station discharge gauging station. Gaps in water quality parameters indicate measurements missed due to site inaccessibility.

Dissolved oxygen levels measured within the LOR during the 2023 runoff season were similar in magnitude to those measured in 2017, the most comparable flow year with measured water quality parameters. A general inverse relationship between temperature and DO was observed, with increasing temperature correlating with decreasing DO. DO remained low or 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. South (i.e., downstream) of Reinhackle, DO measurements trended upward with distance towards Keeler Bridge and the Pumpback Station.

Across all LOR measurement sites, initial depletion of DO corresponds most closely to initial late-May or early peaking of flow. Peak summer flows occurred at different times for each monitoring site, with flows peaking earlier at northerly sites and later at southerly sites. At the most severely depleted monitoring site (Reinhackle), DO remained depleted from mid-May through late August. Reinhackle represents a mid-LOR low in DO, increasing with distance north to the Intake and to the south 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. pH ranged from 8.1 to 6.4. Specific conductivity ranged from 209 μS/cm to 1201 μS/cm, and generally decreased until early August, then increased into September. A notable specific conductivity decrease occurred in correlation to the late-May and June high flows when LOR flows surpassed 400 cfs.

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.

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 2023, 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 2023, as the above items are multi-year commitments.

4.1 DHA Interim Flow Regime and Related Monitoring

Prior to the adaptation of the interim flow schedule, elevated stream discharges to the DHA during the growing season resulted in the growth and expansion of emergent vegetation and the subsequent loss of open-water habitat. The overarching goal of the interim flows is to reverse this trend and provide open water and meadow habitat for both habitat indicator species (HIS) and other wildlife associated with the LORP.

4.1.1 Methodology

Monitoring *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, seasonal habitat flows, or during power outages. Average-daily flows for 2022-2023 RY (April 1, 2022 -March 31, 2023) were compared to the interim-flow schedule to evaluate adherence to the prescribed flows. *Please note that extreme runoff conditions that occurred in 2023*

were not captured in this period – those will be reported in a subsequent LORP Annual Report.

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 2022 summer drying period were documented from aerial photos. Similarly, these aerial photographs were also used to determine the creation of seasonal ponds associated with criterion 3.

4.1.2 Results and Discussion

For 2022-23 RY, actual flows conformed closely to those prescribed for most of the year with deviations occurring primarily from precipitation events and corresponding increases in discharge (Figure 4-1). For instance, in early August of 2022, there was a storm event which resulted in an average-daily peak flow of 44 cfs going to the DHA. Similarly, a series of winter storms caused high flows to the DHA for the months of January and March 2023, which culminated in an average-daily peak flow of 645 cfs on March 21, 2023 (Figure 4-2). A total of 16,072 AF of water was discharged to the DHA between January 1 and March 31 of 2023, which inundated large expanses of the DHA. Lastly, drops in flow below the prescribed discharge were because of flow-measuring equipment malfunctioning (Figure 4-1).

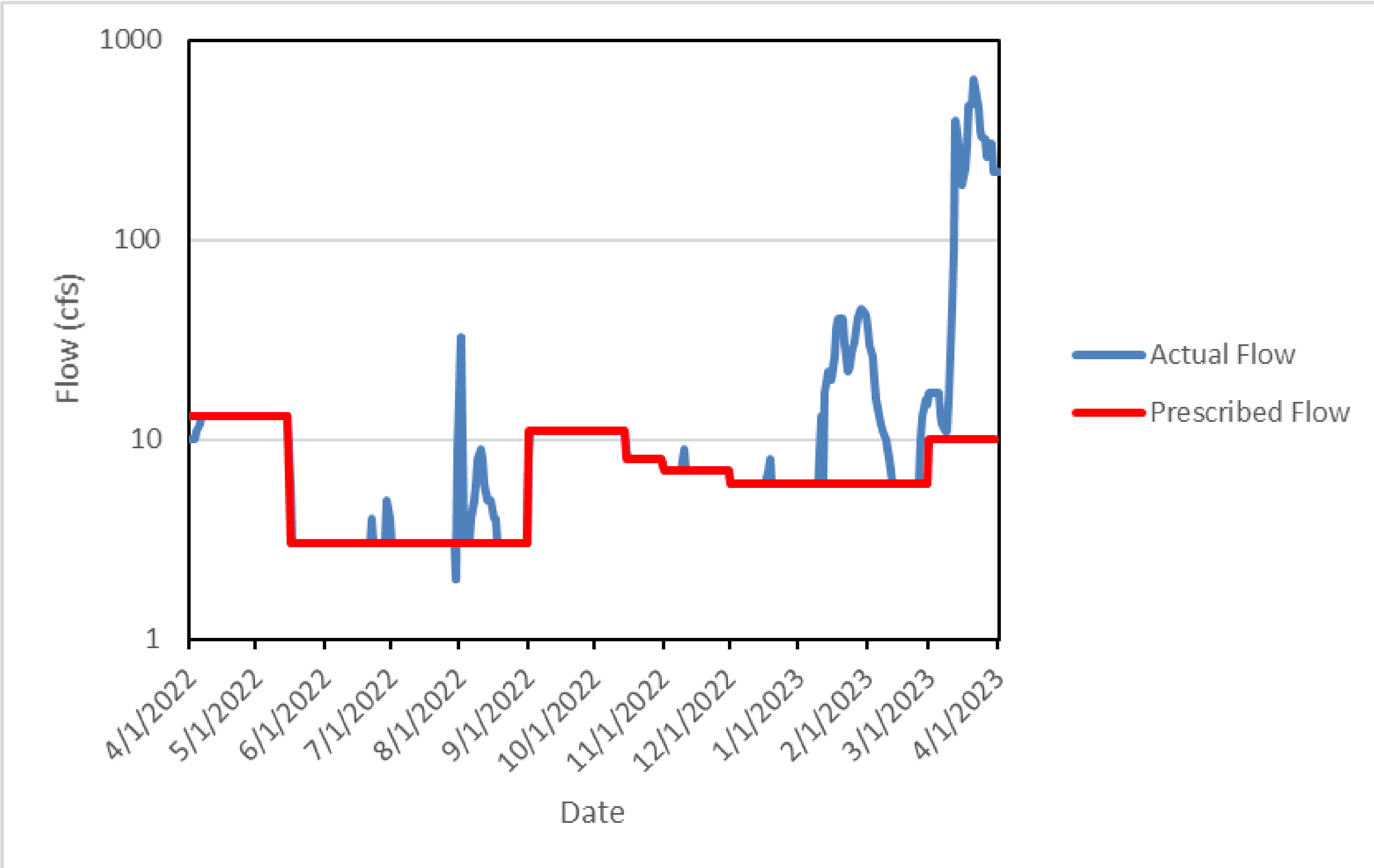


Figure 4-1. Actual flow to the DHA in 2022-23 RY verses prescribed flow (note log-scale along y-axis).

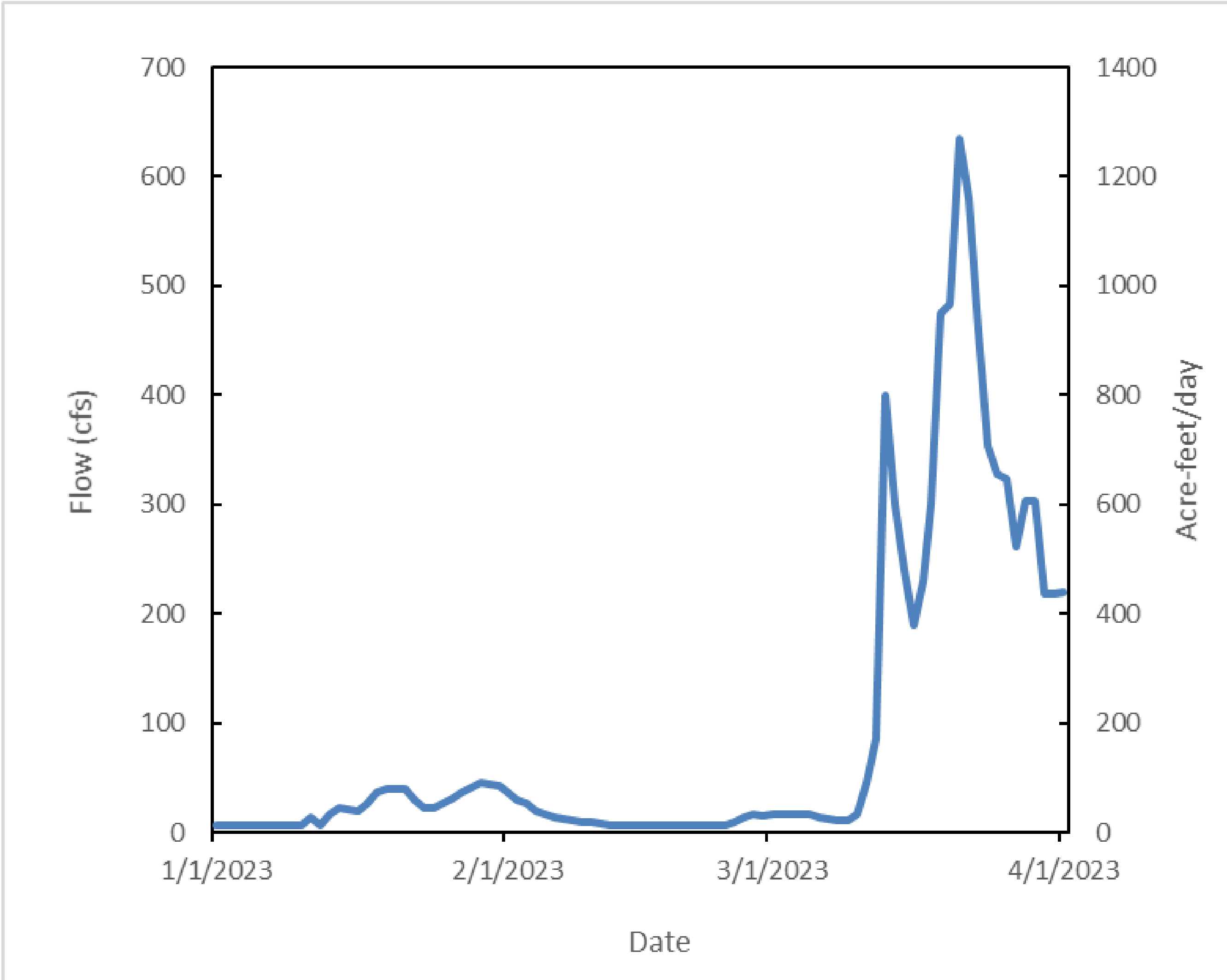


Figure 4-2. Stream discharge associated with the 2023 winter storm events.

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?

To evaluate the effectiveness of the interim flow changes on emergent vegetation, aerial photos of vegetation conditions within the DHA, were qualitatively compared between pre-project and current conditions. Pre-project conditions (August 16, 2019) show extensive emergent vegetation throughout the DHA that is vigorous and actively growing (Figure 4-3). In contrast, conditions associated with Figure 4-4 (August 25, 2022), which was the third consecutive year of interim flows and represents a summer base flow of 4 cfs, show extensive areas of brown vegetation, particularly along the east and south side of the DHA - indicating hydrologic stress.

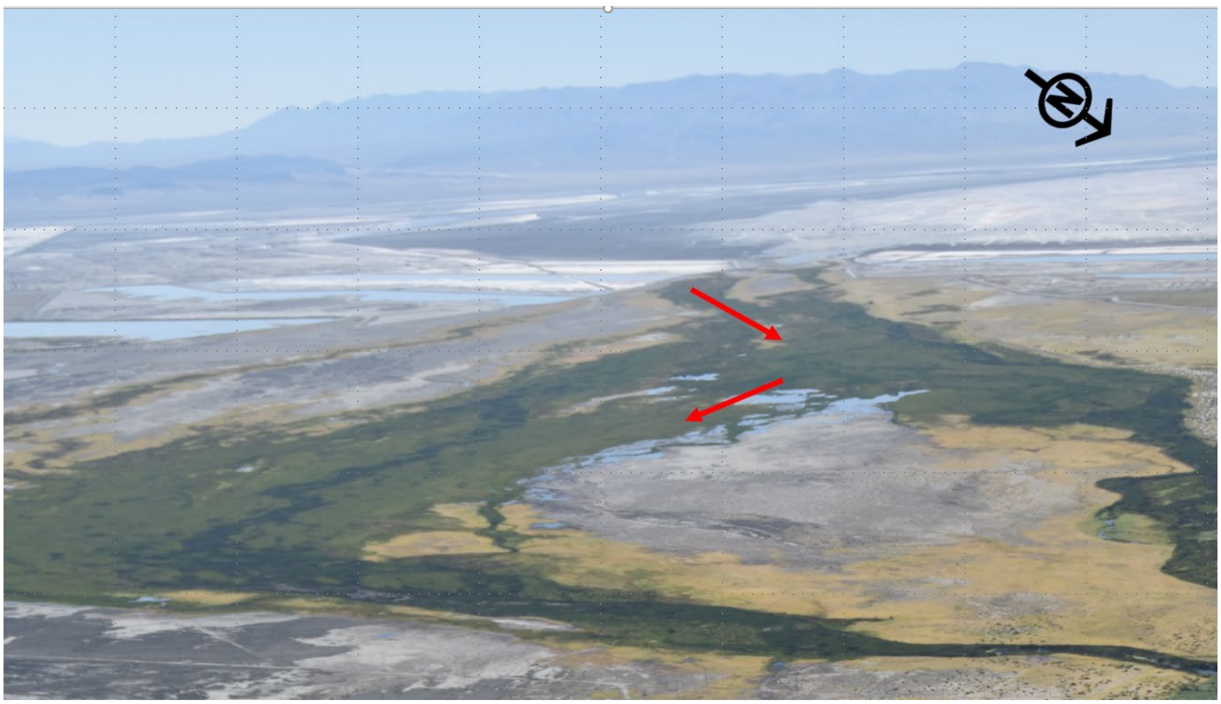


Figure 4-3. August 16, 2019, aerial image of DHA. Red arrows are reference locations.

Figure 4-4. August 25, 2022, aerial image of DHA. Reference locations denoted by red arrows exhibit extensive die-back of emergent vegetation from hydrologic stress.

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 were monitored during the 2022-23 RY are shown in Figure 4-5. Representative photos (Figure 4-6 and Figure 4-7.) from July 6, 2022, show that these ponds did remain flooded in the summer base-flow conditions, thus Criterion 2 was met.

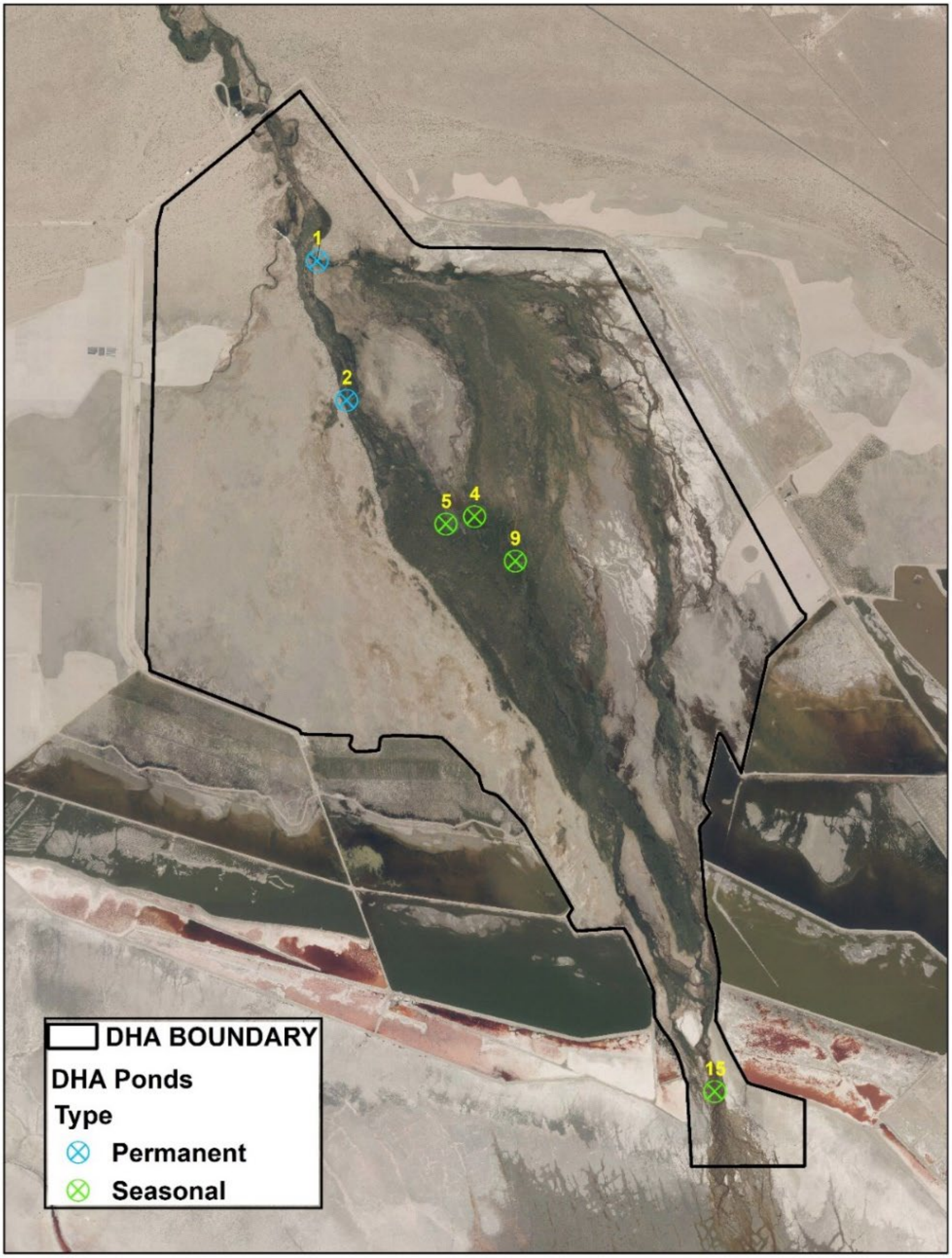


Figure 4-5. Permanent and seasonal ponds monitored in the DHA.

Figure 4-6. July 6, 2022, aerial image of DHA. Red arrow denotes permanent pond 1 during reduced summer flows.

Figure 4-7. July 6, 2022, aerial image of DHA. Red arrow denotes permanent pond 2 during reduced summer flows.

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

On September 1, 2022, the summer base flow of 4 cfs was increased to 11 cfs (Figure 4-1). The locations of seasonal ponds 4, 5, 9, and 15 are shown on Figure 4-5. Flooding of seasonal ponds 4, 5, and 9 were detected on September 6, 2022 (Figure 4-8). Because of the downstream lag time of the flows, seasonal pond 15 did not form until September 28, 2022 (Figure 4-9). Following the formation of these ponds, they were maintained throughout the remainder of 2022-23 RY and therefore Criterion 3 was met.

Figure 4-8. September 6, 2022, aerial Image of DHA. Red arrows denote seasonal ponds 4, 5, and 9 from left to right.

Figure 4-9. September 28, 2022, aerial Image of DHA. Red arrow denotes seasonal pond 15.

4.1.3 Conclusion and Recommendations

Effectiveness of Adaptive Management Flow Regime
All three evaluation criteria were successfully met in 2022-23 RY, and this was the third consecutive year of adherence to the interim flow schedule. During this short time frame all habitat and management objectives were met, which suggests the likelihood of achieving the long-term goals of increasing the habitat diversity of DHA by converting existing stands of emergent vegetation to meadow habitats and creating and maintaining open water areas for HIS and other species.

However, flow conditons associated with the latter portion of 2022-23 RY were some of the highest flows to the DHA in recorded history. And while this report only summarizes conditions associated with 2022-23 RY, these high flows continued to the DHA throughout the growing season of 2023 in response the the historic runoff conditions and storm flows from Tropical Storm Hilary. Consequently, any previous gains in reducing emergent vegetation cover may have been lost. Further, the high flows have likely resulted in geomorphic changes to the DHA environment. The overall impacts of these flows on both permenant and seasonal ponds remains to be seen.

While the short-term goals of DHA are being met, it is unknown how long it will take to achieve the desired conditions of the DHA as specified by the monitoring criteria - it could be multiple years, particularly following large-scale flood events like those in 2023. In response to this uncertainity, the following recommendations may mitigate extraneous events and expedite obtainment of the long-term goals. These recommendations are:

1) Conduct a pilot project of mowing vegetation in and around depressions that would hold water from the fall until the spring. This would create an open setting for waterfowl, shorebirds, and wading birds. Additionally, the decrease in vegetation height would increase visibility in the immediate vicinty of ponds, which would likely attract more wildlife.

   Areas best to mow would be depressions in the southern and/or eastern part of the DHA that dry seasonally under the adaptive management flows, and thus regrowth of vegetation would be limited. This mowing would be done in August or early September prior to fall water releases, when the southern and eastern portions of the delta are dry, and the bird nesting season is over. Since areas to be mowed are administered by the SLC, coordination with and approval by this agency will need to be obtained.

   Although prescribed fire could be utilized to create open areas, implementing a prescribed burn is a lengthy and complex process terms of both permitting and executing. Furthermore, concerns exist about the infestation of recently burned areas with noxious weeds. For instance, wet floodplain features of the LOR have been transformed from native vegetation communities to a persistent monoculture of the invasive fivehook bassia (*Bassia hyssopifolia)* following controlled burns intended to remove dead emergent vegetation. Such a transformation of the DHA would obviously be counterproductive and divert already limited resources into controlling weeds within the DHA. Because of these uncertainties, if buring were to occur in the DHA, it would have to target areas that are dry during the growing season and have an existing abundance of both native grasses and annuals that could rapidly colonize the burn area as to out-compete any potential invasive species.

2) We recommend conducting a qualitative habitat assessment in August 2024. This would entail taking on-the-ground-photopoints to track the impact of summer flows on emergent vegetation and the impacts of the 2023 high flows.

3) Further investigate the use of remote sensing to assess habitat conditions and flow effectiveness. In particular, remote sensing allows a quantitative approach to evaluating how the interim flows are driving changes in both emergent vegetation conditions and the formation and persistence of ponds.

4.2 Blackrock Waterfowl Management Area Interim Management and Monitoring

Since the LORP implementation in 2006, the BWMA has been managed in accordance with guidance in the 1997 MOU, with up to 500 acres flooded year-round proportional to the annual runoff forecast. Management of the BWMA under this legal direction created and maintained habitat for the BWMA HIS, but also resulted in considerable cattail (*Typha* sp.) and bulrush (*Scheoenoplectus* sp.) encroachment when waterfowl units (units) were flooded throughout the growing season. These changes reduced the amount of open water available and resulted in subsequent declines in habitat quality, particularly after the first year of flooding of a unit.

Following an evaluation of the effectiveness of the year-round flooding approach, as defined in the 1997 MOU, LADWP and the County jointly recommended implementing a seasonal flooding regime in the BWMA (LADWP and ICWD 2020). In 2020, LADWP and the County worked together to develop a 5-year Interim Management and Monitoring Plan for the BWMA (Interim Plan) to further improve conditions for the BWMA HIS. The HIS include waterfowl, shorebirds, wading birds, rails, Northern Harrier (*Circus hudsonius*), and Marsh Wren (*Cistothorus palustris*). In the Interim Plan, LADWP and the County proposed a seasonal flooding regime to flood a fixed 500 acres of the BWMA each year from fall to mid-spring, with full dry down in the summer months. This approach is intended to increase habitat quality and habitat productivity by (1) controlling the growth of emergent vegetation to maintain open water habitat, and (2) implementing moist soil management to enhance forage for indicator species (LADWP and ICWD 2021).

LADWP and the County finalized the Interim Plan in April 2021, following consultation with the MOU Parties. The Inyo/Los Angeles Standing Committee set the BWMA flooded acreage for 2022-23 in accordance with the Interim Plan at its June 22, 2022, meeting. The Interim Plan was going to be implemented as adaptive management for a period of 5 years (through April 2026), at which point the success of the project would be reviewed and recommendations for long-term management plan developed.

Implementation of the Interim Plan began in 2021, and the drawing down of water in the units began in May. Additionally, all necessary preparatory work in the Waggoner and Thibaut Units, and the East Winterton Subunit was completed by August 31, 2021. The preparatory work included weed treatment, disking of cattails and bulrush, reinforcement of berms, and upgrading flow measuring stations. The first Flooding cycle (FC) 1 commenced on September 15, 2021, on schedule with the Interim Plan. Water was released to the BWMA throughout the winter to maintain 500 acres of flooded habitats, and then water was shut off on March 4, 2022, to allow for spring drawdown and summer drying. The second FC2 started on September 15, 2022, and water was shut off on March 1, 2023.

4.2.1 Overview of BWMA Interim Plan Effectiveness Monitoring

Active Units, Subunits, and Subbasins in Flooding Cycle 2

In accordance with FC2 of the Interim Plan, the Waggoner Unit, Thibaut Unit, and the East Winterton Subunit of the Winterton Unit were flooded. The units/subunits have been further divided into “subbasins” to allow increased spatial resolution of the monitoring data. Subbasin boundaries were drawn based on topography, the presence of water control structures, and the physical boundaries visible in the field. In this section of the report, flooded extent and avian data will be presented both at the level of subbasin and unit/subunit.

Table 4-1 shows the flooded subbasins in which avian monitoring was conducted in FC2. Figure 4-10 shows the active BWMA units/subunits and subbasins during FC2 (2022-23).

Table 4-1. Subbasins Monitored in FC2 and their Associated Unit and Subunit Designation

Subbasin	Unit	Subunit
WAG1	Waggoner	N/A
WAG2	Waggoner	N/A
WAG3	Waggoner	N/A
WAG4	Waggoner	N/A
WAG5	Waggoner	N/A
WAG6	Waggoner	N/A
WAG7	Waggoner	N/A
TH5	Thibaut	N/A
TH6	Thibaut	N/A
TH7	Thibaut	N/A
TH8	Thibaut	N/A
TH9	Thibaut	N/A
TH10	Thibaut	N/A
TH11	Thibaut	N/A
SW1	Thibaut	South Winterton
SW2	Thibaut	South Winterton
W9	Winterton	East Winterton
W11	Winterton	East Winterton
W12	Winterton	East Winterton
W13	Winterton	East Winterton
W14	Winterton	East Winterton

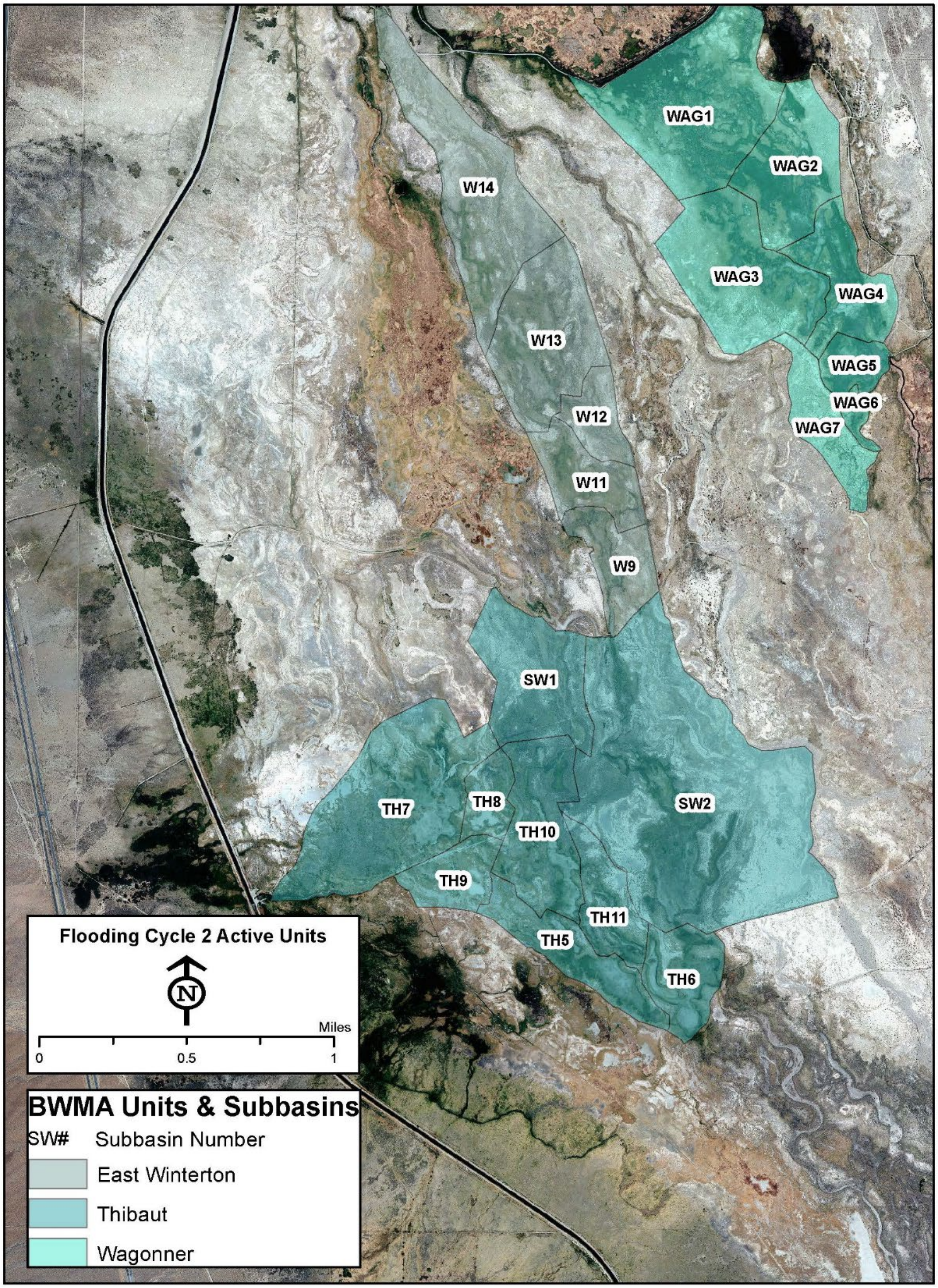


Figure 4-10. Active Units and Subbasins Monitored in FC2 (2022-23)

4.2.2 Flooded Extent Monitoring

Methodology

Flooded extent monitoring involves determining the total number of acres flooded in the BWMA. LADWP staff conducts this monitoring using a Global Positing System (GPS) and walking along the edge of the water in each unit/subunit. This monitoring is used to confirm compliance with the Interim Plan, and to help describe the effectiveness of seasonal filling.

During FC2, the Fall flooded extent monitoring was conducted October 31 through November 2, 2022. Due to extensive flooding in the BWMA from winter and spring storms in 2023, the flooded extent monitoring scheduled for March 2023 was not conducted, as it was known that flooded acreage exceeded the required 500 acres at that time.

Data Summary

The overall flooded acreage value was calculated using the flooded extent ArcView shapefile from Fall 2022. The Clip tool in ArcMap (Version 10.6.1) was used to remove any areas mapped as flooded that were outside the managed units/subunits. This removed some flooded areas from the Thibaut and East Winterton Units. The Split Polygons tool was then used to calculate the amount of flooded acreage for each subbasin.

Results

The results presented in Table 4-2 are the flooded acreages of the subbasins monitored for avian activity. The overall flooded acreage was 469 acres with 159 acres in the Waggoner Unit, 232 acres in the Thibaut Unit, and 79 acres in the East Winterton Subunit. Subbasins WAG7, TH12, TH14, SW1, and W12 had no water at the time the wetted extent was documented and were not included in the table. TH4 had some water in it, but it is not monitored and was removed from the total flooding acreage.

Table 4-2. Flooded Acreages of Monitored Subbasins

FC2 Subbasin Monitoring				
Subbasin	**Unit**	**Subunit**	**Fall 2022***	**Total**
WAG1	Waggoner	N/A	18	
WAG2	Waggoner	N/A	43	
WAG3	Waggoner	N/A	27	
WAG4	Waggoner	N/A	44	
WAG5	Waggoner	N/A	19	
WAG6	Waggoner	N/A	7	159
TH5	Thibaut	N/A	26	
TH6	Thibaut	N/A	29	
TH7	Thibaut	N/A	65	
TH8	Thibaut	N/A	13	
TH9	Thibaut	N/A	2	
TH10	Thibaut	N/A	35	
TH11	Thibaut	N/A	15	
SW2	Thibaut	South Winterton	46	232
W9	Winterton	East Winterton	15	
W11	Winterton	East Winterton	21	
W13	Winterton	East Winterton	29	
W14	Winterton	East Winterton	13	79
			Overall	469

*Flooded acreage recorded between October 31 and November 2. Unit/subunit totals do not add to the overall total due to rounding.

4.2.3 BWMA Avian Surveys

Methodology

Photopoint Monitoring

Photopoints were established in each subbasin and generally consisted of a minimum of two points per subbasin; however, some small basins only have one photopoint. One photo was taken at each photopoint during avian surveys.

Avian Surveys

The BWMA units/subunits were surveyed nine times between October 2022 and April 2023 to evaluate use by the HIS. There are four survey routes in the BWMA: Waggoner, East Winterton, Thibaut, and South Winterton. The East and West Waggoner surveys were conducted simultaneously by two surveyors—one on each survey route. Completing each round of surveys required 4 to 5 person-days.

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 Interim Plan, 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 FC2 monitoring period is equivalent to Fall 4. The South Winterton Subunit remained dry in early fall. The first survey conducted for this subunit was the Fall 5 survey in early November.

Under the Interim Plan, 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 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. The exception to this survey method were Spring 1 and 2 surveys in March 2023, which were conducted using a helicopter due to extensive flooding from increased water releases, and an inability to access sites on the ground.

During each survey, all bird species and number of individuals encountered were recorded. Creating and maintaining diverse natural habitats is an overarching objective of 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 will focus on the BWMA HIS, which include all waterfowl, wading birds, shorebirds, rails, Northern Harrier, and Marsh Wren. 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., White-faced 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 were mapped in the field using ArcGIS Field Maps in order 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	October 4-5, 2022	X		X	X
Fall 4	October 17-20, 2022	X		X	X
Fall 5	November 1-4, 2022	X	X	X	X
Winter 1	December 13-14, 2022	X	X	X	X
Winter 2	February 1-3, 2023	X	X	X	X
Spring 1	March 9, 2023	X	X	X	X
Spring 2	March 27, 2023	X	X	X	X
Spring 3	April 10-12, 2023	X	X	X	X
Spring 4	April 26-28, 2023	X	X	X	X

Data Summary

Photopoint Monitoring

At least one photo from each subbasin was selected from FC1 (2021-2022) and FC2 (2022-2023) to show changes between one flooding cycle to the next. Part of the objective of seasonal flooding is to support the growth of annuals and perennials for forage while also maintaining open water. Most of the photos shown in this report were taken during the Fall 5 survey, the first week of November, which coincided with the flooded extent monitoring. In cases where a photo was not available during this time, another photo was selected as close to November as possible depending on what was available.

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 was divided by the total number of HIS individuals in 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. This two percentages demonstrate the value of each subbasin within each unit/subunit, and each unit/subunit within the BWMA.

Comparison to Previous Years

In order to allow comparison of data from previous years, all existing BWMA avian data were filtered by unit, subunit, and seasonal survey. 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 FC1 and FC2; therefore, there are no data prior to these flooding cycles available for comparison. Surveys included in the analysis were those from the Waggoner Unit, Thibaut Unit, and East Winterton Subunit. Seasonal surveys included were Fall 3, Fall 4, Fall 5, Winter 1, Winter 2, and Spring 2, Spring 3, and Spring 4. Data were categorized into three time periods: Pre-LORP (encompassing data from years 2002-03), LORP (years 2009-17), and Interim Plan implementation (FC1 2021-22; FC2 2022-23).

There are two ways in which data from FC1 and FC2 were compared with prior survey data. The first comparison involved calculating the average number of individuals per HIS Group per survey season for the BWMA. This was calculated for each of the three time periods, with the two flooding cycles calculated individually. Using the average standardized for differing survey effort over the different time periods.

The second comparison involved comparing HIS density in terms of individuals per average flooded acre by unit. This was calculated for two time periods - since implementation of LORP and under the Interim Plan. Avian data were standardized to density to account for differences in the prescribed flooded acreage over the years. This analysis was only done for the Waggoner and Thibaut Units. This analysis was not done for East Winterton since this subunit of Winterton had never been flooded, and comparable data were not available.

4.2.4 Results

Photopoint Monitoring
Photos from at least one photopoint per subbasin or unit in FC1 and FC2 are shown below. The first drawdown after FC1 resulted in a flush of vegetation in most subbasins. Some subbasins had taller annual vegetation such as *Bassia hyssopifolia* and *Helianthus annuus*, which temporarily occlude the open water. However, these annuals typically break down over the course of the flooding cycle, and they also serve as a food source for birds. In contrast, short-statured annual plants, such as those in the Thibaut Flood Unit subbasins (e.g., *Crypsis schoenoides* and *Malvella leprosa*), do not reduce open water habitat.

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 does not include American Coots counted during the helicopter surveys because counting waterfowl was the main focus during these surveys.

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	13		0	
Thibaut	SW2	1900		12	
Thibaut	TH10	1996		13	
Thibaut	TH11	929		6	
Thibaut	TH5	2882		19	
Thibaut	TH6	4571		30	
Thibaut	TH7	2837		18	
Thibaut	TH8	222		1	
Thibaut	TH9	49		0	
			15399		68
East Winterton	W11	113		12	
East Winterton	W12	1		0	
East Winterton	W13	470		49	
East Winterton	W14	287		30	
East Winterton	W9	91		9	
			962		4
Waggoner	WAG1	92		1	
Waggoner	WAG2	1351		21	
Waggoner	WAG3	893		14	
Waggoner	WAG4	2486		39	
Waggoner	WAG5	1231		19	
Waggoner	WAG6	205		3	
Waggoner	WAG7	74		1	
			6332		28
BWMA Total		22693			100

<u>Waggoner Unit</u>

The Waggoner Unit has a total of 18 photopoints across the 7 subbasins (Figure 4-11). Most of the photos included here are from early November 2022 (FC2); however, WAG7, which is not actively managed (i.e., flooded), did not have water in it until January 2022 (FC1) and December 2022 (FC2). Overall, the Waggoner Unit had 28% of the total HIS observations throughout the BWMA (Table 4-4).

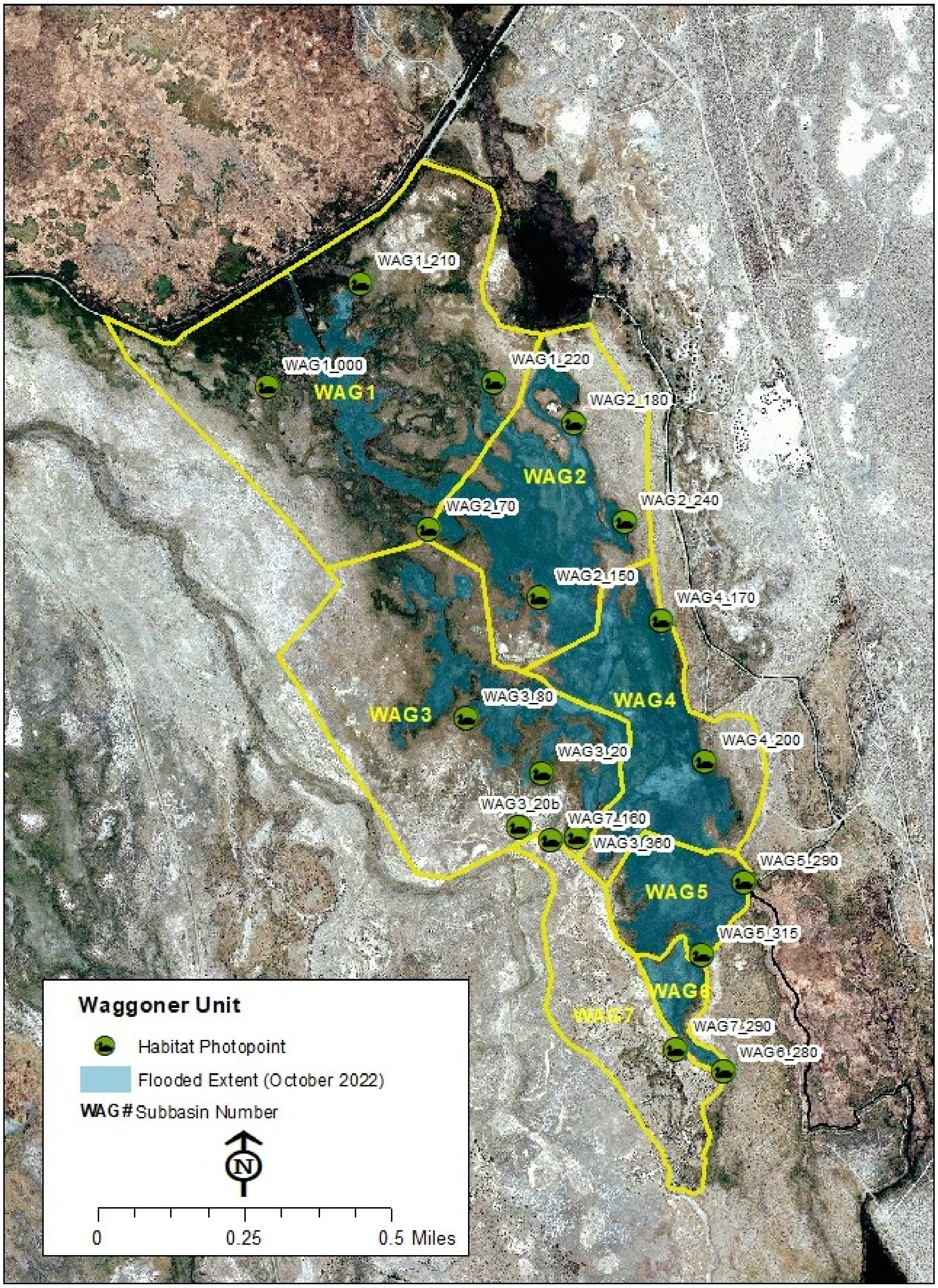


Figure 4-11. Waggoner Unit Subbasins and Photopoints

Subbasin WAG1, Photopoint WAG1_220

WAG1 borders the Blackrock Ditch, which supports a number of willows that attract a variety of songbirds. This subbasin is relatively small and only supports small areas of open water when flooded. There are three photopoints in this subbasin. In FC2, WAG1_220 was the one area that had open water visible at the photopoint; there was no open water observed at the other two photopoints due to vegetation growth. Even at WAG1_220, the density of *Bassia hyssopifolia* and *Helianthus annuus* was such that it obscured the view of the water. However, cover from these two species decreased from fall to spring, and more open water became visible over time (Figure 4-12**,** Figure 4-13**)** WAG1 had 1% of the HIS observations in the Waggoner Unit (Table 4-4).

Figure 4-12. WAG1_220 on November 2, 2021

Figure 4-13. WAG1_220 on November 1, 2022

Subbasin WAG2, Photopoints WAG2_70 and WAG2_240

WAG2 is a large subbasin that has supported a central large, open water pond and some smaller side ponds connected by flooded channels. There are four photopoints in this subbasin. Between FC1 and FC2, there was an increase in *Bassia hyssopifolia* that obscured the water at WAG2_70 (Figure 4-14, Figure 4-15). The other three photopoints also had *Bassia hyssopifolia* and *Helianthus annuus,* though cover declined from fall to spring, maintaining open water at these locations (Figure 4-16, Figure 4-17). WAG2 had 21% of HIS observed in the Waggoner Unit (Table 4-4).

Figure 4-14. WAG2_70 on November 2, 2021

Figure 4-15. WAG2_70 on November 1, 2022

Figure 4-16. WAG2_240 on November 2, 2021

Figure 4-17. WAG2_240 on November 1, 2022

Subbasin WAG3, Photopoint WAG3_360

In WAG3, there is a complex series of small, shallow ponds and small “fingers” of flooding. There are four photopoints in this subbasin. During FC2, *Bassia hyssopfolia* invaded the dry portion of the subbasin at WAG3_360, but it decreased over time as it filled with water (Figure 4-18, Figure 4-19). The other three photopoints showed increases in annual vegetation but retained open water. WAG3 had 14% of the HIS observations in the Waggoner Unit (Table 4-4).

Figure 4-18. WAG3_360 on November 2, 2021

Figure 4-19. WAG3_360 on November 1, 2022

Subbasin WAG4, Photopoint WAG4_200

WAG4 is similar to WAG2 in that it supports a relatively large and deep open water pond. It had the most amount of flooded acreage at approximately 44 acres. Right after initial water releases this season, open water areas were limited and small, but by early November, open water was plentiful. The southern end of WAG4 is where waterfowl were observed (Figure 4-20, Figure 4-21). WAG4 had the highest percent of HIS observations (39%) in the Waggoner Unit (Table 4-4).

Figure 4-20. WAG4_200 on November 2, 2021

Figure 4-21. WAG4_200 on November 1, 2022

Subbasin WAG5, Photopoint WAG5_290

Much of WAG5 is shallow, but waterfowl were observed in slightly deeper areas. There are two photopoints in this subbasin. Between FC1 and FC2, both photopoints show that water remained relatively open in the subbasin (Figure 4-22, Figure 4-23). WAG5 had 19% of the HIS observations in the Waggoner Unit (Table 4-4).

Figure 4-22. WAG5_290 on November 2, 2021

Figure 4-23. WAG5_290 on November 1, 2022

Subbasin WAG6, Photopoint WAG6_280

WAG6 is a very small subbasin at the south end of the Waggoner Unit, and it consists of small, narrow, and shallow ponds. There is only one photopoint in this subbasin. It had the least amount of flooded acreage at 7 acres. Since FC1, there has been some growth of *Helianthus annuus* along the edges of the subbasin, but it still remains relatively open

(Figure 4-24, Figure 4-25). WAG5 had 3% of the HIS observations in the Waggoner Unit (Table 4-4).

Figure 4-24. WAG6_280 on November 2, 2021

Figure 4-25. WAG6_280 on November 1, 2022

Subbasin WAG7, Photopoint WAG7_290

WAG7 is a small, intermittently-flooded area that is not being “actively” managed, but receives water from WAG4 when water levels are high, and some subsurface water from adjacent subbasins. There are two photopoints in this subbasin. WAG7 did not receive water until January 2022 during FC1 (Figure 4-26). During FC2 (2022-2023), water was in WAG7 by December 2022 (Figure 4-27). The habitat in this subbasin is limited, and only had 1% of the HIS observations in the Waggoner Unit (Table 4-4).

Figure 4-26. WAG7_290 on January 11, 2022

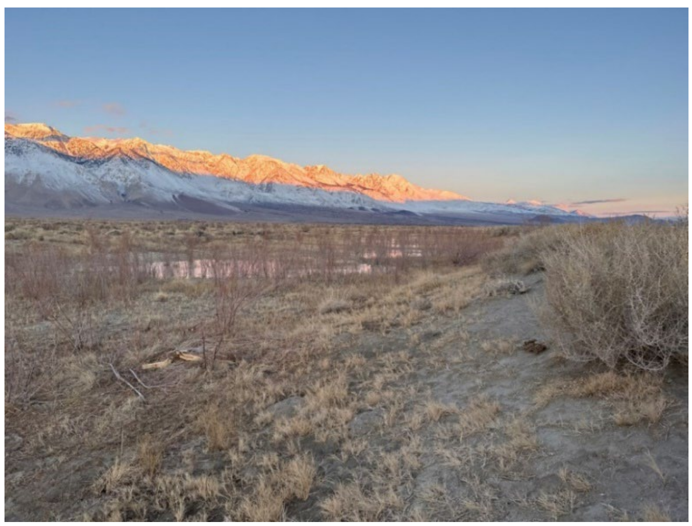


Figure 4-27. WAG7_290 on December 13, 2022

<u>Thibaut Unit</u>

Six subbasins were monitored in the Thibaut Unit, which includes the South Winterton Subunit (Figure 4-28). There are 25 photopoints across the unit and subunit. The Thibaut Unit and South Winterton Subunit had 68% of the HIS observations in the BWMA (Table 4-4).

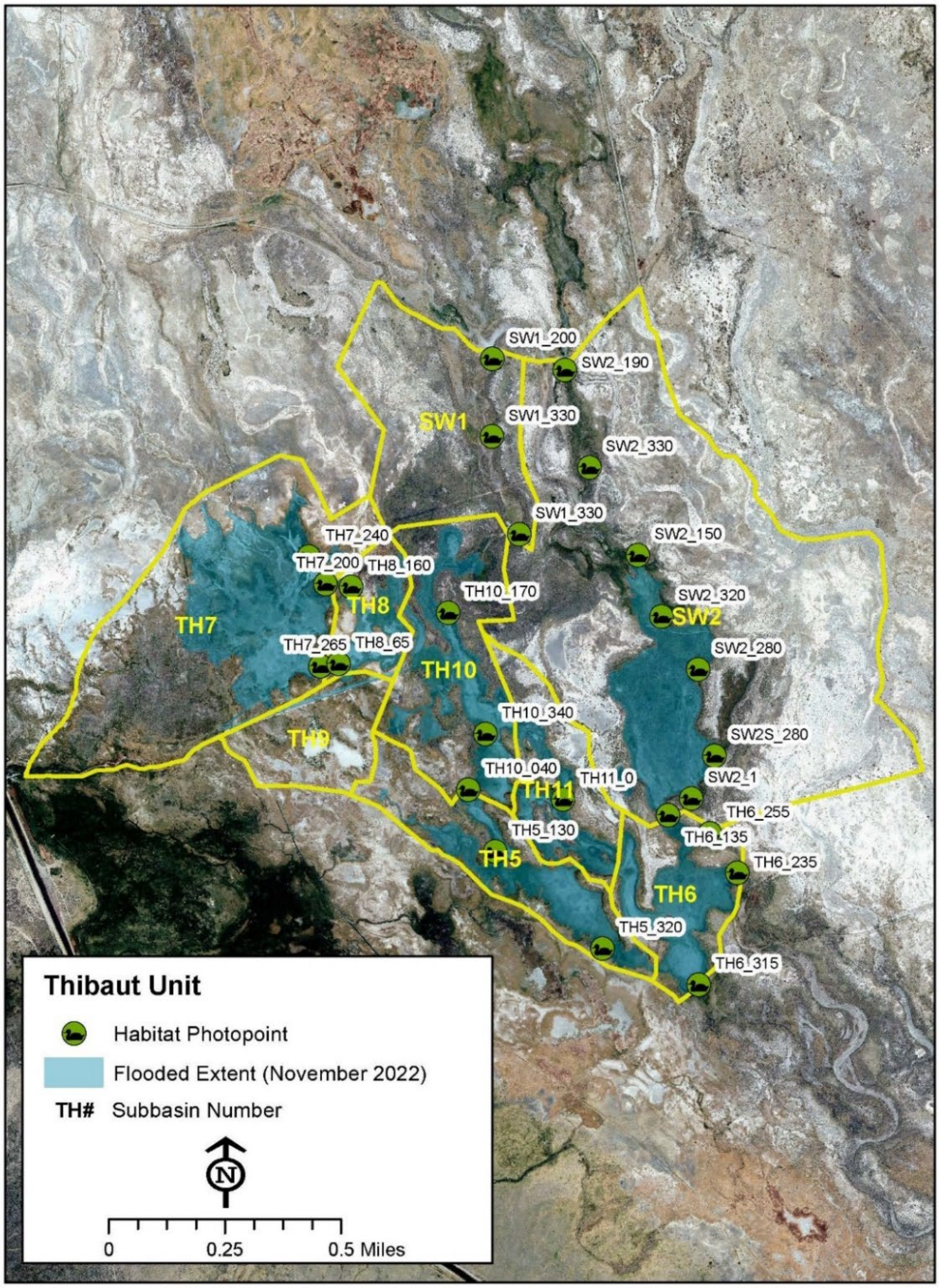


Figure 4-28. Thibaut Unit Subbasins and Photopoints

Subbasin TH5, Photopoint TH5_130

TH5 is a moderately-sized, open-water pond (Figure 4-29). There are two photopoints in this subbasin. In FC2, there was a large, dense stand of *Helianthus annuus* at both photopoints (Figure 4-29 and Figure 4-30); however, the density of this senesced vegetation declined over the monitoring period, resulting in more open water habitat (Figure 4-31). TH5 had 19% of the HIS observations in the Thibaut Unit (Table 4-4).

Figure 4-29. TH5_130 on December 17, 2021

Figure 4-30. TH5_130 on October 5, 2022

Figure 4-31. TH5_130 on December 14, 2022

Subbasin TH6, Photopoint TH6_235

TH6 is a moderately-sized subbasin and likely supports the deepest pond in the BWMA. There are four photopoints in this subbasin. TH6 supports an island used by waterbirds for sleeping and loafing. At the north end of the pond are old tamarisk plants and stumps where waterfowl are often seen sleeping and loafing. There are some small, shallow ponds physically connected to the main pond as well. Photopoint TH6_235 is an example of how there has been some growth of annual vegetation between FC1 and FC2, but it still remains largely open (Figure 4-32, Figure 4-33). The other photopoints show a similar pattern, except for photopoint TH6_235. Here there has been an increase in open water as annual vegetation has broken down between FC1 and FC2. TH6 had the highest percentage (30%) of HIS observations in the Thibaut Unit (Table 4-4).

Figure 4-32. TH6_235 on December 17, 2021

Figure 4-33. TH6_235 on December 14, 2022

Subbasin TH7, Photopoint TH7_265

TH7 is part of the "Thibaut Pond" management area that has been seasonally flooded (October to March) since 2014. TH7 is a large, shallow pond that had the most flooded acreage at approximately 65 acres. There are three photopoints in TH7. The pond has supported large stands of *Helianthus annuus*, but is mostly surrounded by *Distichlis spicata* (Figure 4-34, Figure 4-35). TH7 had 18 % of the HIS observations in the Thibaut Unit (Table 4-4).

Figure 4-34. TH7_265 on December 17, 2021

Figure 4-35. TH7_265 on December 14, 2022

Subbasin TH8, Photopoint TH8_65

TH8 is also part of the “Thibaut Pond” management area that has been seasonally flooded (October to March) since 2014. TH8 includes two small and shallow ponds. There are two photopoints in this subbasin. There was no evidence of an increase in surrounding vegetation, and it remains largely dominated by *Distichlis spicata* (Figure 4-36, Figure 4-37). TH8 had a little over 1% of the HIS observations in the Thibaut Unit (Table 4-4).

Figure 4-36. TH8_65 on December 17, 2021

Figure 4-37. TH8_65 on December 14, 2022

Subbasin TH10, Photopoint TH10_40

TH10 is a long, linear pond surrounded by dense saltbush scrub on the banks. It is one of the larger subbasins with the second highest amount of flooded acreage at approximately 35 acres. This subbasin has three photopoints. TH10 has also supported large stands of *Helianthus annuus*, which tended to decrease throughout the flooding cycle (Figure 4-38, Figure 4-39). TH10 had 13% of the HIS observations in the Thibaut Unit (Table 4-4).

Figure 4-38. TH10_40 on December 17, 2021

Figure 4-39. TH10_40 on December 14, 2022

<u>Subbasin TH11, Photopoint TH11_0</u>

TH11 consists of small, narrow ponds surrounded by dense saltbush scrub on the banks. It is one of the smaller subbasins at approximately 15 flooded acres. It has only one photopoint. This subbasin, like others, supported *Helianthus annuus* along its banks (Figure 4-40, Figure 4-41). TH11 had 6% of the HIS observations seen in the Thibaut Unit (Table 4-4).

Figure 4-40. TH11_0 on December 17, 2021

Figure 4-41. TH11_0 on December 14, 2022

Subbasin SW1, Photopoints SW1_330 (North and South)

SW1 was not monitored in FC1, but was in FC2. SW1 had no water in it at the time the flooded extent was mapped. SW1 is relatively wide and shallow. There are three photopoints in this subbasin. By March 2023, water had filled SW1, but because the BWMA was flooded and could not be surveyed on foot, the most recent photo was from April 2023. Water had mostly filled the subbasin by photopoints SW1_330 (north and south) (Figure 4-42, Figure 4-43). Only 2 HIS species and 14 HIS individuals were observed in SW1 (Table 4-4).

Figure 4-42. SW1_330 (north) on April 10, 2023

Figure 4-43. SW1_330 (south) on April 10, 2023

Subbasin SW2, Photopoints SW2_150 and SW2_320

SW2 is a large subbasin that includes a large, moderately deep pond and a second small, shallow pond to the north. The large, main pond was densely covered with *Bassia hyssopifolia* prior to flooding. There are seven photopoints in this subbasin. In FC2, *Bassia hyssopifolia* was once again abundant in SW2, and had colonized the smaller pond to the north, but as seen in other subbasins, this vegetation declined over the flooding cycle (Figure 4-44, Figure 4-45,

Figure 4-46, Figure 4-47). The total average flooded acreage for SW2 was approximately 46 acres. SW2 had 12% of the HIS observations in the Thibaut Unit (Table 4-4).

Figure 4-44. SW2_150 on December 20, 2021

Figure 4-45. SW2_150 on December 1, 2022

Figure 4-46. SW2_320 on December 20, 2021

Figure 4-47. SW2_320 on December 13, 2022

East Winterton Subunit

Five subbasins were monitored in the East Winterton Subunit (Figure 4-48). East Winterton Subunit had 4% of the HIS observations in the BWMA (Table 4-4). There are 14 photopoints in this subunit.

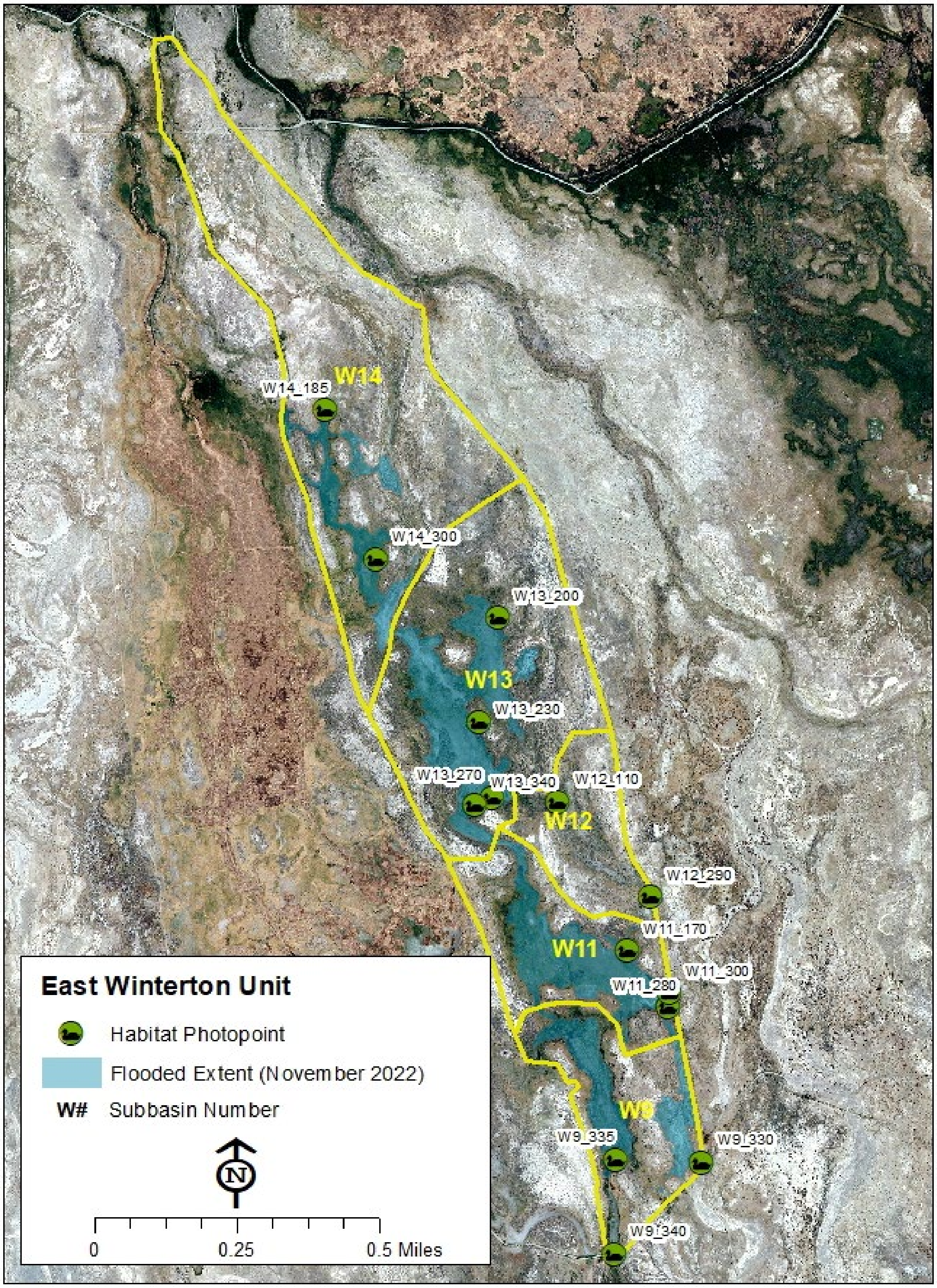


Figure 4-48. East Winterton Subbasins and Photopoints

Subbasin W9, Photopoints W9_335 and W9_340

W9 is a relatively shallow subbasin with three photopoints. Since W9 was intermittently flooded in 2021 (FC1), the earliest photo was from January 2022. Photopoint W9_335 overlooks a large pond that, in November 2022 (FC2), had dense cover of *Helianthus annuus* (Figure 4-49, Figure 4-50). Photopoint W9_340 is located at the very southern end of the subunit and overlooks a small, narrow pond. This photopoint also shows *Helianthus annuus* colonizing this area (Figure 4-51, Figure 4-52). This subbasin supported 9% of the HIS observations in the Winterton Subunit (Table 4-4).

Figure 4-49. W9_335 on January 11, 2022

Figure 4-50. W9_335 on November 4, 2022

Figure 4-51. W9_340 on January 11, 2022

Figure 4-52. W9_340 on November 11, 2022

Subbasin W11, Photopoint W11_170

W11 supported a moderately-sized open water pond, with approximately 21 flooded acres. There are two photopoints in this subbasin. The basin is highly vegetated with saltgrass (*Distichlis spicata*). Between FC1 and FC2, this subbasin has supported stands of *Helianthus annuus* (Figure 4-53, Figure 4-54). This subbasin had 12% of the HIS observations in this subunit (Table 4-4).

Figure 4-53. W11_170 on November 1, 2021

Figure 4-54. W11_170 on November 4, 2022

Subbasin W12, Photopoint W12_110

W12 is a small, shallow shrubby subbasin with little open water area (Figure 4-55, Figure 4-56). It is intermittently flooded. There are two photopoints in this subbasin. At the time of the flooded extent mapping in FC2, there was no water in W12. This subbasin had only one HIS observation in this subunit (Table 4-4).

Figure 4-55. W12_110 on November 1, 2021

Figure 4-56. W12_110 on November 4, 2022

Subbasin W13, Photopoint W13_340

W13 is dominated by dense stands of saltbrush (*Atriplex* sp.) and rabbitbrush (*Ericameria nauseosa*). There are four photopoints in this subbasin. In FC1, it supported the largest open water area in East Winterton and supported the most HIS. In FC2, *Bassia hyssopifolia* was observed around the photopoints (Figure 4-57, Figure 4-58), and it was moderately-sized with approximately 29 flooded acres. It also had the highest percentage of HIS observations in this subunit at 49% (Table 4-4).

Figure 4-57. W13_340 on November 1, 2021

Figure 4-58. W13_340 on November 4, 2022

Subbasin W14, Photopoint W14_300

W14 contained a mix of small, shallow, grassy ponds and shrubby areas. In FC2, it was approximately 13 flooded acres. There are two photopoints in this subbasin. There was no single pond of any significant size, but instead, the habitat was relatively braided and broken up. This subbasin supported stands of *Helianthus annuus* in some areas (Figure 4-59, Figure 4-60). This subbasin supported the second highest percentage of HIS observations in this subunit at 30% (Table 4-4).

Figure 4-59. W14_300 on November 1, 2021

Figure 4-60. W14_300 on November 4, 2022

4.2.5 Avian Survey Results

General Habitat Conditions
The Fall surveys were initiated while units/subunits and subbasins were still in the process of filling. By the Fall 5 survey, the flooded extent was 469 acres in the managed units/subunits of the BWMA. The flooded extent was not mapped in March, but LADWP and the County agreed the targeted 500 acres was reached. During the Winter surveys, between December and February, the subbasins were mostly ice-covered. The first spring survey in mid-March was approximately two weeks after water releases ceased. In spring of 2023 (FC2), the above-normal runoff, increased precipitation, and additional emergency water releases resulted in conditions that prevented the Spring 1 and 2 surveys from being conducted on foot. By mid-April, the water had receded, and conditions had improved such that the last two Spring surveys were conducted on foot. However, the above normal runoff resulted in increased flows to the BWMA and prevented the units/subunits from being dried out during the following summer period in 2023.

BWMA Avian Species Composition
At total of 101 bird species and 35,145 individuals (HIS and non-HIS) were detected in the BWMA during FC2 (2022-2023) (Table 4-5). East Winterton Unit (51) and South Winterton Subunit (54) had a similar number of species detected. Waggoner (74) had the greatest number of bird species and Thibaut (65) had the second highest number (Table 4-5).

A total of 22,894 of individuals observed were HIS, comprising 65% of all birds (HIS and non-HIS) recorded (Table 4-6). The Thibaut Unit supported the highest number of HIS individuals (13,486) and East Winterton the fewest (962). Waterfowl were the most abundant HIS Group. The total number of individuals in the Waterfowl Group represented 66% of all the HIS individuals observed. The number of individuals in the Rail Group represented 30% of all the HIS individuals observed (99% of rails were American Coot). The Wading Birds and Shorebirds Group together represented approximately 3% of all HIS individuals encountered. The number of Northern Harrier and Marsh Wren together represented approximately 0.6% of all the HIS individuals observed.

Table 4-5. Bird Species and Number by Unit/Subunit for FC2 (2022-23). HIS are in orange text.

English Name	Scientific Name	East Winterton	South Winterton	Thibaut	Waggoner	Total
Greater White-fronted Goose	***Anser albifrons***	**23**		**46**		**69**
Snow Goose	***Anser caerulescens***			**2**		**2**
Cackling Goose	***Branta hutchinsii***				**1**	**1**
Canada Goose	***Branta canadensis***	**4**		**7**	**5**	**16**
Blue-winged Teal	***Spatula discors***			**2**		**2**
Cinnamon Teal	***Spatula cyanoptera***	**65**	**179**	**533**	**645**	**1422**
Northern Shoveler	***Spatula clypeata***	**15**	**170**	**477**	**532**	**1194**
American Wigeon	***Mareca americana***	**20**	**47**	**685**	**32**	**784**
Gadwall	***Mareca strepera***	**43**	**40**	**1381**	**215**	**1679**
Mallard	***Anas platyrhynchos***	**293**	**13**	**439**	**153**	**898**
Northern Pintail	***Anas acuta***	**63**		**507**	**73**	**643**
Green-winged Teal	***Anas crecca***	**204**	**176**	**2557**	**694**	**3631**
Lesser Scaup	***Aythya affinis***			**126**		**126**
Redhead	***Aythya americana***		**24**	**110**	**17**	**151**
Ring-necked Duck	***Aythya collaris***		**47**	**232**	**88**	**367**
Canvasback	***Aythya valisineria***		**31**	**39**	**81**	**151**
Bufflehead	***Bucephala albeola***	**10**	**83**	**189**	**332**	**614**
Ruddy Duck	***Oxyura jamaicensis***	**55**	**409**	**1086**	**1209**	**2759**
California Quail	*Callipepla californica*			16	2	18
Pied-billed Grebe	*Podilymbus podiceps*		13	8	4	25
Eared Grebe	*Podiceps nigricollis*		33	58	71	162
White-winged Dove	*Zenaida asiatica*				1	1
Mourning Dove	*Zenaida macroura*	10			5	15
Sora	***Porzana carolina***	**1**	**2**	**7**	**4**	**14**
American Coot	***Fulica americana***	**54**	**502**	**4148**	**2154**	**6858**
Black-necked Stilt	***Himantopus mexicanus***		**14**		**2**	**16**
American Avocet	***Recurvirostra americana***		**4**	**15**	**17**	**36**
Killdeer	***Charadrius vociferus***	**2**		**4**	**7**	**13**
Western Sandpiper	***Calidris mauri***	**3**		**5**		**8**
Least Sandpiper	***Calidris minutilla***		**5**	**12**	**2**	**19**
Short-billed Dowitcher	***Limnodromus griseus***		**1**			**1**
Long-billed Dowitcher	***Limnodromus scolopaceus***	**2**		**10**	**15**	**27**
Wilson's Snipe	***Limnodromus scolopaceus***	**15**	**4**	**7**	**24**	**50**
Lesser Yellowlegs	***Tringa flavipes***	**2**				**2**
Greater Yellowlegs	***Tringa melanoleuca***	**26**	**1**	**9**	**13**	**49**
Franklin's Gull	*Leucophaeus pipixcan*		2			2
California Gull	*Larus californicus*		1	2	82	85
Caspian Tern	*Hydroprogne caspia*	1				1
Wilson's Storm-Petrel	*Oceanites oceanicus*			20		20
Double-crested Cormorant	*Nannopterum auritum*				1	1
American White Pelican	*Pelecanus erythrorhynchos*			1	560	561
Great Egret	***Ardea alba***			**3**		**3**
Great Blue Heron	***Ardea herodias***				**4**	**4**
Black-crowned Night-Heron	***Nycticorax nycticorax***		**2**		**2**	**4**
White-faced Ibis	***Plegadis chihi***		**150**	**260**	**14**	**424**
Turkey Vulture	*Cathartes aura*			1		1
Golden Eagle	*Aquila chrysaetos*			2		2
Northern Harrier	***Circus hudsonius***	**11**	**3**	**9**	**17**	**40**
Cooper's Hawk	*Accipiter cooperii*	1				1
Bald Eagle	*Haliaeetus leucocephalus*				1	1
Red-tailed Hawk	*Buteo jamaicensis*	2			5	7
Rough-legged Hawk	*Buteo lagopus*	1				1
Great Horned Owl	*Bubo virginianus*			1		1
Burrowing Owl	*Athene cunicularia*	1				1

Table 4-5 (continued). Bird Species and Number by Unit/Subunit for FC2 (2022-23). HIS are in orange text.

English Name	Scientific Name	East Winterton	South Winterton	Thibaut	Waggoner	Total
Short-eared Owl	*Asio flammeus*	1				1
Northern Flicker	*Colaptes auratus*		7	9	16	32
Merlin	*Falco columbarius*	1	1	2	1	5
American Kestrel	*Falco sparverius*	1		1	1	3
Black Phoebe	*Sayornis nigricans*	2		3	4	9
Black-billed Magpie	*Sayornis nigricans*		1		4	5
Loggerhead Shrike	*Lanius ludovicianus*	1		2	4	7
Common Raven	*Corvus corax*	18	7	19	16	60
Horned Lark	*Eremophila alpestris*	99		35	101	235
Bank Swallow	*Riparia riparia*				6	6
Tree Swallow	*Tachycineta bicolor*	45	111	3	26	185
Violet-green Swallow	*Tachycineta thalassina*	3				3
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*		20			20
Barn Swallow	*Stelgidopteryx serripennis*	12	338	46	258	654
Cliff Swallow	*Petrochelidon pyrrhonota*		43	3	6	52
Ruby-crowned Kinglet	*Corthylio calendula*		1		2	3
Bewick's Wren	*Thryomanes bewickii*	11	1	4	3	19
Marsh Wren	***Cistothorus palustris***	**24**	**6**	**55**	**17**	**102**
LeConte's Thrasher	*Toxostoma lecontei*	3				3
Sage Thrasher	*Oreoscoptes montanus*		1			1
Northern Mockingbird	*Mimus polyglottos*		1		3	4
Mountain Bluebird	*Sialia currucoides*			3		3
American Robin	*Turdus migratorius*			1	5	6
American Pipit	*Anthus rubescens*	70	9	49	50	178
House Finch	*Haemorhous mexicanus*	5		2	44	51
Lawrence's Goldfinch	*Spinus lawrencei*				1	1
Lesser Goldfinch	*Spinus psaltria*				35	35
American Goldfinch	*Spinus tristis*	132	20		3	155
Brewer's Sparrow	*Spizella breweri*		20			20
Chipping Sparrow	*Spizella passerina*	2				2
Dark-eyed Junco	*Junco hyemalis*		1			1
White-crowned Sparrow	*Zonotrichia leucophrys*	894	250	338	519	2001
Bell's Sparrow	*Artemisiospiza belli*	4	11			15
Vesper Sparrow	*Pooecetes gramineus*		1		3	4
Savannah Sparrow	*Passerculus sandwichensis*	366	58	475	831	1730
Lincoln's Sparrow	*Melospiza lincolnii*	22	2	28	43	95
Song Sparrow	*Melospiza melodia*	16	3	33	64	116
Spotted Towhee	*Pipilo maculatus*			1		1
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*		158	80	14	252
Western Meadowlark	*Sturnella neglecta*	76	31	148	265	520
Red-winged Blackbird	*Agelaius phoeniceus*	835	168	1430	2217	4650
Brown-headed Cowbird	*Molothrus ater*		25		11	36
Brewer's Blackbird	*Euphagus cyanocephalus*				13	13
Orange-crowned Warbler	*Leiothlypis celata*			1	2	3
Common Yellowthroat	*Leiothlypis celata*			7	6	13
Yellow-rumped Warbler	*Setophaga coronata*	5	6	2	83	96
Wilson's Warbler	*Cardellina pusilla*				1	1
Unidentified Dabbling Duck		**27**		**374**	**101**	**502**
Unidentified Diving Duck				**150**		**150**
Unidentified Dowitcher					**37**	**37**
Unidentified Shorebird					**25**	**25**
Unidentified Sparrow					12	12
Unidentified Swallow			16	3		19
Total Birds Recorded		3602	3273	16323	11937	35135
Species Richness		51	54	65	73	101

The Thibaut Unit had the highest number of individuals in the Waterfowl, Rail, and Wading Birds Group during FC2. It had 17 of the 18 waterfowl species, with the highest number of individuals for three species: Green-winged Teal (2,557), Gadwall (1,381), and Ruddy Duck (1,086) (Table 4-5, Table 4-6). The most common rail species was American Coot (4,148), and the most common wading bird was White-faced Ibis (260).

The Waggoner Unit had the highest number of shorebirds, with a total of 11 species and 142 individuals. The total number of individuals in the Shorebird Group was highest for Wilson’s Snipe (24) and American Avocet (17). The BWMA attracted an additional 67 species not designated as HIS, including large numbers of migrating swallows, and migrating and overwintering blackbirds and sparrows.

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

Species Group	East Winterton	South Winterton	Thibaut	Waggoner	BWMA Total
Waterfowl	822	1219	8942	4178	15161
Shorebirds	50	29	62	142	283
Rails	55	504	4155	2158	6872
Wading Birds	0	152	263	20	435
Northern Harrier	11	3	9	17	40
Marsh Wren	24	6	55	17	102
Total HIS	962	1913	13486	6532	22893
Non-HIS	2640	1360	2837	5405	12242
Total All Bird Species	3602	3273	16323	11937	35135

Seasonal Patterns of Abundance

HIS were observed using the BWMA throughout the flooding period (Figure 4-61). Northern Harrier and Marsh Wren were not included in the seasonal analysis because the Interim Plan 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 Interim Plan. Overall, the trend in the number of HIS individuals varied by 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.

One factor that may have affected the number of HIS individuals detected during the Spring surveys in FC2 was the use of a helicopter to conduct surveys. The first two surveys during the spring (1 and 2) required the use of a helicopter due to extensive flooding that made it impossible to survey on foot. During these helicopter surveys, the focus was on counting waterfowl. Consequently, other HIS Groups (Wading Birds, Shorebirds, Rails) were not counted. Therefore, the number of HIS individuals was likely lower in Spring 1 and 2 since rails, especially American Coots, were not consistently counted and they represent at least one third of the total number of HIS individuals (Table 4-6). The difference in the Winter 2 survey numbers may be a result of survey timing. In FC2, the Winter 2 survey was conducted a month later than in FC1 because of weather delays.

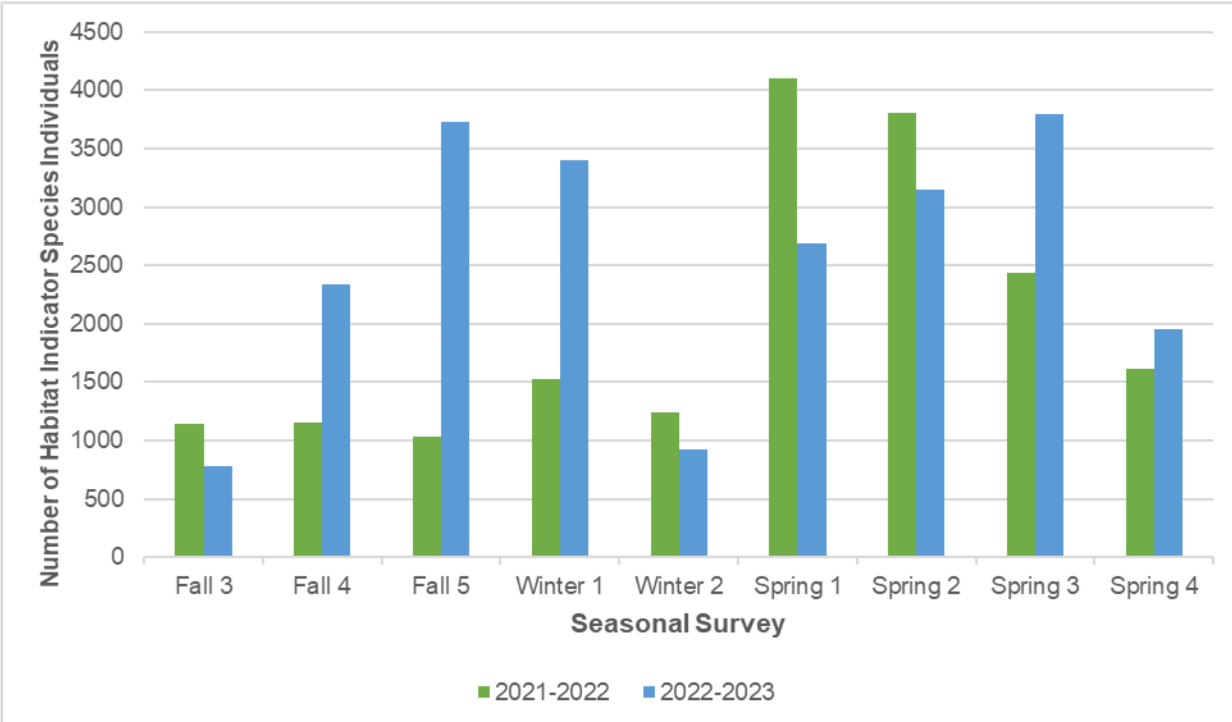


Figure 4-61. Seasonal Abundance of Habitat Indicator Species for All Units/Subunits during FC1 (2021-22) and FC2 (2022-23)

Spatial Distribution

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. Overall, the Thibaut Unit supported 59% of all HIS individuals. The TH6 and TH5 subbasins supported the highest percentage of HIS individuals within the Thibaut Unit, at approximately 20 and 14%, respectively. The Waggoner Unit had the second highest percentage of HIS individuals (28%) with WAG4 having the highest percentage of HIS individuals at 11% (Figure 4-62).

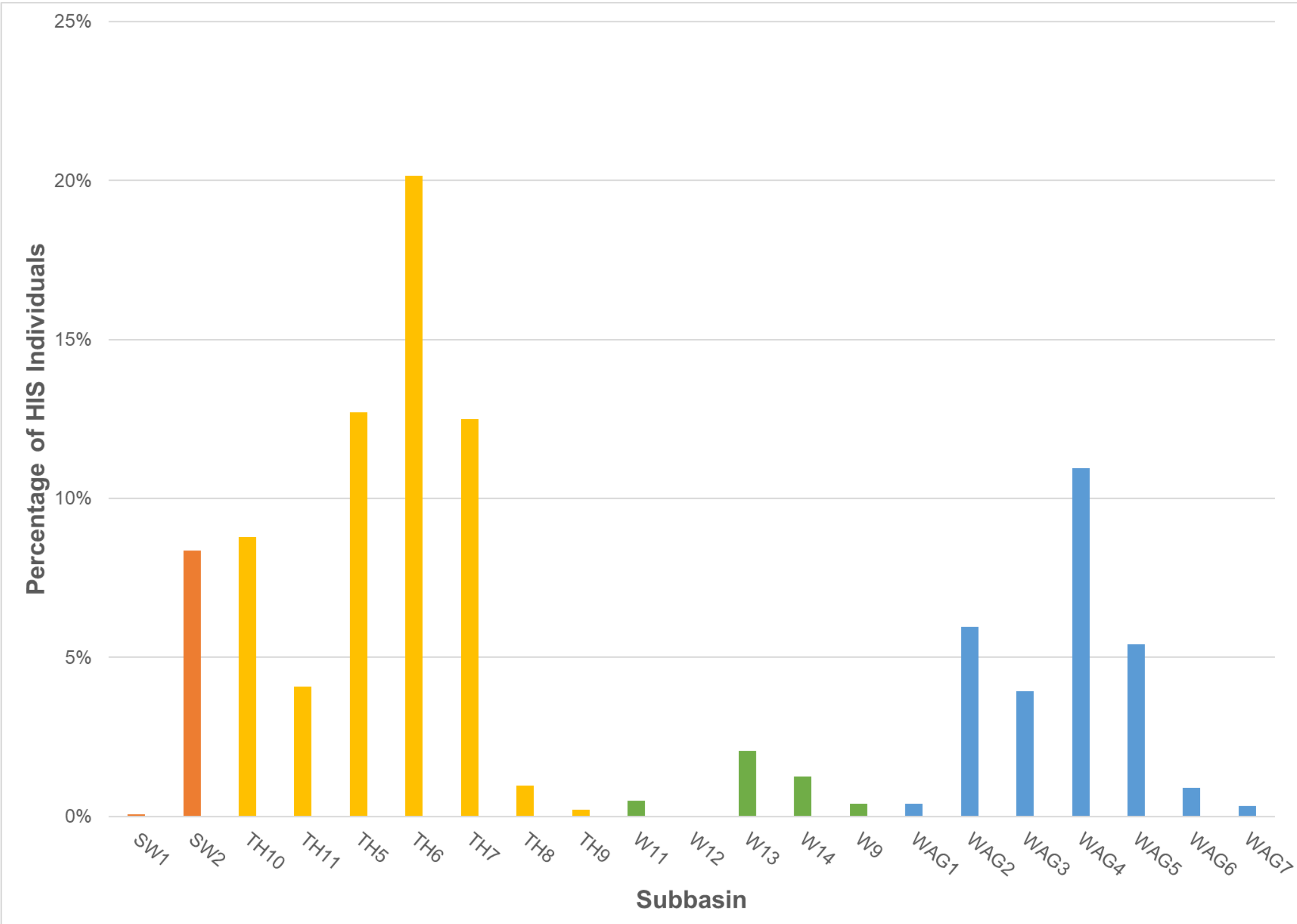


Figure 4-62. Percentage of Habitat Indicator Species Individuals by Subbasin

Comparison to Previous Years

During FC1 (2021-22) and FC2 (2022-23), the HIS Groups showed differing responses to implementation of the Interim Plan, with waterfowl showing the most significant positive response. The average number of waterfowl observed per survey has increased over the two flooding cycles. During FC1, the average number of waterfowl observed per survey was almost double that seen over the 2010-17 period of LORP implementation. In FC2, this value increased to over double compared to the 2010-17 period.

In FC2, shorebird use was slightly higher than observed during pre-project conditions but was lower as compared to FC1 and the 2010-17 period. Due to the very wet conditions of spring 2023, a spring drawdown did not occur, and there was less shorebird habitat at the end of FC2 as compared to FC1. Conversely, wading bird and rail use was higher in FC2 than the other three time periods (Pre-project, 2010-17, FC1). However, it is important to note that the rail group was dominated by one species, the American Coot. Use by Marsh Wren was highest during the 2010-17 period compared to the other periods, although Marsh Wren use was higher in FC2 compared to FC1. Use by Northern Harrier has declined over time with FC2 being the lowest. Overall, the average number of HIS individuals observed has increased over time, with the highest level being in FC2.

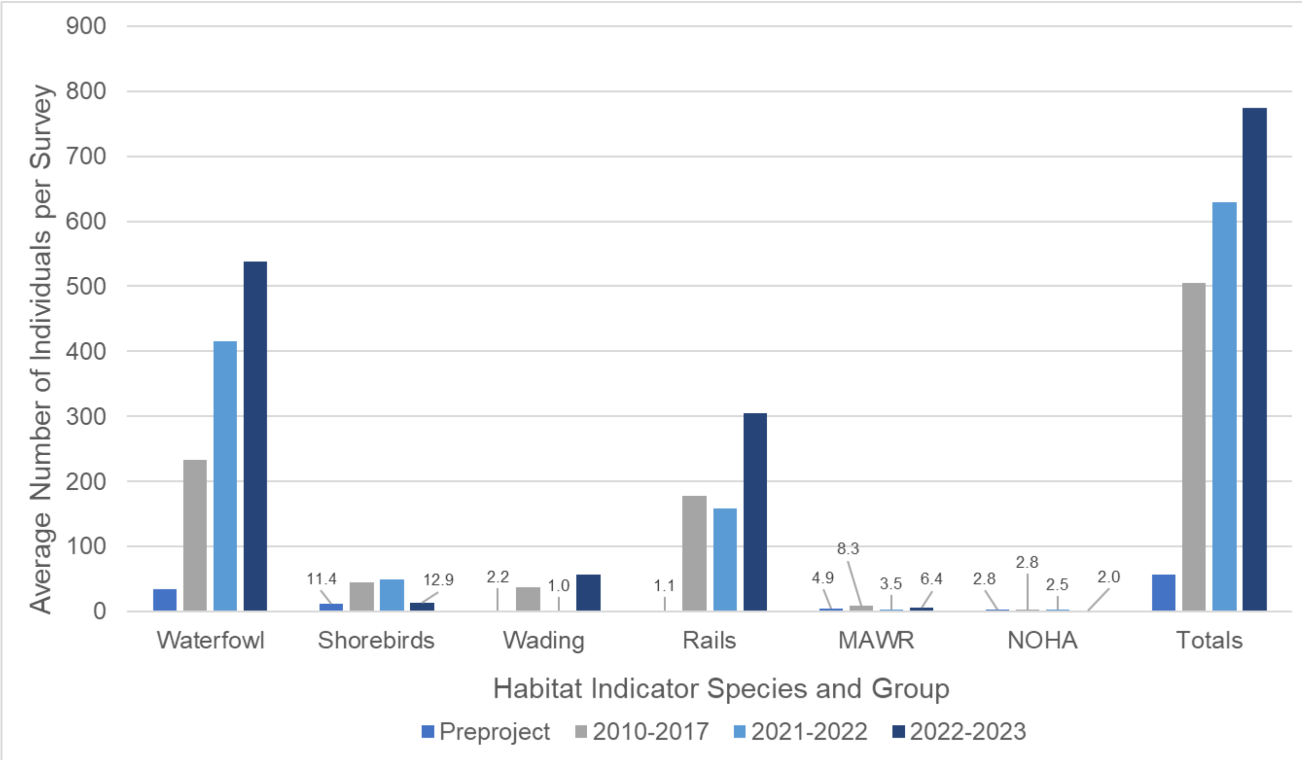


Figure 4-63. Average Number of Individuals in Each HIS Group per Survey (MAWR = Marsh Wren, NOHA = Northern Harrier). A Comparison Across Four Different Time Periods.

In FC1 of the Interim Plan, the observed density of both waterfowl and shorebirds in the Waggoner Unit was approximately six times higher than observed in 2009-10, and rail density doubled (Figure 4-64). In FC2, the observed density of waterfowl was also six times higher than 2009-10, and rail density quadrupled. However, the observed density of shorebirds in FC2 was lower compared to that in FC1, though it was double what was observed in 2009-10. In contrast, the density of wading birds has been lower under the Interim Plan than under prior management.

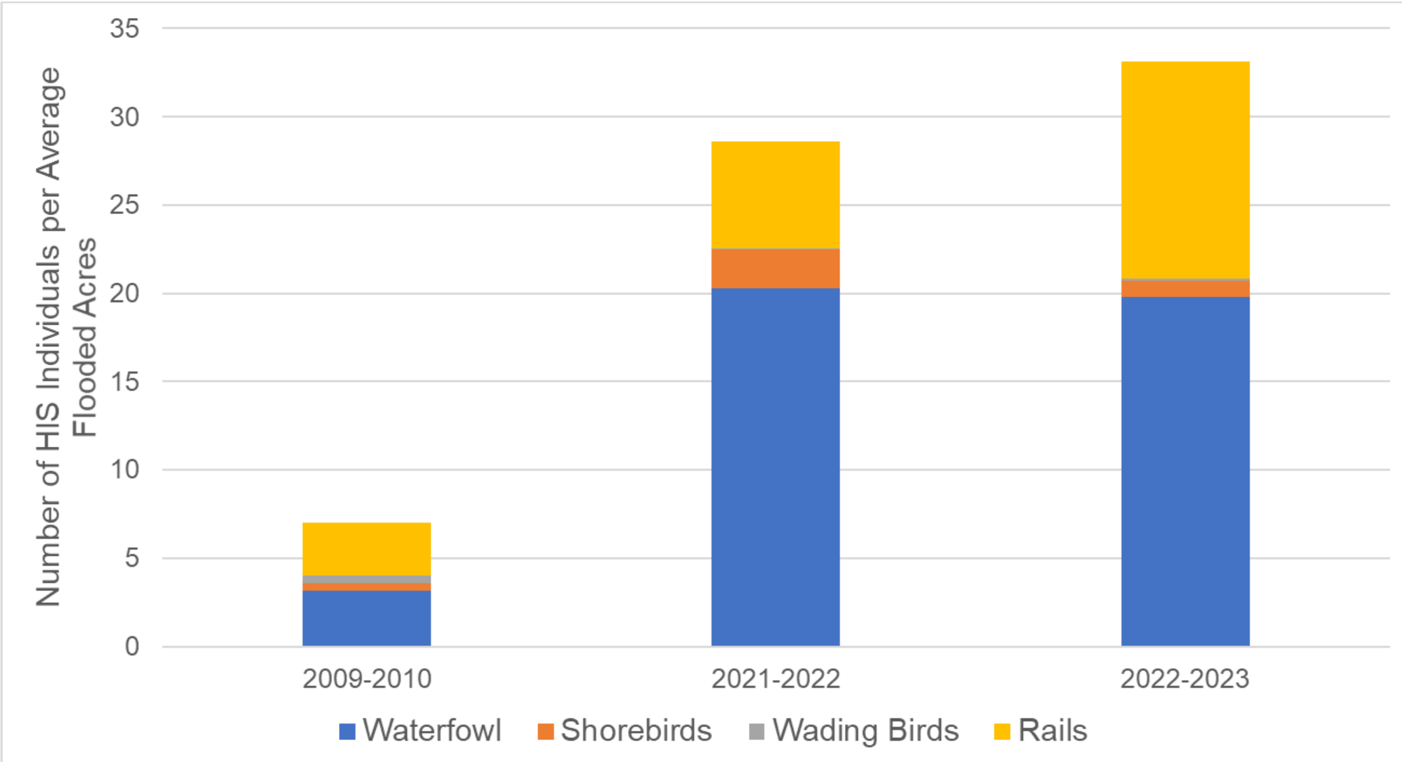


Figure 4-64. Number of HIS Individuals per Average Flooded Acres. A Comparison of Bird Density in the Waggoner Unit Under LORP Management (2009-10), and FC1 and FC2 Interim Plan (2021-22, 2022-23).

The Thibaut Unit has been active for more years than Waggoner, allowing for a longer comparison of how density has changed under LORP management compared to adaptive management under FC1 and FC2 (Figure 4-65). Because South Winterton was not flooded in previous years, it was not included in totals for each HIS Group. Similar to the Waggoner Unit, the observed density of waterfowl and rails increased over time, with the highest density for both groups occurring in FC2. Waterfowl density was seven times higher than observed in 2010-11, and rail density was over forty times higher. Shorebird density exhibited a similar trend to that observed in the Waggoner Unit. It increased up until FC1 and then declined in FC2, which was the lowest observed across all time periods. Wading bird density increased up until 2017, then declined over the two flooding cycles. However, wading bird density in the Thibaut Unit in FC2 was higher than FC1, and four times higher than what was observed in 2010-11.

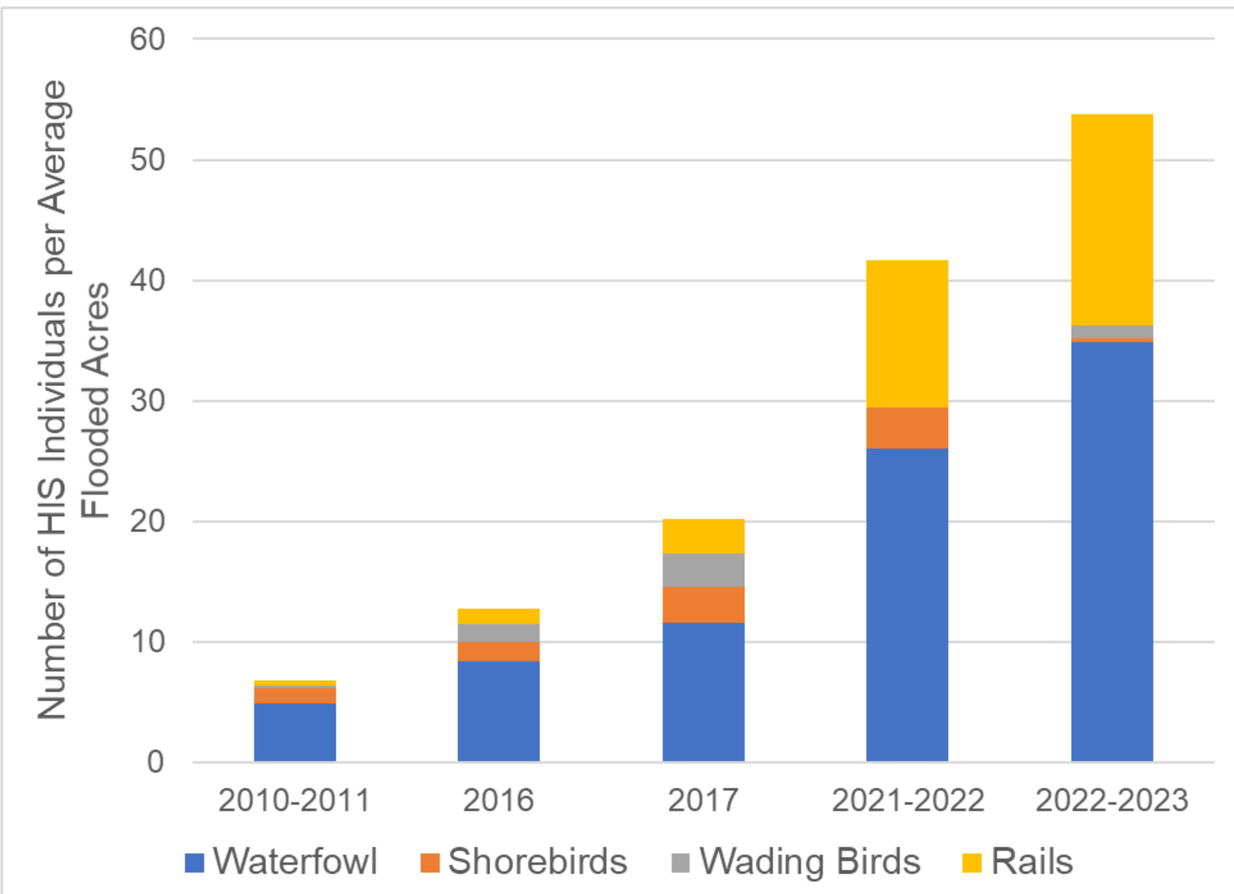


Figure 4-65. Number of HIS Individuals per Average Flooded Acres. A Comparison of Bird Density in the Thibaut Unit Each Survey Year Under LORP Management (2010, 2016, and 2017), and FC1 and FC2 Interim Plan (2021-22, 2022-23).

4.2.6 Discussion and Recommendations

Since implementation of the Interim Plan, there have been two flooding cycles. FC2 was the first year there was a complete drawdown and reflooding cycle. Both flooding cycles have been effective at creating habitat and attracting the BWMA HIS. The initial flood-up of the units has gone as planned, though meeting the 500 acres of flooded habitat target has been variable. In FC1, the flooded acreage was 496 by early November. However, in FC2, the flooded acreage in the managed units/subunits was 469 around the same time. HIS were seen in the BWMA during every survey, and standing water remained in at least some subbasins through the end of spring migration. This means habitat was available fall, winter, and spring for migratory waterfowl, shorebirds, wading birds, and rails. During FC2, higher than normal spring runoff resulted in extensive flooding in the BWMA as water was directed towards this area. Therefore, we were unable to achieve a complete drawdown in spring and in the summer months that followed.

The Waterfowl and Rail HIS Groups have shown the best response to implementation of the Interim Plan compared to the prior management strategy of year-round flooding. Not only were the number of individuals in the Waterfowl and Rail HIS Groups higher, but their densities were much higher as compared to all previous years, suggesting improved habitat quality such that more individuals per acre could be supported as compared to previous years. The average number of individuals in the Shorebirds and Wading Birds HIS Groups has been more variable over time. In FC2, the average number of individuals in the Shorebirds HIS Group, across all survey units, was almost as low as pre-project conditions. This may have been attributable to the lack of a spring drawdown that would create shallow water habitats and mudflats favored by shorebirds. In contrast, these types of habitats were created during the spring drawdown in FC1. The average number of individuals in the Wading Birds HIS Group, across all survey units, was highest in FC2, but lowest in FC1. 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 Interim Plan favors the creation of open water habitat while minimizing the marsh habitat these two species depend upon.

The spring drawdown and summer drying maintained open water habitat created during initial site preparation and facilitated a robust and diverse growth of vegetation in the subbasins. Several plant species observed during vegetation monitoring produce seeds consumed by waterfowl (Martin and Uhler, 1949; Smith et al., 1995), including sedges (*Carex* spp.), swamp Timothy (*Crypsis schoenoides*), willow dock (*Rumex salicifolius*), Arctic rush (*Juncus arcticus*), hardstem bulrush (*Schoenoplectus acutus*) and smartweed (*Polygonum* spp.). The nutritional value of many of the native plant species occurring in the subbasins of the BWMA is not known. Even if these plant species do not produce seeds or vegetative parts directly consumed by species such as waterfowl, their presence will support various invertebrate communities. Casual observations during bird surveys suggest that aquatic invertebrate species consumed by waterfowl and shorebirds such as water fleas (*Daphnia* sp.), copepods, and midges have also successfully colonized the seasonally flooded ponds of the BWMA.

We recommend continuing the avian survey program as implemented in FC1 and FC2, including the mid-March “Spring 1” survey that was added. During FC2, one complete drawdown and reflood sequence was achieved. This seems to have benefited the Waterfowl and Rail HIS Groups, whereas it is difficult to determine how the Wading Birds and Shorebirds HIS Groups may respond over time. Successive monitoring will allow improved understanding of the response of the HIS to the management change and factors influencing the seasonal and spatial distribution of HIS as a function of flooding regimes and subbasin habitat conditions and characteristics.

Lastly, the interim plan outlines the objective of measuring, mapping, and evaluating water depth to enhance our understanding of the relationship of depth on waterbird habitat utilization. Unfortunately, during the initial two years of the project (2022-2023), water depth measurements were not possible. In 2022, limited equipment availability hindered the work, while in 2023, access was impossible due to extraordinary flooding. In future years, we will complete an aerial mapping of basin topography. The resulting topographic map, coupled with wetted extent measurements, will allow the calculation of water depth within the units.

4.3 BWMA - Remote Sensing

The aim of this study was to assess satellite sensor data's efficacy in flood mapping and estimating flooded acreage for the BWMA, potentially replacing the need for field mapping flooded perimeters using GPS.

NIR Thresholding
The process involved querying and downloading Sentinel 2 data through the Earth Engine JavaScript API (code available here: https://code.earthengine.google.com/0111e25bb2ded66de5b4295be9242892). Water-covered pixels display low NIR reflectance, while vegetation, adapted to be highly reflective in NIR, facilitated straightforward isolation of water through NIR thresholding. ArcGIS processing entailed assigning 20x20m pixels as binary rasters (e.g., water, no water), and summarization within each flooding unit allowed for acreage calculations (Figure 4-66). These steps are slated for automation within the application next year. Over time, the increase in NIR reflectance from vegetation like bulrush and cattail in open ponds will enable tracking of water versus marsh vegetation changes annually (Figure 4-67).

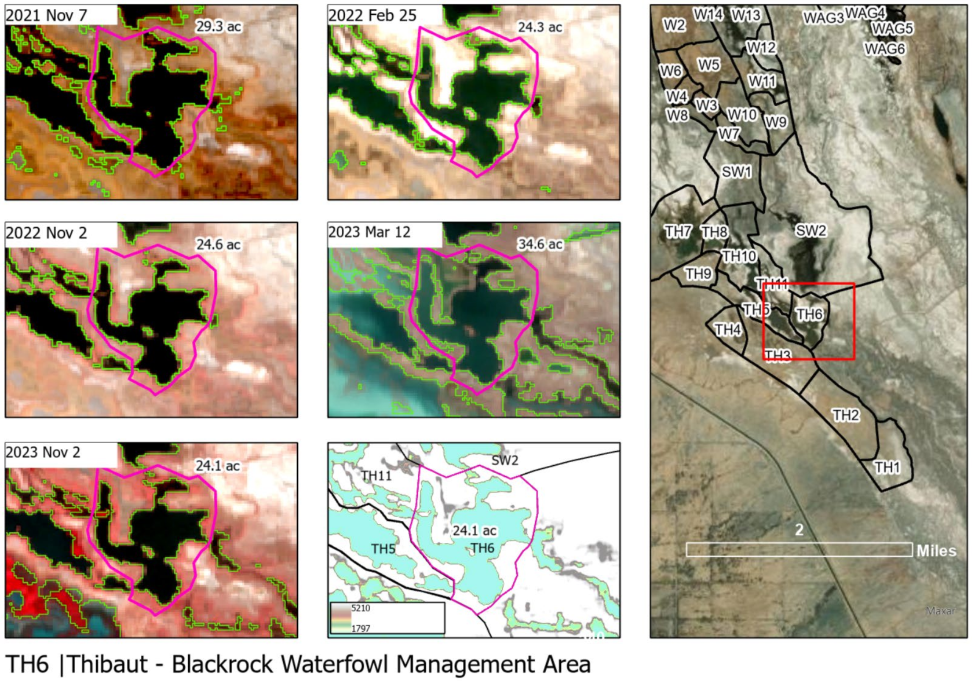


Figure 4-66. Example subunit water mapping and acreage. Thibaut unit TH6 open water ranged from 29 to 24 acres in the fall - and 24 to 44 acres in the spring (Nov 2021 to Nov 2023).

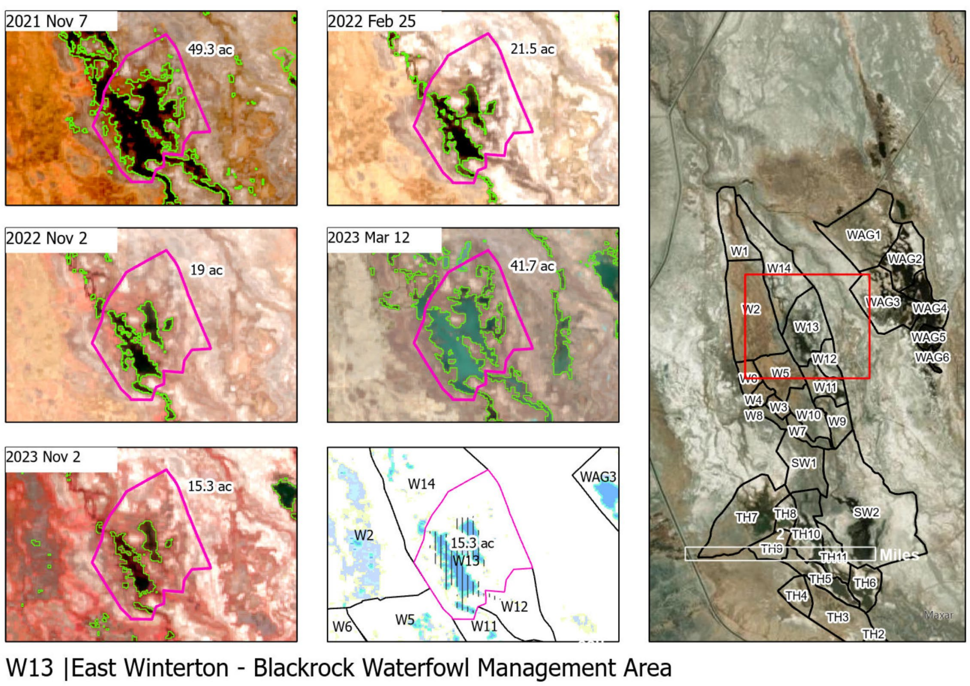


Figure 4-67. East Winterton W13 disked to reduce cattail and bulrush in 2021, with some infilling of vegetation into 2023.

Comparison to Field Mapping

The NIR thresholding technique tended to overestimate tracklog acreage in fall and underestimate it in spring comparing fall 2021 and spring 2022 tracklogs to satellite acreage estimates (Figure 4-68). The deviations from GPS tracklogs primarily arose from excluding shallowly flooded mixed pixels with dense vegetation, masking water spectral reflectance characteristics. Remote sensing estimates aligned closely (within 2%) with field-mapped estimates in 25% of subbasins where waterlines were well-defined by elevation gradients. However, in areas with water sheeting across landscapes and mixed with highly NIR-reflective emergent vegetation, the NIR thresholding approach proved inadequate to delineate all flooded pixel types that are typically included in the acreage summary and compared to the 500 acre seasonal flooding goal. Methods of mixed pixel classification will be developed and added to the application.

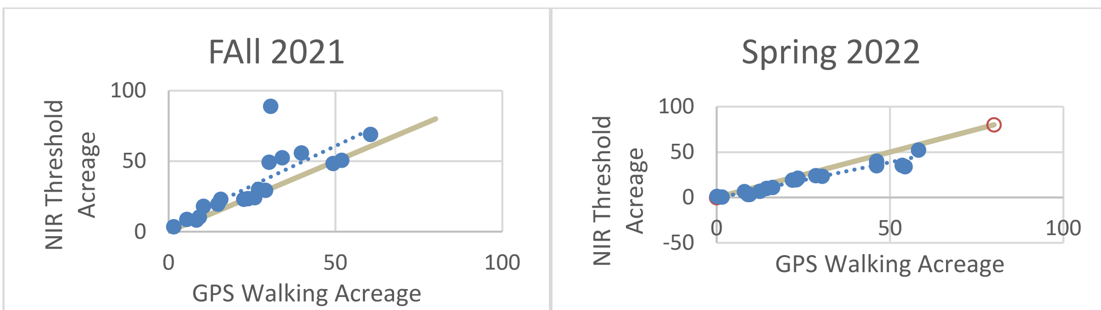


Figure 4-68. Fall 2021 and Spring 2022 GPS Walking Acreage compared to NIR threshold acreage. Fall (left) and spring (right) relationship between remote sensing and GPS mapping flooded acreage. The 1:1 perfect agreement is in grey. A few outlier subbasins contribute heavily to total error and bias switched from overestimate in fall to underestimate in spring, on average.

The spreading operation necessitated by the 2023 runoff filled all the BWMA subunits, preventing the seasonal drying and production of annual food plants like the summer of 2022 (Figure 4-69). The summer growth of emergent vegetation in 2023 has started infilling some of the ponds. The next summer drying is scheduled for March 1, 2024, to restart the seasonal flooding management.

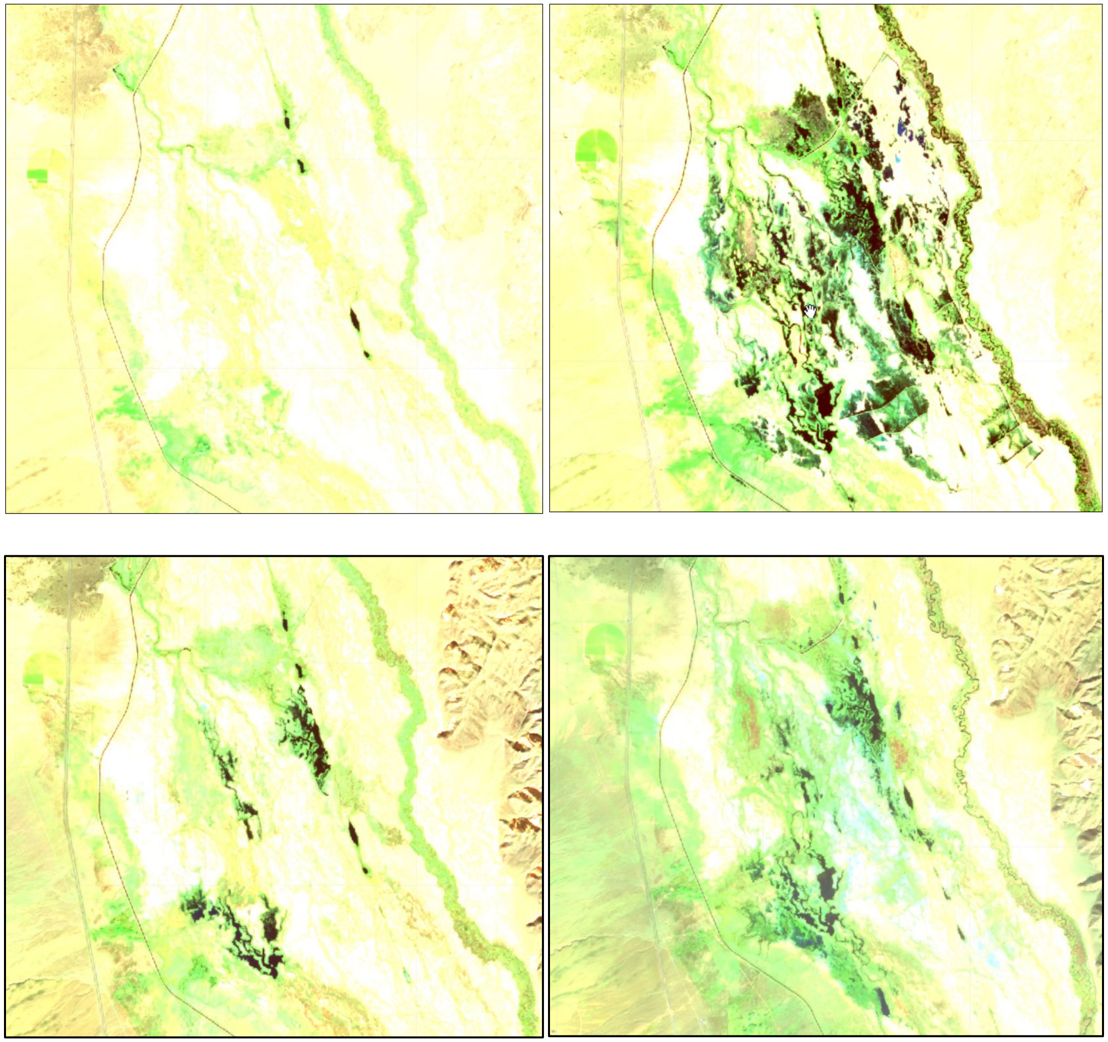


Figure 4-69. Top left - July 2, 2022, units dry. Top right - July 2, 2023, units full. Bottom left - November 2, 2022. Bottom right – November 2, 2023.

4.4 TREE RECRUITMENT

Three adaptive management actions were originally proposed in the 2020 LORP Annual Report (LADWP and ICWD, 2020) and subsequent 2020-2021 LORP Workplan (LADWP and ICWD, 2021) to understand past and current riparian tree recruitment within the project area. These actions included: *1)* describing conditions that allowed tree establishment under pre-project settings (prior to re-watering), *2)* assessing conditions that have permitted limited recruitment since project initiation (post re-watering), and *3)* identifying current biological processes that could limit tree germination or establishment. This review summarizes work to-date (as of October 2023) on the LORP project area.

Action Item 1: Historic Recruitment

The first adaptive management recommendation to understand historic or pre-project tree recruitment was initiated during summer 2020 and continued in 2021 and 2022 with riparian vegetation transects located within LORP reaches 2, 4, 5, and 6. Reach 1 and the islands (reach 4) are currently excluded from the study due to fire and confounding hydrologic influences in the islands. Riparian survey methods are described in detail in the 2020 and 2021 ICWD annual reports (see: Type D – Riparian Vegetation Monitoring Annual Status Report 2021, Appendix 1: Type D Monitoring Program and studies for the Long Term Water Agreement; ICWD 2020, 2021).

This project was not completed in summer 2023 due to high flows preventing access (Figure 4-70). Data will be analyzed when the field component of the project is complete, and a more comprehensive analysis will be presented in the 2024 or 2025 LORP Annual Report.

Figure 4-70. Normal and high-flow comparisons on the LOR Project. Images a) and c) depict two riparian transect bank-full locations under normal summer flows (50-90 cfs) during 2022 in a and 2021 in c, while b) and d) show the same locations during approximately 200 and 579 cfs; inundated under 0.4 and 4.4 ft of water, respectively, in June 2023.

Action Item 2: Successful Recruitment Locations Post-implementation

The second adaptive management item involved surveying successful tree recruitment locations post-LORP implementation. To understand the conditions that permitted riparian tree germination and establishment from 2008 - 2018, a set of recruitment sites identified during the LORP Rapid Assessment Survey (RAS) that survived into 2018 were re-visited. During spring 2021-2022, 45 sites were assessed using full survey techniques (Figure 4-70). At these locations: *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) were recorded along line-point transects. 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 2020-2021).

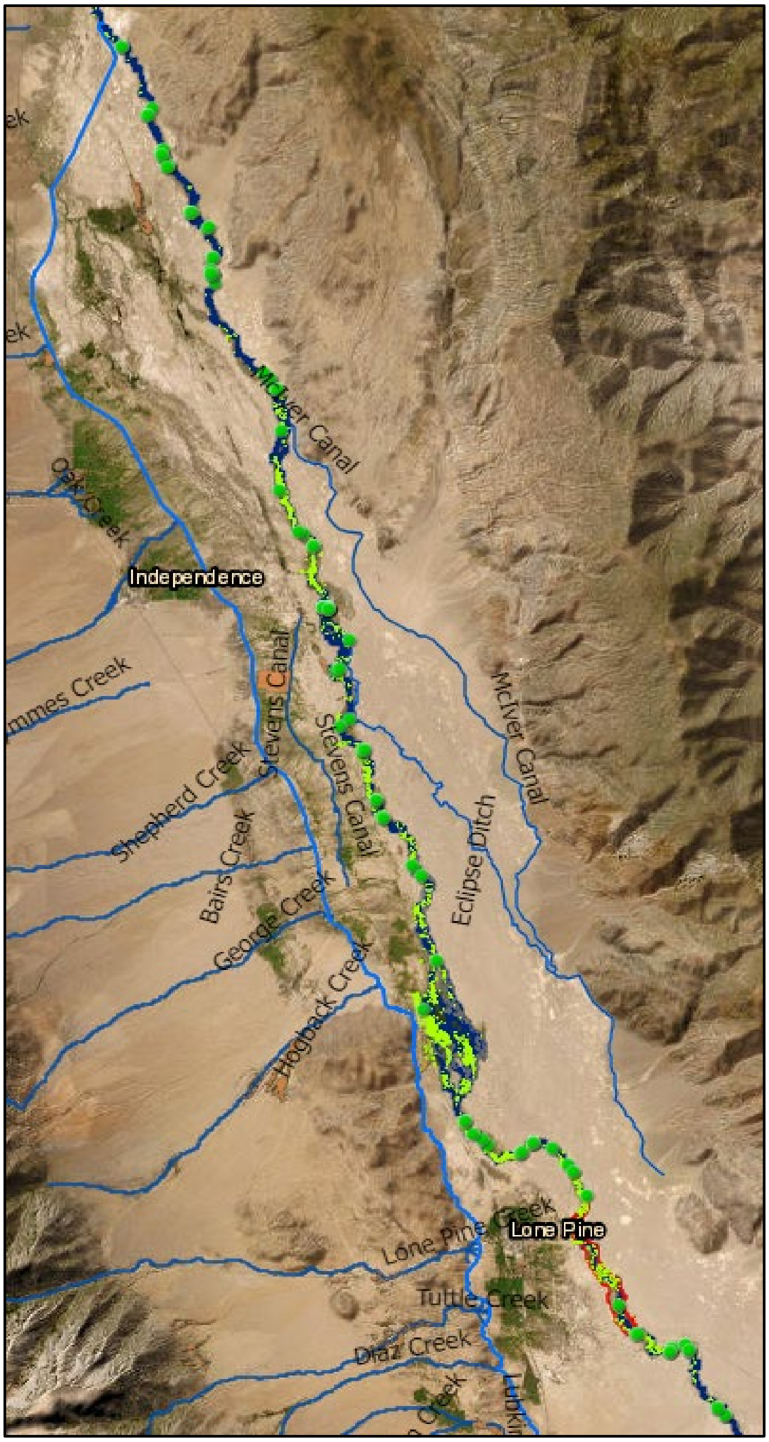


Figure 4-71. Lower Owens River tree recruitment locations (green dots) that have been revisited as part of the tree recruitment assessment. For reference, the Owens River is depicted in navy blue, and the Aqueduct and tributary creeks are shown in lighter shades of blue. Mature tree polygons are depicted in lime green.

During 2023, 16 new sites were visited, and tree heights and basal diameters recorded, however high flow conditions inundated the ground, preventing sampling other items described above (Figure 4-70); this work is anticipated for spring 2024.

Action Item 3: Plant competition and removals

Assessing the impact of plant competition on tree recruitment or survival was identified as a study topic due to apparent limited tree recruitment on the project, particularly in the lower reaches. Because riparian trees are disturbance adapted species and typically require mechanical disturbance or wetting of bare soils, and such disturbance or wetting of higher elevation floodplains is not occurring regularly on the LORP, it is possible that neighboring plant species that established post implementation are crowding potential recruitment locations adjacent to the bank.

Methods

Several drought years without a seasonal habitat flow prevented this work; however, the 2023 runoff season was historic at 244% of normal. The seasonal habitat flow in 2023 was consequently much larger than 200 cfs, maxing at 767 cfs at the intake on June 22 and 626 cfs at the pumpback station on June 27, 2023. These high flows allowed a test of a plant removal technique. It was difficult to determine the best time to initiate removals because of the unpredictability of the river stage and timing of peak flow. Access to sites was also problematic in this historic year, with road closures and flooding. Thus, only five 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 2-4 meters long and perpendicular to the channel (Figure 4-72).

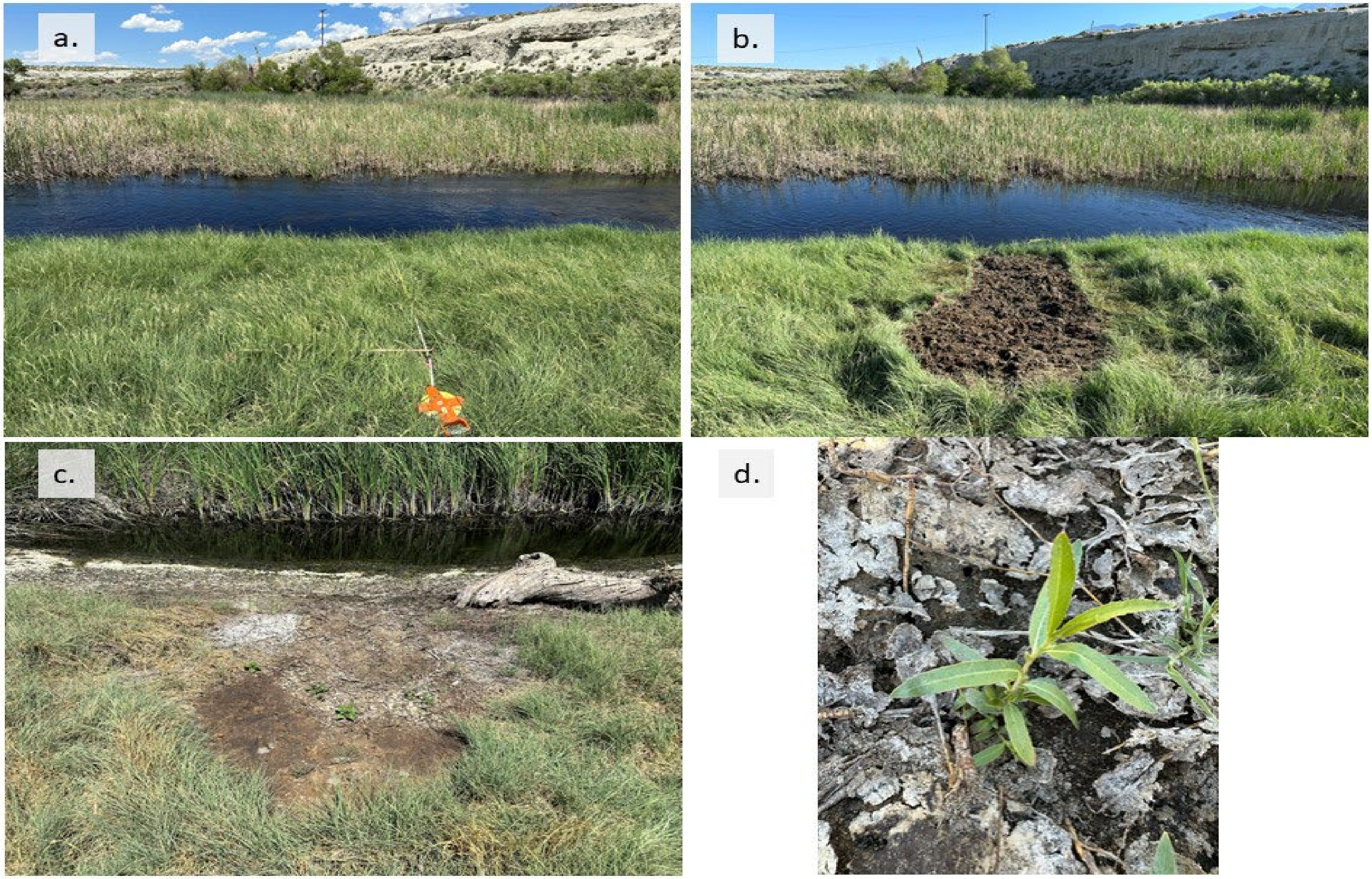


Figure 4-72. A plant removal site on the LOR Project in June 2023. Image *a)* depicts the site pre-removal, *b)* shows post-plant removal. Images *c)* and *d)* depict the site after high flows; *c)* with recruitment and *d)* a closeup of a *Salix sp*. tree seedling.

Preliminary results

At the five removal locations, a total of 10 *Salix sp*. seedlings were detected, with 7 found on Reach 5, and 3 on Reach 6 (Table 4-7). On LORP Reach 5, recruitment occurred at two removal sites; a greater number of locations than most years post project inception (with primarily no recruitment) and twice the number of sites as two of the three years with recruitment (Table 4-7) as assessed by the RAS. Previously, the greatest recruitment recorded on reaches 5 and 6 was in the first three years of the project when there was little plant competition on formerly dry banks and low elevation floodplain surfaces (2007-2009). On reach 6, three individuals were recorded at one of two removal sites, just less than the mean number of recruitment locations (1.5) since the beginning of the project (Table 4-7).

Table 4-7. Tree seedlings present at removal sites on LORP Reaches 5 and 6 in 2023.

Site	Reach	Date	# Salix sp.
1	5	8/17/2023	0
2	5	8/17/2023	6
3	5	8/17/2023	1
4	6	8/17/2023	3
5	6	*not visited in August*	

Table 4-8. LORP riparian tree recruitment locations in all years the Rapid Assessment Survey occurred post LORP implementation.

Year	Reach 5	Reach 6
2007		4
2008	3	3
2009		3
2010		
2011	1	2
2012		
2013		1
2014		1
2015		
2016		
*2017	1	2
Total	**5**	**16**

** 2017 recruits were recorded in 2018*

Unfortunately, this season was unpredictable; a hurricane in late August 2023 resulted in a breach of the aqueduct and flows up to 870 cfs out of the Alabama gates that when combined with flows out of the LORP intake, resulted in a short-term peak of 1170 cfs at the Pumpback station. These flows killed or removed all tree recruits within the removal experiment, but since they were unprecedented would not be expected to occur again or in the near future. It would be appropriate to retry this approach in a year closer to or just above 100% runoff.

In spring and summer 2023 we will continue environmental and biological assessments of known recruitment locations, and riparian transects along the LORP. Competition assessment via vegetation removals will continue given an adequate seasonal habitat flow (100% runoff year). It is expected that a more thorough analysis of findings from riparian tree recruitment work will be presented in a subsequent (2024 or 2025) annual report.

4.5 Noxious Weed Surveillance and Treatment

4.5.1 Noxious Species Survey – Inyo and Mono Counties Agricultural Commissioner's Office

The CAC manages weed infestations within the LORP project area in collaboration with LADWP and in coordination with the ICWD. All three agencies contribute funds to support the efforts.

CAC manages all plant species designated as noxious by California Department of Food and Agriculture (CDFA); however, within the boundaries of the LORP, our agency places significant emphasis on monitoring, controlling, and eradicating *Lepidium latifolium*. *Lepidium latifolium,* commonly referred to as perennial pepperweed, is the principal noxious invasive plant species in the 78,000-acre project area.

Within the LORP, various activities, including LADWP operations and maintenance, flooding, wildlife activity, cattle grazing, off road vehicle use, and other recreational activities, cause soil disturbance that is associated with the introduction of weed species and weed seed dispersal. A significant source of weed contamination originates from outside the LORP boundary. The middle Owens River, from the Pleasant Valley Dam to the LORP Intake, harbors significant populations of *Lepidium* that can be transported downstream to contaminate the LOR and the LORP area. To mitigate spread, CAC treats areas of extensive *Lepidium* populations upstream of the LORP as grant funding permits. LADWP also has a weed management program that operates on city-owned lands. DWP manages weeds along the Owens River from Warm Springs Road to the LORP intake.

The primary goal of the CAC program is to control weeds, preserving a healthy native plant habitat, and to support wildlife, including threatened and endangered species. Weed control plays a role in reducing stream bank erosion, controlling dust, maintaining a healthy fire regime, protecting open-range agriculture, and enhancing recreational experiences.

The summer of 2023 presented considerable challenges for invasive weed treatments in the LORP area. The record-breaking 2022-2023 snowpack and associated runoff limited access to areas requiring treatment. Similar challenges were encountered after the heavy 2016-2017 snowfall and runoff. Staff shortages were another significant challenge for CAC, with only one full-time seasonal employee dedicated to treating all invasive weed projects overseen by CAC. Two inspectors assisted with the treatments as time permitted.

Weed treatment in the LORP began in May. As in previous years, efforts were made to visit all previously known *Lepidium latifolium* sites. However, high-water levels and flooding continued throughout most of the growing season, rendering many known *Lepidium* sites, treatment areas, and roads inaccessible. Flooding suppressed *Lepidium latifolium* in flooded areas, but new growth on the edge of flooded areas could not be treated due to herbicide restrictions that prohibit application near water. Despite these conditions and challenges, CAC was able to treat 7.1 acres. However, the populations of this noxious weed are likely to rebound to at least 2022 levels (14.14 net acres treated) next season. In 2018, following another record-breaking water-year there was a notable increase in growth compared to the 2016 season, which followed a dry water-year (Figure 4-73).

Beyond the challenges presented by record runoff, maintaining adequate staffing for effective management of such a large site is imperative. With only one employee dedicated to invasive weed control, the crucial task of surveying and mapping out weeds across the entire LORP area becomes challenging.

Activities in the 2024 growing season should include expanded survey efforts. As we observed after the 2017 runoff season, the 2018 weed survey found a significant increase in *Lepidium* infestation within a single growing season. It is likely the same will happen in 2024, with many new populations becoming established due to floodwaters moving seeds and root fragments downstream.

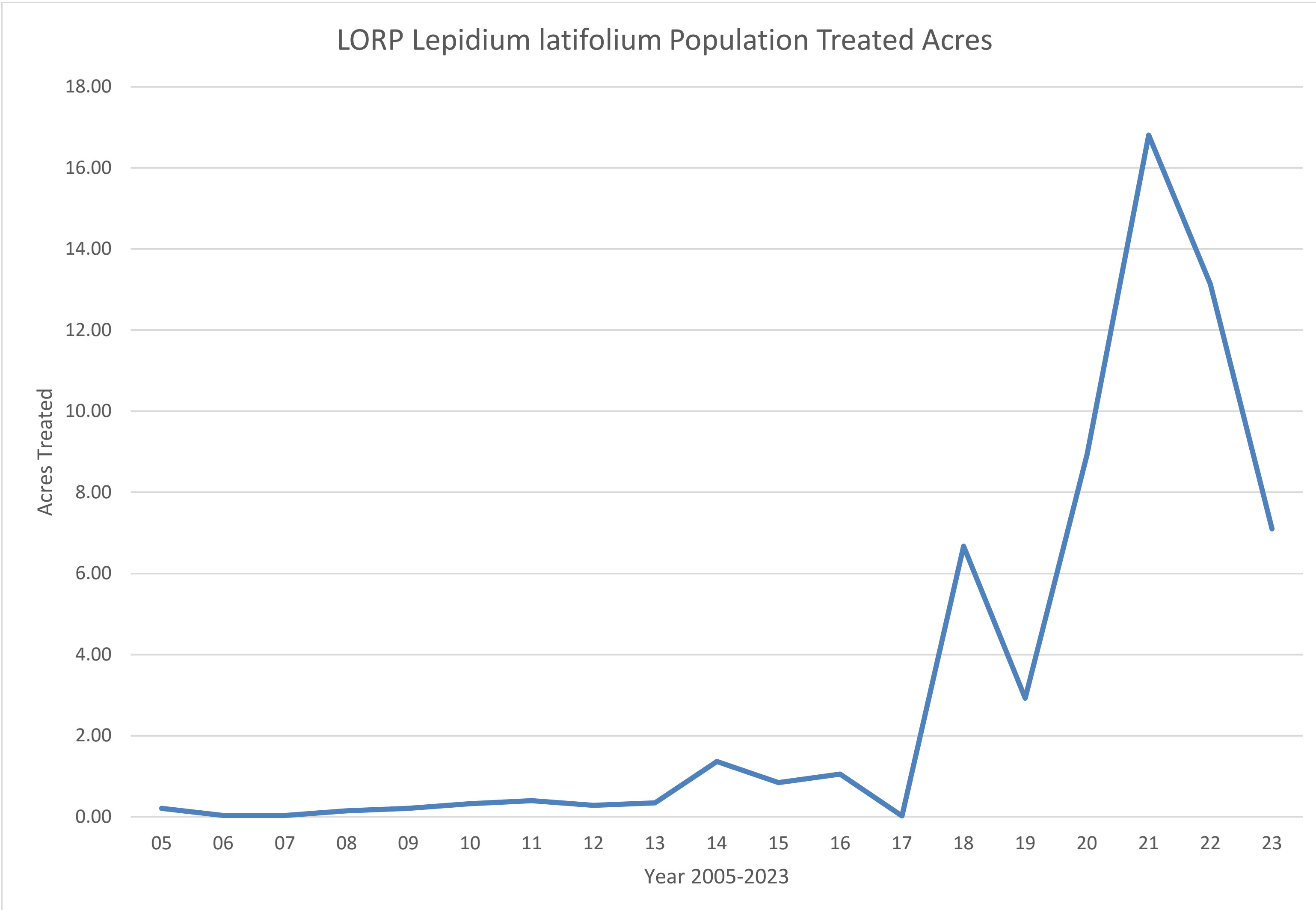


Figure 4-73. LORP Lepidium latifolium Population Treated Acres. Treated acres of pepperweed (*Lepidium latifolium*), along the LORP, from 2005 through 2023.

4.5.2 LADWP Noxious Weed Treatment

Salt Cedar Treatment

A total of 400 acres were canvassed for salt cedar (*Tamarisk spp*) treatment within the LORP in 2022-2023 (Figure 4-74).

During the 2022-2023 season, salt cedar treatment efforts were focused on the Goose 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. Retreatment of areas previously cut occurred at Goose Lake and north of Blackrock ditch near Upper Twin Lake.

The 2022-2023 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 turbo saw and grapple rake attachment was utilized to cut, 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 Cal Fire.

Pepperweed Treatment

Due to historic runoff associated with snowpack from the previous winter, limited pepperweed control was performed throughout the Owens Valley in 2023. No treatment occurred within the boundary of the LORP. In early spring of 2023, a state of emergency was declared and LADWP weed control staff were reassigned to control flooding for the majority of the summer.

Pepperweed treatment will resume beginning in April 2024 and will continue through mid-October 2024.

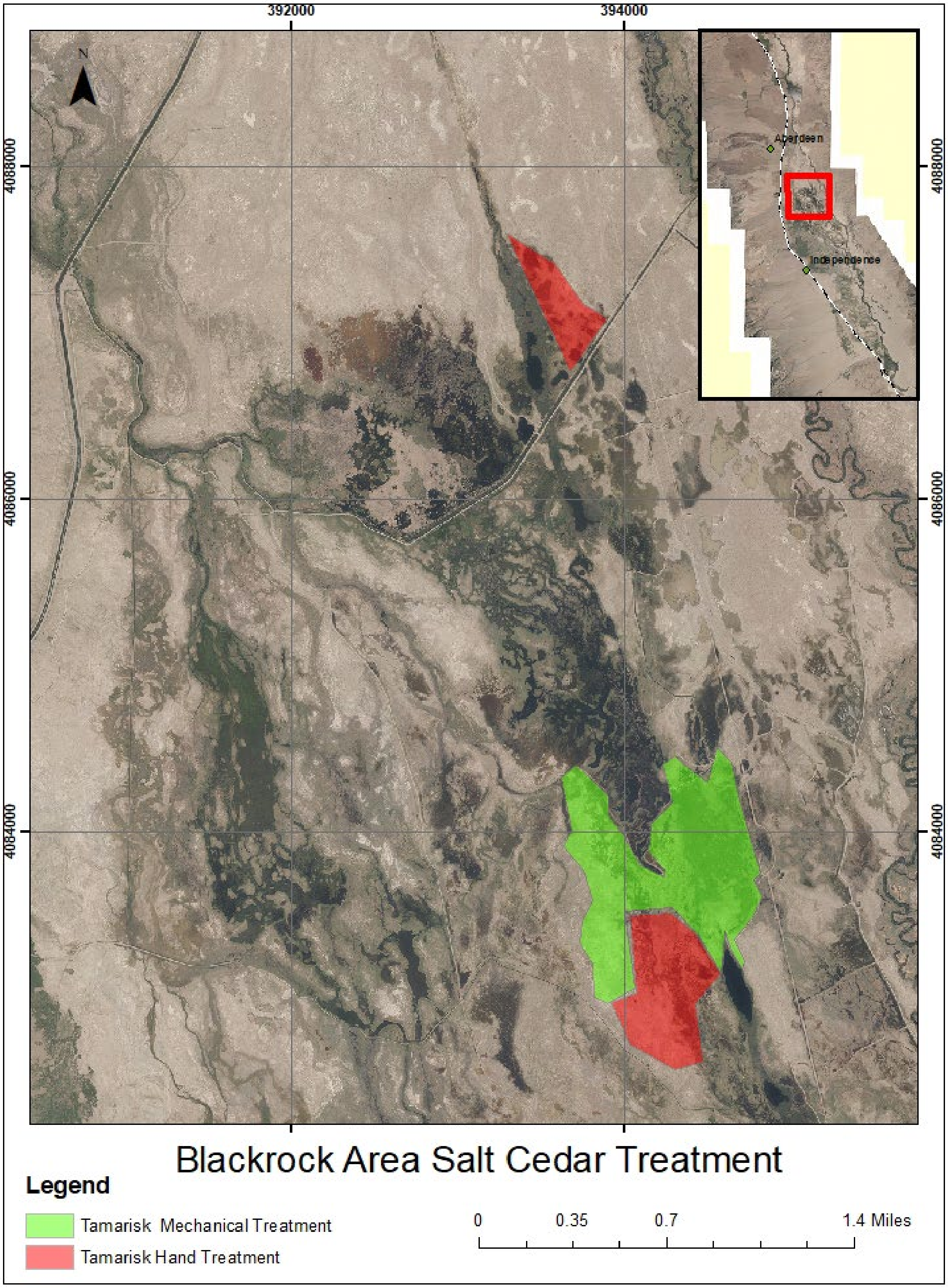


Figure 4-74. Salt Cedar (*Tamarix spp.)* treatment in the Blackrock Area.

5.0 MOSQUITO ABATEMENT

The Owens Valley Mosquito Abatement Program (OVMAP) performs surveillance and controls mosquito populations, along with mosquito-borne arbovirus testing within the LORP area. OVMAP works in cooperation with the LADWP and with the assistance of the ICWD. Funds from all three agencies support the effort. OVMAP monitors several different species of mosquitoes that are prevalent throughout the expansive 78,000-acre LORP area.

This past year was another exceptionally challenging year for managing mosquito populations, abatement surveillance and treatments within the LORP area. Flooding that accompanied the record-breaking 2022-2023 winter snowpack (296% of normal) and runoff (233% of normal) challenged control efforts. Months-long flooding prevented access in many locations, hampered treatment efforts, and supercharged mosquito populations, echoing in many ways the impacts experienced during the last exceptionally heavy water-year in 2016-2017.

Another major hurdle was inadequate staffing at OVMAP, with only one full-time supervisor dedicated to overseeing all mosquito projects. The supervisor performed trapping, species identification, and disease surveillance, while other field staff assisted when available. In total, approximately 547 people-hours were devoted to LORP activities.

Surveillance and treatments began in April and went through the end of October 2023. Attempts were made to visit all previously known mosquito breeding sites; however, due to the extreme runoff and water spreading, many sites, treatment areas, and roads were underwater or otherwise inaccessible. High water and flooding continued throughout most of the mosquito breeding season. The flooded areas produced some high-density mosquito breeding populations in inaccessible areas. Limited access hampered treatment efforts, and adult mosquito abundance was greater than had ever been recorded in the service area. One CO2 Encephalitis Virus Surveillance (EVS) trap, left overnight at the lower part of the LORP near the Delta Habitat Area, caught approximately 13,000 adult mosquitoes. For comparison, an EVS trap collection during a similar time of year in 2022 yielded 223 adult mosquitoes. According to officials from the California Department of Public Health, the trap counts were some of the highest in the state. The total number of mosquitoes trapped around the LORP boundaries, including the delta, tallied up to around 21,700 for the 2023 season.

In terms of disease surveillance, OVMAP sent in 24 Mosquito Pool samples collected from the LORP areas, with one coming back as a West Nile positive. This Mosquito Pool sample was collected from the Black Rock Fish Hatchery.

Beyond the physical and environmental challenges posed by the record runoff lies the ongoing struggle to recruit sufficient staff to effectively manage such a vast field area. In 2023, with only one employee exclusively dedicated to mosquito control, it had been challenging to allocate time for the necessary tracking surveys across the entirety of the LORP area.

The extent of next season’s mosquito abatement activity will depend upon several factors, including the size of 2023-2024 snowpack and associated runoff, staff availability, the ability to procure adequate equipment and supplies, and the level of funding available to support the program.

6.0 PUBLIC MEETING AND COMMENTS

6.1 LORP Annual Public Meeting

The LORP 2023 Draft Annual Report was released for public review on December 21, 2023. A public meeting discussing the report was held on January 10, 2024 in person and via *Zoom* at the Inyo County Water Department's Office at 2 p.m. An audio recording of the meeting can be made available upon request. The 2023 LORP Annual Report presentations given by both LADWP and ICWD staff are provided in the LORP Public Meeting/Comments Appendix 1.

6.2 LORP 2023 Draft Annual Report Comments

LADWP and Inyo County accepted additional written comments on the LORP 2023 Draft Annual Report through January 25, 2024. A comment letter was received from CDFW on February 2, 2024. This letter is provided in Public Meeting/Comments Appendix 2.

6.3 Appendices

APPENDIX 1. PRESENTATIONS FROM LORP PUBLIC MEETING

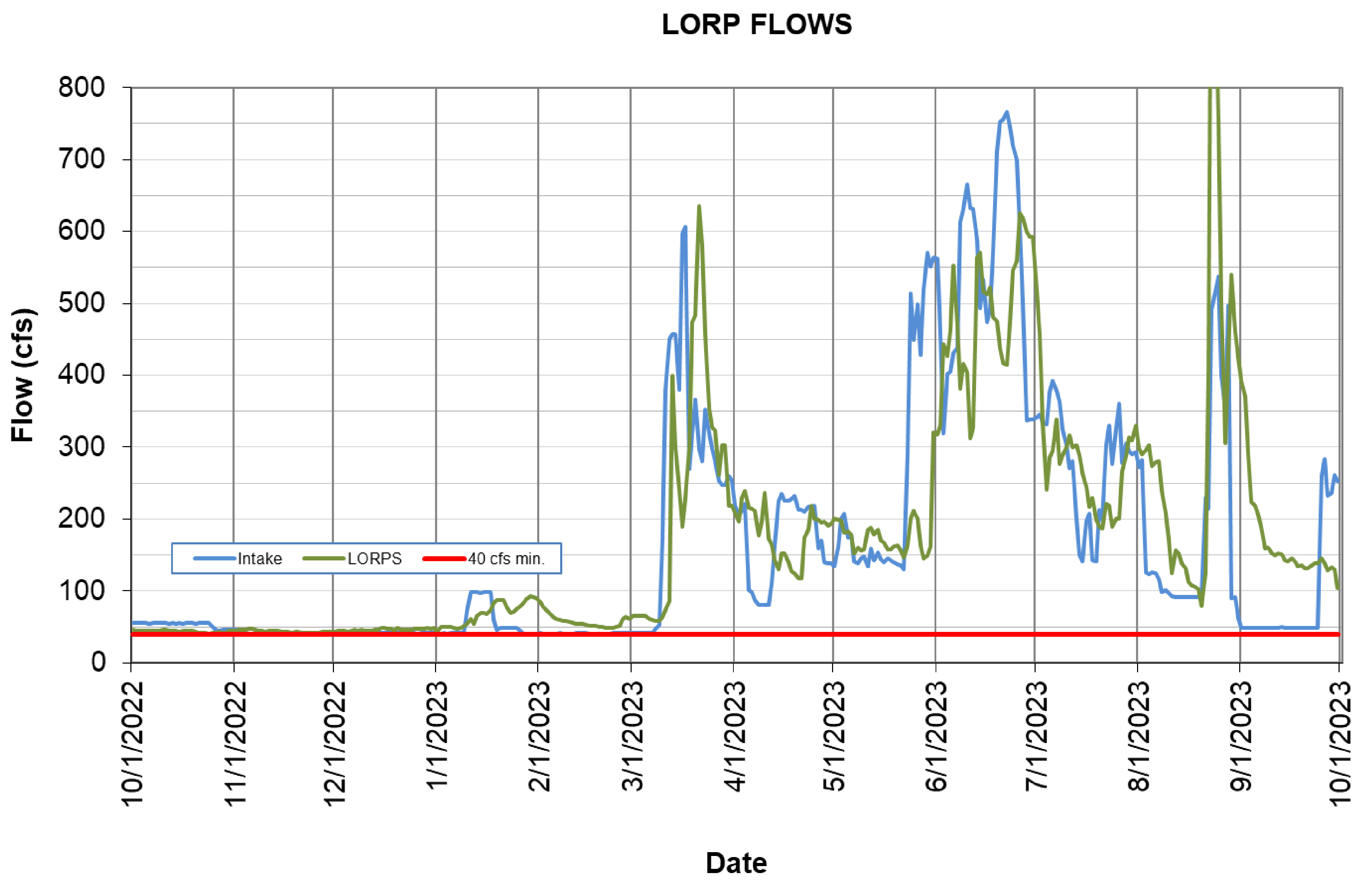

LOWER OWENS RIVER PROJECT
2023 ANNUAL REPORT MEETING

Hydrology

Tony Tillemans

Hydrologic Monitoring

2022 – 2023 Hydro Year	
40 cfs minimum flow compliance	Minimum flows met thru Hydro Year
Reporting Requirements	Daily and Monthly reports available on ladwp.com, and Realtime data
Mean flow to Delta	141 cfs
Interim BWMA	Year 3 Postponed by MOU Parties, to be implemented Fall 2024
Owens River Basin Runoff Forecast	244% of Normal for April 2023 – March 2024
Summer Intake Releases	Average flow of 416 cfs from May – August 2024



LORP FLOWS
Flow (cfs)
800
700
600
500
400
300
200
100
0
Intake
LORPS
40 cfs min.
10/1/2022
11/1/2022
12/1/2022
1/1/2023
2/1/2023
3/1/2023
4/1/2023
5/1/2023
6/1/2023
7/1/2023
8/1/2023
9/1/2023
10/1/2023
Date

Water Quality Monitoring

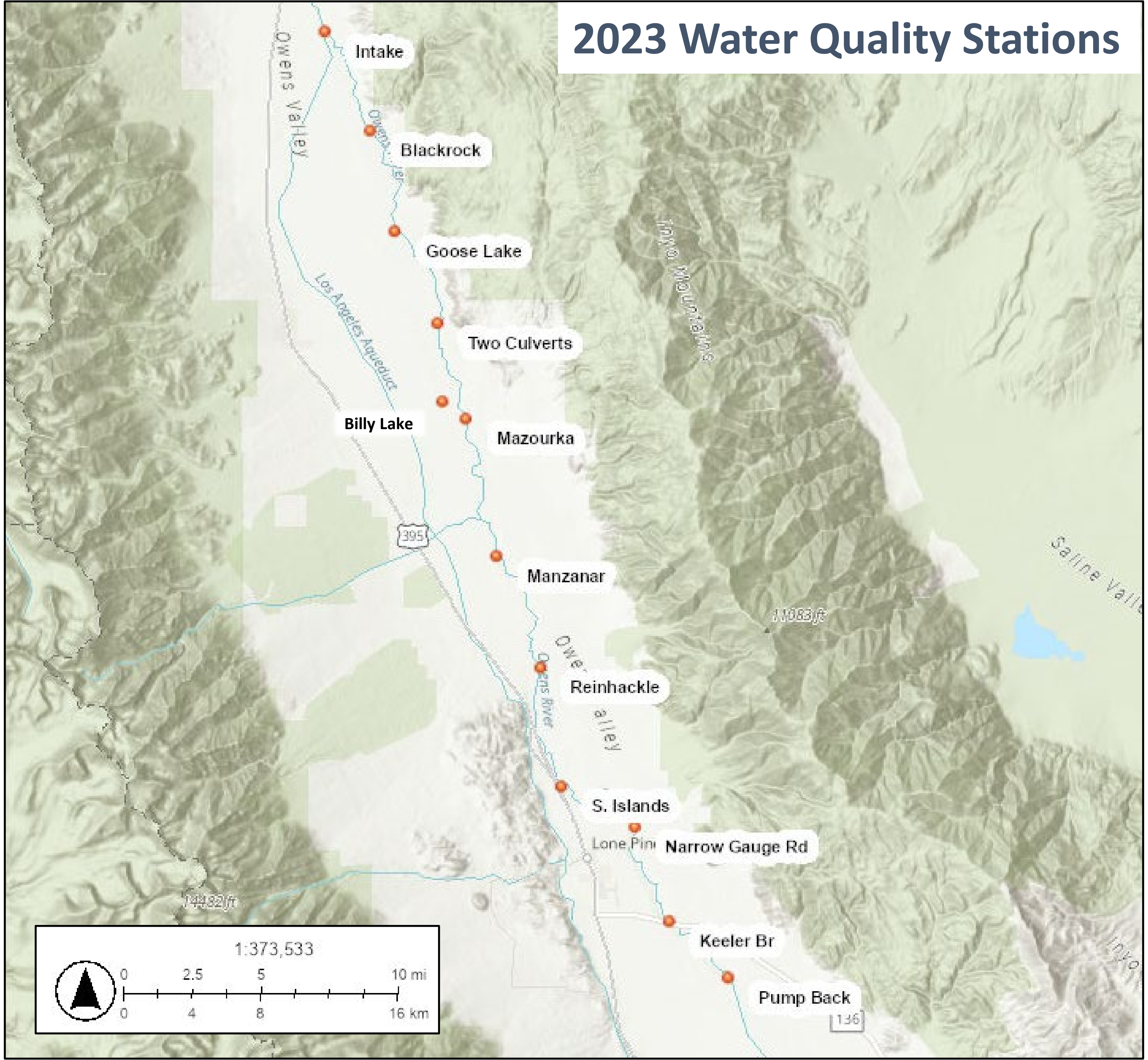
Tim Moore

LOR 2023 Water Quality Monitoring

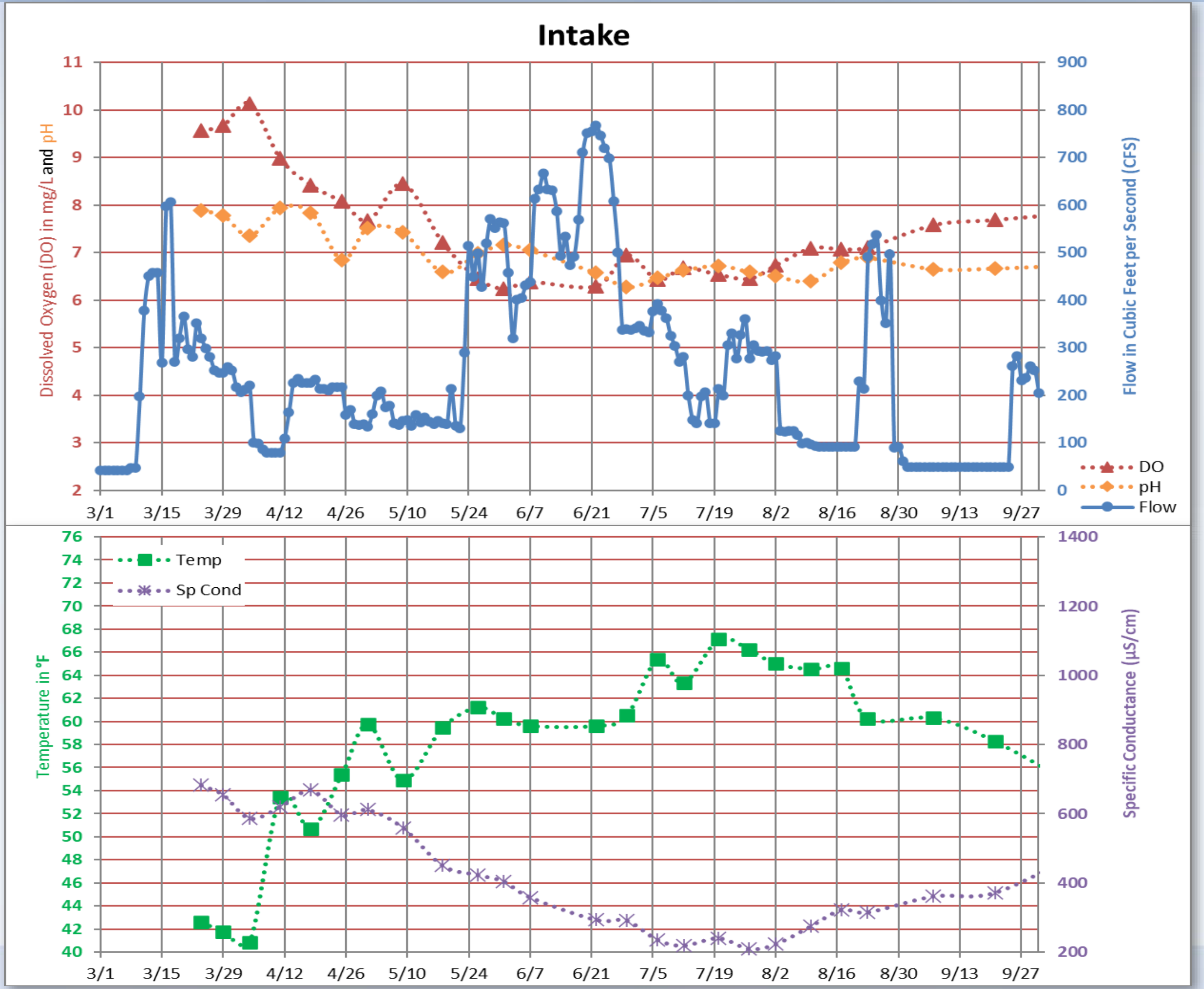
Parameters:

- Dissolved Oxygen (DO), mg/L
- Temperature (Temp), °F
- Specific Conductivity (Sp Cond), µS/cm
- pH

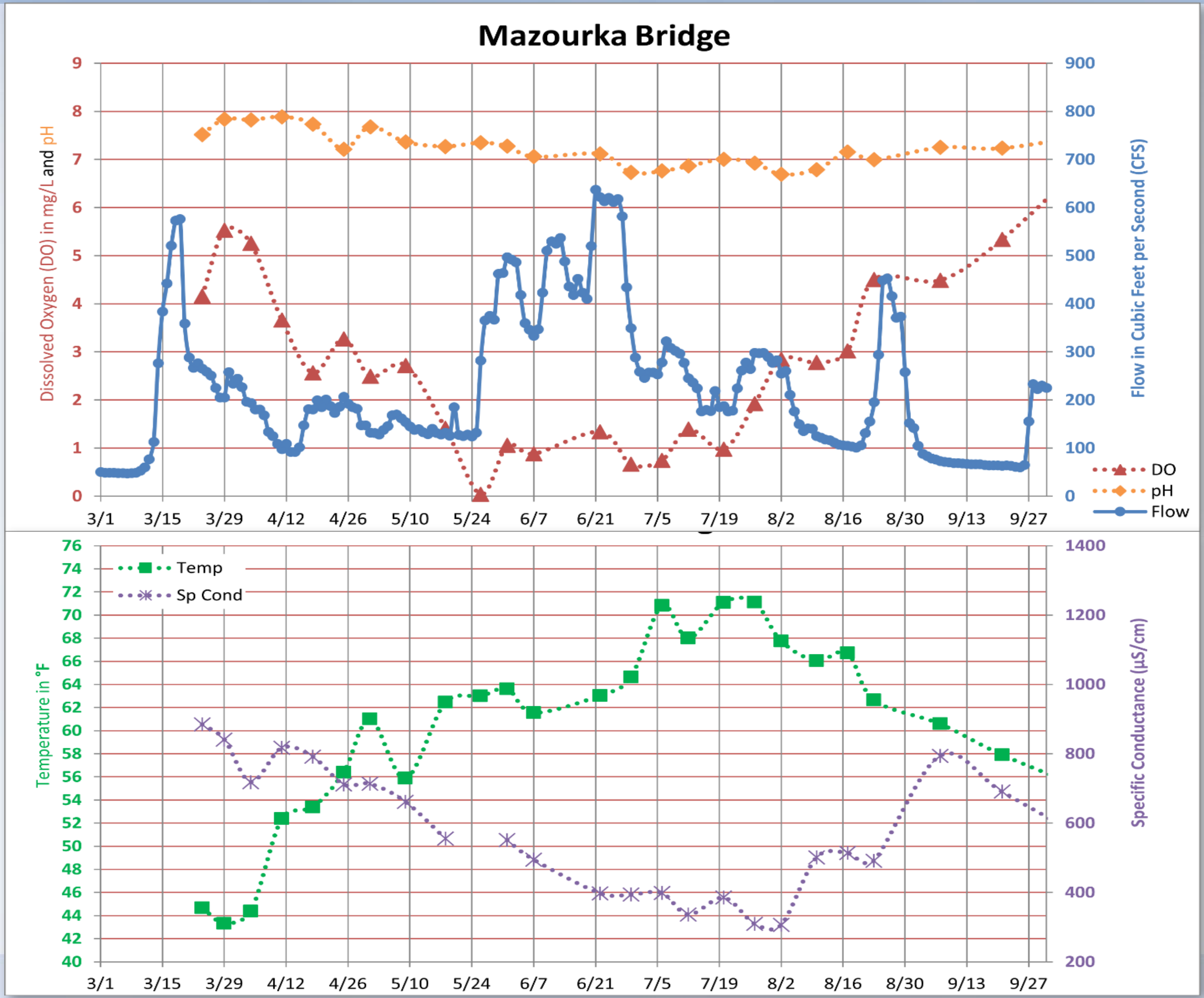
2023 Water Quality Stations



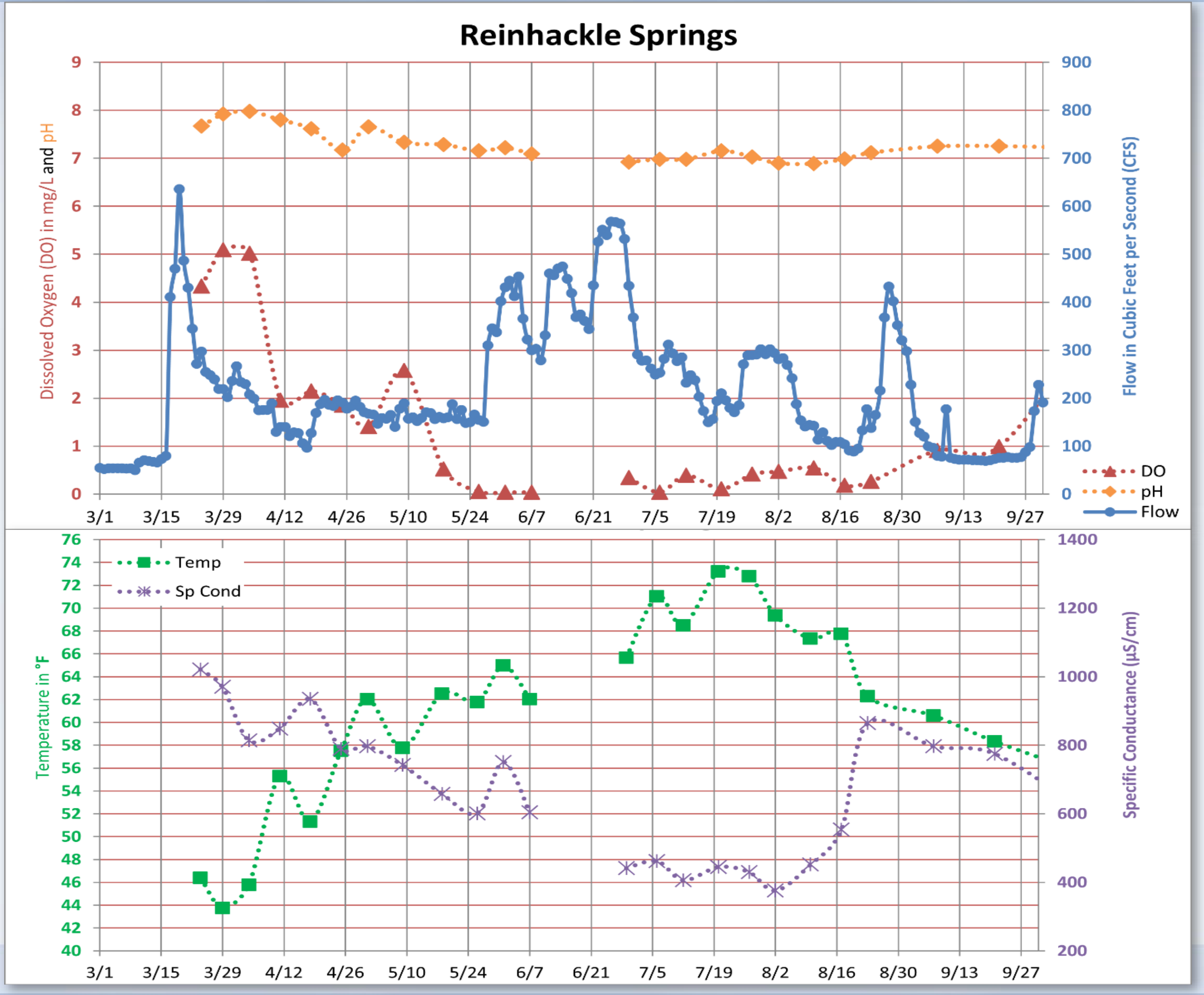
LOR 2023 Water Quality Monitoring



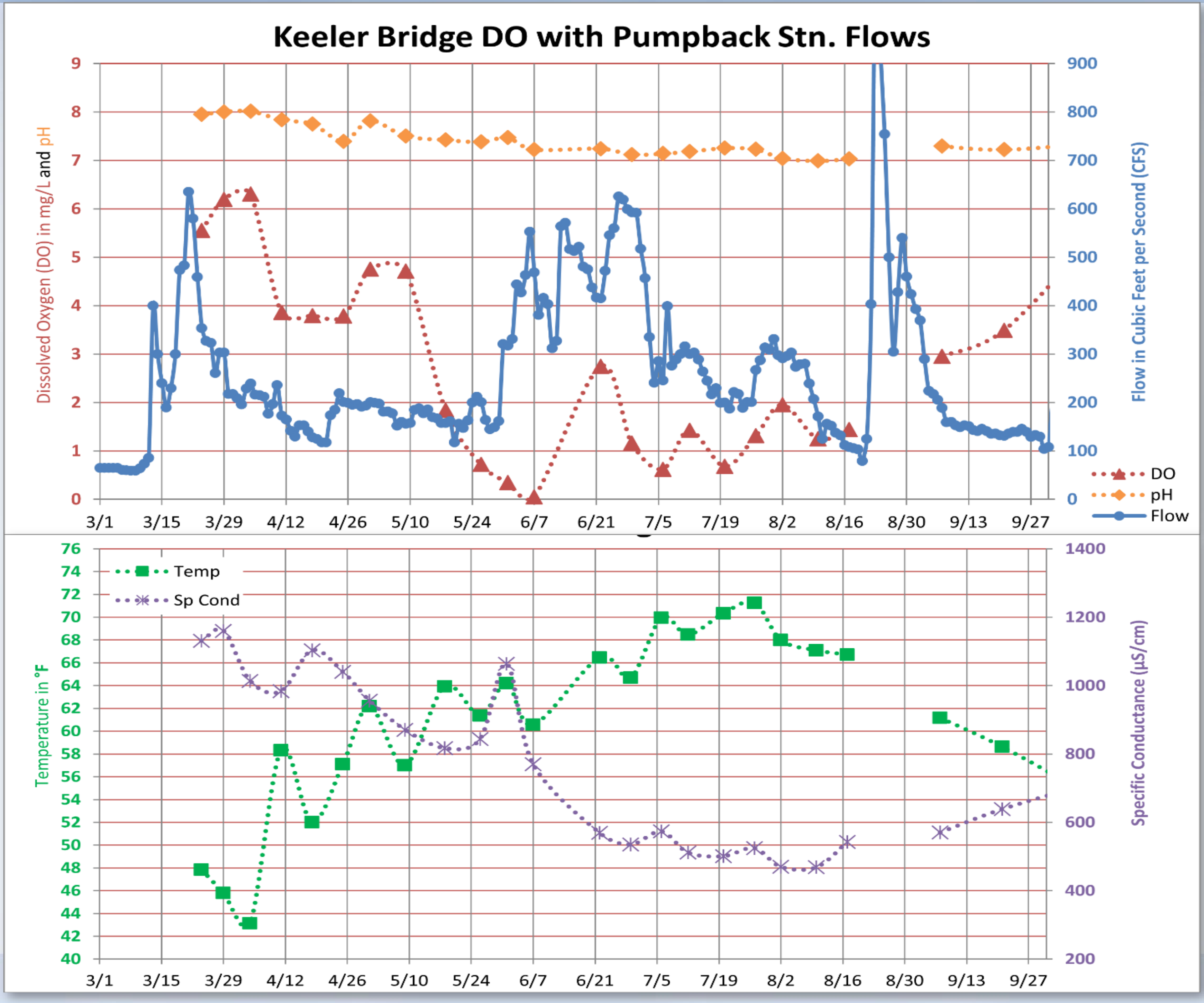
LOR 2023 Water Quality Monitoring



LOR 2023 Water Quality Monitoring



LOR 2023 Water Quality Monitoring



LOR 2023 Water Quality Monitoring

Findings:

- Inverse relationship between DO and Temperature.

- General trend of decreasing DO with increasing distance south from the Intake to Reinhackle Springs; then upward with distance towards Keeler Bridge and the Pumpback Station.

- DO levels in the LOR ranged from more than 10 mg/L at the LOR Intake in mid-April to 0.0 mg/L at Reinhackle Springs in late May.

- Evidence of fish stress coincided with the lowest DO measurements. No major fish kills within the LOR were observed or reported.

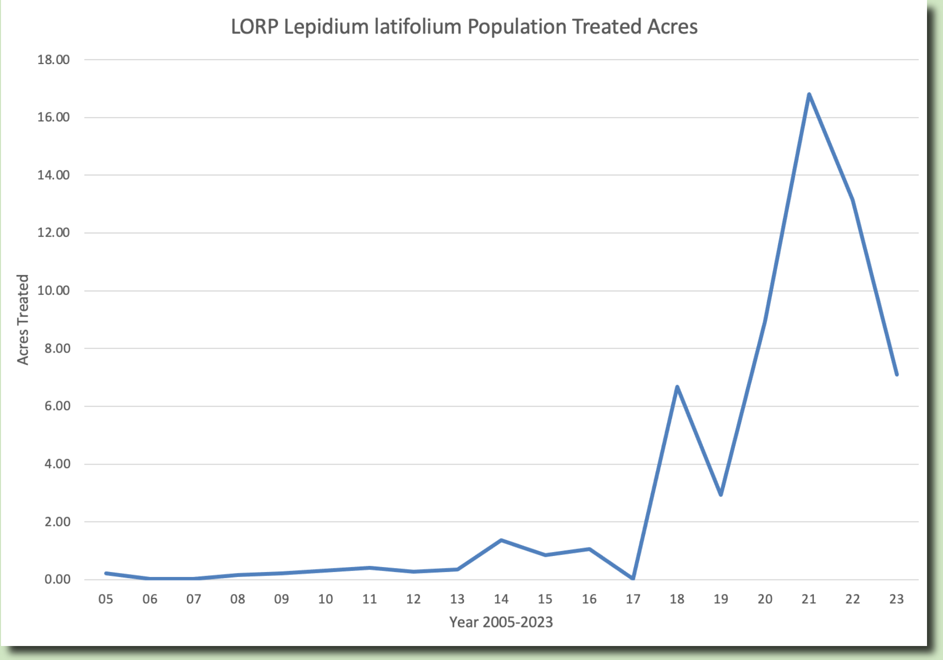
Weed Treatment & Mosquito Abatement

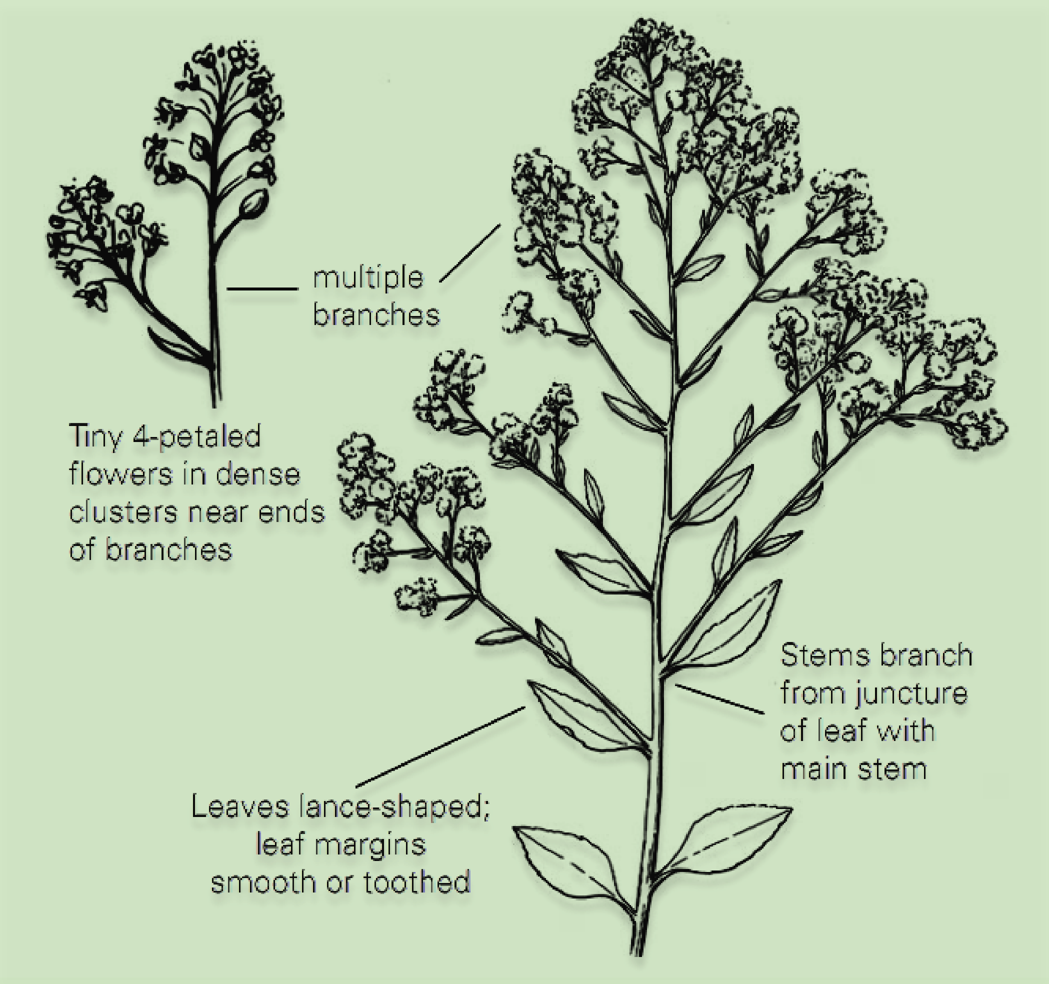
Larry Freilich

Noxious Weed: Pepperweed

Inyo and Mono Counties Agricultural Commissioner's Office+ ICWD+LADWP effort

- Flooding suppressed
- 7.1 acres treated by Co. Ag



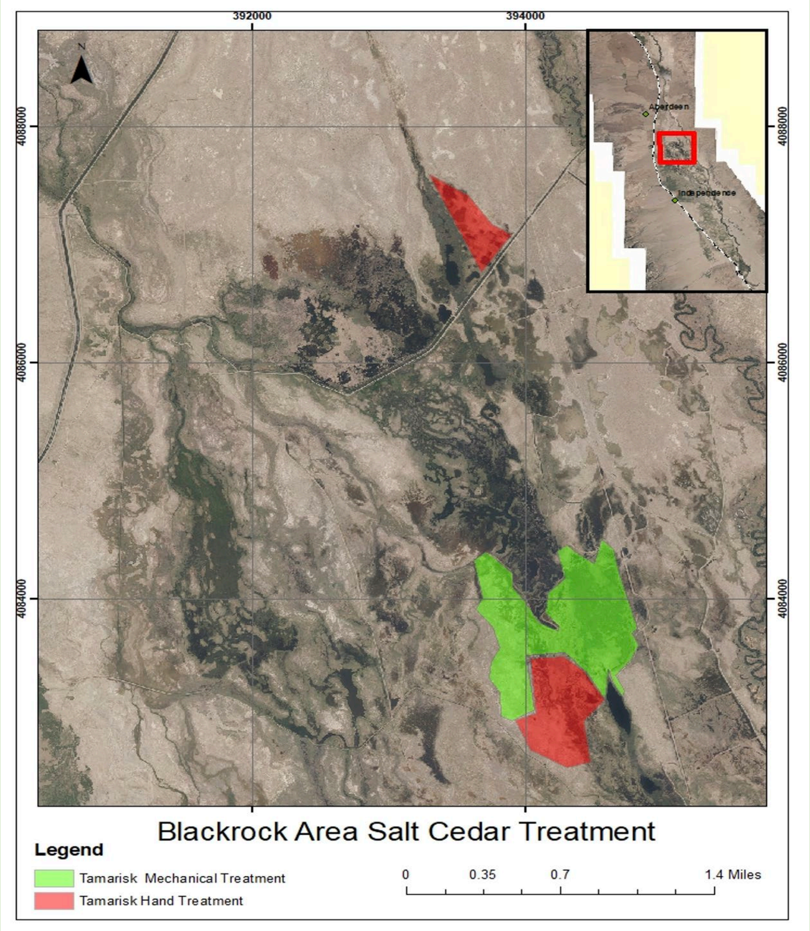


Lepidium latifolium (LELA2), commonly referred to as perennial pepperweed

Noxious Weed: Saltcedar

ICWD+LADWP Effort

- 400 acres surveyed by LADWP
- Off-river Lakes and Ponds (Goose and Twin Lakes)



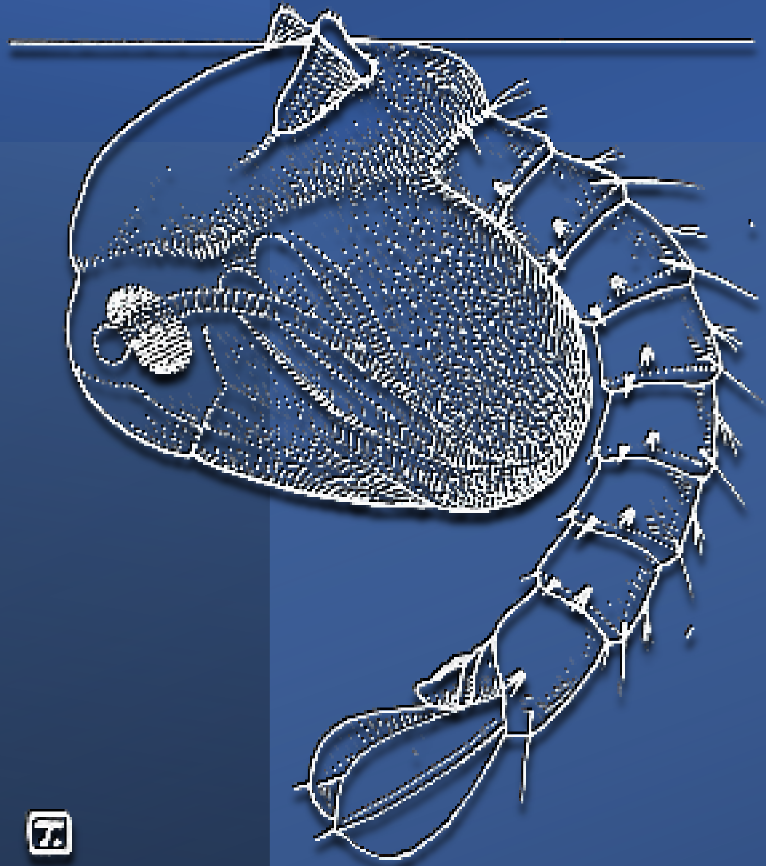
Tamarisk ramosissima (TARA), commonly referred to as Saltcedar

Mosquito Abatement

Owens Valley Mosquito Abatement Program (**OVMAP**)

- Mosquito-borne arbovirus testing within the LORP
- Trapping, species identification, and disease surveillance
- “Supercharged” mosquito populations
- Trap numbers were some of the highest in the state
- Flooding limited access
- 547 person-hours – April to October
- Staffing

Pesticide /Materials	Totals
EVS Traps (each)	55
BVA 2 (oz)	197
Aquabac (lbs.)	495
P-525 (oz)	56
Vectobac GR (lbs.)	125
Vectomax (lbs.)	5
Mosquito Pool Disease samples	24



Adaptive Management – Avian Monitoring

David Livingston

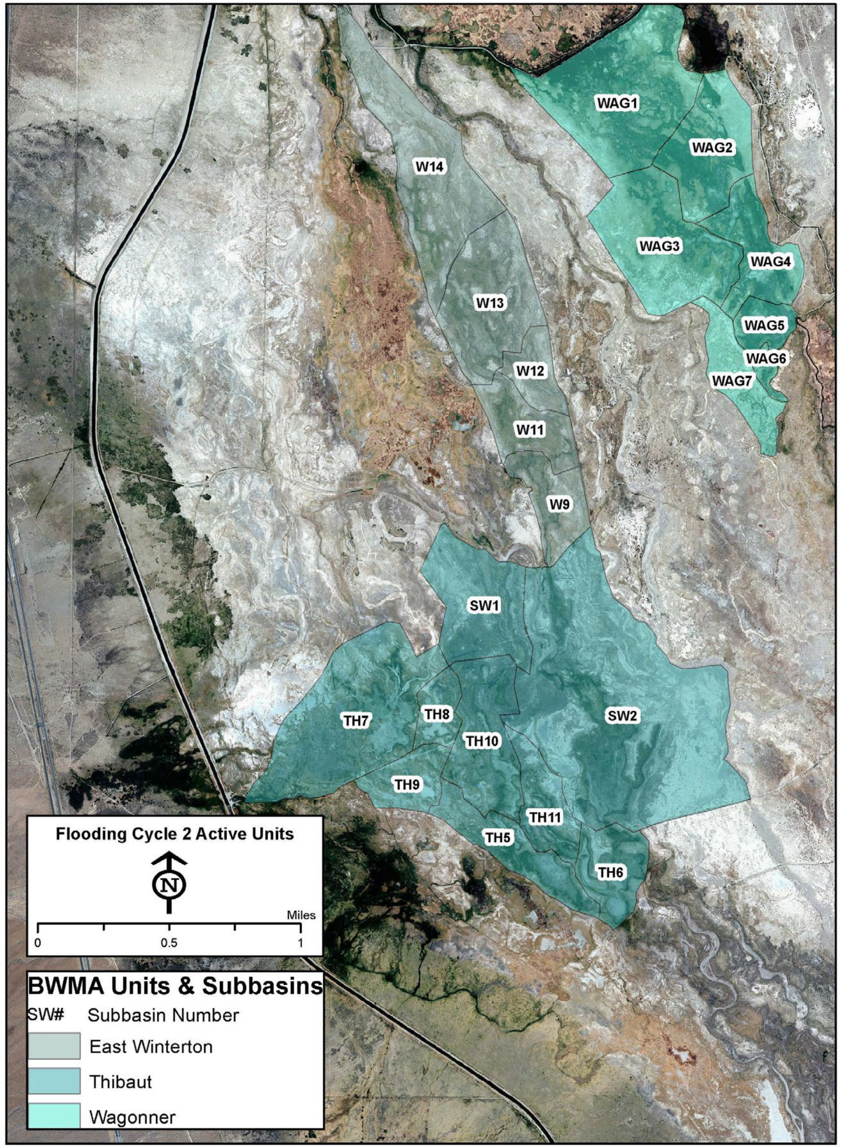
BWMA – Avian Surveys

Interim Management and Monitoring Plan

- Two flooding cycles FC1 (2021-22) and FC2 (2022-23)
- Seasonal flooding of a fixed 500 acres from fall to mid-spring
- Monitor Habitat Indicator Species (HIS)
  - Waterfowl, Shorebirds, Wading Birds, Rails (Groups)
  - Northern Harrier & Marsh Wren (Species)
- Nine surveys conducted through fall and spring

Blackrock Waterfowl Management Area

- Waggoner and Thibaut Units, and East Winterton and South Winterton Subunits were flooded
  - First year of a complete drawdown and reflooding cycle
- Flooded extent was 472 acres in fall (too wet to map in spring, but over 500 acres)

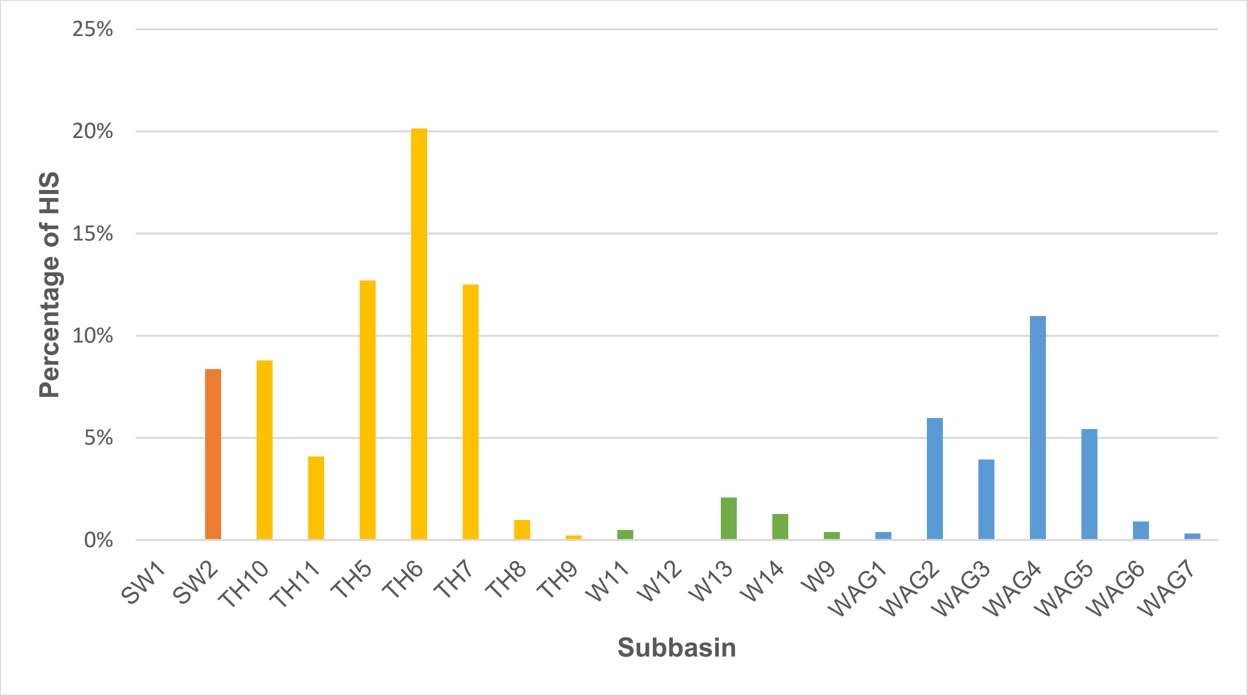


Habitat Indicator Species

- A total of 22,894 HIS detected
  - 65% of the HIS composite
- Waterfowl most abundant (66%)
- Rails (30%)
- Wading and Shorebirds (3%)

Percentage of HIS by Subbasin

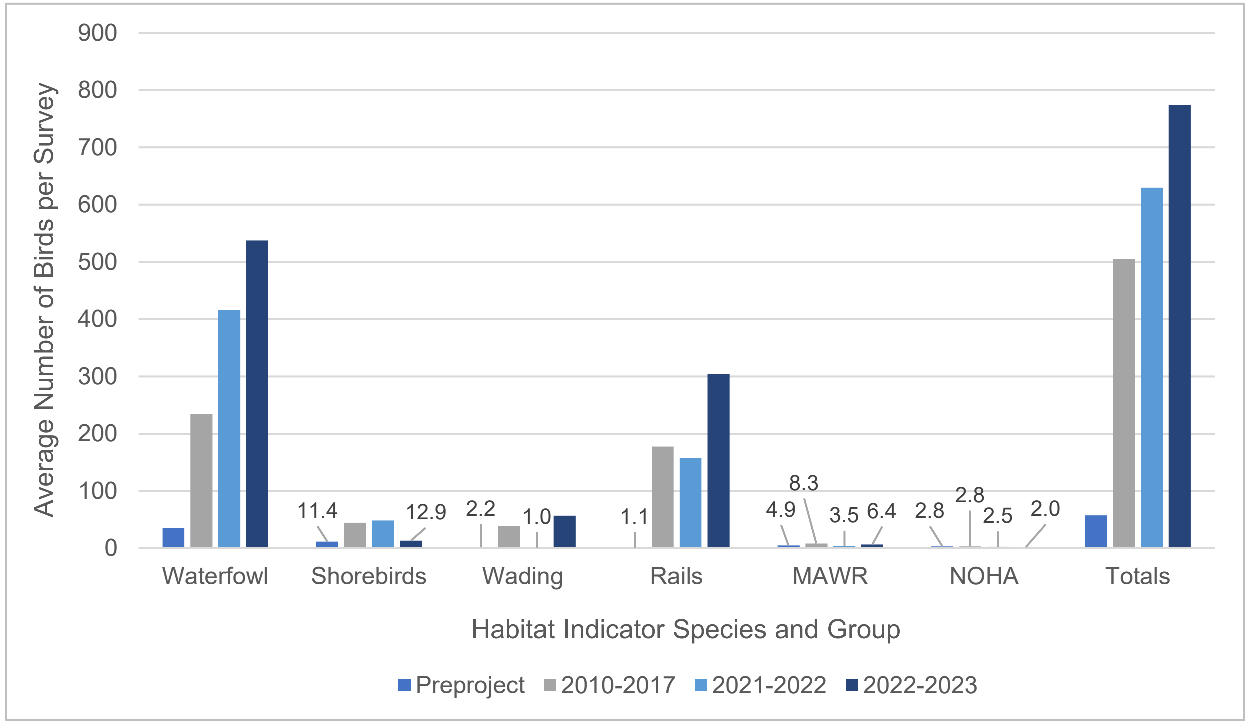
- Individual subbasins varied in their attractiveness to birds
- Thibaut supported 59%
  - Subbasin TH6 had the highest
- Waggoner supported 28%
  - Subbasin WAG4 had the highest
- South Winterton (8%) & East Winterton (4%) were the lowest



Average Number of HIS per Survey

Pre-project versus Project Implementation

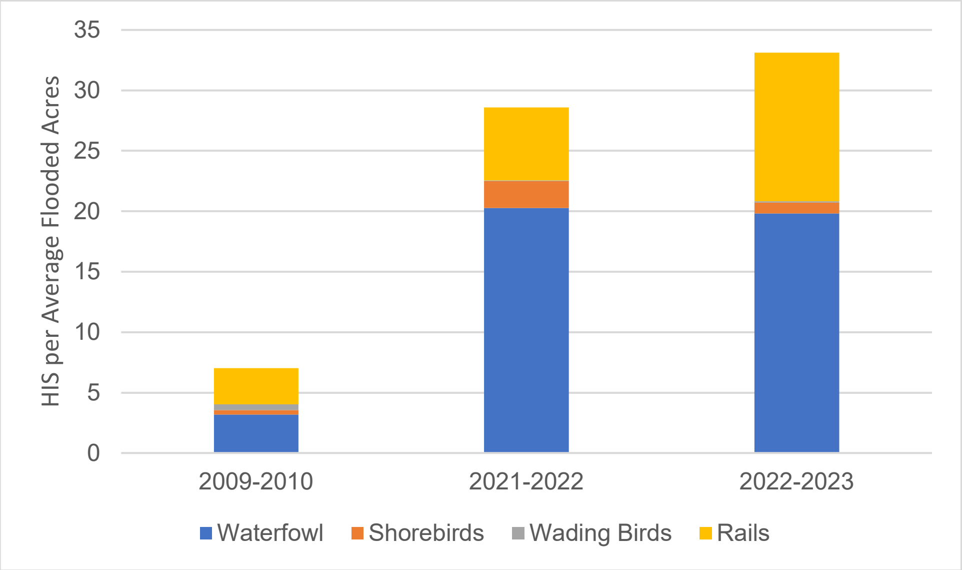
- Overall, average number of HIS has increased
  - Waterfowl had greatest response
  - Shorebirds increased, but declined in FC2
  - Wading Birds & Rails increased in FC2
  - Marsh Wren had the second-highest average number in FC2
  - Northern Harrier was at its lowest in FC2



HIS per Average Flooded Acres

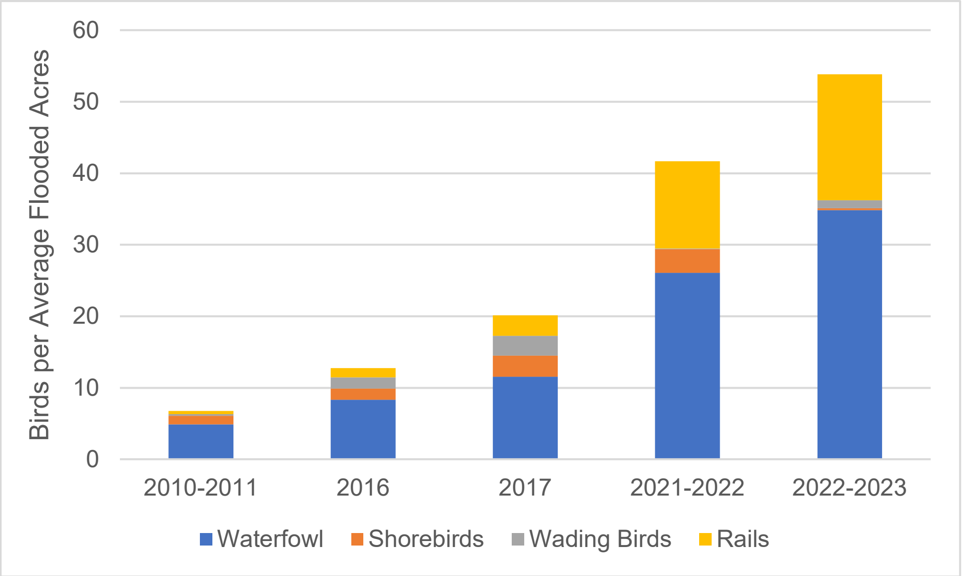
Pre-project versus Project Implementation

Bird Density in Waggoner Unit



- Waterfowl & Rail density increased
- In FC2, Shorebird density higher than pre-project, but lower than FC1
- Wading bird density lower during Interim Plan

Bird Density in Thibaut Unit



- Waterfowl & Rail density increased
- Shorebird density higher in FC1, lowest in FC2
- Wading bird density was variable, but higher in FC2 than FC1

Adaptative Management- BWMA

Summary

- Waterfowl & Rails have shown the best response to management under the Interim Plan
- Bird densities were also higher compared to previous years
- Shorebirds, Wading Birds, Marsh Wren and Northern Harrier trends have been more variable over time
- Recommend continuing the avian survey program
  - Understand response of HIS to the Interim Plan
  - Understand factors influencing seasonal & spatial distribution of HIS

Adaptive Management – DHA Interim Flow Regime

David Livingston

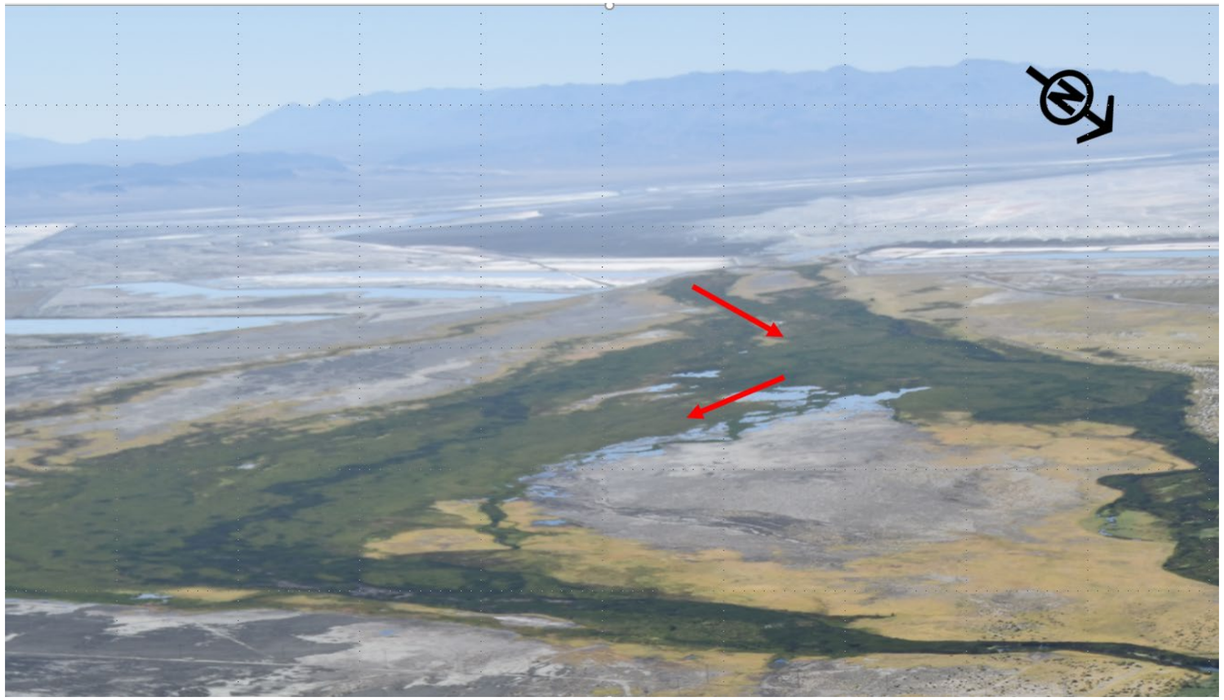
Adaptative Management- Delta Habitat Area

Goal = Reduce emergent vegetation expansion and growth using flows

Evaluate effectiveness =

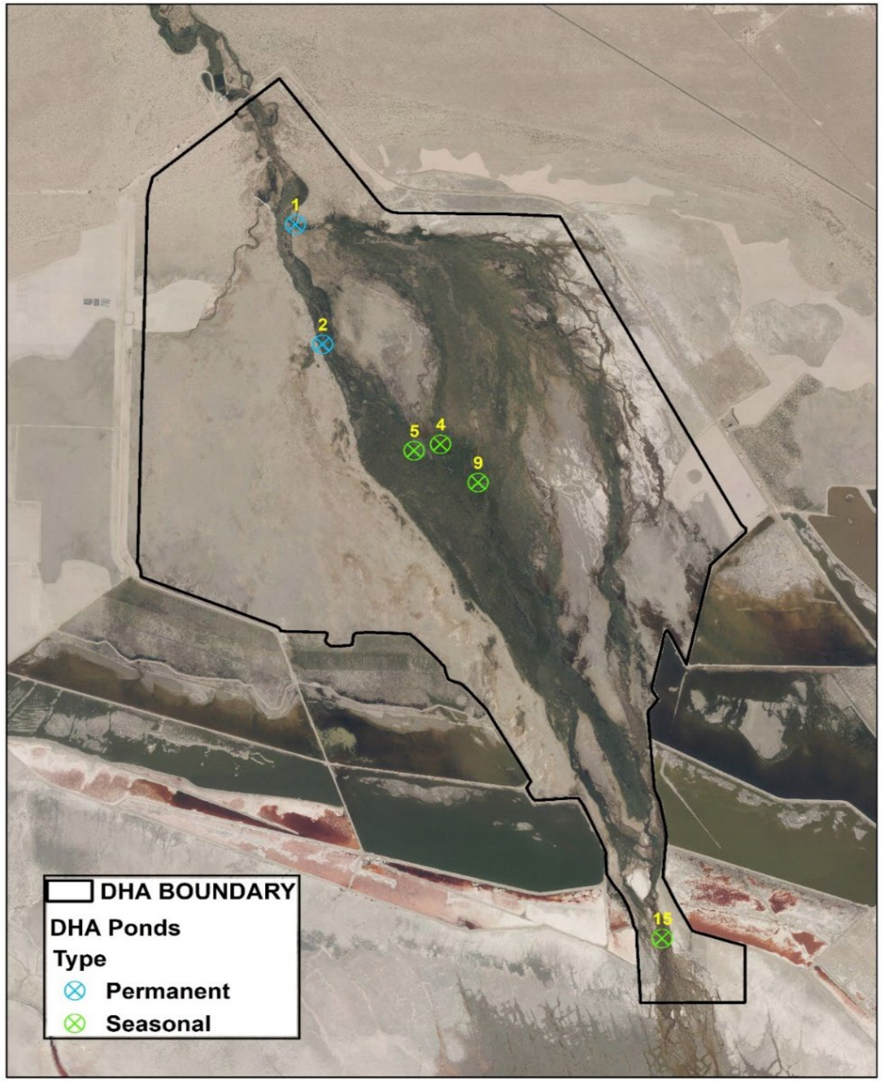
1. Summer flows stressing emergent veg
2. Maintain permeant ponds
3. Develop seasonal ponds – Sept to May

Adaptative Management- Delta


August 16, 2019


August 25, 2022

Adaptative Management- Delta



Adaptative Management- Delta

July 6, 2022

Adaptative Management- Delta

July 6, 2022

Adaptative Management- Delta

September 6, 2022

Adaptative Management- Delta

September 28, 2022

Adaptive Management – Tree Recruitment

Meredith Jabis

LORP Adaptive Management: Riparian Tree recruitment

Meredith Jabis
Inyo County Water Department

Questions:
Tree recruitment

1. Describe conditions that allowed tree establishment: *pre-project*

2. Assess conditions permitting recruitment: *post project initiation*

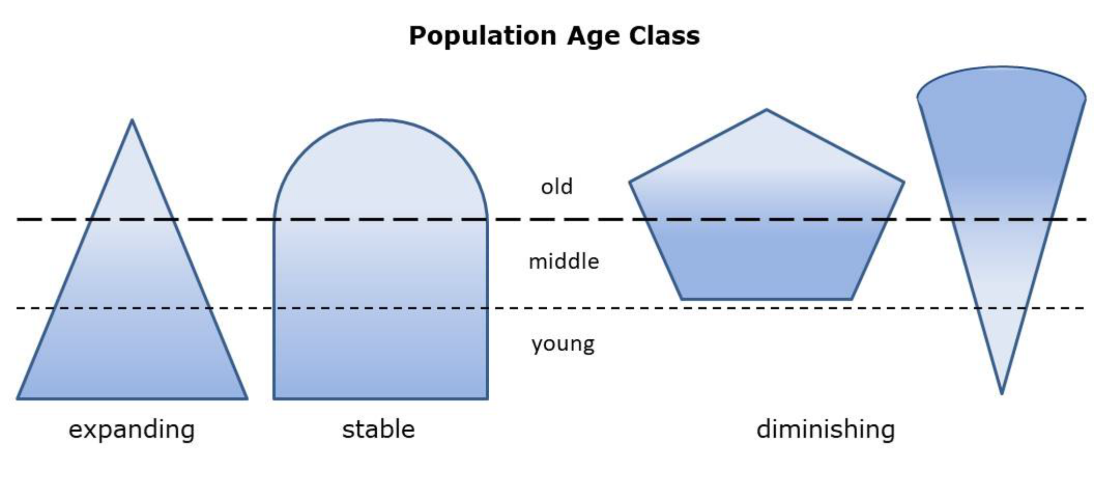
3. identifying current biological processes that could limit tree germination or establishment.

Action Item 1.

Tree establishment: Pre project

1. Historic conditions
   a. Establishment on /off river
   b. Role of fire
   c. Supplemental water
   d. Topographic elevation relative to stage

2. Current age- and size-structure of Owens River riparian forests
   - expanding, stable or diminishing?



Action Item 1. not completed in 2023

High flows and inundation prevented access to river and ground surfaces

Action item 2.

Tree recruitment: post-project implementation

Re-visit recruitment sites

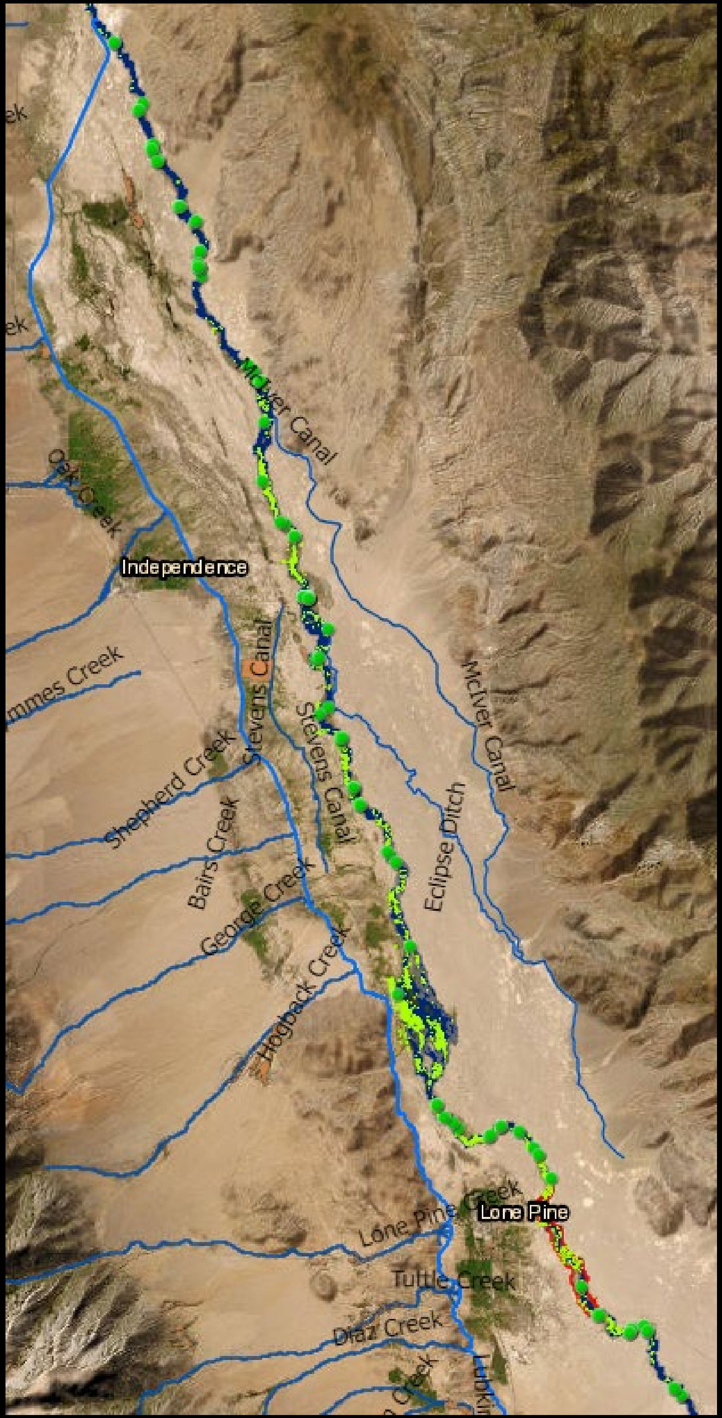
- identified during the LORP Rapid Assessment Survey (RAS)

Action Item 2.
Recruitment Post-project: data collected

- Tree count, basal diameter, height
- ~~Co-occurring species recorded~~
- Tree topographic elevation relative to water stage
- ~~Patch distance from channel~~
- ~~Soils: salinity and texture~~
- ~~Collected saplings (dead trees) for age estimates~~

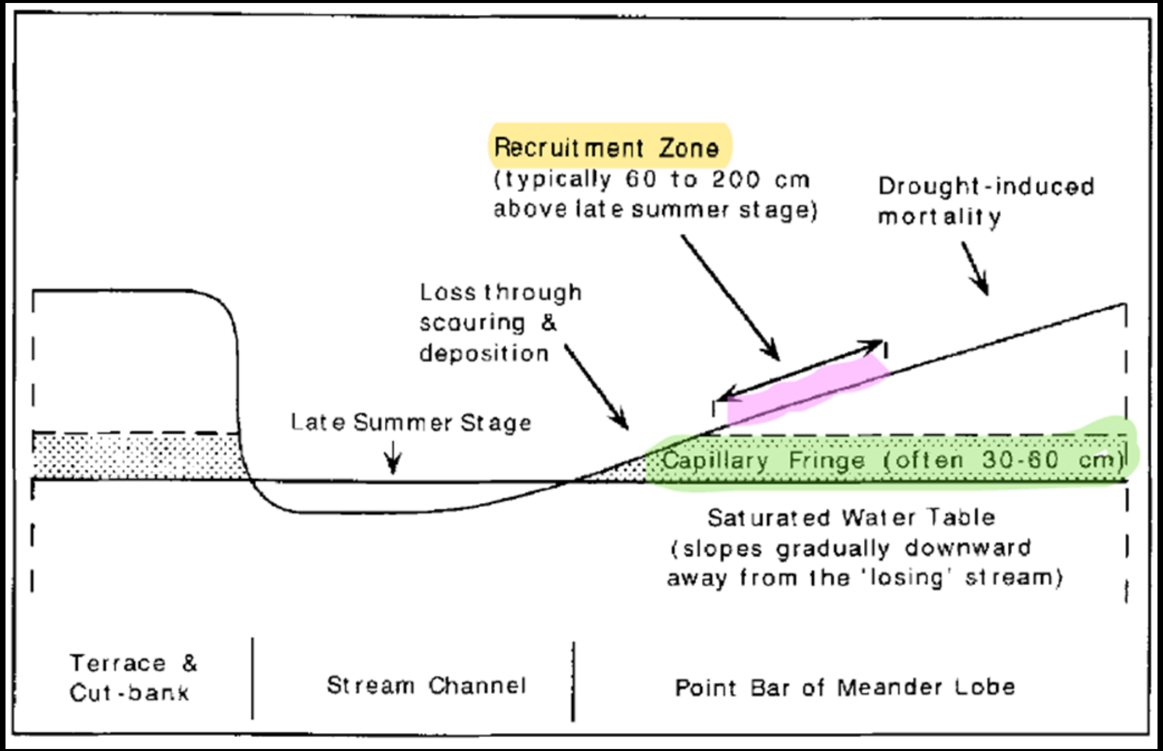
Action item 2.
Post-project Recruitment

- 35 sites with complete sampling across all reaches
- 16 additional in 2023
  - incomplete (inundated)



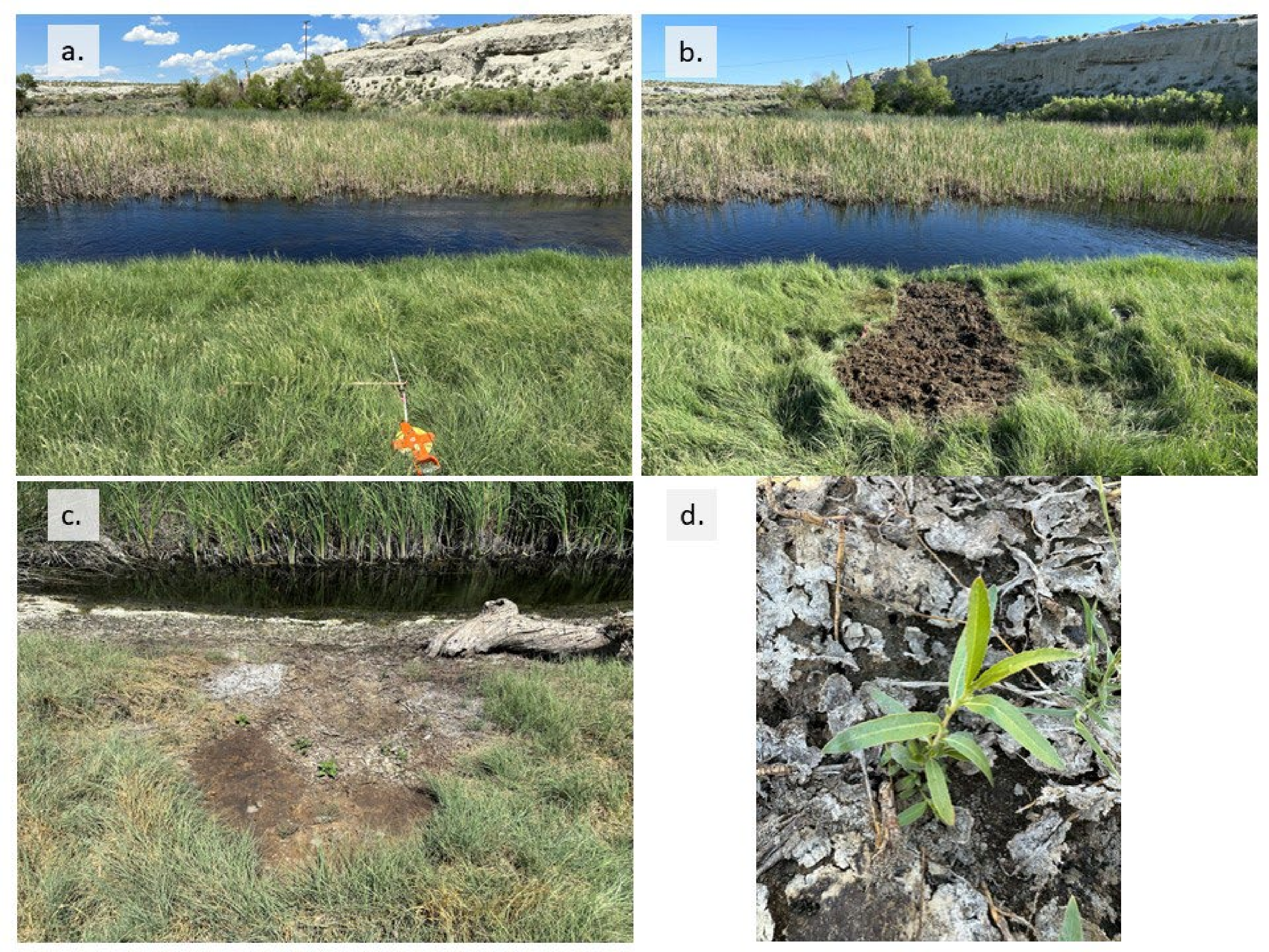
Action item 3.
Plant competition on recruitment surfaces

- Riparian trees are disturbance adapted species
- natural flooding regimes:
  - mechanical disturbance to bank and low-lying floodplains
  - wetting of soils on higher elevation floodplain with fewer established plants



Mahoney & Rood 1998

Action item 3. Plant competition on recruitment surfaces



Removal experiment: reaches 5 & 6

Action item 3.
Plant competition on recruitment surfaces

- Plant removals at 5 sites
- Reaches 5 & 6: lowest recruitment
  - Reach 5: 3 sites
  - Reach 6: 2 sites
- Recruitment at 3 of 5 sites (possibly 4… but a hurricane)
- 10 recruits total

Site	Reach	Date	# Salix sp.
1	5	8/17/2023	0
2	5	8/17/2023	6
3	5	8/17/2023	1
4	6	8/17/2023	3
5	6	not visited in August	

Action item 3. Plant competition on recruitment surfaces

- Success: more recruitment sites on Reach 5 than since initial implementation

- Partial success: all recruits destroyed in the August hurricane

- Preliminary results suggest a larger effort during the next ~ 100% water year is justified

In conclusion, and looking forward

Holly Alpert

APPENDIX 2. PUBLIC COMMENT LETTER FROM CADFW.

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Inland Deserts Region
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www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

Via email

February 2, 2024

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Dr. Holly Alpert, Director
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Halpert@inyocounty.us

Subject: California Department of Fish and Wildlife Comments on the Lower Owens River Project 2023 Draft Annual Report

Mr. Perez and Dr. Alpert:

The California Department of Fish and Wildlife (CDFW) appreciates the opportunity to provide comments on the Lower Owens River Project (LORP) 2023 Draft Annual Report (Report). CDFW, as a 1997 Memorandum of Understanding (MOU) party, and in its capacity as a Trustee Agency, has a vested interest to work with all parties to help meet the goals of the LORP as outlined in the 1991 Environmental Impact Report (EIR) for water management practices and facilities in the Owens Valley, 1997 MOU, 2004 EIR for the LORP, and associated technical memoranda. As stated in Section II.B of the 1997 MOU:

"*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*."

Summary of the previous 2022 Annual Report Comments

CDFW continues to believe the goals of the LORP have not been met, as previously outlined in CDFW's Comment Letter on the 2022 LORP Annual Report (Attachment 1) and in previous years letters. As described in its 2022 comment letter, CDFW's primary concerns relate to specific data identified in the 2022 LORP Annual Report:

1) The area of tule marsh associated with the Lower Owens River has doubled in area since 2000, now occupying areas that were once open water.
2) The area of riparian trees associated with the Lower Owens River has declined by approximately 520 acres.
3) The avian species diversity along the Lower Owens River in 2022 was the lowest recorded to date.

For more than a decade CDFW has provided specific comments and recommendations to address these issues including modifications to the timing and magnitude of the Seasonal Habitat Flows (SHF) guided by a panel of river restoration experts. CDFW also supports the use of clonal pole planting to increase understory habitat, and the use of alternative release points for the SHF to encourage riparian tree recruitment and establishment.

Our comments regarding this year's 2023 Draft Annual Report are as follows:

<u>General Comments</u>

<u>Biological Monitoring</u>

The Report shows a noticeably reduced amount of reported biological monitoring information, such as *Habitat Indicator Species* status and vegetative conditions along the riverine area of the LORP, as compared to previous Annual Reports. In light of the ongoing inability to meet the LORP goals, CDFW believes that continued monitoring and reporting is essential to help inform adaptive management actions to achieve the goals of the Project.

For example, vegetation mapping in the years that followed 2017 indicated that the high flows produced from one wet year (2017) were ineffective in slowing the profusion of marsh and ineffective at grading the river channel (2018-2022 LORP Annual Reports). Unfortunately, at this time, 2023 vegetation mapping data isn't available to confirm if the record high flows of 2022/2023 caused significant changes to riparian or marsh vegetation alliances.

<u>Tule Control</u>

Marsh areas, dominated by cattail (*Typha* spp.) and hard-stem bulrush (*Schoenoplectus acutus*), have doubled since pre-LORP conditions in 2000 (2022 Annual Report) and this change in vegetation has had a clear negative influence on flows in the river as well as other open-water areas of the LORP, often diminishing channel capacity by buildup of both live and decayed plants, diminishing flow velocity and at times precluding an open channel. CDFW recommends implementing a tule control program in key sections of the river to maintain open water habitat and required flows.

Specific Comments

Section 2.2 Measurement issues

The Report states that the bubbler measuring device that is used to measure the SHFs has been removed from the *Below LORP Intake* gaging station. With the bubbler removed, how will SHFs or potentially higher flows such as those observed in 2023 be measured when the Langemann Gate is submerged? At what flow does the Langemann gate become submerged? CDFW recommends installing a Sontek SW flow meter at the downstream end of the intake structure to provide more accurate and reliable flow measurements at this location.

Section 3.0 Water Quality Monitoring

Water quality monitoring efforts in 2023 collected instantaneous measurements of temperature, dissolved oxygen, specific conductivity, and pH at 12 sites on the Lower Owens River. The Report states that the release of SHFs aimed at willow and cottonwood recruitment can cause lethally low dissolved oxygen levels for fish due to sediment mobilization (p. 3-1). Given the importance of sediment dynamics in relationship to flow and fish kills and given that sediment is one of the key drivers of fish kills, CDFW recommends including turbidity monitoring in subsequent water quality monitoring efforts. CDFW recommends subsequent Annual Reports assess sediment loads by reach, as well as any patterns of hysteresis.

Water quality data was collected at 12 sites along the Lower Owens River, yet the Report presents data for only four of these sites. The Report states that these four sites best represent the trends in measured parameters and that therefore the data presented and discussed is limited to these sites. CDFW requests that the data from all 12 sites be included in the final Report analysis and discussion, including graphs showing the longitudinal trends for each constituent at representative time periods throughout the year.

Section 4.4 Tree Recruitment

CDFW encourages continued efforts to establish new natural woody recruits, while also supporting adaptive management recommendations that protect existing riparian trees and support localized habitat enhancement for certain reaches of the LORP. Reattempting tree tubing, for example, could help protect woody recruit seedlings, increasing their survival rate as they establish to weather the effects of prolonged periods of drought and extreme wet years evident in the Owens Valley.

The plant competition and removal experiment along the banks of the LORP trialed by the Inyo County Water Department in 2023 showed that co-occurring vegetation in the riverine-riparian area of the LORP competed with riparian tree seedling establishment. CDFW is supportive of further, larger scale trials.

<u>Conclusion</u>

CDFW is committed to the success of this Project and recommends recruiting a panel of qualified river restoration experts to assist in developing adaptive management tools to help the LORP meet the goals outlined in the LORP governing documents.

In addition to these comments on the Report, CDFW anticipates following up with additional correspondence further addressing the goals of the LORP and progress or lack of progress toward meeting them, as well as any further recommendations CDFW may have to help reach these goals. CDFW welcomes further discussion of next steps to help the LORP achieve its goals.

If you have any questions regarding this letter, please contact Trisha Moyer at (760) 835-4304 or at Patricia.Moyer@wildlife.ca.gov.

Sincerely,

DocuSigned by:
Alisa Ellsworth
84FBB8273E4C480...

Alisa Ellsworth
Environmental Program Manager

ec: <u>California Department of Fish and Wildlife</u>
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Attachment 1: CDFW's Comment Letter on the 2022 Draft LORP Annual Report

State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
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www.wildlife.ca.gov

GAVIN NEWSOM, Governor
CHARLTON H. BONHAM, Director

Via email

July 13, 2023

Mr. Adam Perez, Los Angeles Aqueduct Manager
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Adam.Perez@ladwp.com

Dr. Holly Alpert, Director
Inyo County Water Department
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Halpert@inyocounty.us

Subject: California Department of Fish and Wildlife Comments on the Lower Owens River Project 2022 Annual Report

Mr. Perez and Dr. Alpert:

The California Department of Fish and Wildlife (CDFW) appreciates the opportunity to provide comments on the Lower Owens River Project (LORP) 2022 Draft Annual Report (Report). Stemming from the 1997 Memorandum of Understanding (MOU) between the City of Los Angeles Department of Water and Power (LADWP), the Inyo County Water Department (ICWD), CDFW, the California State Lands Commission, the Sierra Club and the Owens Valley Committee (MOU Parties), the MOU Parties have a collective interest and duty in restoring the Lower Owens River.

CDFW, as a MOU party, and in its capacity as a Trustee Agency, provides comments on the 2022 status of the LORP and encourages the MOU Parties to jointly determine the management actions needed now to meet the goals of the LORP set forth in the 1991 EIR, 2004 EIR and the 1997 MOU (MOU, Section II.B.):

> "*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*."

After 15 years of implementation of the LORP it is evident that the Project has not met the goals stated in the 1997 MOU. Specifically, the Lower Owens River is not on track to establish a healthy, functioning riverine-riparian ecosystem, for the benefit of biodiversity and threatened and endangered species. The LORP currently does not provide sufficient riparian forest development needed to benefit biodiversity and threatened and endangered species as specified in the MOU.

CDFW is concerned about three findings of the Report that are closely related to the timing, duration and magnitude of the Seasonal Habitat Flows (SHF) prescribed by the 2004 EIR: 1) the area of tule marsh associated with the Lower Owens River has doubled in area since 2000, now occupying areas that were once open water (p. 3-20), 2) the area of riparian trees associated with the Lower Owens River has declined by approximately 520 acres (p. 3-26), and 3) the avian species diversity along the Lower Owens River in 2022 is the lowest to yet be recorded (p. xv).

Seasonal Habit Flows

CDFW continues to be concerned that the LORP objectives have not been met and continue to not be met by following the 2004 EIR hydrograph (Chart 2-2 & Chart 2-1). As stated in CDFW comments in previous years, even when implementing a maximum SHF release of 200 cubic feet per second (cfs), this SHF magnitude and schedule does not provide adequate stream flows to achieve the intended LORP seasonal habitat goals. The LORP goals include creation of sufficient disturbance to establish and maintain native riparian vegetation and channel morphology (CDFW 2017 mobilization study; 2017 & 2021 LORP Seasonal Habitat Flow and Blackrock Waterfowl Are Flooded Acreage Letters). Reliance on the hydrograph as described in the 2004 LORP EIR to inform SHF magnitude, timing, and duration is less effective now that tule density in the channel has increased to the point where the river system needs SHF's above 200 cfs to yield the flushing flow benefits that 200 cfs SHF was intended to provide based on 2004 stream conditions. As a threshold matter, a thorough analysis of flow changes and predicted results is needed to validate such a change to the existing flow regime; and thus, a revision to the 2004 EIR hydrograph may be appropriate.

The timing of SHF was intended to "roughly coincide with the spring run-off and to facilitate dispersal and germination of riparian plant species" (LORP Monitoring Adaptive Management Plan [MAMP], Section 4.2.3 Seasonal Habitat Flows). Record-high precipitation in 2023 has created unprecedented runoff conditions in 2023 that will result in previously unseen LORP flows from late May through early August 2023. SHF in the spring were intended to disperse and germinate riverine-riparian tree seeds. Since excess flows will continue until the fall, outside of the growing season, the SHF's goal to establish native riparian vegetation may not be supported by the extreme conditions of 2023, and any previous riparian vegetation gains may indeed be lost due to prolonged flooding.

Pre-LORP modeling predicted that after rewatering the Lower Owens River, tule marsh would occupy over 50% of riverine landforms, totaling 350 acres of tule marsh within the

LORP planning area (Technical Memorandum No. 9). However, according to the Report, in 2022, the tule marsh in the LORP has expanded to over 1600 acres (*Figure 3-11*). As described above, this expansion is due to the LORP's prescribed flow regime (40 cfs base flows and limited SHF of up to 200 cfs in wet years, no SHF in drought years) creating ideal conditions for tule marsh proliferation and expansion.

In turn, the tule marsh expansion has prevented the establishment of a functioning, healthy riverine-riparian ecosystem along the LORP. According to the Report, the riparian tree area along the LORP has declined from 260 acres in 2009 to 180 acres in 2022. Additionally, the 2022 mapped tree area includes invasive species such as tamarisk (*Tamarix ramosissima*) and Russian olive (*Elaeagnus angustifolia*); such species are actively being treated and eradicated as a part of the LORP and should not be counted towards a functioning, healthy riverine-riparian ecosystem. Thus, it is imperative that ICWD and LADWP map riparian forest separately from tamarisk and Russian olive.

Establishment of riparian trees requires, among other factors, availability of water in the form of substantially wet floodplain soils. The SHF have not been sufficient in duration and amount to provide these basic criteria for riparian tree recruitment. Despite repeated calls of the MOU parties for adaptive management of the LORP, the Project's failure to establish a healthy riverine-riparian ecosystem has not been addressed.

A functioning, healthy riverine-riparian ecosystem would consist of a mixed, multi-story canopy of willows (*Salix* sp.), cottonwoods (*Populus fremontii*), wild rose (*Rosa* sp.) and other riparian species. In a healthy riverine-riparian system, larger woody trees provide shading, thus controlling tule growth and expansion. As identified in the MOU, a functioning, healthy riverine-riparian ecosystem would also support a diversity and abundance of avian fauna, including threatened and endangered species.

The Report states that 2022 marked the lowest diversity of avian species recorded since monitoring of the LORP began. The Report concludes that a combination of limited riparian tree cover and increases in tule marsh area have inhibited the LORP from creating breeding bird diversity for 19 habitat indicator species (HIS)[1] associated with the LORP. HIS are used as a measure to determine whether or not the LORP has improved habitat for species that are state listed as threatened or endangered under the California Endangered Species Act (CESA), as well as common avian species. Currently, according to the findings of the Report, the predominant breeding bird

[1] HIS: wood duck, yellow-billed cuckoo, Virginia rail, sora, least bittern, great blue heron, northern harrier, red-shouldered hawk, Swainson's hawk, long-eared owl, belted kingfisher, Nuttall's woodpecker, willow flycatcher, Warbling vireo, tree swallow, marsh wren, yellow-breasted chat, yellow warbler, and blue grosbeak

community of the LORP consists of non-HIS and non CESA listed species associated with marsh habitat.

Recommendations:

As in previous years (CDFW's 2014 Annual Report Comment letter), CDFW again emphasizes that the avian HIS require diverse habitat types including riparian forest canopy for the Swainson's hawk (*Buteo swainsoni*), a CESA-listed threatened species, and riparian understory vegetation (such as willow stands) for the southwestern willow flycatcher (*Empidonax traillii extimus*), a CESA-listed endangered species (CDFW, 2014). To continue to measure the LORP vegetation's ability to support wildlife, including threatened and endangered avian species such as the Swainson's hawk and the southwestern willow flycatcher, CDFW recommends continued avian monitoring of the LORP.

During the LORP Public Meeting on June 22, 2023, LADWP staff estimated that the largest contiguous patch of riparian trees in the LORP area only covers approximately eight acres. Page 4-42 of the Report further elaborates that the amount of woody recruitment anticipated at the onset of the Project, has not been realized and is not expected to self-sustain.

CDFW encourages continued efforts to establish new natural woody recruits along the LORP, while also supporting adaptive management recommendations to manage land in a way that protects existing riparian trees and to perform localized habitat enhancement for certain reaches of the LORP. Reattempting tree tubing, for example, could help establish woody recruit seedlings, increasing their survival rate as they establish to weather the effects of prolonged periods of drought and extreme wet years evident in the Owens Valley.

LADWP proposed, and CDFW agrees, that exploring the clonal reproductive potential of the riparian shrub sandbar willow (*Salix exigua*) could be an effective and sustainable means of establishing dense understory in oxbows or stream bars along the LORP. To maximize survival, pole planting clones to colonize new areas should consider placement location that resembles the parent stem's location on the bank. Pole plantings should be monitored regularly and consistently, with established and agreed upon success criteria that can be measured and tracked over time to predict the long-term survival and area coverage of the plantings.

Establishing riparian shrub cover however, does not replace riparian trees' ecosystem functions for the Lower Owens River. Rather, propagating riparian shrub cover creates an opportunity to increase foraging and nesting habitat in areas low in cover and habitat quality that may otherwise be dominated by tule or alkali meadow, which already comprise the majority of the LORP. Establishing riparian shrub cover may also support riparian woody tree recruitment and establishment.

CDFW strongly urges ICWD and LADWP to reevaluate the relevance and application of the hydrograph in the 2004 EIR, in the context of prevailing conditions such as climate change, extreme precipitation events, and extended periods of drought that were not comprehended during the LORP planning phases and preparation of the 2004 LORP EIR. Without even considering these climate variables, the hydrograph outlined in the 2004 LORP EIR has been implemented for over ten years and has not been successful at achieving the LORP goals and objectives. Through the adaptive management process, ICWD and LADWP are to “make adjustments to the initially proposed flow regimes and other management actions” to conform with the LORP goal of enhancing native fisheries and riparian habitats along 62 miles of the LORP (2004 LORP EIR, Section 2.10.5 Adaptive Management). In light of the current poor performance of the LORP in achieving its riparian habitat goals, such adaptive management appears warranted.

To this end, CDFW also recommends establishing a panel of river restoration experts in 2023 to scientifically analyze and determine appropriate flow regimes for the LORP to better support the longstanding-and currently unmet-goals of the LORP. The high flows of over 1600 cfs the LORP has experienced in 2023, and the continued elevated flows the LORP is currently experiencing, provide an opportunity to study the effects of flows above 200 cfs on the hydrograph and vegetation communities associated with the LORP, as well as on County and Caltrans infrastructure capacity along the LORP.

Additionally, CDFW supports experimenting with potential alternative release points for the SHF to inundate riparian surfaces in need of riparian tree recruitment and establishment.

Considering the LORP’s goals of restoring riparian habitat for ecosystem health and biodiversity, and for threatened and endangered species habitat in the Lower Owens River watershed, CDFW encourages ICWD and LADWP to apply for state-funded *Watershed Restoration Grant Programs*.

To proactively address increases in perennial pepperweed (*Lepidium latifolium*) (LELA) colonization of the LORP, CDFW recommends that LADWP and ICWD consider implementing a specific LELA monitoring treatment plan to prevent and treat the significant increase in LELA that is expected to establish this summer due to flooding conditions in the LORP.

CDFW appreciates the opportunity to provide comments on the status of the LORP. CDFW strives to engage and work with the MOU Parties to bring about change in the Lower Owens River through LORP progress and a continued commitment to achieve the goals agreed upon by all parties in the MOU.

If you have any questions regarding this letter, please contact Trisha Moyer at (760) 835-4304 or at Patricia.Moyer@wildlife.ca.gov.

Sincerely,

DocuSigned by:
Magdalena Rodriguez
938A012E7285407...

For Alisa Ellsworth
Environmental Program Manager

cc: California Department of Fish and Wildlife
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