2013
Lower Owens River Project
Annual Report

April 11, 2014

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EXECUTIVE SUMMARY

The 2013 Lower Owens River Project Annual Report contains the results of the seventh year monitoring of the Lower Owens River Project (LORP). Monitoring included hydrologic monitoring, seasonal habitat flow, rapid assessment survey, land (range) management, saltcedar and weed control.

The hydrologic monitoring section describes flow conditions in the LORP regarding attainment with the 2007 Stipulation & Order flow and reporting requirements and LORP *1991 Environmental Impact Report* (EIR) goals. For the 2012-13 water year, which covers October 2012 to September 2013, LADWP was fully compliant with all the 2007 Stipulation & Order flow and reporting requirements. Off-River Lakes and Ponds level goals were fully met and the mean flow to the Delta was 8.9cfs, achieving the required 6-9 cfs annual flow. The agreement to manage wetted acreage in the BWMA by setting constant flows by seasons, continued with generally good results. The section also describes flow measurement issues and finishes with a commentary on flow losses and gains through the different reaches of the Lower Owens River.

The 2013 seasonal habitat flow was timed to occur with seed release of woody riparian vegetation; which is an objective of the flow release pertinent to the 1997 MOU. The time for the peak 58 cfs flow to move down the Lower Owens River was 13 days 10 hours from the LORP Intake to the Pumpback Station. Given the low peak release only marginal inundation was observed during the peak flow in the LORP monitoring plots and no additional analysis was conducted.

The Rapid Assessment Survey (RAS) was conducted in August 2013 and required approximately 64 people days to complete. The amount of woody recruitment recorded in 2013 was down about 10% from 2012, and less than all prior years except 2010. Differing from last year, 2013 woody recruitment was greatest in Reach 2 & 3.

The 2013 LORP land management monitoring efforts continued with monitoring utilization across all leases, rare plant monitoring, and streamside monitoring for woody recruitment, irrigated pasture condition scoring was conducted on leases that rated below the standard of 80% the previous year.

Despite dry conditions, pasture utilization adhered to standards established for both riparian (up to 40%) and upland (up to 65%) areas. LADWP Watershed Resources staff are concerned with the continued drought conditions and decreased forage production for the 2013-14 grazing season. However, utilization rates will not be adjusted for dry conditions in upland or riparian pastures.

The condition of irrigated pastures declined on several of the leases in the LORP Project area, the drop in conditions is largely attributed to the lack of snowpack run off, resulting in reduced irrigation supply.

2013 marks the fifth year collecting rare plant trend plot data for *Sidalcea covillei* (Owens Valley Checkerbloom), and *Calochortus excavates* (Inyo County Star Tulip) for the LORP. The objective of the study was to monitor impacts of grazing exclusion on Owens Valley checkerbloom. Results from a statistical analysis show an increase in numbers over time in grazed sites and a decrease in numbers over time in ungrazed sites.

The Streamside Monitoring Protocol in 2013 included the sampling juvenile tree heights. Total juvenile tree counts changed little from 2012 to 2013, browsing decreased in the spring and remained static over the summer. Summer flow management however has impacted many of the plots. One third of all juvenile tree willows were partially submerged for 2-3 months. These sustained high summer flows stressed trees and enabled the expansion of tule and cattails onto the gravel and sand bars and adjacent floodplains, placing the young willows in direct competition with emergent wetland plant species and decreasing future opportunities for tree willow germination events on those sites.

LORP area weed management efforts 2013 mirrored 2012 levels essentially. All known *Lepidium latifolium* sites within the LORP area were treated or surveyed in 2013; all sites were treated three times. Invasive plant populations totaled 0.30 net acres, up by 0.02 aces in 2012. Individual sites totaled 39 in 2013, one new site was discovered in 2013. Of the 39 known sites, 29 sites (74%) had no plants present in 2013. After five continuous years of no growth, sites may be considered eradicated.

In 2012-2013, saltcedar crews worked in the water-spreading basins that border the west side of the Lower Owens River and in the LORP riverine-riparian area along the river. Approximately 203 acres in this zone were treated. With the assistance of the California Department of Forestry and Fire Protection and the Los Angeles Department of Water and Power, about 660 piles of dry slash, which had accumulated over the years, were burned in the 2012-13 field season.

1.0 Lower Owens River Project Introduction

The Lower Owens River Project (LORP) is a large-scale habitat restoration project in Inyo County, California being implemented through a joint effort by the Los Angeles Department of Water and Power (LADWP) and Inyo County (County). The LORP was identified in a *1991 Environmental Impact Report* (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* (MOU), signed by LADWP, the County, California Department of Fish and Game (CDFG), California State Lands Commission (SLC), Sierra Club, and the Owens Valley Committee. 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 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."

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 water year forecast in the Blackrock Waterfowl Management Area (BWMA), maintenance of several Off-River Lakes and Ponds, modifications to land management practices, and construction of new facilities including a pump station to capture a portion of the water released to the river.

The LORP was evaluated under CEQA resulting in the completion of an EIR in 2004.

1.1 Monitoring and Reporting Responsibility

Section 2.10.4 of the Final LORP EIR states that the County and LADWP will prepare an annual report that includes data, analysis, and recommendations. Monitoring of the LORP will be conducted annually by the Inyo County Water Department (ICWD), LADWP and the MOU consultants, Mr. Mark Hill and Dr. William Platts of Ecosystem Sciences (ES) according to the methods and schedules described under each monitoring method as described in Section 4 of the *Lower Owens River Monitoring Adaptive Management and Reporting Plan* (Ecosystem Sciences, 2008).

Specific reporting procedures are also described under each monitoring method. The MOU requires that the County and LADWP provide annual reports describing the environmental conditions of the LORP. LADWP and the County are to prepare an annual report and include the summarized monitoring data collected, the results of analysis, and recommendations regarding the need to modify project actions as recommended by the MOU consultants, ES. This LORP Annual Report describes monitoring data, analysis, and recommendations for the LORP based on data collected during the 2013 field season (March-October). The development of the LORP Annual Report is a collaborative effort between the ICWD, LADWP, and the MOU consultants. Personnel from these entities participated in different sections of the report writing, data collection, and analysis.

The 2007 Stipulation & Order also requires the release to the public and representatives of the Parties identified in the MOU a draft of the annual report. 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 Final 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 Final LORP EIR."

Generally, LADWP is the lead author for a majority of the document and is responsible for overall layout, and content management. Specifically, LADWP wrote: Sections 1.0 Introduction; 2.0 Hydrologic Monitoring, which includes the Seasonal Habitat Flow, and Hydraulics and Tule Control; 3.0 Delta Habitat Area Assessment; 4.0 Land Management; 6.0 Alabama Gates Flow Releases; 7.0 LORP Creel Survey, and Section 9.0 Public Comments.

Section 8.0, Weed Control was authored by the Inyo/Mono Counties Agricultural Commission. ICWD completed the 5.0 Rapid Assessment Survey and Section 8.0 Saltcedar Reports.

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

This document represents the reporting requirements for the LORP Annual Report for 2013.

1.2 2013 Monitoring

2013 was the sixth year of monitoring for the LORP. The monitoring that was conducted included:

- Seasonal Habitat Flow (May 2013)
- Rapid Assessment Survey (August 2013)
- Hydrologic Monitoring (throughout 2013)
- Land Management (throughout 2013)
- Streamside Monitoring for Woody Species Regeneration and other Riparian (May and September 2013)
- Weed Monitoring and Treatment (growing Season 2013)

2.0 HYDROLOGIC MONITORING

2.1 River Flows

On July 12, 2007, a Court Stipulation & Order was issued requiring LADWP to meet specific flow requirements for the LORP. From the issue date through September 2013, LADWP has been in compliance with the flow requirements outlined in the Stipulation & Order. The flow requirements are listed below:

1. Minimum of 40 cubic feet per second (cfs) released from the Intake at all times.
2. None of the in-river measuring stations has 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 3 individual days out of every 15 days.
4. The 15-day running average of the in-river flow measuring stations is no less than 40 cfs.

On July 14, 2009, 6 of the 10 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 that LADWP was in compliance with the Stipulation & Order, from October 2012 through September 2013, for the 4 in-river stations (see Hydrological 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, Blackrock Waterfowl Management Area (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.

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.

2.1.2 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 accuracy of the Sontek meters are affected by factors which change the levels or velocities in the river. One of those factors is seasonal changes, such as spring/summer vegetation growth, which cause water levels to increase and velocities to decrease. Another factor is sediment build-up. As a band of sediment builds up on or near the measuring station section, the water levels of the section can increase or velocities can be shifted-both of which affect the accuracy of the Sontek meters. 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 meters. 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. All of the meters on the LORP are calibrated at a minimum of once per month, per the 2007 Stipulation & Order, to maintain the accuracy of the meters.

A commentary on each station along the LORP follows:

<u>Below LORP Intake</u>

Measurement Devices: Langemann Gate & WaterLOG H-350XL Bubbler System

The Langemann Gate regulates and records the flow values 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). In case of submergence, the WaterLOG H-350XL was installed as a back up to the Langemann Gate measurement. The WaterLOG H-350XL is a bubbler system that uses pressurized air to measure stage, which is applied to a rating curve. It was hoped the bubbler system would possibly allow for an accurate measurement of stage even in silt/sediment conditions. However, any system of water measurement using stage must be calibrated through the full range of flows and in similar seasonal conditions in order for measurements to be accurate. Also, due to the flat slope of the river channel in the LORP, velocities in the river are extremely low causing large fluctuations in stage as conditions in the river channel go through the normal seasonal cycles of vegetation activity and dormancy in the summer and winter, respectively.

Similar to the 2011 and 2012 seasonal habitat flow releases, during the 2013 seasonal habitat flow release the Langemann Gate was used for measurement through the entire schedule of flows. Unlike 2010, the LORP Intake downstream level did not rise to a level where submergence of the Langemann Gate occurred. The lower stage height was likely due to the lower flow release for the 2013 seasonal habitat flow.

To date, calibrating the bubbler for seasonal habitat flows has proven difficult and will likely never give accurate results. More data points can be collected to allow for a better flow curve to be established, but with the flat slope of the upper reaches of the river causing low velocities, using stage height only to measure flow accurately at the LORP Intake may not be possible.

<u>LORP at Mazourka Canyon Road</u>

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.

<u>LORP at Reinhackle Springs</u>

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.

<u>LORP at Pumpback Station</u>

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

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

2.2 Flows to the Delta

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 *1991 Environmental Impact Report* (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

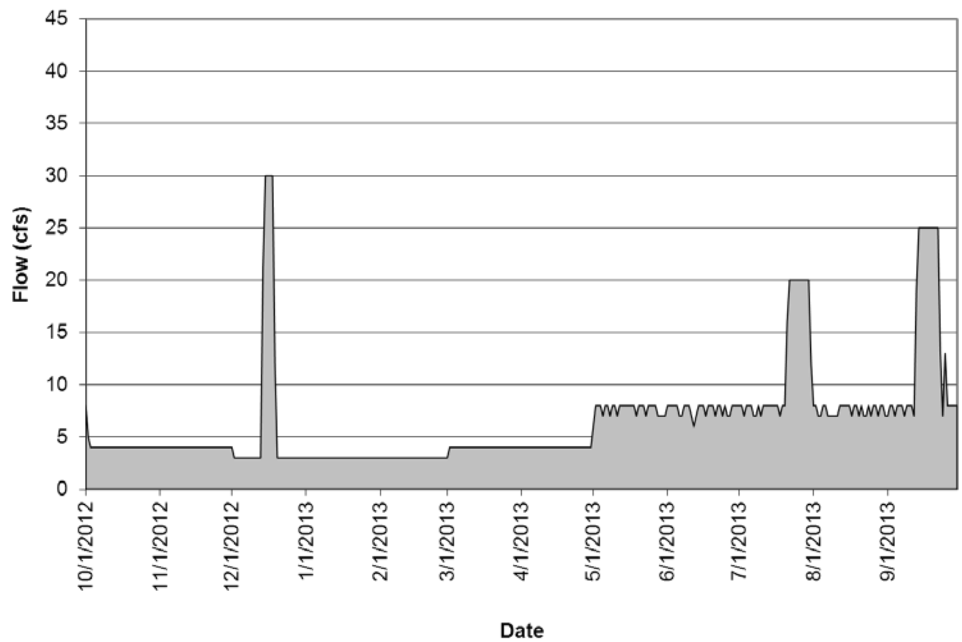
Additionally, pulse flows were scheduled to be released to the Delta (LORP EIR, section 2.4):

- 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

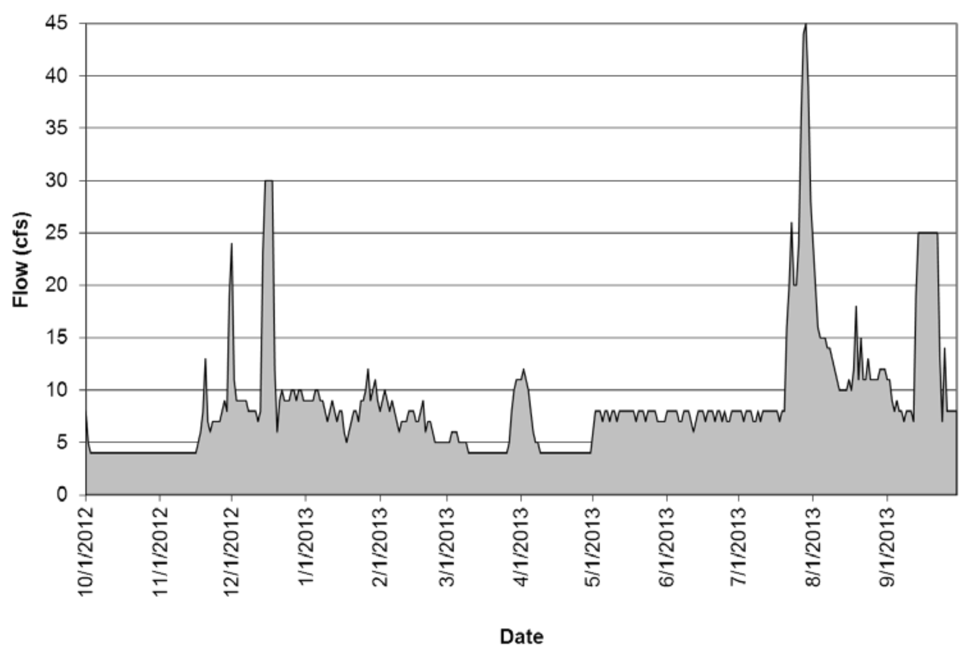
The scheduled base and pulse flows for the 2012-13 water year targeted an average of 7 cfs to the Delta. Due to unintended flows, the release to the Delta was much higher than the planned 7 cfs even after excluding Delta releases during the seasonal habitat flow. Unintended flows are released to the Delta when intense rainstorms cause river flows to exceed the limited maximum capacity 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 (see figures below). The final October 2012 to September 2013 average flow to the Delta was 8.9 cfs.

All of the scheduled flows to the Delta were released as planned except for the Period 1, March-April pulse release for which an adaptive management measure was implemented. Additionally, the scheduled pulse flow for June-July occurred during the dual occurrence of scheduled aqueduct maintenance and an intense rainstorm that resulted in large amount of water reaching the Pumpback Station when the scheduled pulse flow was released. This resulted in a pulse flow that reached a higher peak and lasted longer than the normal schedule release. The pulse flow peaked at 45 cfs during the 10-day scheduled release at the end of July, while the additional water due to the rainstorm and aqueduct releases led to additional spillage throughout the month of August.

For future operations, the upcoming November-December and March-April delta pulse flows will be released from the LORP Intake in late December and early March.



Hydrologic Monitoring Figure 1. Langemann Release to Delta



Hydrologic Monitoring Figure 2. Langemann and Weir Release to Delta

2.2.1 Adaptive Management Results:

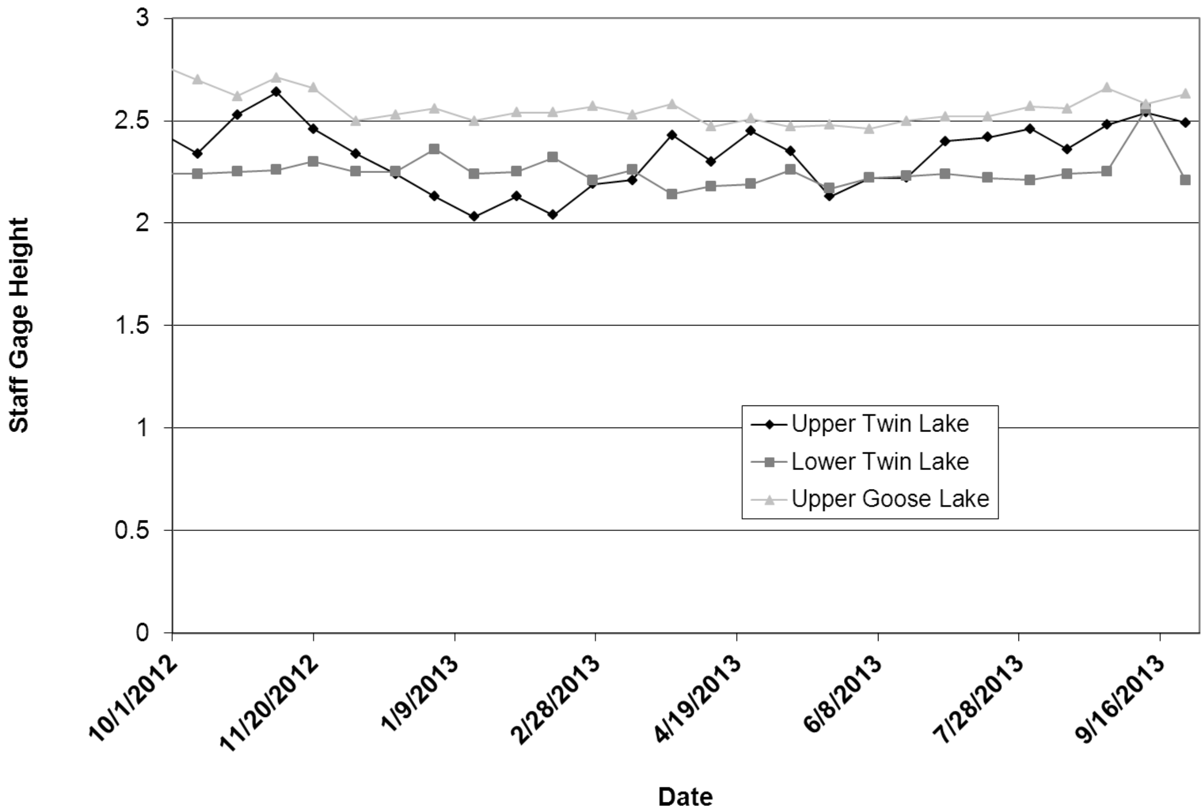
For Period 1, the March-April pulse flow, operations followed an adaptive management recommendation and the pulse flow was released from the LORP Intake rather than the Pumpback Station Langemann Gate. On March 14, 2013, the LORP Intake was increased from 40 cfs to 61 cfs (a 21 cfs increase, which follows the normal 4 cfs to 25 cfs increase for the Period 1 pulse flow) where it remained for 10 days until being reduced back to normal operational flows. River flow at the Pumpback Station was 48 cfs at the time of the release and increased up to a high of 59 cfs as the increased flows reached the Pumpback Station. As a result, for Period 1 the release to the Delta was as follows:

Date	Flow (cfs)
3/27/13	5
3/28/13	8
3/29/13	10
3/30/13	11
3/31/13	11
4/1/13	5
4/2/13	5

As can be seen from the data above, losses in the river reduced the pulse flow significantly. The losses likely occurred because winter make-water had already started to decrease by the time March began. The high winter flow for the river at the Pumpback Station occurred on February 19 when the river was flowing at 57 cfs. By the time the March-April pulse flow was released from the LORP Intake on March 14, flows at the Pumpback Station had decreased to 49 cfs. Assuming the observed trend continued during the duration of the pulse flow release, the increased flows at the Intake were offset somewhat by the decrease of the winter make-water inflows to the river.

2.3 Off-River Lakes and Ponds

The BWMA and Off-River Lakes and Ponds Hydrologic Data Reporting Plan requires that Upper Twin Lake, Lower Twin Lake, and Goose Lake be maintained between 1.5 and 3.0 feet on their respective staff gauges, and that Billy Lake be maintained full (i.e., at an elevation that maintains outflow from the lake). At no time during the period of October 2012 to September 2013, did any of the gages indicate below a 1.5 foot stage height (see following figure).



Hydrologic Monitoring Figure 3. Off-River Lakes and Ponds Staff Gages

<u>Billy Lake</u>

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. LADWP maintains Billy Lake by monitoring the Billy Lake Return station to always ensure some flow is registering there. The table in Hydrological Appendix 2, presents the annual summary of flows, and shows that at no time did the flow at Billy Lake Return Station fall to zero for a day. Billy Lake Return had a minimum daily average flow of 0.7 cfs for the year, so Billy Lake remained full for the entire year (see the following table).

Hydrologic Monitoring Table 1. LORP Flows – Water Year 2012-13

Station Name	Average Flow (cfs)	Maximum Flow (cfs)	Minimum Flow (cfs)
Below River Intake	57.2	91.0	42.0
Blackrock Return Ditch	1.5	5.0	0.5
Goose Lake Return	1.2	2.0	1.0
Billy Lake Return	1.3	4.5	0.7
Mazourka Canyon Road	59.4	89.0	41.0
Locust Ditch Return	0.5	7.0	0.0
Georges Ditch Return	0.0	2.0	0.0
Reinhackle Springs	58.8	83.0	42.0
Alabama Gates Return	1.3	111.0	0.0
At Pumpback Station	52.5	93.0	29.0
Pump Station	43.6	48.0	19.0
Langemann Gate to Delta	6.5	30.0	3.0
Weir to Delta	2.4	25.0	0.0

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.

An adaptive management recommendation was implemented on April 1, 2011, and flow to Thibaut Pond was turned off to dry out the pond. No further water has been released through the end of September 2013. However, due to a 2012 adaptive management recommendation, flow to Thibaut Pond will be turned on once again on October 16 and will remain on for the winter season.

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 beginning of the 2012-13 Runoff Year, wetted acreage measurements were collected eight times per year, once in the middle of each season and once at the end of each season. For the first half of the 2013-14 Runoff Year, only the middle of each season measurements were collected. The end of season measurements were discontinued because they added very little information compared to the middle of season measurements and required extensive manpower for taking the each measurement. The measurements are performed by using GPS and walking the perimeter of the wetted edges of the waterfowl area. When both middle and end of season measurements are made the measurement in the middle of the season counts as the average for the entire season (see table below).

Hydrologic Monitoring Table 2. BWMA Wetted Acreage

Winterton Unit

ET Season	Read Date	Wetted Acreage	Inflow
Spring	5/9/2012	93	0

Thibaut Unit

ET Season	Read Date	Wetted Acreage	Inflow

Drew Unit

ET Season	Read Date	Wetted Acreage	Inflow
Spring	5/5/2012 5/31/2012	306* 330	7.1
Summer	7/12/2012 N/A	318* N/A	7.1
Fall	9/18/2012 10/17/2012	334* 337	5.6
Winter	1/17/2013 4/16/2013	334* 276	1.8
Spring	5/6/2013 N/A	299** N/A	5.6
Summer	7/9/2013 N/A	278** N/A	5.7
Fall	9/19/2013 N/A	287** N/A	4.7

Waggoner Unit

ET Season	Read Date	Wetted Acreage	Net Inflow

** These measurements count towards the 2012-2013 runoff year acreage goal.*
*** These measurements count towards the 2013-2014 runoff year acreage goal.*

2.4.1 Blackrock Waterfowl Management Area Results for April 2012 to March 2013

The runoff forecast for runoff year 2012-13, was 65%, thus the waterfowl acreage goal for this year was 325 acres.

On April 17, the spring flows were set, resulting in the inflows to Winterton being shut off and the inflows to Drew increased to 7.1 cfs. When the wetted perimeter was measured with GPS in the middle of the spring season, the wetted area was 306 acres for Drew.

The June 1 waterfowl inflows for the Drew area were not changed because there was almost no difference between the existing inflow to Drew and the calculated flow based on the previous year's average (0.2 cfs lower). When the wetted perimeter was measured with GPS in the middle of the summer season, the wetted area was 318 acres for Drew.

On August 21, the fall flows were set resulting in the inflows to Drew being decreased to 5.6 cfs. When the wetted perimeter was measured with GPS in the middle of the fall season, the wetted area was 334 acres for Drew.

On October 17, the winter flows were set resulting in the inflows to Drew being decreased to 1.8 cfs. When the wetted perimeter was measured with GPS in the middle of the winter season, the wetted area was 334 acres for Drew.

The average waterfowl wetted acreage for the entire Runoff Year of 2012-13 was 327 acres, which was just above the goal of 325 acres.

2.4.2 Blackrock Waterfowl Management Area Results for April 2013 to September 2013

The runoff forecast for runoff year 2013-14 is 54%, thus the waterfowl acreage goal for this year is 270 acres.

On April 16, the spring flows were set and the inflows to Drew were increased to 5.6 cfs. When the wetted perimeter was measured with GPS in the middle of the spring season, the wetted area was 299 acres for Drew.

On June 3, the summer flows were set and the inflows to Drew were increased to 5.7 cfs. When the wetted perimeter was measured with GPS in the middle of the summer season, the wetted area was 278 acres for Drew.

On August 19, the fall flows were set and the inflows to Drew were decreased to 4.7 cfs. When the wetted perimeter was measured with GPS in the middle of the fall season, the wetted area was 287 acres for Drew.

The average wetted acreage for the 2013-14 Runoff Year is 286 acres through the end of the fall season.

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 the period of October 2012 to September 2013. 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 the table below. ET rates fall sharply during late fall - winter and increase dramatically during the spring - 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 sporadic runoff from storms also result in flow increases.

Hydrologic Monitoring Table 3. Average Monthly River Flow Losses/Gains From the Intake to the Pumpback Station during the 2012 and 2013 Water Year

	Month	Flow (cfs)	Acre-Feet-Per-Day
2012	OCT	-6	-11
	NOV	+5	+10
	DEC	+7	+14
2013	JAN	+7	+13
	FEB	+6	+12
	MAR	-5	-10
	APR	-2	-4
	MAY	-8*	-15*
	JUN	-46*	-92*
	JUL	-42	-83
	AUG	-22	-44
	SEP	-18	-36
	AVG MONTH	**-10 cfs**	**-20 AcFt**

** Data influenced by the 2013 seasonal habitat flow*

The summer flow losses for May and June 2013 were influenced by the Seasonal Habitat Flow and may not be typical for predicting future losses.

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 41,400 acre-feet, inflows from augmentation spillgates were 4,200 acre-feet, and outflows from the Pumpback Station were 38,000 acre-feet. This yields a loss of 7,500 acre-feet for the year, a daily average of approximately 10.4 cfs between the Intake and the Pumpback Station. Water loss during the 2012-13 water year (October 2012 to September 2013) represents about 17% of the total released flow from the Intake and augmentation spillgates into the river channel.

For the year, the river lost an average of 10.4 cfs (17%) compared to an average loss of 15.1 cfs (23%) for the previous year. The decrease in losses is an unknown because up until this year the losses in the river had formed a correlation between runoff and river losses where the lower runoff years resulted in lower losses. When comparing the river losses on a month-by-month basis to the previous year, the decrease in losses is spread evenly over the entire year. LADWP will be able to form a better analysis and predict future river losses once more data points are established.

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

From December 2012 to March 2013, an average flow of 47 cfs was released into the Lower Owens River from the Intake. An additional 4 cfs was provided from augmentation ditches, for a total accumulated release of 51 cfs. The average flow reaching the Pumpback Station was 55 cfs, an increase of 4 cfs during the period. During the winter, ET is low and any “make water” coming into the river is additive. Part of the “make water” was probably stored during earlier periods in subsurface aquifers and may also be a result of higher winter season precipitation.

The river reach from the Intake to the Mazourka Canyon Road gaging station gained 1 cfs, while the reach from Mazourka Canyon Road to the Reinhackle gaging station gained 3 cfs and Reinhackle to the Pumpback Station gained 0 cfs (see table below). A water “gaining” reach, during harsh winter conditions, can benefit an ecosystem in many ways. Incoming water, especially if it is subsurface, tends to increase winter river water temperatures, reduces icing effects, increases dissolved oxygen, when water surface ice is melted by increasing the re-aeration rate, and adds nutrients.

Hydrologic Monitoring Table 4. Winter Flow Losses/Gains, December 2012 to March 2013

Recording Station	Average Flow (cfs)	Gain or Loss (cfs)	Accumulative (cfs)
Intake*	47	N/A	N/A
Mazourka	52	+1	+1
Reinhackle	55	+3	+4
Pumpback	55	-0	+4

Note: All numbers are rounded to the nearest whole value

* The following augmentation stations are added

1 cfs added at the Blackrock Return Ditch

1 cfs added at the Goose Lake Return

1 cfs added at the Billy Lake Return

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

During the summer period of June 2013 to September 2013, all river reaches lost water. The effects of ET are evident from the high total flow loss (-32 cfs) between the Intake to the Pumpback Station. Summer flow losses were 36 cfs higher than conditions during the winter season. The largest flow losses occurred at the Reinhackle to Pumpback Station reach (-18 cfs) (see following table).

Hydrologic Monitoring Table 5. Summer Flow Losses/Gains, June 2013 to September 2013

Recording Station	Average Flow (cfs)	Gain or Loss (cfs)	Accumulative (cfs)
Intake*	77	N/A	N/A
Mazourka	71	-10	-10
Reinhackle**	67	-4	-14
Pumpback	53	-18	-32

Note: All numbers are rounded to the nearest whole value
* The following augmentation stations are added
2 cfs added at the Blackrock Return Ditch
1 cfs added at the Goose Lake Return
1 cfs added at the Billy Lake Return
** The following augmentation station is added
3 cfs added at the Alabama Gates Return

2.6 Seasonal Habitat Flow

2.6.1 Seasonal Habitat Flow

Flows in the Lower Owens River and its tributaries, including return ditches, are monitored by LADWP's automatic and manual metering equipment. The maximum average daily flow released from the LORP Intake during the seasonal habitat flow was 56 cfs on May 22. The maximum average daily flow release from Alabama Gates Return during the seasonal habitat flow was 30 cfs on May 29. See Seasonal Habitat Flow Appendix 2.

2.6.2 LORP Inflows

Just before the high flow release, the LORP inflows were 45 cfs at the Intake with an additional 9 cfs added down river at various augmentation points. The seasonal habitat flows were scheduled to be released at the Intake and Alabama Gates Return as described in the following table.

Hydrologic Monitoring Table 6. Prescribed Seasonal Habitat Flow Change

Date	Time	Intake Prescribed Flow Change
May 21	2:00 PM	from 42 to 50 cfs
May 22	2:00 PM	from 50 to 53 cfs
May 23	2:00 PM	from 53 to 50 cfs
May 24	2:00 PM	from 50 to 42 cfs
Date	**Time**	**Alabama Gates Prescribed Flow Change**
May 28	10:00 AM	from 0 to 10 cfs
May 28	4:00 PM	from 10 to 50 cfs
May 28	10:00 PM	from 50 to 87 cfs
May 29	4:00 AM	from 87 to 60 cfs
May 29	10:00 AM	from 60 to 0 cfs

2.6.3 Flow Peaks and Travel Times

The time for the peak of 58 cfs to flow down the LORP was approximately 13 days from the Intake to the Pumpback Station. Based on previous studies, the velocities averaged well under 1 ft/sec during the seasonal habitat flows. The time for the peak augmentation flow of 87 cfs from Alabama Gates to flow to the Pumpback Station was approximately 4 days. A schedule of the peaks and travel times taken at the Lower Owens River measuring stations is presented in the following table.

Hydrologic Monitoring Table 7. Seasonal Habitat Flow Peaks and Time Schedule

Station	Peak	Peak Flow (cfs)	Travel Time from Intake	Distance (miles)
Intake	May 23 at 7:00 a.m.	58	--	--
Mazourka	May 26 at 9:00 p.m.	60	3 days, 14 hour	24
Reinhackle	May 30 at 8:00 p.m.	57	7 days, 13 hours	13
Above Pumpstation	June 5 at 5:00 p.m.	43	13 days, 10 hours	21
Station	**Peak**	**Peak Flow (cfs)**	**Travel Time from Alabama Gates**	**Distance (miles)**
Alabama Gates	May 28 at 10:00 p.m.	87	--	--
Above Pumpstation	June 1 at 10:00 p.m.	55	4 days, 0 hours	--

The travel time for the 2013 seasonal habitat flows to move from the Intake to the Pumpback Station was similar to the 2009 and 2012 seasonal habitat flows. These flows were also similar in that they had lower peak flows. In 2008, the total peak flow travel time was 8 days, the quickest observed, likely due to the lack of vegetation in the channel. These travel times are presented in the following table.

Hydrologic Monitoring Table 8. Seasonal Habitat Peak Flow and Travel Time

Year	Peak Flow	Travel Time
2008	220 cfs	8 days, 12 hours
2009	110 cfs	13 days
2010	209 cfs	16 days, 13 hours
2011	205 cfs	15 days, 6 hours
2012	92 cfs	13 days, 4 hours
2013	58 cfs	13 days, 10 hours

Due to the extremely low seasonal habitat flow releases no further analysis was performed.

2.7 LORP Hydraulics and Tule Distribution

The physical controls over the growth and distribution of tules along the Lower Owens River were analyzed as recommended by the MOU consultants in the Adaptive Management portion of the 2012 LORP Annual Report. In particular the consultant's state that although deeper water excludes expansion of tules by effectively drowning them, there are much shallower portions of the LORP that are free of tules and therefore some other mechanism must be at work in limiting their distribution. This analysis is to identify what this mechanism is and where it is occurring along the LORP.

Because the density of tules increases as one moves downstream from the relatively confined reaches upstream of "Two Culverts" to a wider and subsequently less confined river, the influence of the river's hydraulics on tule distribution was examined. In doing so, the hydraulic model developed by Northwest Hydraulic Consultants (NHC) (2012) was used to calculate both the boundary shear stress and the critical shear stress along the river. The former is the erosional or driving force the flow of the river imparts on the channel bed and is responsible for eroding sediment and uprooting tules. The latter is the resistance to erosion and uprooting. When boundary shear stress exceeds the critical shear values associated with either sediment or tules erosion or uprooting occurs. As an aside, uprooting of tules was examined as it is thought to be more effective in controlling their distribution as the rhizomes are removed and thereby eliminates their ability to regrow unlike the breaking of their stalks (Liffen *et al.*, 2011; LORP, 2012).

2.7.1 Driving Force

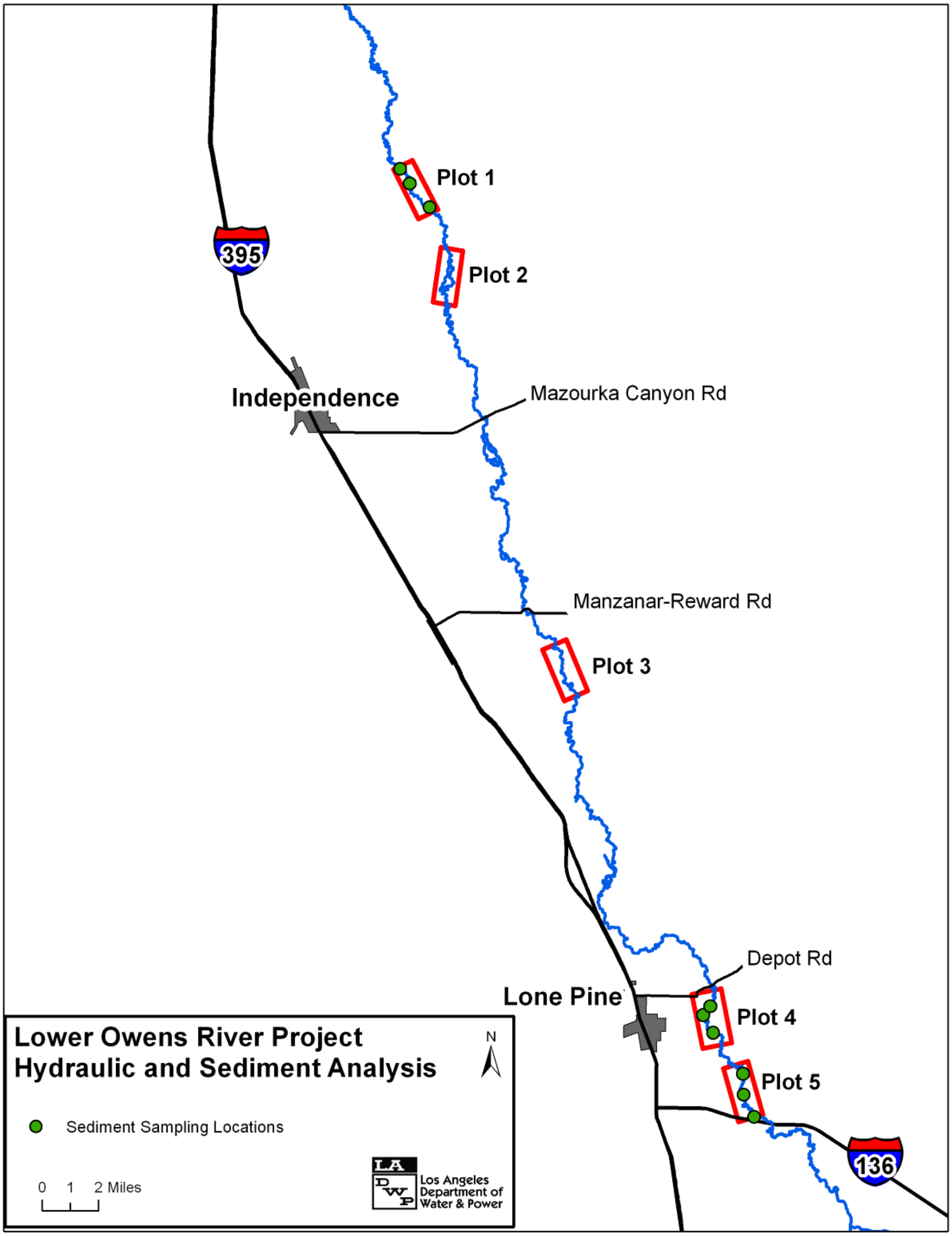
The driving force or boundary shear stress is the product of

$$\tau_b = \rho_w R S$$

Where:

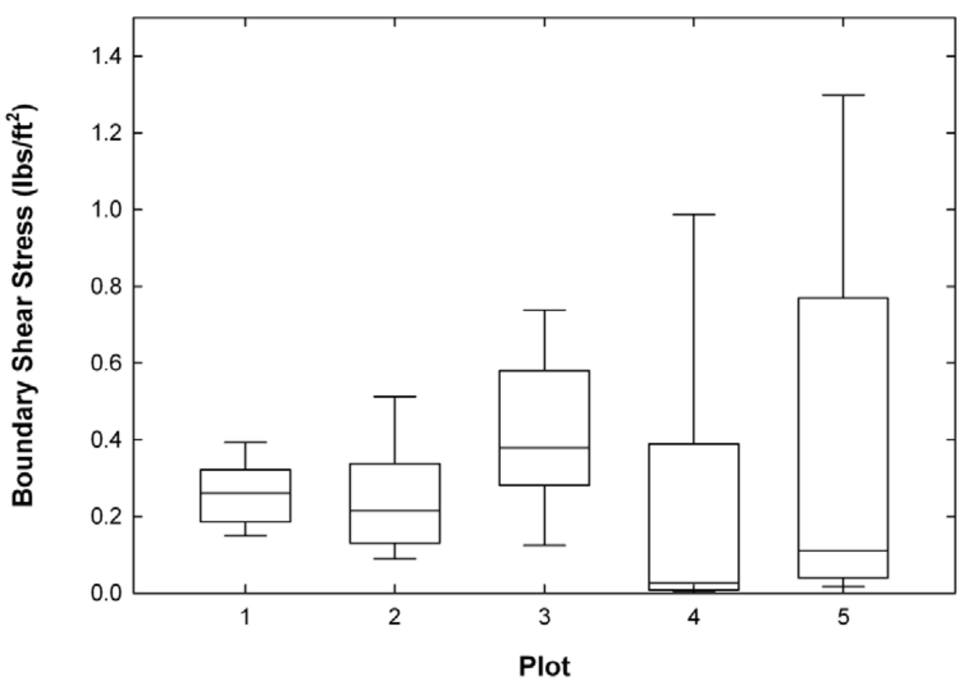
τ_b is the boundary shear stress in lbs./ft^2.,
ρ_w is the density of water,
R is the hydraulic radius (channel area divided by the wetted perimeter); and
S is the slope of the water surface.

Boundary shear stress was calculated at each cross section along the five plots spanning the Lower Owens River (Figure 4) and hydraulic radii values associated with the maximum seasonal habitat-flow used in the NHC's hydraulic model were used (Table 9). These flows provide the greatest opportunity to induce erosion as discharges above these values spread across the floodplain and/or lost to off-channel features, such as side channels thereby lessen their erosive powers.



Hydrologic Monitoring Figure 4. Plot and sediment sampling locations along the LORP

Median boundary shear-stress values increase slightly downstream from plot 1 to 3 and then rapidly decline below plot 3 (Figure 5, Table 9). This trend is most likely the effects of channel shape and tules. Plots 1 is well confined, in that the main channel is not readily connected to the floodplain as the river has incised below the former floodplain and all or the majority of stream flow is now contained within its channel during the peak seasonal flow (Figure 6). Plot 2 is semi-confined, although at flows greater than 200 cfs, water is out of the main channel (Figure 6). Similarly, in plots 4 and 5 there is significantly less water within the main channel at higher flows, as water is lost to both the floodplain and discontinuous side channels when flows are greater than 80 and 100 cfs, respectively (Figure 6) (NHC, 2012). Plot 3, is also less confined but dense tules in the study area and a complex of beaver dams downstream of the plot greatly influence water surface elevation (as opposed to only the channel shape) (Figure 6). This effectively causes a backwater effect, which artificially elevates the depth of water and thereby results in an inflated hydraulic radius and thus higher shear stress values (NHC, 2012). It is probable that without the current densities of tules and dams, shear stress values would be comparable to upstream values. Backwater effects from tules are also a likely influence on depths along plots 4 and 5, but its influence on shear stress values is secondary to flow loss.



Hydrologic Monitoring Figure 5. Boundary Sheer Stress Values for Individual Plots, LORP

2.7.2 Resistive Force

In determining the resistive force of the sediment along the channel bed, critical shear stress was also calculated for each plot and is equivalent to

$$\tau_{cr} = 0.25d_*^{-0.6}(\rho_s-\rho_w)dTan\varphi) \text{ (lbs./ft}^2.)$$

Where:

$$d_* = d[(G-1)g/v^2]^{1/3}$$

τ_{cr} is critical shear stress in lbs./ft^2.,
φ is the angle of repose of the particle,
G is the specific gravity of sediment,
g is acceleration due to gravity,
ρ_s is the density of sediment,
ρ_w is the density of water,
v is the kinematic velocity; and
d is the median particle size.

The angle of repose is dependent upon the sediment size (Table 10). The median particle size for each plot was found through sieve analysis by collecting sediment at, or near, the deepest portion of the channel bed (thus representing the coarsest fraction of the sediment along the bed) at the upper, middle and lower portions of the individual plots and in relatively straight portions of the channel (Figure 4). However, no samples were collected in plots 2 and 3 because of the absent of coarse sediment. In plot 2, the numerous sites visited lacked sediment as the channel bottom is composed of thick tule root-mats, while in plot 3 there is no discernibly continuous channel. Instead, open channel that contains primarily organics along the channel bottom are interspersed among dense tules.

Median particle size decreased from very coarse to medium-sized sands in the downstream direction as well as the critical shear stress values associated with these sediments (Table 9). In comparison, boundary shear stress values for plot 1 are nearly 70 times the needed force to mobilize sediment particles up to the median size (Table 9). Similarly, plot 4 and plot 5 have respectively 10 and 55 times the needed force to move its sediment (Table 9). Simply put, the river at the maximum seasonal habitat flows possesses ample energy to erode and transport sediment.

Hydrologic Monitoring Table 9. Sediment Particle Size, Boundary, and Critical Shear Stress Values Associated with Specified Stream Flows

Plot Number	**Median Particle Size** (in.)	**Boundary Shear Stress** (lbs./ft.^{2})	**Critical Shear Stress** (lbs./ft.^{2})	**Maximum Stream Flow Modeled** (cfs)
1	0.05	0.27	0.004	200
2	*n/a*	0.21	*n/a*	200
3	*n/a*	0.38	*n/a*	160
4	0.02	0.03	0.003	80
5	0.01	0.11	0.002	100
	n/a = not collected.			

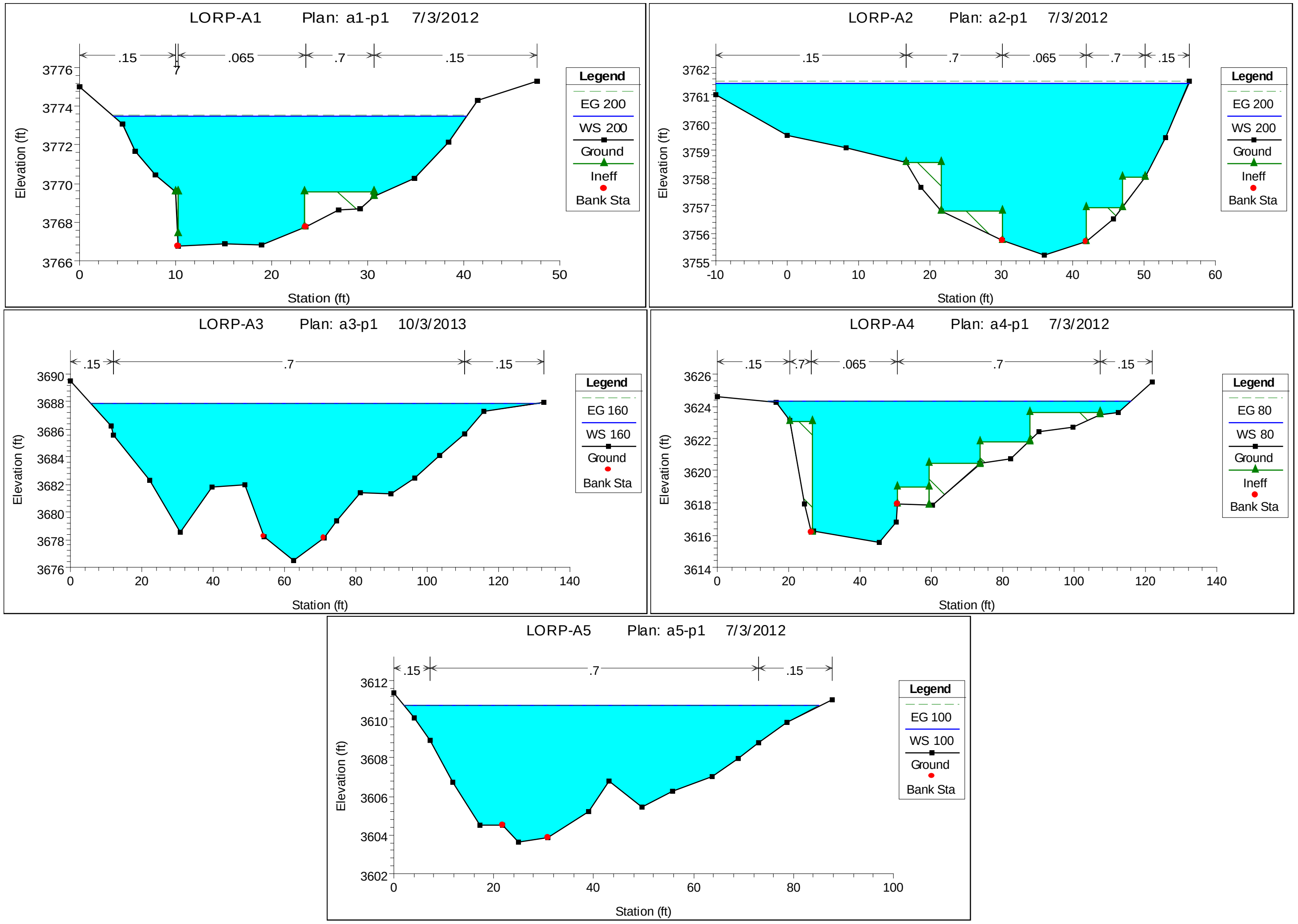
However, this is not the case with tules as the seasonal habitat flows lack the force to uproot tules. Field values, in which a pulling device was used to measure the median force needed to uproot an individual *Sparganim erectum*, which is closely related to cattails, was 3.4 lbs./ft.^{2} (Liffen *et al.*, 2011). While Pollen-Bankhead *et al*. (2011) report that 230 lbs./ft.^{2} or nearly 70 times as much force is needed to uproot a group or stand of the same species. In contrast, the near-maximum boundary shear stress value for the all plots is approximately 1.3 lbs./ft.^{2} (Figure 5.)

2.7.3 Summary

Paradoxically, tules do not exist entirely throughout the Lower Owens River. Water depth has been noted as a potential limiting factor to their establishment and growth, but in many areas, tules are absent in water shallower than the reported depths needed to eliminate them (LORP, 2012). Instead, the ability of the river to scour sediment and undermine the root system of tules may also be a contributing factor in limiting their distribution. This is probable in plot 1 because of the highly confined nature of the channel, which leads to high boundary shear stress values. Subsequently, tules are found predominately along a narrow margin on the banks. Further, there must be ample boundary shear stress at lower flows to prevent tules from encroaching upon the open channel as the maximum seasonal-habitat flow is relatively short in duration and occurs infrequently. Future analysis is needed to determine the lowest flow capable of moving sediment in this plot and the others. Although the maximum seasonal habitat flows are competent to erode sediment in the downstream plots, their effect on tule removal is most likely local. The dense and well established tule stands in these plots effectively dissipates much of the erosive force of the flood waters and thereby minimizes their ability to erode sediment or uproot tules. Instead water depth is more probable in controlling tules in plots 2 through 5. In sum, channel shape primarily drives tule distribution; well-confined channels have sufficient erosion rates to limit tules expansion, while semi and un-confined channels rely primarily upon water depth.

Hydrologic Monitoring Table 10. Angle of repose values for sand (adapted from Julien, 1995)

Sands	Size (in.)	φ (degrees)
Very Coarse	>0.04	32
Coarse	>0.02	31
Medium	>0.01	30
Fine	>0.005	30



Hydrologic Monitoring Figure 6. Representative Cross Sections for Plots 1-5

2.8 Hydraulics and Tule Control Reference

Julien, P.Y. 1995. *Erosion and sedimentation.* Cambridge University Press, New York.

Los Angeles Department of Water and Power 2012. *Additional information on tules and cattails as they relate to the LORP*. *In* 2012 Lower Owens River Project Annual Report. Los Angeles Department of Water and Power, Bishop, CA.

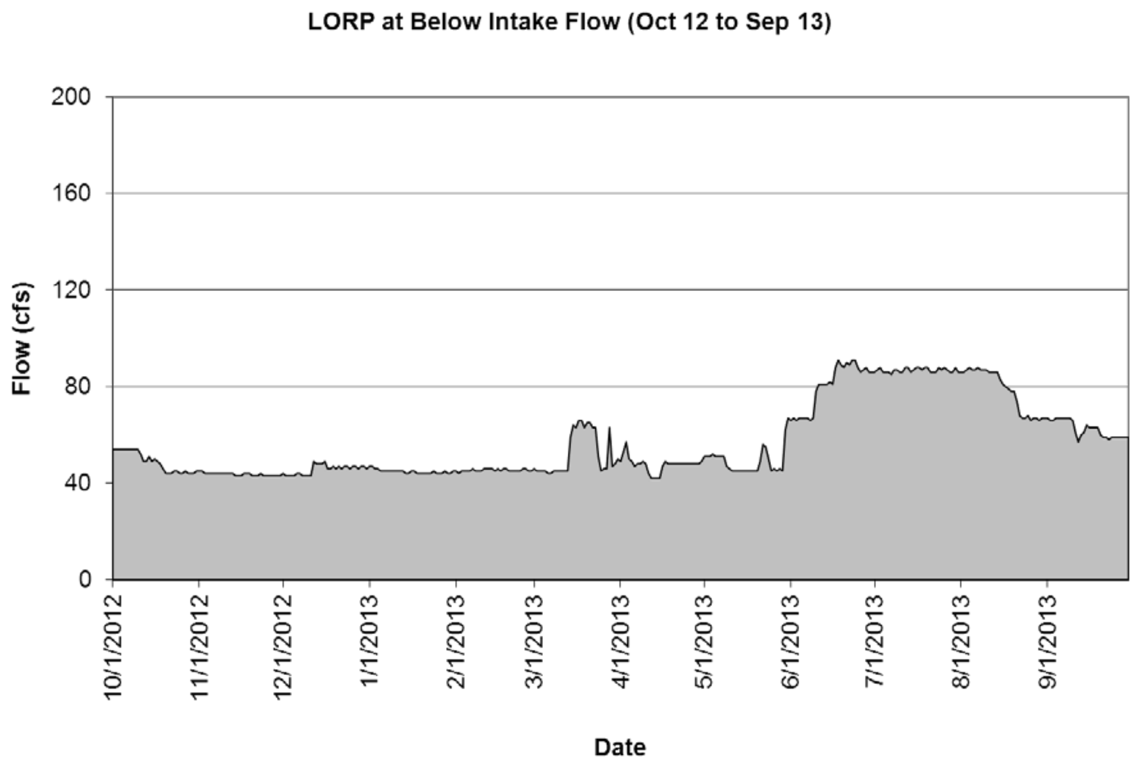
Liffen, T., Gurnell, A.M., O'Hare, M.T., Pollen-Bankhead, N., Simon, A. 2011. *Biomechanical properties of the emergent aquatic macrophyte Sparganium erectum: Implications for fine sediment retention in low energy rivers.* Ecological Engineering 37, 1925– 1931.

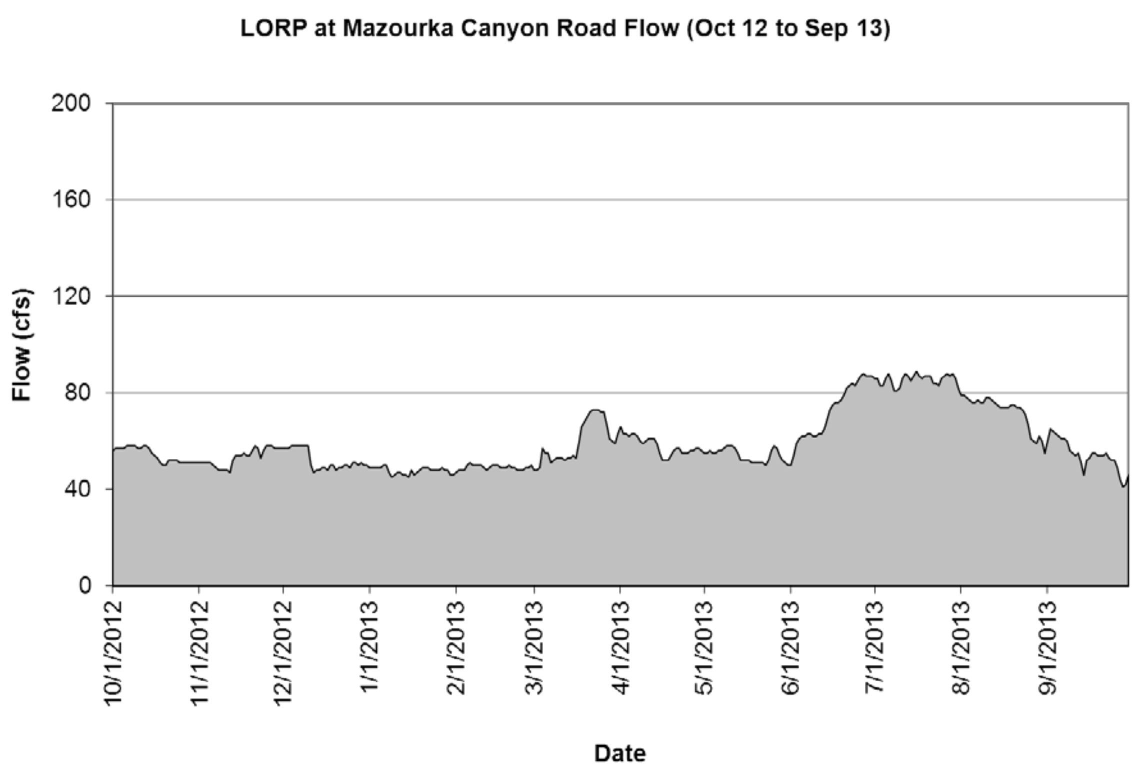
Northwest Hydraulic Consultants. 2012. *Lower Owens River Project Hydraulic Model*. Consultant's report prepared for the City of Los Angeles Department of Water and Power (+ appendices). Pasadena, CA.

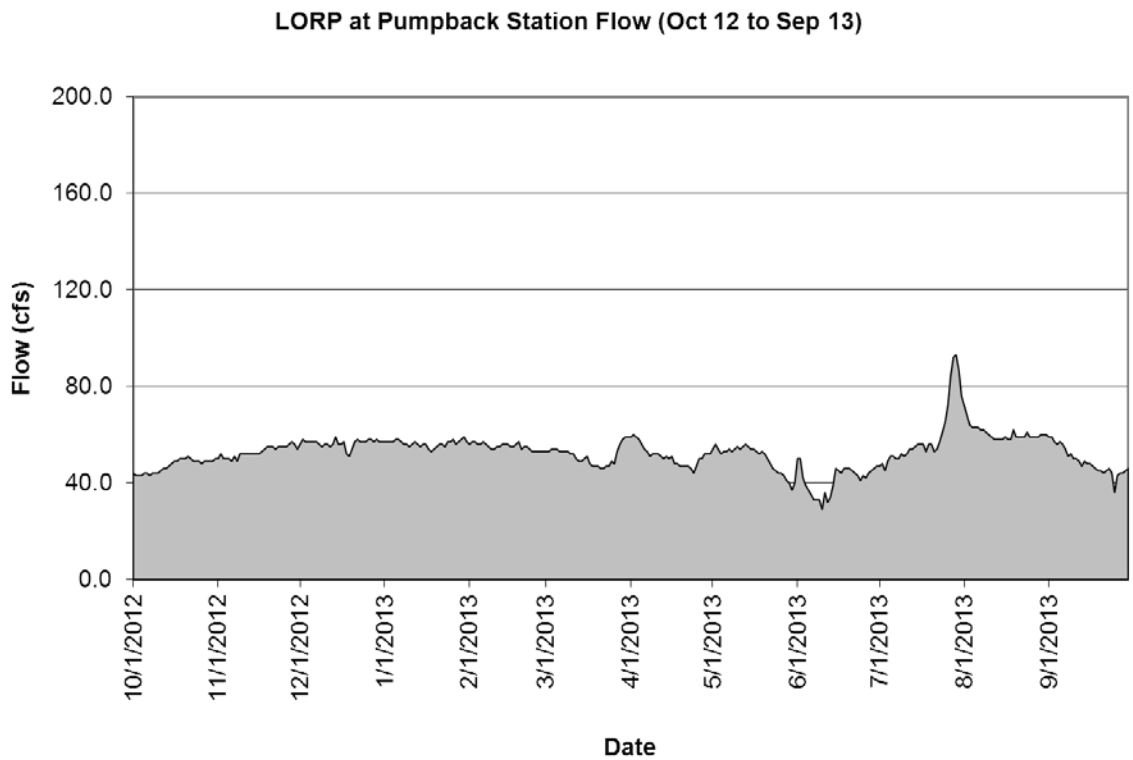
Pollen-Bankhead, N., Thomas, R.E., Gurnell, A.M., Liffen, T., Simon, A., O'Hare, M.T., 2011. *Quantifying the potential for flow to remove the emergent aquatic macrophyte Sparganium erectum from the margins of low-energy rivers*. Ecological Engineering 37, 1779– 1788.

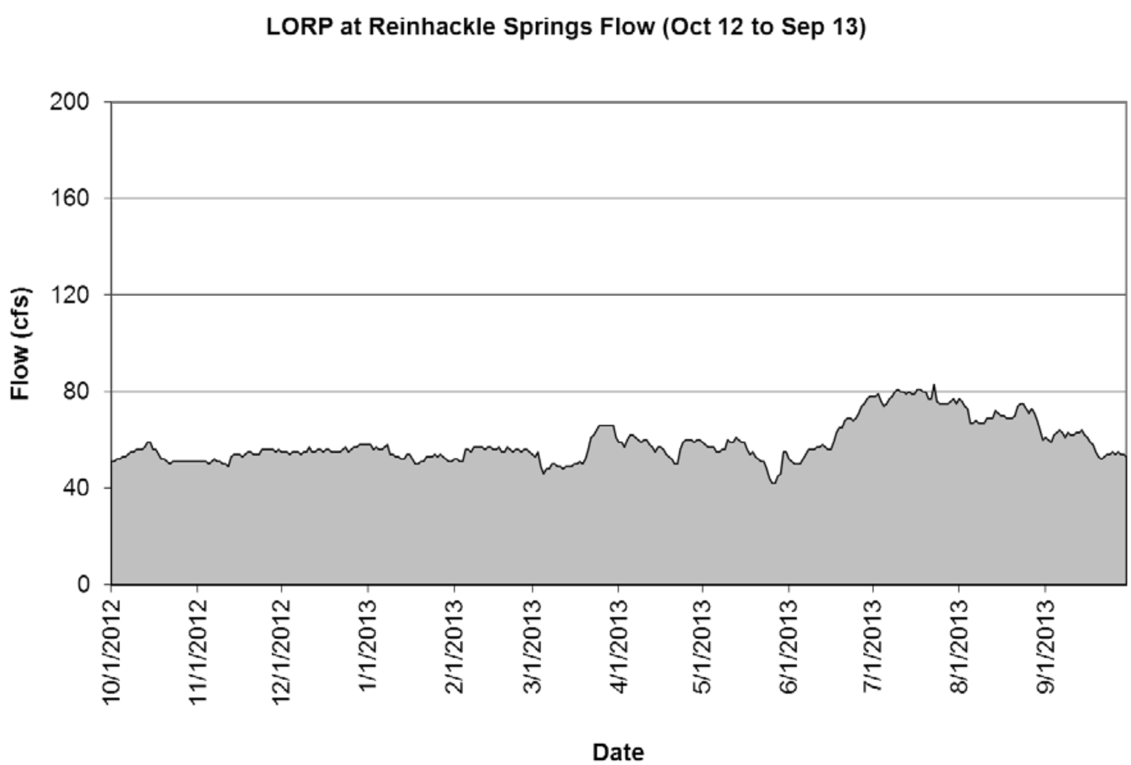
2.9 Appendix

Appendix 1. Hydrologic Monitoring Graphs






LORP at Pumpback Station Flow (Oct 12 to Sep 13)
Flow (cfs)
200.0
160.0
120.0
80.0
40.0
0.0
10/1/2012
11/1/2012
12/1/2012
1/1/2013
2/1/2013
3/1/2013
4/1/2013
5/1/2013
6/1/2013
7/1/2013
8/1/2013
9/1/2013
Date


LORP at Reinhackle Springs Flow (Oct 12 to Sep 13)
Flow (cfs)
200
160
120
80
40
0
10/1/2012
11/1/2012
12/1/2012
1/1/2013
2/1/2013
3/1/2013
4/1/2013
5/1/2013
6/1/2013
7/1/2013
8/1/2013
9/1/2013
Date

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
10/1/2012	54.0	1.0	2.0	1.1	56.0	0.0	0.0	51.0	0.0	44.0	36.0	8.0	0.0	51.3
10/2/2012	54.0	1.0	2.0	1.1	57.0	0.0	0.0	51.0	0.0	43.0	38.0	5.0	0.0	51.3
10/3/2012	54.0	2.0	2.0	1.1	57.0	0.0	0.0	52.0	0.0	43.0	39.0	4.0	0.0	51.5
10/4/2012	54.0	1.0	2.0	1.0	57.0	0.0	2.0	52.0	0.0	43.0	39.0	4.0	0.0	51.5
10/5/2012	54.0	1.0	2.0	1.0	57.0	0.0	0.0	53.0	0.0	44.0	40.0	4.0	0.0	52.0
10/6/2012	54.0	1.0	2.0	1.0	58.0	0.0	0.0	53.0	0.0	44.0	40.0	4.0	0.0	52.3
10/7/2012	54.0	1.0	1.0	1.0	58.0	0.0	0.0	54.0	0.0	43.0	39.0	4.0	0.0	52.3
10/8/2012	54.0	1.0	1.0	1.1	58.0	0.0	0.0	55.0	0.0	44.0	40.0	4.0	0.0	52.8
10/9/2012	54.0	1.0	1.0	1.1	58.0	0.0	0.0	55.0	0.0	44.0	40.0	4.0	0.0	52.8
10/10/2012	54.0	1.0	1.0	1.1	57.0	0.0	0.0	56.0	0.0	44.0	40.0	4.0	0.0	52.8
10/11/2012	52.0	1.0	1.0	1.1	57.0	0.0	0.0	56.0	0.0	45.0	41.0	4.0	0.0	52.5
10/12/2012	49.0	1.0	1.0	1.2	58.0	0.0	0.0	56.0	0.0	46.0	42.0	4.0	0.0	52.3
10/13/2012	49.0	1.0	2.0	1.2	58.0	0.0	0.0	57.0	0.0	46.0	42.0	4.0	0.0	52.5
10/14/2012	51.0	1.0	2.0	1.4	57.0	0.0	0.0	59.0	0.0	47.0	43.0	4.0	0.0	53.5
10/15/2012	49.0	1.0	1.0	1.4	55.0	0.0	0.0	59.0	0.0	48.0	44.0	4.0	0.0	52.8
10/16/2012	50.0	1.0	1.0	1.5	54.0	0.0	0.0	56.0	0.0	49.0	45.0	4.0	0.0	52.3
10/17/2012	49.0	1.0	1.0	1.5	53.0	0.0	0.0	56.0	0.0	49.0	45.0	4.0	0.0	51.8
10/18/2012	48.0	1.0	1.0	1.4	51.0	0.0	0.0	54.0	0.0	50.0	46.0	4.0	0.0	50.8
10/19/2012	46.0	1.0	1.0	1.4	50.0	0.0	0.0	52.0	0.0	50.0	46.0	4.0	0.0	49.5
10/20/2012	44.0	1.0	1.0	1.4	50.0	0.0	0.0	52.0	0.0	50.0	46.0	4.0	0.0	49.0
10/21/2012	44.0	1.0	1.0	1.3	52.0	0.0	0.0	51.0	0.0	51.0	47.0	4.0	0.0	49.5
10/22/2012	44.0	1.0	1.0	1.2	52.0	0.0	0.0	50.0	0.0	50.0	46.0	4.0	0.0	49.0
10/23/2012	45.0	1.0	1.0	1.2	52.0	0.0	0.0	51.0	0.0	49.0	45.0	4.0	0.0	49.3
10/24/2012	45.0	1.0	1.0	1.2	52.0	0.0	0.0	51.0	0.0	49.0	45.0	4.0	0.0	49.3
10/25/2012	44.0	2.0	1.0	1.1	51.0	0.0	0.0	51.0	0.0	49.0	45.0	4.0	0.0	48.8
10/26/2012	44.0	1.0	2.0	1.1	51.0	0.0	0.0	51.0	0.0	48.0	44.0	4.0	0.0	48.5
10/27/2012	45.0	1.0	2.0	1.0	51.0	0.0	0.0	51.0	0.0	49.0	45.0	4.0	0.0	49.0
10/28/2012	44.0	2.0	2.0	1.1	51.0	0.0	0.0	51.0	0.0	49.0	45.0	4.0	0.0	48.8
10/29/2012	44.0	1.0	2.0	1.2	51.0	0.0	0.0	51.0	0.0	49.0	45.0	4.0	0.0	48.8
10/30/2012	44.0	1.0	2.0	1.2	51.0	0.0	0.0	51.0	0.0	49.0	45.0	4.0	0.0	48.8
10/31/2012	45.0	1.0	1.0	1.3	51.0	0.0	0.0	51.0	0.0	50.0	46.0	4.0	0.0	49.3

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 Gate to Delta	Weir to Delta	In Channel Average Flow
11/1/2012	45.0	2.0	1.0	1.3	51.0	0.0	0.0	51.0	0.0	50.0	46.0	4.0	0.0	49.3
11/2/2012	45.0	2.0	1.0	1.3	51.0	0.0	0.0	51.0	0.0	52.0	48.0	4.0	0.0	49.8
11/3/2012	44.0	2.0	1.0	1.3	51.0	0.0	0.0	51.0	0.0	50.0	46.0	4.0	0.0	49.0
11/4/2012	44.0	1.0	1.0	1.3	51.0	0.0	0.0	51.0	0.0	50.0	46.0	4.0	0.0	49.0
11/5/2012	44.0	1.0	1.0	1.3	51.0	0.0	0.0	50.0	0.0	50.0	46.0	4.0	0.0	48.8
11/6/2012	44.0	2.0	1.0	1.2	50.0	0.0	0.0	51.0	0.0	49.0	45.0	4.0	0.0	48.5
11/7/2012	44.0	3.0	1.0	1.2	49.0	0.0	0.0	52.0	0.0	51.0	47.0	4.0	0.0	49.0
11/8/2012	44.0	2.0	1.0	1.2	48.0	0.0	0.0	51.0	0.0	49.0	45.0	4.0	0.0	48.0
11/9/2012	44.0	3.0	1.0	1.2	48.0	0.0	0.0	51.0	0.0	52.0	48.0	4.0	0.0	48.8
11/10/2012	44.0	2.0	1.0	1.1	48.0	0.0	0.0	50.0	0.0	52.0	48.0	4.0	0.0	48.5
11/11/2012	44.0	3.0	1.0	1.1	48.0	0.0	0.0	50.0	0.0	52.0	48.0	4.0	0.0	48.5
11/12/2012	44.0	2.0	1.0	1.1	47.0	0.0	0.0	49.0	0.0	52.0	48.0	4.0	0.0	48.0
11/13/2012	44.0	2.0	1.0	1.1	52.0	0.0	0.0	53.0	0.0	52.0	48.0	4.0	0.0	50.3
11/14/2012	43.0	3.0	1.0	1.2	54.0	0.0	0.0	54.0	0.0	52.0	48.0	4.0	0.0	50.8
11/15/2012	43.0	3.0	1.0	1.2	54.0	0.0	0.0	54.0	0.0	52.0	48.0	4.0	0.0	50.8
11/16/2012	43.0	2.0	1.0	1.2	54.0	0.0	0.0	54.0	0.0	52.0	48.0	4.0	0.0	50.8
11/17/2012	44.0	2.0	1.0	1.2	55.0	0.0	0.0	53.0	0.0	53.0	48.0	4.0	1.0	51.3
11/18/2012	44.0	2.0	1.0	1.2	54.0	0.0	0.0	54.0	0.0	54.0	48.0	4.0	2.0	51.5
11/19/2012	44.0	2.0	1.0	1.3	54.0	0.0	0.0	55.0	0.0	55.0	47.0	4.0	4.0	52.0
11/20/2012	43.0	2.0	1.0	1.3	56.0	0.0	0.0	55.0	0.0	55.0	42.0	4.0	9.0	52.3
11/21/2012	43.0	2.0	1.0	1.3	58.0	0.0	0.0	54.0	0.0	55.0	48.0	4.0	3.0	52.5
11/22/2012	43.0	3.0	1.0	1.3	57.0	0.0	0.0	54.0	0.0	54.0	48.0	4.0	2.0	52.0
11/23/2012	44.0	2.0	1.0	1.3	53.0	0.0	0.0	54.0	0.0	55.0	48.0	4.0	3.0	51.5
11/24/2012	43.0	2.0	1.0	1.3	56.0	0.0	0.0	56.0	0.0	55.0	48.0	4.0	3.0	52.5
11/25/2012	43.0	2.0	1.0	1.3	58.0	0.0	0.0	56.0	0.0	55.0	48.0	4.0	3.0	53.0
11/26/2012	43.0	2.0	1.0	1.3	58.0	0.0	0.0	56.0	0.0	55.0	48.0	4.0	3.0	53.0
11/27/2012	43.0	2.0	1.0	1.3	58.0	0.0	0.0	56.0	0.0	56.0	48.0	4.0	4.0	53.3
11/28/2012	43.0	2.0	1.0	1.3	57.0	0.0	0.0	56.0	0.0	57.0	48.0	4.0	5.0	53.3
11/29/2012	43.0	2.0	1.0	1.3	57.0	0.0	0.0	55.0	0.0	56.0	48.0	4.0	4.0	52.8
11/30/2012	43.0	2.0	1.0	1.4	57.0	0.0	0.0	56.0	0.0	54.0	35.0	4.0	15.0	52.5
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
12/1/2012	44.0	2.0	1.0	1.4	57.0	0.0	0.0	55.0	0.0	56.0	32.0	4.0	20.0	53.0
12/2/2012	43.0	2.0	1.0	1.4	57.0	0.0	0.0	55.0	0.0	58.0	47.0	3.0	8.0	53.3
12/3/2012	43.0	2.0	1.0	1.3	57.0	0.0	1.0	55.0	0.0	57.0	48.0	3.0	6.0	53.0
12/4/2012	43.0	2.0	1.0	1.3	58.0	0.0	0.0	54.0	0.0	57.0	48.0	3.0	6.0	53.0
12/5/2012	43.0	1.0	1.0	1.3	58.0	0.0	0.0	55.0	0.0	57.0	48.0	3.0	6.0	53.3
12/6/2012	44.0	1.0	1.0	1.3	58.0	0.0	0.0	55.0	0.0	57.0	48.0	3.0	6.0	53.5
12/7/2012	44.0	1.0	1.0	1.3	58.0	0.0	0.0	55.0	0.0	57.0	48.0	3.0	6.0	53.5
12/8/2012	43.0	1.0	1.0	1.3	58.0	0.0	0.0	54.0	0.0	56.0	48.0	3.0	5.0	52.8
12/9/2012	43.0	1.0	1.0	1.2	58.0	0.0	0.0	55.0	0.0	55.0	47.0	3.0	5.0	52.8
12/10/2012	43.0	1.0	1.0	1.1	58.0	0.0	0.0	55.0	0.0	56.0	48.0	3.0	5.0	53.0
12/11/2012	43.0	1.0	1.0	1.2	50.0	0.0	0.0	57.0	0.0	56.0	48.0	3.0	5.0	51.5
12/12/2012	49.0	1.0	1.0	1.2	47.0	0.0	0.0	55.0	0.0	55.0	48.0	3.0	4.0	51.5
12/13/2012	48.0	1.0	1.0	1.2	48.0	0.0	0.0	55.0	0.0	56.0	48.0	3.0	5.0	51.8
12/14/2012	48.0	1.0	1.0	1.1	48.0	0.0	0.0	56.0	0.0	59.0	36.0	21.0	2.0	52.8
12/15/2012	48.0	2.0	1.0	1.0	49.0	0.0	0.0	56.0	0.0	56.0	26.0	30.0	0.0	52.3
12/16/2012	49.0	1.0	1.0	1.1	49.0	0.0	0.0	55.0	0.0	56.0	26.0	30.0	0.0	52.3
12/17/2012	46.0	1.0	1.0	1.2	48.0	0.0	0.0	56.0	0.0	57.0	27.0	30.0	0.0	51.8
12/18/2012	46.0	1.0	1.0	1.3	50.0	0.0	0.0	56.0	0.0	52.0	22.0	30.0	0.0	51.0
12/19/2012	47.0	1.0	1.0	1.3	50.0	0.0	0.0	55.0	0.0	51.0	39.0	12.0	0.0	50.8
12/20/2012	46.0	1.0	1.0	1.3	48.0	0.0	0.0	55.0	0.0	54.0	48.0	3.0	3.0	50.8
12/21/2012	47.0	1.0	1.0	1.3	49.0	0.0	0.0	55.0	0.0	57.0	48.0	3.0	6.0	52.0
12/22/2012	46.0	1.0	1.0	1.3	49.0	0.0	0.0	55.0	0.0	58.0	48.0	3.0	7.0	52.0
12/23/2012	47.0	1.0	1.0	1.3	50.0	0.0	0.0	56.0	0.0	57.0	48.0	3.0	6.0	52.5
12/24/2012	47.0	1.0	1.0	1.5	50.0	0.0	0.0	57.0	0.0	57.0	48.0	3.0	6.0	52.8
12/25/2012	46.0	1.0	1.0	1.4	49.0	0.0	0.0	55.0	0.0	57.0	48.0	3.0	6.0	51.8
12/26/2012	47.0	1.0	2.0	1.4	51.0	0.0	0.0	56.0	0.0	58.0	48.0	3.0	7.0	53.0
12/27/2012	47.0	2.0	2.0	1.4	51.0	0.0	0.0	57.0	0.0	58.0	48.0	3.0	7.0	53.3
12/28/2012	46.0	1.0	2.0	1.4	50.0	0.0	0.0	57.0	0.0	57.0	48.0	3.0	6.0	52.5
12/29/2012	47.0	2.0	1.0	1.4	51.0	0.0	0.0	58.0	0.0	58.0	48.0	3.0	7.0	53.5
12/30/2012	47.0	1.0	1.0	1.4	50.0	0.0	0.0	58.0	0.0	57.0	47.0	3.0	7.0	53.0
12/31/2012	46.0	1.0	1.0	1.4	50.0	0.0	0.0	58.0	0.0	57.0	48.0	3.0	6.0	52.8

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1/1/2013	47.0	1.0	1.0	1.4	49.0	0.0	0.0	58.0	0.0	57.0	48.0	3.0	6.0	52.8
1/2/2013	47.0	1.0	1.0	1.4	49.0	0.0	0.0	58.0	0.0	57.0	48.0	3.0	6.0	52.8
1/3/2013	46.0	1.0	1.0	1.5	49.0	0.0	0.0	56.0	0.0	57.0	48.0	3.0	6.0	52.0
1/4/2013	46.0	3.0	1.0	1.5	49.0	0.0	0.0	57.0	0.0	57.0	48.0	3.0	6.0	52.3
1/5/2013	45.0	2.0	1.0	1.5	49.0	0.0	0.0	56.0	0.0	58.0	48.0	3.0	7.0	52.0
1/6/2013	45.0	2.0	1.0	1.5	50.0	0.0	0.0	56.0	0.0	58.0	48.0	3.0	7.0	52.3
1/7/2013	45.0	2.0	1.0	1.4	50.0	0.0	0.0	57.0	0.0	57.0	48.0	3.0	6.0	52.3
1/8/2013	45.0	2.0	1.0	1.4	47.0	0.0	0.0	58.0	0.0	56.0	47.0	3.0	6.0	51.5
1/9/2013	45.0	3.0	2.0	1.4	45.0	0.0	0.0	54.0	0.0	56.0	48.0	3.0	5.0	50.0
1/10/2013	45.0	2.0	1.0	1.4	46.0	0.0	0.0	54.0	0.0	55.0	48.0	3.0	4.0	50.0
1/11/2013	45.0	2.0	1.0	1.4	47.0	0.0	0.0	53.0	0.0	56.0	48.0	3.0	5.0	50.3
1/12/2013	45.0	2.0	1.0	1.4	47.0	0.0	0.0	53.0	0.0	57.0	48.0	3.0	6.0	50.5
1/13/2013	45.0	2.0	1.0	1.4	46.0	0.0	0.0	52.0	0.0	56.0	48.0	3.0	5.0	49.8
1/14/2013	44.0	2.0	2.0	1.4	46.0	0.0	0.0	52.0	0.0	55.0	48.0	3.0	4.0	49.3
1/15/2013	44.0	2.0	1.0	1.4	45.0	0.0	0.0	54.0	0.0	56.0	48.0	3.0	5.0	49.8
1/16/2013	45.0	2.0	1.0	1.4	48.0	0.0	0.0	54.0	0.0	56.0	48.0	3.0	5.0	50.8
1/17/2013	45.0	2.0	1.0	1.4	46.0	0.0	0.0	52.0	0.0	54.0	48.0	3.0	3.0	49.3
1/18/2013	44.0	2.0	1.0	1.4	47.0	0.0	0.0	50.0	0.0	53.0	48.0	3.0	2.0	48.5
1/19/2013	44.0	2.0	1.0	1.4	48.0	0.0	0.0	50.0	0.0	54.0	48.0	3.0	3.0	49.0
1/20/2013	44.0	3.0	1.0	1.4	49.0	0.0	0.0	51.0	0.0	55.0	48.0	3.0	4.0	49.8
1/21/2013	44.0	2.0	1.0	1.4	49.0	0.0	0.0	51.0	0.0	56.0	48.0	3.0	5.0	50.0
1/22/2013	44.0	3.0	1.0	1.4	49.0	0.0	1.0	53.0	0.0	56.0	48.0	3.0	5.0	50.5
1/23/2013	44.0	2.0	1.0	1.3	48.0	0.0	0.0	53.0	0.0	55.0	48.0	3.0	4.0	50.0
1/24/2013	45.0	3.0	1.0	1.3	48.0	0.0	0.0	53.0	0.0	57.0	48.0	3.0	6.0	50.8
1/25/2013	44.0	3.0	1.0	1.3	48.0	0.0	0.0	54.0	0.0	57.0	48.0	3.0	6.0	50.8
1/26/2013	44.0	3.0	1.0	1.3	48.0	0.0	0.0	53.0	0.0	58.0	48.0	3.0	7.0	50.8
1/27/2013	44.0	3.0	2.0	1.4	49.0	0.0	0.0	54.0	0.0	56.0	44.0	3.0	9.0	50.8
1/28/2013	45.0	3.0	1.0	1.4	48.0	0.0	0.0	53.0	0.0	57.0	48.0	3.0	6.0	50.8
1/29/2013	44.0	3.0	1.0	1.4	48.0	0.0	0.0	52.0	0.0	58.0	48.0	3.0	7.0	50.5
1/30/2013	44.0	2.0	1.0	1.4	46.0	0.0	0.0	51.0	0.0	59.0	48.0	3.0	8.0	50.0
1/31/2013	45.0	2.0	1.0	1.4	46.0	0.0	0.0	51.0	0.0	57.0	48.0	3.0	6.0	49.8
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2/1/2013	45.0	1.0	1.0	1.3	47.0	0.0	0.0	52.0	0.0	56.0	48.0	3.0	5.0	50.0
2/2/2013	44.0	1.0	1.0	1.4	48.0	0.0	0.0	52.0	0.0	57.0	48.0	3.0	6.0	50.3
2/3/2013	45.0	1.0	1.0	1.4	48.0	0.0	0.0	51.0	0.0	57.0	47.0	3.0	7.0	50.3
2/4/2013	45.0	1.0	1.0	1.4	48.0	0.0	0.0	51.0	0.0	56.0	47.0	3.0	6.0	50.0
2/5/2013	45.0	1.0	1.0	1.4	50.0	0.0	0.0	56.0	0.0	56.0	48.0	3.0	5.0	51.8
2/6/2013	45.0	1.0	1.0	1.4	51.0	0.0	0.0	56.0	0.0	57.0	48.0	3.0	6.0	52.3
2/7/2013	46.0	1.0	1.0	1.3	50.0	0.0	0.0	55.0	0.0	56.0	48.0	3.0	5.0	51.8
2/8/2013	45.0	1.0	1.0	1.3	50.0	0.0	0.0	57.0	0.0	55.0	48.0	3.0	4.0	51.8
2/9/2013	45.0	1.0	1.0	1.3	50.0	0.0	0.0	57.0	0.0	54.0	48.0	3.0	3.0	51.5
2/10/2013	45.0	1.0	1.0	1.3	50.0	0.0	0.0	57.0	0.0	54.0	47.0	3.0	4.0	51.5
2/11/2013	46.0	1.0	1.0	1.4	49.0	0.0	0.0	57.0	0.0	55.0	48.0	3.0	4.0	51.8
2/12/2013	46.0	1.0	1.0	1.4	48.0	0.0	0.0	56.0	0.0	55.0	48.0	3.0	4.0	51.3
2/13/2013	46.0	1.0	1.0	1.4	49.0	0.0	0.0	57.0	0.0	56.0	48.0	3.0	5.0	52.0
2/14/2013	46.0	1.0	1.0	1.4	50.0	0.0	0.0	57.0	0.0	56.0	48.0	3.0	5.0	52.3
2/15/2013	45.0	1.0	1.0	1.4	50.0	0.0	0.0	56.0	0.0	56.0	48.0	3.0	5.0	51.8
2/16/2013	46.0	1.0	1.0	1.4	50.0	0.0	0.0	56.0	0.0	55.0	48.0	3.0	4.0	51.8
2/17/2013	45.0	1.0	1.0	1.4	49.0	0.0	0.0	57.0	0.0	55.0	48.0	3.0	4.0	51.5
2/18/2013	46.0	1.0	1.0	1.3	49.0	0.0	0.0	55.0	0.0	56.0	48.0	3.0	5.0	51.5
2/19/2013	46.0	1.0	1.0	1.3	49.0	0.0	0.0	55.0	0.0	57.0	48.0	3.0	6.0	51.8
2/20/2013	45.0	1.0	1.0	1.3	50.0	0.0	0.0	57.0	0.0	54.0	48.0	3.0	3.0	51.5
2/21/2013	45.0	1.0	1.0	1.3	49.0	0.0	0.0	56.0	0.0	55.0	48.0	3.0	4.0	51.3
2/22/2013	45.0	2.0	1.0	1.3	49.0	0.0	0.0	55.0	0.0	55.0	48.0	3.0	4.0	51.0
2/23/2013	45.0	1.0	1.0	1.3	48.0	0.0	0.0	56.0	0.0	54.0	48.0	3.0	3.0	50.8
2/24/2013	45.0	1.0	1.0	1.3	48.0	0.0	0.0	56.0	0.0	53.0	48.0	3.0	2.0	50.5
2/25/2013	46.0	2.0	1.0	1.3	48.0	0.0	0.0	55.0	0.0	53.0	48.0	3.0	2.0	50.5
2/26/2013	46.0	1.0	1.0	1.3	49.0	0.0	1.0	56.0	0.0	53.0	48.0	3.0	2.0	51.0
2/27/2013	45.0	1.0	1.0	1.3	49.0	0.0	1.0	56.0	0.0	53.0	48.0	3.0	2.0	50.8
2/28/2013	45.0	1.0	1.0	1.3	50.0	0.0	0.0	55.0	0.0	53.0	48.0	3.0	2.0	50.8

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3/1/2013	46.0	1.0	1.0	1.2	48.0	0.0	0.0	54.0	0.0	53.0	48.0	3.0	2.0	50.3
3/2/2013	45.0	1.0	1.0	1.2	48.0	0.0	0.0	53.0	0.0	53.0	48.0	4.0	1.0	49.8
3/3/2013	45.0	2.0	2.0	1.2	49.0	0.0	0.0	55.0	0.0	54.0	48.0	4.0	2.0	50.8
3/4/2013	45.0	1.0	1.0	1.1	57.0	0.0	0.0	49.0	0.0	54.0	48.0	4.0	2.0	51.3
3/5/2013	45.0	2.0	1.0	1.2	55.0	0.0	0.0	46.0	0.0	54.0	48.0	4.0	2.0	50.0
3/6/2013	44.0	1.0	1.0	1.4	55.0	0.0	0.0	48.0	0.0	53.0	48.0	4.0	1.0	50.0
3/7/2013	44.0	2.0	1.0	1.5	51.0	0.0	0.0	48.0	0.0	53.0	48.0	4.0	1.0	49.0
3/8/2013	45.0	1.0	1.0	1.6	52.0	0.0	0.0	50.0	0.0	53.0	48.0	4.0	1.0	50.0
3/9/2013	45.0	1.0	1.0	1.7	53.0	0.0	0.0	50.0	0.0	53.0	48.0	4.0	1.0	50.3
3/10/2013	45.0	1.0	1.0	1.7	53.0	0.0	0.0	49.0	0.0	52.0	48.0	4.0	0.0	49.8
3/11/2013	45.0	1.0	1.0	1.7	53.0	0.0	0.0	49.0	0.0	52.0	48.0	4.0	0.0	49.8
3/12/2013	45.0	1.0	1.0	1.7	52.0	0.0	0.0	48.0	0.0	50.0	46.0	4.0	0.0	48.8
3/13/2013	45.0	1.0	1.0	1.7	53.0	0.0	0.0	49.0	0.0	49.0	45.0	4.0	0.0	49.0
3/14/2013	59.0	1.0	1.0	1.7	53.0	0.0	0.0	49.0	0.0	49.0	45.0	4.0	0.0	52.5
3/15/2013	64.0	2.0	1.0	1.7	54.0	0.0	0.0	49.0	0.0	50.0	46.0	4.0	0.0	54.3
3/16/2013	63.0	1.0	1.0	1.6	53.0	0.0	0.0	50.0	0.0	51.0	47.0	4.0	0.0	54.3
3/17/2013	66.0	1.0	1.0	1.6	59.0	0.0	0.0	50.0	0.0	48.0	44.0	4.0	0.0	55.8
3/18/2013	66.0	2.0	1.0	1.5	66.0	0.0	0.0	51.0	0.0	47.0	43.0	4.0	0.0	57.5
3/19/2013	63.0	2.0	1.0	1.5	68.0	0.0	0.0	50.0	0.0	47.0	43.0	4.0	0.0	57.0
3/20/2013	65.0	1.0	1.0	1.6	70.0	0.0	0.0	52.0	0.0	47.0	43.0	4.0	0.0	58.5
3/21/2013	65.0	2.0	1.0	1.6	72.0	0.0	0.0	56.0	0.0	46.0	42.0	4.0	0.0	59.8
3/22/2013	63.0	2.0	1.0	1.6	73.0	0.0	0.0	61.0	0.0	46.0	42.0	4.0	0.0	60.8
3/23/2013	63.0	1.0	1.0	1.6	73.0	0.0	0.0	62.0	0.0	47.0	43.0	4.0	0.0	61.3
3/24/2013	51.0	1.0	1.0	1.6	73.0	0.0	0.0	64.0	0.0	47.0	43.0	4.0	0.0	58.8
3/25/2013	45.0	1.0	1.0	1.6	72.0	0.0	0.0	66.0	0.0	49.0	45.0	4.0	0.0	58.0
3/26/2013	46.0	1.0	2.0	1.6	72.0	0.0	0.0	66.0	0.0	48.0	44.0	4.0	0.0	58.0
3/27/2013	46.0	1.0	2.0	1.6	67.0	0.0	0.0	66.0	0.0	53.0	48.0	4.0	1.0	58.0
3/28/2013	63.0	1.0	2.0	1.6	61.0	0.0	0.0	66.0	0.0	56.0	48.0	4.0	4.0	61.5
3/29/2013	47.0	1.0	2.0	1.6	60.0	0.0	0.0	66.0	0.0	58.0	48.0	4.0	6.0	57.8
3/30/2013	48.0	1.0	1.0	1.6	59.0	0.0	0.0	66.0	0.0	59.0	48.0	4.0	7.0	58.0
3/31/2013	50.0	1.0	1.0	1.5	63.0	0.0	0.0	61.0	0.0	59.0	48.0	4.0	7.0	58.3

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Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
4/1/2013	49.0	1.0	1.0	1.5	66.0	0.0	0.0	59.0	0.0	59.0	48.0	4.0	7.0	58.3
4/2/2013	53.0	2.0	1.0	1.5	63.0	0.0	0.0	59.0	0.0	60.0	48.0	4.0	8.0	58.8
4/3/2013	57.0	1.0	1.0	1.4	63.0	0.0	0.0	57.0	0.0	59.0	48.0	4.0	7.0	59.0
4/4/2013	50.0	1.0	2.0	1.4	62.0	0.0	0.0	60.0	0.0	58.0	48.0	4.0	6.0	57.5
4/5/2013	49.0	1.0	2.0	1.2	63.0	0.0	0.0	62.0	0.0	56.0	48.0	4.0	4.0	57.5
4/6/2013	47.0	1.0	1.0	1.2	63.0	0.0	0.0	62.0	0.0	54.0	48.0	4.0	2.0	56.5
4/7/2013	48.0	1.0	1.0	1.3	62.0	0.0	0.0	61.0	0.0	53.0	48.0	4.0	1.0	56.0
4/8/2013	48.0	1.0	1.0	1.3	60.0	0.0	0.0	60.0	0.0	51.0	46.0	4.0	1.0	54.8
4/9/2013	49.0	1.0	1.0	1.4	59.0	0.0	0.0	59.0	0.0	52.0	48.0	4.0	0.0	54.8
4/10/2013	48.0	1.0	1.0	1.3	60.0	0.0	0.0	60.0	0.0	52.0	48.0	4.0	0.0	55.0
4/11/2013	44.0	1.0	1.0	1.3	61.0	0.0	0.0	60.0	0.0	52.0	48.0	4.0	0.0	54.3
4/12/2013	42.0	1.0	1.0	1.3	61.0	0.0	0.0	58.0	0.0	51.0	47.0	4.0	0.0	53.0
4/13/2013	42.0	2.0	1.0	1.3	61.0	0.0	0.0	57.0	0.0	50.0	46.0	4.0	0.0	52.5
4/14/2013	42.0	2.0	1.0	1.3	59.0	0.0	0.0	55.0	0.0	51.0	47.0	4.0	0.0	51.8
4/15/2013	42.0	1.0	1.0	1.2	55.0	0.0	0.0	57.0	0.0	50.0	46.0	4.0	0.0	51.0
4/16/2013	47.0	1.0	1.0	1.2	52.0	0.0	0.0	57.0	0.0	51.0	47.0	4.0	0.0	51.8
4/17/2013	49.0	1.0	1.0	1.1	52.0	0.0	0.0	56.0	0.0	48.0	44.0	4.0	0.0	51.3
4/18/2013	48.0	1.0	1.0	1.0	52.0	0.0	0.0	54.0	0.0	48.0	44.0	4.0	0.0	50.5
4/19/2013	48.0	1.0	1.0	1.0	54.0	0.0	0.0	53.0	0.0	47.0	43.0	4.0	0.0	50.5
4/20/2013	48.0	1.0	1.0	1.1	56.0	3.0	0.0	52.0	0.0	47.0	43.0	4.0	0.0	50.8
4/21/2013	48.0	1.0	1.0	1.2	57.0	7.0	0.0	50.0	0.0	47.0	43.0	4.0	0.0	50.5
4/22/2013	48.0	1.0	1.0	1.3	57.0	5.0	0.0	50.0	0.0	47.0	43.0	4.0	0.0	50.5
4/23/2013	48.0	0.5	1.0	1.2	55.0	5.0	0.0	56.0	0.0	46.0	42.0	4.0	0.0	51.3
4/24/2013	48.0	1.0	1.0	1.1	55.0	6.0	0.0	59.0	0.0	44.0	40.0	4.0	0.0	51.5
4/25/2013	48.0	1.0	1.0	1.1	55.0	6.0	0.0	60.0	0.0	47.0	43.0	4.0	0.0	52.5
4/26/2013	48.0	2.0	1.0	1.1	56.0	6.0	0.0	60.0	0.0	50.0	46.0	4.0	0.0	53.5
4/27/2013	48.0	1.0	1.0	1.1	56.0	6.0	0.0	60.0	0.0	50.0	46.0	4.0	0.0	53.5
4/28/2013	48.0	1.0	1.0	1.1	57.0	6.0	0.0	59.0	0.0	52.0	48.0	4.0	0.0	54.0
4/29/2013	48.0	1.0	1.0	1.2	57.0	6.0	0.0	60.0	0.0	52.0	48.0	4.0	0.0	54.3
4/30/2013	49.0	1.0	1.0	1.2	56.0	6.0	0.0	60.0	0.0	52.0	48.0	4.0	0.0	54.3

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Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
5/1/2013	51.0	1.0	1.0	1.3	55.0	5.0	0.0	59.0	0.0	54.0	48.0	6.0	0.0	54.8
5/2/2013	51.0	1.0	1.0	1.3	55.0	5.0	0.0	58.0	0.0	56.0	48.0	8.0	0.0	55.0
5/3/2013	51.0	1.0	1.0	1.3	56.0	5.0	0.0	57.0	0.0	54.0	46.0	8.0	0.0	54.5
5/4/2013	52.0	1.0	1.0	1.4	55.0	5.0	0.0	57.0	0.0	52.0	44.0	8.0	0.0	54.0
5/5/2013	51.0	1.0	1.0	1.4	55.0	5.0	0.0	57.0	0.0	53.0	46.0	7.0	0.0	54.0
5/6/2013	51.0	1.0	1.0	1.4	56.0	5.0	0.0	55.0	0.0	53.0	45.0	8.0	0.0	53.8
5/7/2013	51.0	2.0	1.0	1.4	56.0	6.0	0.0	55.0	0.0	54.0	46.0	8.0	0.0	54.0
5/8/2013	51.0	2.0	1.0	1.5	57.0	6.0	0.0	56.0	0.0	53.0	46.0	7.0	0.0	54.3
5/9/2013	47.0	1.0	1.0	1.5	58.0	5.0	0.0	56.0	0.0	54.0	46.0	8.0	0.0	53.8
5/10/2013	46.0	2.0	1.0	1.5	58.0	5.0	0.0	60.0	0.0	55.0	47.0	8.0	0.0	54.8
5/11/2013	45.0	2.0	1.0	1.5	58.0	5.0	0.0	59.0	0.0	54.0	47.0	7.0	0.0	54.0
5/12/2013	45.0	1.0	1.0	1.5	57.0	5.0	0.0	59.0	0.0	55.0	47.0	8.0	0.0	54.0
5/13/2013	45.0	2.0	1.0	1.6	55.0	5.0	0.0	61.0	0.0	56.0	48.0	8.0	0.0	54.3
5/14/2013	45.0	1.0	1.0	1.6	52.0	5.0	0.0	60.0	0.0	55.0	47.0	8.0	0.0	53.0
5/15/2013	45.0	1.0	1.0	1.6	52.0	5.0	0.0	59.0	0.0	54.0	46.0	8.0	0.0	52.5
5/16/2013	45.0	2.0	1.0	1.6	52.0	5.0	0.0	59.0	0.0	54.0	46.0	8.0	0.0	52.5
5/17/2013	45.0	1.0	1.0	1.6	52.0	5.0	0.0	56.0	0.0	53.0	45.0	8.0	0.0	51.5
5/18/2013	45.0	1.0	1.0	1.5	51.0	5.0	0.0	54.0	0.0	52.0	44.0	8.0	0.0	50.5
5/19/2013	45.0	1.0	1.0	1.5	51.0	5.0	0.0	55.0	0.0	53.0	46.0	7.0	0.0	51.0
5/20/2013	45.0	2.0	1.0	1.5	51.0	5.0	0.0	53.0	0.0	52.0	44.0	8.0	0.0	50.3
5/21/2013	49.0	1.0	1.0	1.5	51.0	4.0	0.0	52.0	0.0	50.0	42.0	8.0	0.0	50.5
5/22/2013	56.0	2.0	1.0	1.5	51.0	0.0	0.0	51.0	0.0	48.0	40.0	8.0	0.0	51.5
5/23/2013	55.0	1.0	1.0	1.5	50.0	0.0	0.0	51.0	0.0	46.0	39.0	7.0	0.0	50.5
5/24/2013	50.0	1.0	1.0	1.4	52.0	0.0	0.0	48.0	0.0	45.0	37.0	8.0	0.0	48.8
5/25/2013	45.0	2.0	1.0	1.4	56.0	0.0	0.0	44.0	0.0	44.0	36.0	8.0	0.0	47.3
5/26/2013	46.0	1.0	1.0	1.5	58.0	0.0	0.0	42.0	0.0	44.0	36.0	8.0	0.0	47.5
5/27/2013	45.0	1.0	1.0	1.5	57.0	0.0	0.0	42.0	0.0	43.0	35.0	8.0	0.0	46.8
5/28/2013	46.0	1.0	1.0	1.5	54.0	0.0	0.0	45.0	22.0	41.0	34.0	7.0	0.0	46.5
5/29/2013	45.0	1.0	1.0	1.5	52.0	0.0	0.0	46.0	30.0	40.0	33.0	7.0	0.0	45.8
5/30/2013	62.0	1.0	1.0	1.5	51.0	0.0	0.0	55.0	0.0	37.0	30.0	7.0	0.0	51.3
5/31/2013	67.0	2.0	1.0	1.5	50.0	0.0	0.0	55.0	0.0	40.0	33.0	7.0	0.0	53.0
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6/1/2013	66.0	1.0	1.0	1.4	50.0	0.0	0.0	52.0	0.0	50.0	42.0	8.0	0.0	54.5
6/2/2013	67.0	1.0	1.0	1.4	54.0	0.0	0.0	51.0	0.0	50.0	42.0	8.0	0.0	55.5
6/3/2013	66.0	1.0	1.0	1.4	59.0	0.0	0.0	50.0	0.0	42.0	34.0	8.0	0.0	54.3
6/4/2013	67.0	1.0	1.0	1.3	61.0	0.0	0.0	50.0	0.0	39.0	31.0	8.0	0.0	54.3
6/5/2013	67.0	1.0	1.0	1.3	62.0	0.0	0.0	50.0	0.0	37.0	29.0	8.0	0.0	54.0
6/6/2013	67.0	1.0	1.0	1.3	62.0	0.0	0.0	52.0	0.0	35.0	28.0	7.0	0.0	54.0
6/7/2013	67.0	1.0	1.0	1.3	63.0	0.0	0.0	54.0	0.0	33.0	26.0	7.0	0.0	54.3
6/8/2013	66.0	1.0	1.0	1.3	63.0	0.0	0.0	56.0	0.0	33.0	25.0	8.0	0.0	54.5
6/9/2013	67.0	1.0	1.0	1.3	62.0	0.0	0.0	56.0	0.0	33.0	25.0	8.0	0.0	54.5
6/10/2013	78.0	1.0	1.0	1.3	62.0	0.0	0.0	56.0	9.0	29.0	21.0	8.0	0.0	56.3
6/11/2013	81.0	1.0	1.0	1.2	63.0	0.0	0.0	57.0	15.0	36.0	29.0	7.0	0.0	59.3
6/12/2013	81.0	1.0	1.0	1.2	63.0	0.0	0.0	57.0	15.0	32.0	26.0	6.0	0.0	58.3
6/13/2013	81.0	1.0	1.0	1.2	65.0	0.0	0.0	58.0	15.0	34.0	27.0	7.0	0.0	59.5
6/14/2013	81.0	1.0	1.0	1.2	69.0	0.0	0.0	57.0	15.0	39.0	31.0	8.0	0.0	61.5
6/15/2013	82.0	1.0	1.0	1.3	73.0	0.0	0.0	56.0	15.0	46.0	38.0	8.0	0.0	64.3
6/16/2013	81.0	1.0	1.0	1.3	75.0	0.0	0.0	56.0	15.0	45.0	37.0	8.0	0.0	64.3
6/17/2013	88.0	1.0	1.0	1.3	76.0	0.0	0.0	59.0	15.0	44.0	37.0	7.0	0.0	66.8
6/18/2013	91.0	1.0	1.0	1.3	76.0	0.0	0.0	63.0	6.0	46.0	38.0	8.0	0.0	69.0
6/19/2013	89.0	1.0	1.0	1.3	77.0	0.0	0.0	65.0	0.0	46.0	38.0	8.0	0.0	69.3
6/20/2013	88.0	1.0	1.0	1.4	79.0	0.0	0.0	65.0	0.0	46.0	38.0	8.0	0.0	69.5
6/21/2013	90.0	1.0	1.0	1.4	82.0	0.0	0.0	68.0	0.0	45.0	38.0	7.0	0.0	71.3
6/22/2013	89.0	1.0	1.0	1.4	83.0	0.0	0.0	69.0	0.0	44.0	36.0	8.0	0.0	71.3
6/23/2013	91.0	1.0	1.0	1.4	84.0	0.0	0.0	69.0	0.0	43.0	35.0	8.0	0.0	71.8
6/24/2013	91.0	1.0	1.0	1.4	83.0	0.0	0.0	68.0	0.0	41.0	34.0	7.0	0.0	70.8
6/25/2013	88.0	1.0	1.0	1.4	85.0	0.0	0.0	69.0	0.0	43.0	35.0	8.0	0.0	71.3
6/26/2013	86.0	1.0	1.0	1.4	87.0	0.0	0.0	71.0	0.0	42.0	35.0	7.0	0.0	71.5
6/27/2013	87.0	1.0	1.0	1.4	88.0	0.0	0.0	74.0	0.0	44.0	37.0	7.0	0.0	73.3
6/28/2013	88.0	1.0	1.0	1.4	87.0	0.0	0.0	75.0	0.0	45.0	37.0	8.0	0.0	73.8
6/29/2013	86.0	1.0	1.0	1.4	87.0	0.0	0.0	77.0	0.0	46.0	38.0	8.0	0.0	74.0
6/30/2013	86.0	1.0	1.0	1.4	87.0	0.0	0.0	78.0	0.0	47.0	39.0	8.0	0.0	74.5

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7/1/2013	86.0	1.0	1.0	1.3	86.0	0.0	0.0	78.0	0.0	47.0	39.0	8.0	0.0	74.3
7/2/2013	87.0	1.0	1.0	1.3	86.0	0.0	0.0	78.0	0.0	48.0	40.0	8.0	0.0	74.8
7/3/2013	88.0	1.0	1.0	1.3	83.0	0.0	0.0	79.0	0.0	45.0	38.0	7.0	0.0	73.8
7/4/2013	86.0	1.0	1.0	1.3	83.0	0.0	0.0	76.0	0.0	49.0	41.0	8.0	0.0	73.5
7/5/2013	86.0	1.0	1.0	1.4	86.0	0.0	0.0	74.0	0.0	51.0	43.0	8.0	0.0	74.3
7/6/2013	86.0	2.0	1.0	1.3	88.0	0.0	0.0	75.0	0.0	51.0	43.0	8.0	0.0	75.0
7/7/2013	85.0	1.0	1.0	1.2	85.0	0.0	0.0	77.0	0.0	50.0	43.0	7.0	0.0	74.3
7/8/2013	87.0	1.0	1.0	1.2	81.0	0.0	0.0	78.0	0.0	50.0	43.0	7.0	0.0	74.0
7/9/2013	87.0	1.0	1.0	1.1	81.0	0.0	0.0	80.0	0.0	52.0	44.0	8.0	0.0	75.0
7/10/2013	86.0	2.0	1.0	1.3	82.0	0.0	0.0	81.0	0.0	51.0	44.0	7.0	0.0	75.0
7/11/2013	86.0	2.0	1.0	1.3	86.0	0.0	0.0	80.0	0.0	52.0	44.0	8.0	0.0	76.0
7/12/2013	88.0	1.0	1.0	1.2	88.0	0.0	0.0	80.0	0.0	54.0	46.0	8.0	0.0	77.5
7/13/2013	88.0	2.0	1.0	1.1	87.0	0.0	0.0	79.0	0.0	54.0	46.0	8.0	0.0	77.0
7/14/2013	86.0	2.0	1.0	1.2	85.0	0.0	0.0	80.0	0.0	55.0	47.0	8.0	0.0	76.5
7/15/2013	87.0	1.0	1.0	1.1	87.0	0.0	0.0	79.0	0.0	56.0	48.0	8.0	0.0	77.3
7/16/2013	88.0	1.0	1.0	0.9	89.0	0.0	0.0	79.0	0.0	56.0	48.0	8.0	0.0	78.0
7/17/2013	88.0	1.0	1.0	0.7	87.0	0.0	0.0	81.0	0.0	56.0	48.0	8.0	0.0	78.0
7/18/2013	87.0	2.0	1.0	1.0	86.0	0.0	0.0	81.0	0.0	53.0	46.0	7.0	0.0	76.8
7/19/2013	88.0	2.0	1.0	1.1	87.0	0.0	0.0	80.0	0.0	56.0	48.0	8.0	0.0	77.8
7/20/2013	88.0	2.0	1.0	1.1	87.0	0.0	0.0	80.0	0.0	56.0	48.0	8.0	0.0	77.8
7/21/2013	86.0	3.0	1.0	1.2	87.0	0.0	0.0	77.0	32.0	53.0	37.0	16.0	0.0	75.8
7/22/2013	86.0	5.0	1.0	1.1	84.0	0.0	0.0	77.0	75.0	54.0	34.0	20.0	0.0	75.3
7/23/2013	86.0	5.0	2.0	1.4	84.0	0.0	0.0	83.0	111.0	57.0	31.0	20.0	6.0	77.5
7/24/2013	88.0	5.0	2.0	4.5	83.0	0.0	0.0	76.0	48.0	61.0	41.0	20.0	0.0	77.0
7/25/2013	87.0	5.0	2.0	1.8	86.0	0.0	0.0	75.0	23.0	65.0	45.0	20.0	0.0	78.3
7/26/2013	88.0	5.0	2.0	1.8	87.0	0.0	0.0	75.0	1.0	72.0	48.0	20.0	4.0	80.5
7/27/2013	87.0	5.0	2.0	1.9	88.0	0.0	0.0	75.0	0.0	84.0	48.0	20.0	16.0	83.5
7/28/2013	86.0	4.0	2.0	1.9	87.0	0.0	0.0	75.0	0.0	92.0	48.0	20.0	24.0	85.0
7/29/2013	86.0	2.0	2.0	1.8	88.0	0.0	0.0	76.0	0.0	93.0	48.0	20.0	25.0	85.8
7/30/2013	88.0	2.0	2.0	1.7	86.0	0.0	0.0	77.0	0.0	87.0	48.0	20.0	19.0	84.5
7/31/2013	86.0	2.0	2.0	1.7	82.0	0.0	0.0	75.0	0.0	76.0	48.0	12.0	16.0	79.8
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

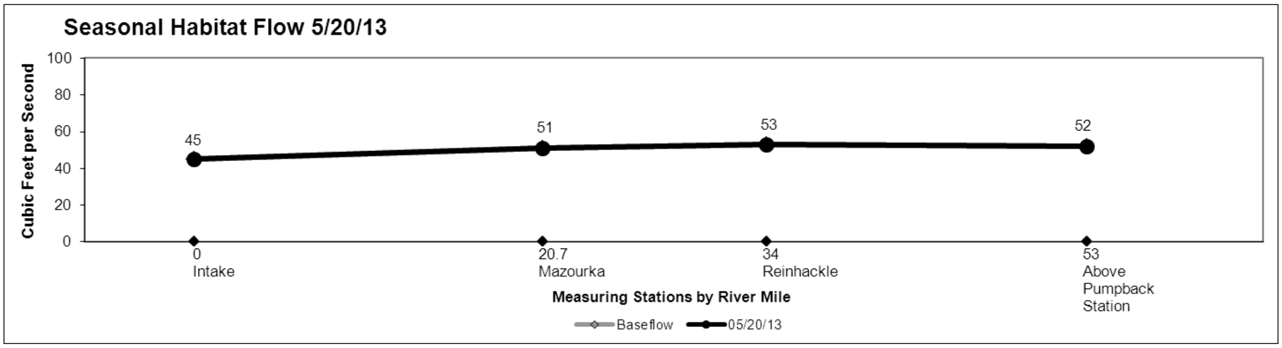
Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langeman n Gate to Delta	Weir to Delta	In Channel Average Flow
8/1/2013	86.0	2.0	2.0	1.6	79.0	0.0	0.0	77.0	0.0	72.0	48.0	8.0	16.0	78.5
8/2/2013	86.0	2.0	1.0	1.6	79.0	0.0	0.0	76.0	0.0	68.0	48.0	8.0	12.0	77.3
8/3/2013	87.0	2.0	1.0	1.7	78.0	0.0	0.0	74.0	0.0	64.0	48.0	7.0	9.0	75.8
8/4/2013	88.0	2.0	1.0	1.7	77.0	0.0	0.0	73.0	0.0	63.0	48.0	7.0	8.0	75.3
8/5/2013	87.0	2.0	1.0	1.6	76.0	0.0	0.0	67.0	0.0	63.0	48.0	8.0	7.0	73.3
8/6/2013	87.0	2.0	1.0	1.6	76.0	0.0	0.0	67.0	0.0	63.0	48.0	8.0	7.0	73.3
8/7/2013	88.0	1.0	1.0	1.5	77.0	0.0	0.0	68.0	0.0	62.0	48.0	7.0	7.0	73.8
8/8/2013	87.0	1.0	1.0	1.5	76.0	0.0	0.0	67.0	0.0	62.0	48.0	7.0	7.0	73.0
8/9/2013	87.0	1.0	1.0	1.4	76.0	0.0	0.0	67.0	0.0	61.0	48.0	7.0	6.0	72.8
8/10/2013	87.0	1.0	1.0	1.2	78.0	0.0	0.0	67.0	0.0	60.0	48.0	7.0	5.0	73.0
8/11/2013	86.0	2.0	1.0	1.3	78.0	0.0	0.0	69.0	0.0	59.0	48.0	7.0	4.0	73.0
8/12/2013	86.0	1.0	1.0	1.3	77.0	0.0	0.0	69.0	0.0	58.0	48.0	8.0	2.0	72.5
8/13/2013	86.0	1.0	1.0	1.4	76.0	0.0	0.0	69.0	0.0	58.0	48.0	8.0	2.0	72.3
8/14/2013	86.0	1.0	1.0	1.3	75.0	0.0	0.0	72.0	0.0	58.0	48.0	8.0	2.0	72.8
8/15/2013	83.0	1.0	1.0	1.2	74.0	0.0	0.0	71.0	0.0	58.0	48.0	8.0	2.0	71.5
8/16/2013	81.0	1.0	1.0	1.0	74.0	0.0	0.0	70.0	0.0	59.0	48.0	8.0	3.0	71.0
8/17/2013	80.0	1.0	1.0	0.9	74.0	0.0	0.0	70.0	0.0	58.0	48.0	7.0	3.0	70.5
8/18/2013	79.0	1.0	1.0	1.0	74.0	0.0	0.0	69.0	0.0	58.0	46.0	8.0	4.0	70.0
8/19/2013	78.0	1.0	2.0	1.1	75.0	0.0	0.0	69.0	0.0	62.0	44.0	8.0	10.0	71.0
8/20/2013	78.0	2.0	2.0	1.2	75.0	0.0	0.0	69.0	0.0	59.0	48.0	7.0	4.0	70.3
8/21/2013	74.0	1.0	2.0	1.3	74.0	0.0	0.0	70.0	0.0	59.0	44.0	8.0	7.0	69.3
8/22/2013	68.0	2.0	2.0	1.3	74.0	0.0	0.0	74.0	0.0	59.0	48.0	7.0	4.0	68.8
8/23/2013	67.0	1.0	2.0	1.3	73.0	0.0	0.0	75.0	0.0	59.0	48.0	7.0	4.0	68.5
8/24/2013	67.0	2.0	2.0	1.3	71.0	0.0	0.0	75.0	0.0	61.0	48.0	8.0	5.0	68.5
8/25/2013	68.0	1.0	2.0	1.2	67.0	0.0	0.0	73.0	0.0	59.0	48.0	7.0	4.0	66.8
8/26/2013	66.0	1.0	2.0	1.1	61.0	0.0	0.0	71.0	0.0	59.0	48.0	8.0	3.0	64.3
8/27/2013	67.0	1.0	2.0	1.1	60.0	0.0	0.0	73.0	0.0	59.0	48.0	8.0	3.0	64.8
8/28/2013	67.0	1.0	2.0	1.1	59.0	0.0	0.0	71.0	0.0	59.0	48.0	7.0	4.0	64.0
8/29/2013	66.0	2.0	2.0	1.3	62.0	0.0	0.0	68.0	0.0	60.0	48.0	8.0	4.0	64.0
8/30/2013	67.0	2.0	2.0	1.3	60.0	0.0	0.0	64.0	0.0	60.0	48.0	8.0	4.0	62.8
8/31/2013	67.0	1.0	2.0	1.3	55.0	0.0	0.0	60.0	0.0	60.0	48.0	7.0	5.0	60.5
Notes:	These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.													

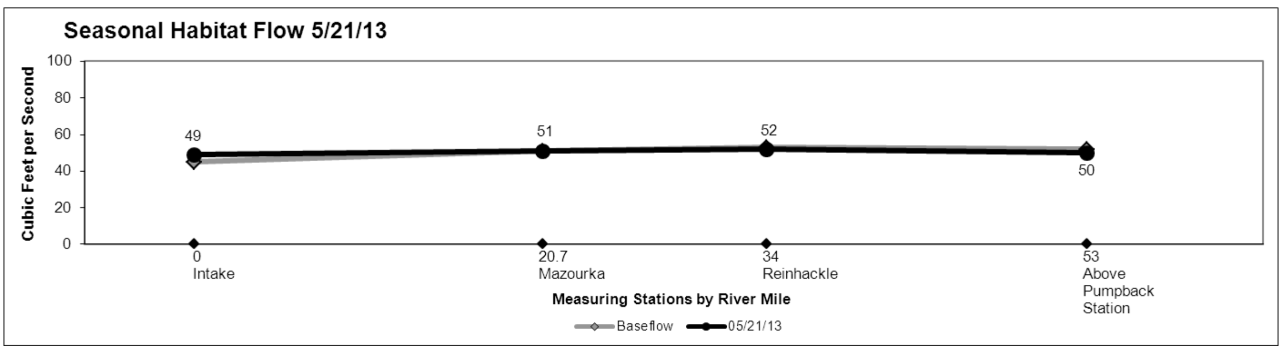
Flow Gaging Station / Date	Below River Intake	Blackrock Ditch Return	Goose Lake Return	Billy Lake Return	Mazourka Canyon Road	Locust Ditch Return	Georges Ditch Return	Reinhackle Springs	Alabama Gates Return	At Pumpback Station	Pump Station	Langemann Gate to Delta	Weir to Delta	In Channel Average Flow
9/1/2013	67.0	2.0	2.0	1.9	60.0	0.0	0.0	61.0	0.0	59.0	48.0	7.0	4.0	61.8
9/2/2013	66.0	2.0	2.0	1.5	65.0	0.0	0.0	60.0	0.0	59.0	48.0	8.0	3.0	62.5
9/3/2013	66.0	1.0	2.0	1.6	64.0	0.0	0.0	59.0	0.0	57.0	48.0	8.0	1.0	61.5
9/4/2013	67.0	1.0	2.0	1.6	63.0	0.0	0.0	62.0	0.0	56.0	48.0	7.0	1.0	62.0
9/5/2013	67.0	2.0	2.0	1.6	62.0	0.0	0.0	63.0	0.0	57.0	48.0	8.0	1.0	62.3
9/6/2013	67.0	1.0	2.0	1.5	61.0	0.0	0.0	64.0	0.0	56.0	48.0	8.0	0.0	62.0
9/7/2013	67.0	2.0	2.0	1.5	61.0	0.0	0.0	63.0	0.0	54.0	46.0	8.0	0.0	61.3
9/8/2013	67.0	1.0	1.0	1.4	60.0	0.0	0.0	61.0	0.0	51.0	44.0	7.0	0.0	59.8
9/9/2013	67.0	2.0	1.0	1.3	56.0	0.0	0.0	63.0	0.0	52.0	44.0	8.0	0.0	59.5
9/10/2013	66.0	1.0	1.0	1.2	55.0	0.0	0.0	62.0	0.0	50.0	42.0	8.0	0.0	58.3
9/11/2013	61.0	1.0	1.0	1.1	54.0	0.0	0.0	62.0	0.0	50.0	42.0	8.0	0.0	56.8
9/12/2013	57.0	1.0	1.0	1.1	55.0	0.0	0.0	63.0	0.0	49.0	42.0	7.0	0.0	56.0
9/13/2013	60.0	1.0	2.0	1.0	51.0	0.0	0.0	63.0	0.0	47.0	28.0	19.0	0.0	55.3
9/14/2013	61.0	2.0	2.0	1.0	46.0	0.0	0.0	64.0	0.0	49.0	24.0	25.0	0.0	55.0
9/15/2013	64.0	1.0	2.0	1.1	52.0	0.0	0.0	62.0	0.0	48.0	23.0	25.0	0.0	56.5
9/16/2013	63.0	1.0	2.0	1.1	53.0	0.0	0.0	61.0	0.0	48.0	23.0	25.0	0.0	56.3
9/17/2013	63.0	1.0	2.0	1.1	55.0	0.0	0.0	59.0	0.0	47.0	22.0	25.0	0.0	56.0
9/18/2013	63.0	1.0	2.0	1.1	55.0	0.0	0.0	58.0	0.0	46.0	21.0	25.0	0.0	55.5
9/19/2013	63.0	1.0	2.0	1.2	54.0	0.0	0.0	55.0	0.0	45.0	20.0	25.0	0.0	54.3
9/20/2013	60.0	2.0	2.0	1.3	54.0	0.0	0.0	53.0	0.0	45.0	20.0	25.0	0.0	53.0
9/21/2013	59.0	2.0	2.0	1.3	54.0	0.0	0.0	52.0	0.0	44.0	19.0	25.0	0.0	52.3
9/22/2013	59.0	1.0	2.0	1.3	55.0	0.0	0.0	53.0	0.0	45.0	20.0	25.0	0.0	53.0
9/23/2013	58.0	1.0	2.0	1.3	53.0	0.0	0.0	54.0	0.0	46.0	33.0	13.0	0.0	52.8
9/24/2013	59.0	1.0	2.0	1.3	52.0	0.0	0.0	54.0	0.0	44.0	37.0	7.0	0.0	52.3
9/25/2013	59.0	1.0	2.0	1.2	52.0	0.0	0.0	55.0	0.0	36.0	22.0	13.0	1.0	50.5
9/26/2013	59.0	1.0	2.0	1.1	49.0	0.0	0.0	54.0	0.0	43.0	35.0	8.0	0.0	51.3
9/27/2013	59.0	1.0	2.0	1.0	44.0	0.0	0.0	55.0	0.0	44.0	36.0	8.0	0.0	50.5
9/28/2013	59.0	1.0	2.0	1.0	41.0	0.0	0.0	54.0	0.0	44.0	36.0	8.0	0.0	49.5
9/29/2013	59.0	2.0	2.0	1.1	42.0	0.0	0.0	54.0	0.0	45.0	37.0	8.0	0.0	50.0
9/30/2013	59.0	2.0	2.0	1.2	46.0	0.0	0.0	53.0	0.0	46.0	38.0	8.0	0.0	51.0

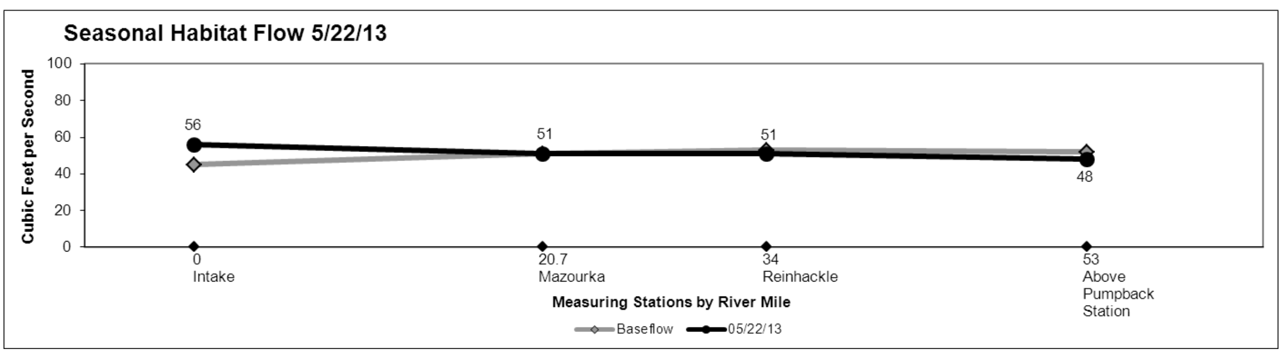
Notes: These measurements are not on the main channel of the Owens River, therefore highlighted columns are not included in average calculations.

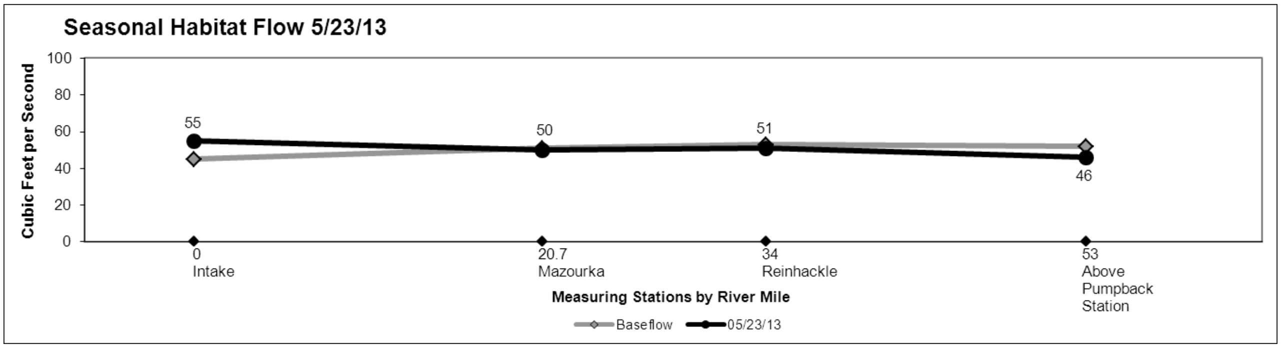
Appendix 3. Daily Average River Flow by Measuring Station and River mile for each day that the flow release occurred.

Values reported at the Pumpback Station represent the amount of flow being pumped back to the LAA. The difference between the Above Pumpback Station and Pumpback Station is the amount of water released to the Owens Lake Delta.

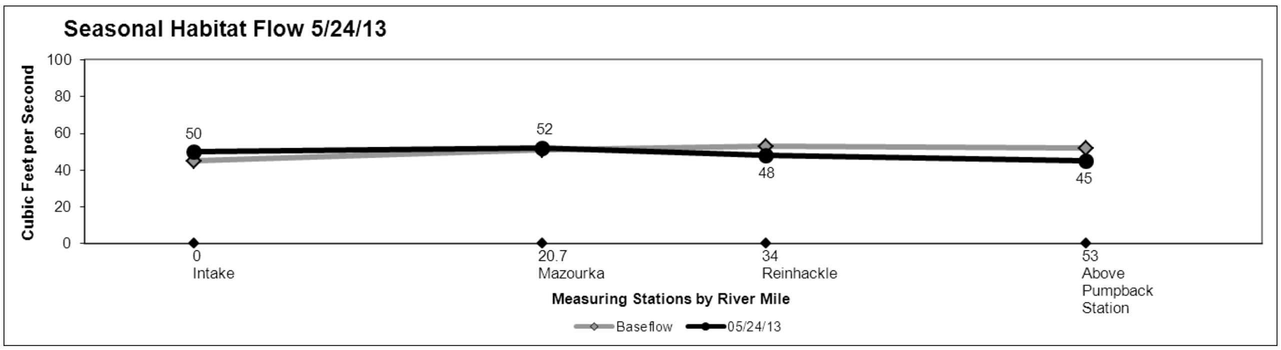




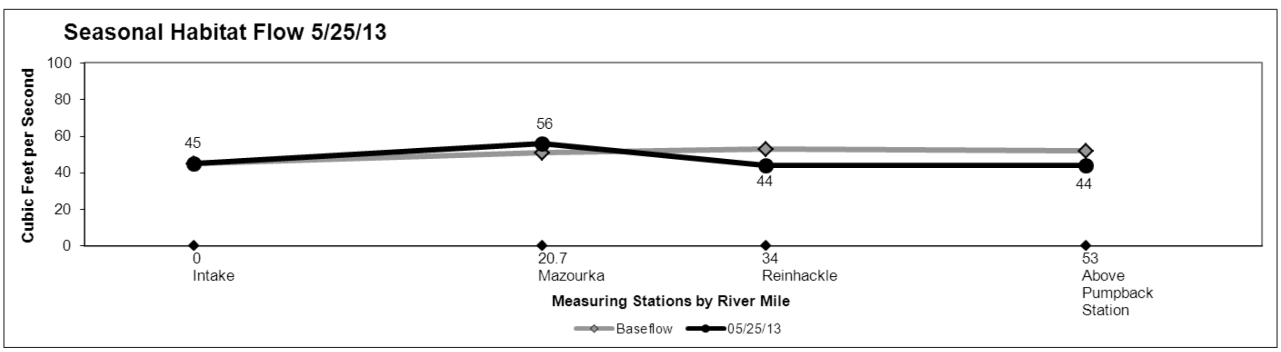




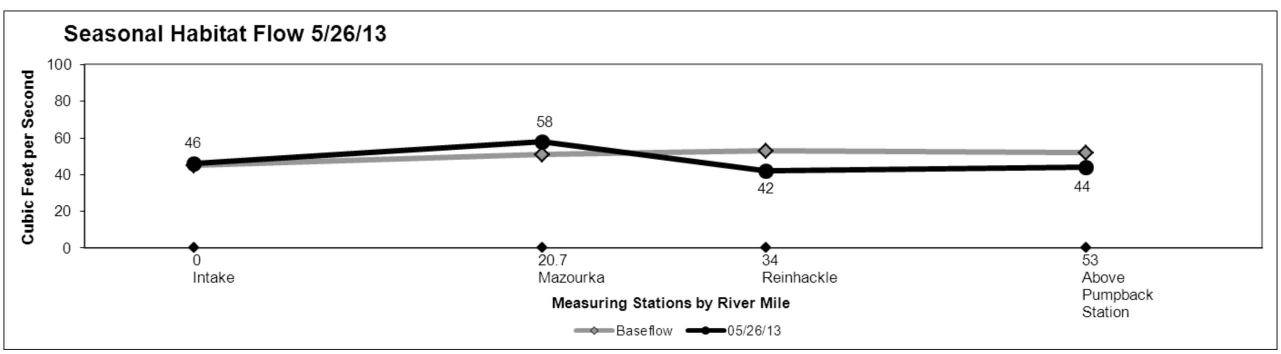
Seasonal Habitat Flow 5/23/13
Cubic Feet per Second
100
80
60
40
20
0
55
50
51
46
0
Intake
20.7
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
05/23/13



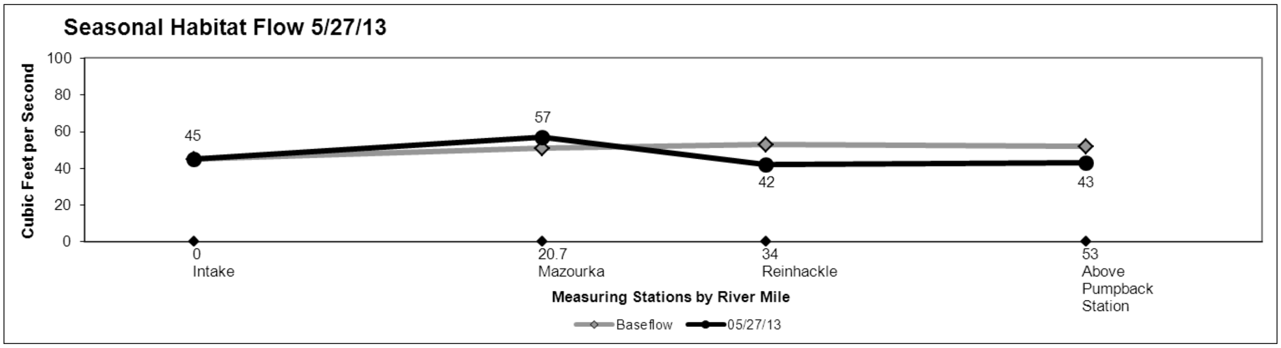
Seasonal Habitat Flow 5/24/13
Cubic Feet per Second
100
80
60
40
20
0
50
52
48
45
0
Intake
20.7
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
05/24/13

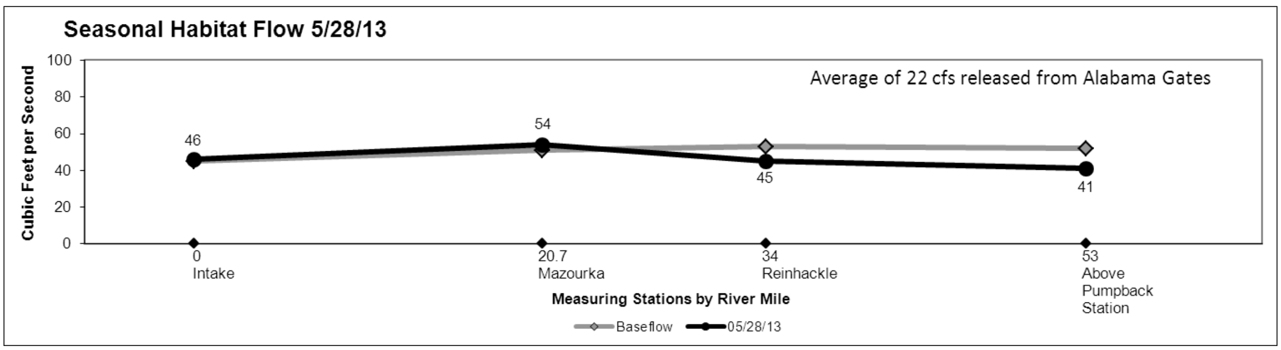


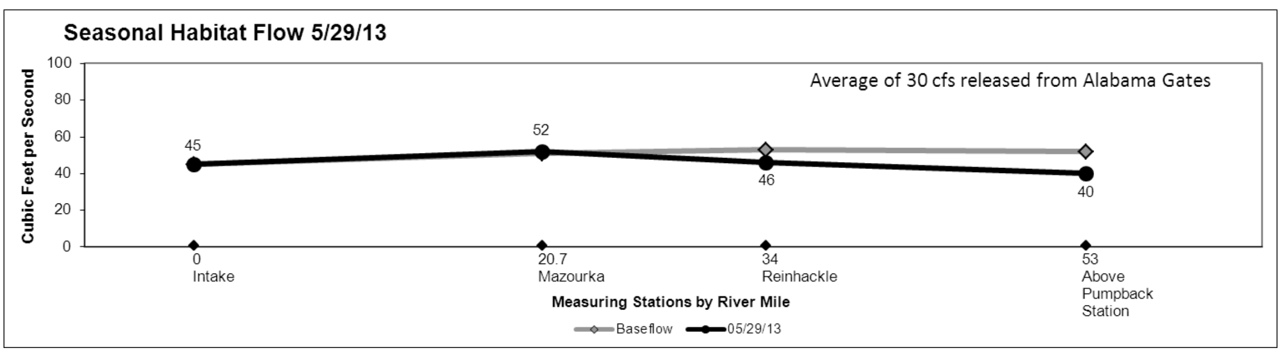
Seasonal Habitat Flow 5/25/13
Cubic Feet per Second
100
80
60
40
20
0
45
56
44
44
0
Intake
20.7
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
05/25/13

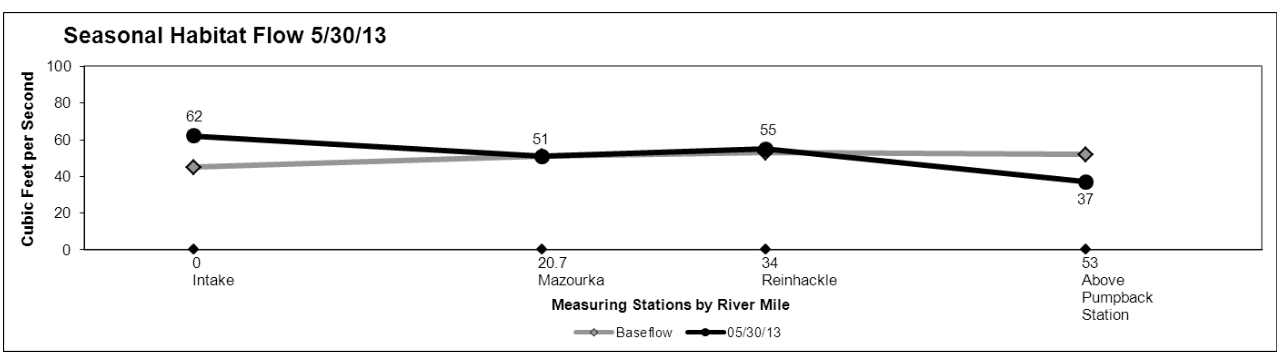


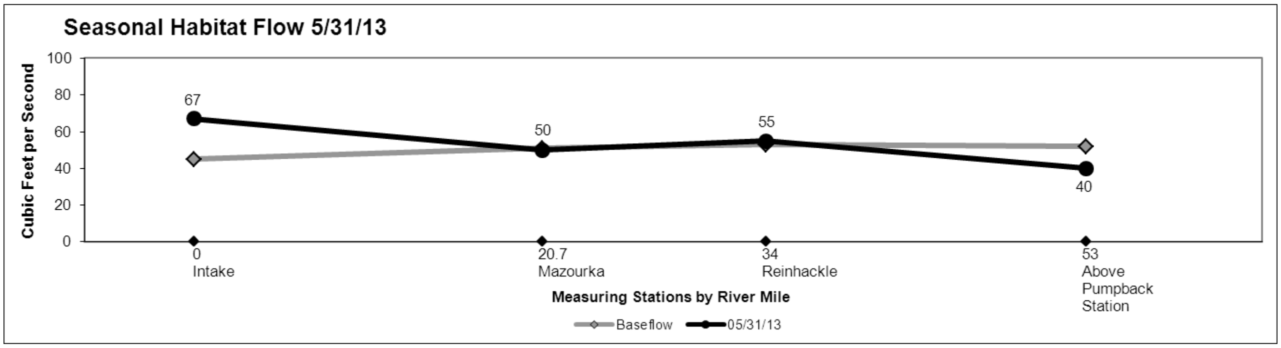
Seasonal Habitat Flow 5/26/13
Cubic Feet per Second
100
80
60
40
20
0
46
58
42
44
0
Intake
20.7
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
05/26/13

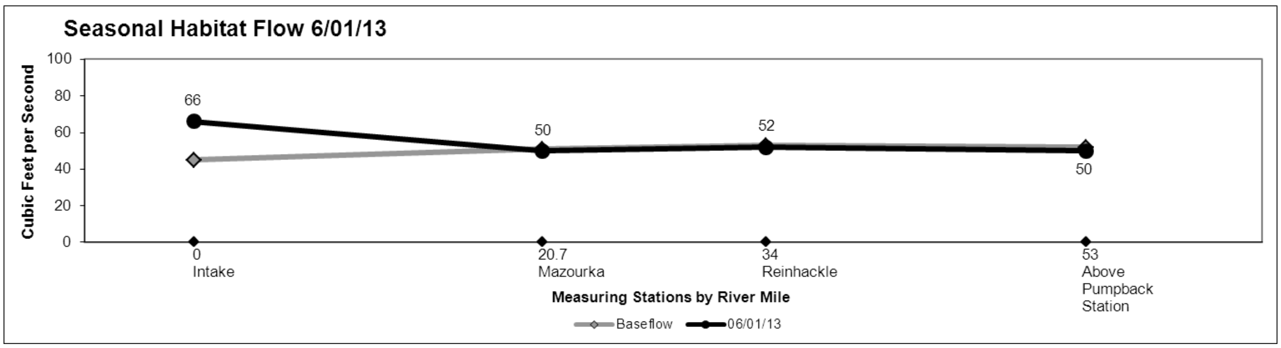

Seasonal Habitat Flow 5/27/13
Cubic Feet per Second
100
80
60
40
20
0
45
57
42
43
0
Intake
20.7
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
05/27/13

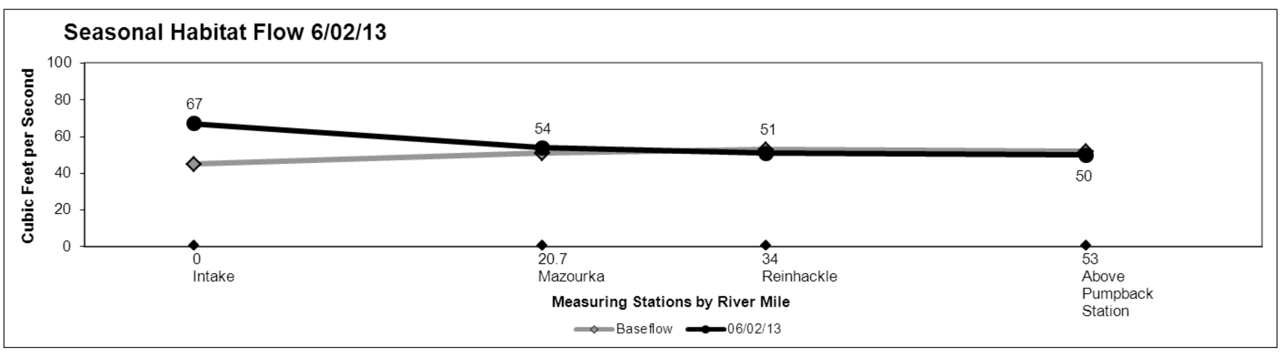

Seasonal Habitat Flow 5/28/13
Average of 22 cfs released from Alabama Gates
Cubic Feet per Second
100
80
60
40
20
0
46
54
45
41
0
Intake
20.7
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
05/28/13

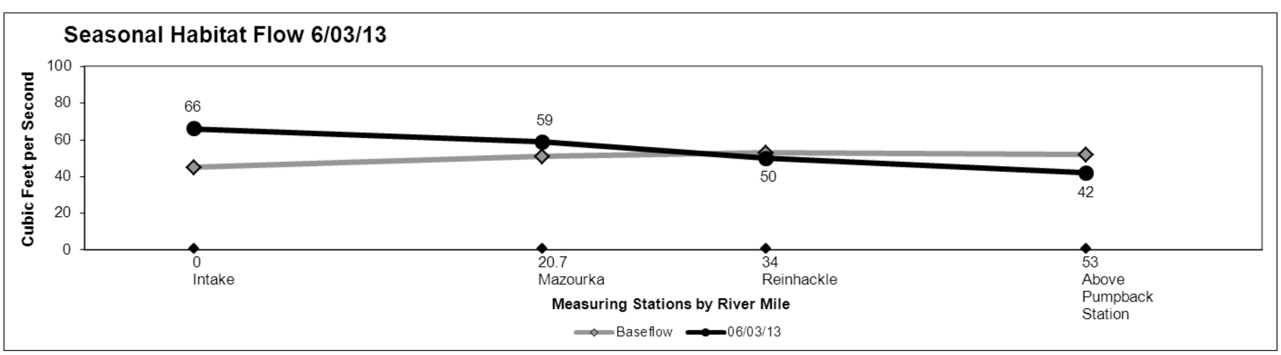

Seasonal Habitat Flow 5/29/13
Average of 30 cfs released from Alabama Gates
Cubic Feet per Second
100
80
60
40
20
0
45
52
46
40
0
Intake
20.7
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
05/29/13

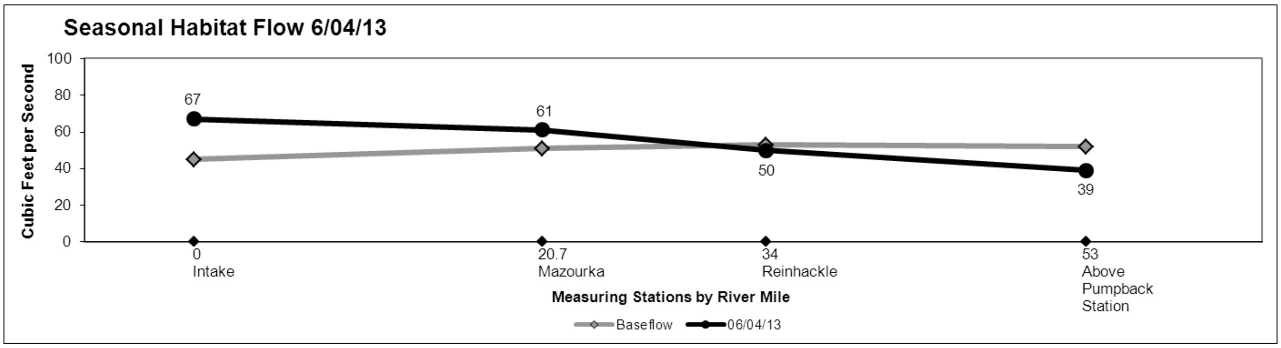

Seasonal Habitat Flow 5/30/13
Cubic Feet per Second
100
80
60
40
20
0
62
51
55
37
0
Intake
20.7
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
05/30/13


Seasonal Habitat Flow 5/31/13
Cubic Feet per Second
100
80
60
40
20
0
67
50
55
40
0
Intake
20.7
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
05/31/13


Seasonal Habitat Flow 6/01/13
Cubic Feet per Second
100
80
60
40
20
0
66
50
52
50
0
Intake
20.7
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
06/01/13


Seasonal Habitat Flow 6/02/13
Cubic Feet per Second
100
80
60
40
20
0
67
54
51
50
0
Intake
20.7
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
06/02/13


Seasonal Habitat Flow 6/03/13
Cubic Feet per Second
100
80
60
40
20
0
66
59
50
42
0
Intake
20.7
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
06/03/13


Seasonal Habitat Flow 6/04/13
Cubic Feet per Second
100
80
60
40
20
0
67
61
50
39
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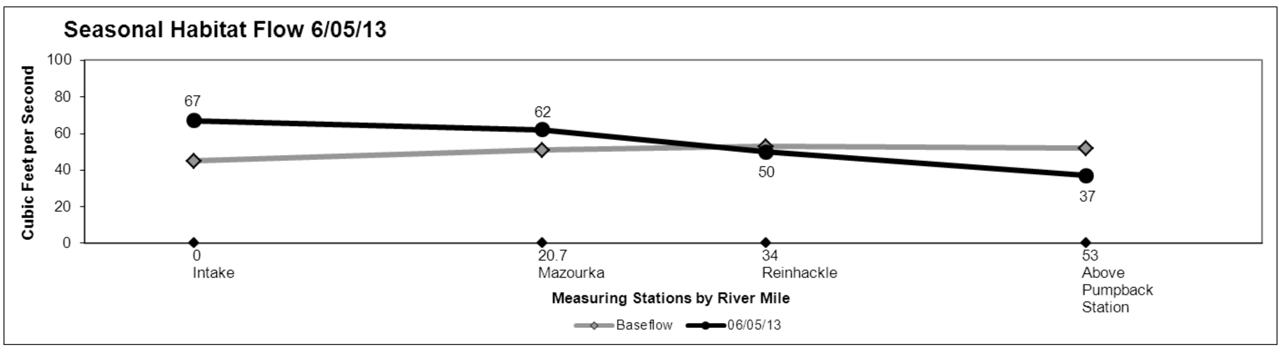
Intake
20.7
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
06/04/13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Cubic Feet per Second
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80
60
40
20
0
67
62
50
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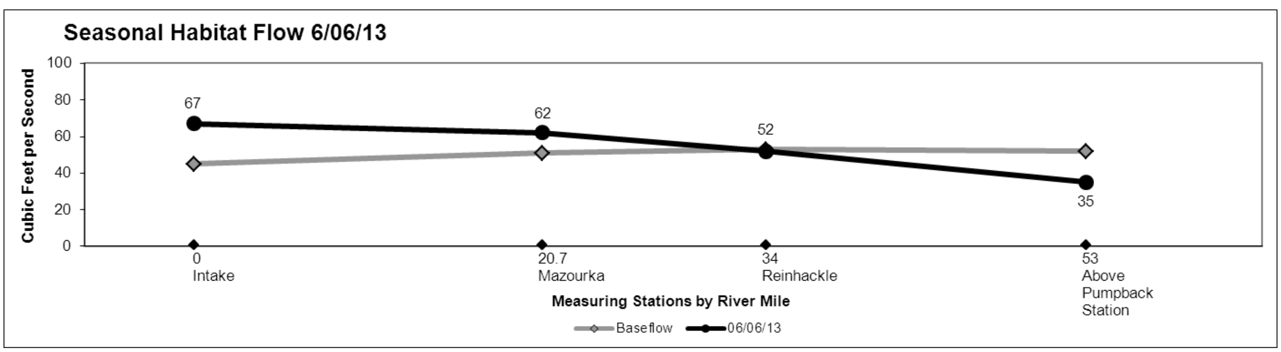
20.7
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
06/05/13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60
40
20
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20.7
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34
Reinhackle
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Pumpback
Station
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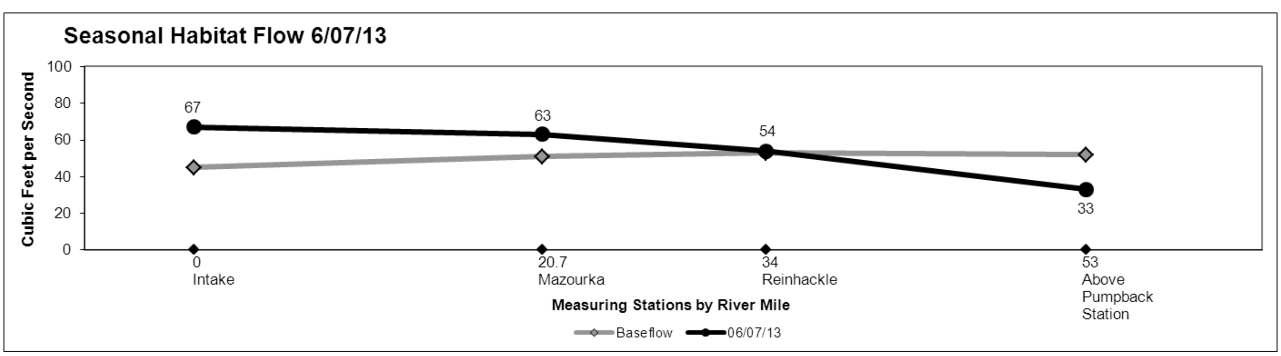
Baseflow
06/06/13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Station
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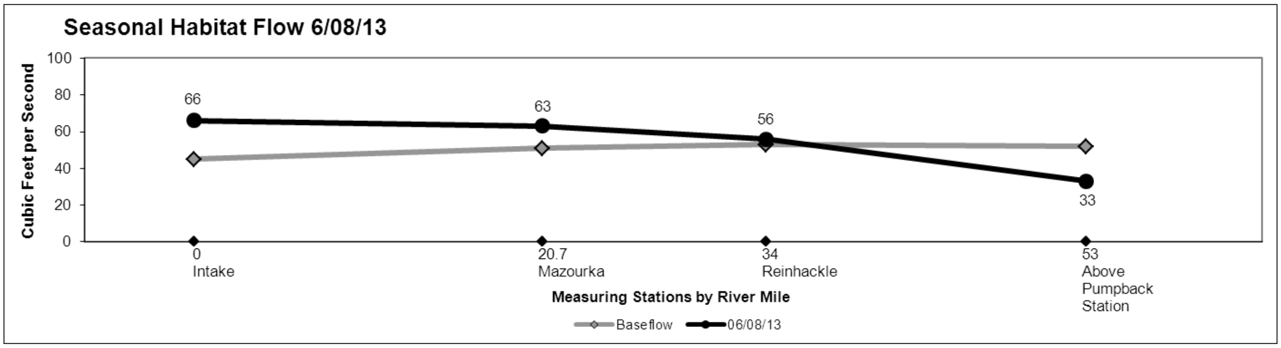
Baseflow
06/07/13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Cubic Feet per Second
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66
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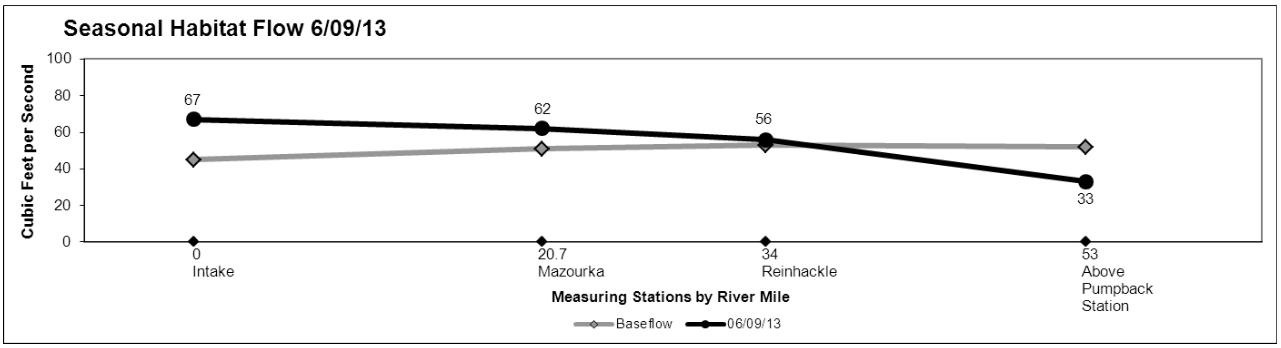
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
06/08/13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Reinhackle
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Above
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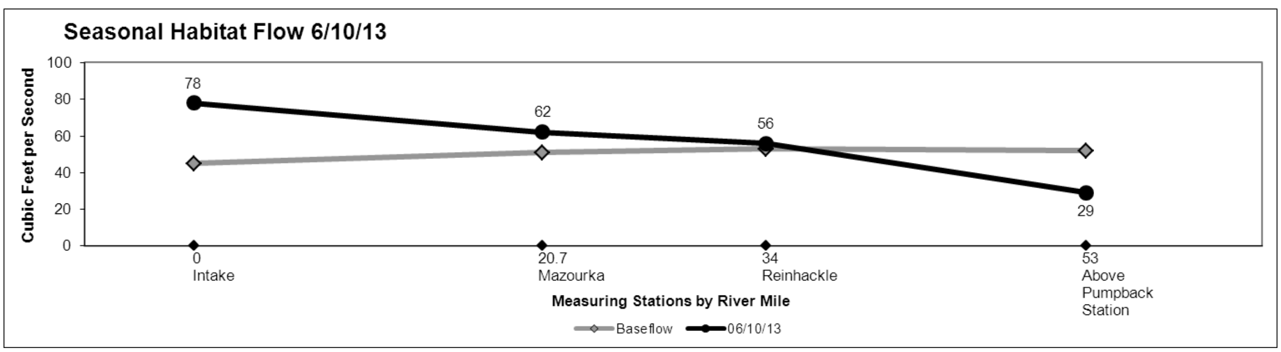
Station
Measuring Stations by River Mile
Baseflow
06/09/13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Cubic Feet per Second
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Intake
20.7
Mazourka
34
Reinhackle
53
Above
Pumpback
Station
Measuring Stations by River Mile
Baseflow
06/10/13

3.0 Delta Habitat Area Assessment

The Delta Habitat Area (DHA) is a large wetland complex that lies on the historic bed of Owens Lake at the mouth of the Owens River (WHA 2004). The DHA is 3,313 acres in size and includes both vegetated and unvegetated wetland and upland habitats. The management goal for the DHA is to maintain or enhance habitat conditions consistent with the needs of habitat indicator species (Ecosystem Sciences 2008). A minimum of 755 acres of vegetated wetland habitats will be maintained in the DHA under the Lower Owens River Project (LORP), which is the baseline acreage present prior to project implementation (LADWP 2004). Habitat management includes the implementation of base flows and seasonal habitat pulse flows.

The vegetation conditions and current use by habitat indicator species in the DHA were documented in 2013. The specific LORP monitoring metrics completed (see Table 4.01, Ecosystem Sciences 2008) were finalization of the Landscape Vegetation Mapping, Wetland Avian Surveys, and Indicator Species Habitat Monitoring using California Wildlife Habitat Relationship system (California Department of Fish and Game-CIWTG, 2008).

3.1 Description of the Delta Habitat Area

Vegetated wetlands in the DHA are distributed along east and west branches that split at the north divergence and re-converge about two miles south (Figure 1). An island of sparsely vegetated uplands exists between the two branches in the northern end of the DHA. The west branch is largely confined by the existence of a stabilized dune system that begins south of the powerline crossing, and extends south beyond the “elbow”. The area to the west of the dune system is largely dominated by sparse shrubs on wind-blown or eolian deposits. The east branch is sustained by overflow from the west branch into a confined channel that extends east approximately 0.6 miles. At this point, the there are numerous rivulets and small channels that trend south, which serve to spread water out across a large area. Drainage from these channels and rivulets converges with the west channel before splitting again into a lower east and west branch. Outflow from the lower east and west branch exists as sheet flow over sparsely playa in the brine pool transition area which drains to the brine pool.

Delta Habitat Area

Delta Habitat Figure 1. Overview of the Delta Habitat Area

3.2 Delta Habitat Area Management

The management objectives for the DHA are to supply an annual average flow of 6 to 9 cfs to maintain vegetated wetlands and create and enhance habitat conditions consistent with the needs of habitat indicator species (Ecosystem Sciences 2008). Three types of flow releases may occur into the DHA: 1) base flow, 2) pulse flows released from the pumpback station, and 3) bypass of seasonal habitat flow in riverine that exceed the capacity of the pumpback station. The annual average flow is calculated from the combined base flow and four seasonal pulse flows. Flows in the west branch generally remain more confined to the channel, while flow along the east branch spreads across a broad floodplain through many shallow braided channels, flooding marsh, meadow habitats, small ponds, and barren playa. The following is the original pulse flow schedule, and the ecological purpose of each pulse flow (Section 2.4.2.3 of the LORP EIR).

Delta Habitat Table 1. LORP EIR Original Pulse Flow Schedule

Pulse Flow Period		Duration/Flow		Ecological Purpose
Period 1	March-April	10 days	25 cfs	Early growth of saltgrass
Period 2	June-July	10 days	20 cfs	General wetland support
Period 3	September	10 days	25 cfs	Wetlands/migrating
Period 4	November-December	5 days	30 cfs	Wintering birds

The actual flow releases to the DHA during the 2012-2013 water year deviated from the above, and details are provided in Section 2 Hydrological Monitoring. The following is a summary of the releases as they pertain to conditions observed in the DHA that might influence use by habitat indicator species.

The targeted annual average flow to the DHA, for the 2012-2013 water year including base and pulse flows was 7 cfs, but the final calculated average flow for the period October 2012 to September 2013 was 8.9 cfs. All of the scheduled flows to the Delta were released as planned except for the March-April pulse flow, in which operations followed an adaptive management recommendation and released the pulse flow from the LORP Intake rather than the Pumpback Station. As stated in the Hydrological Monitoring Section, the change in release point resulted in a significant reduction in magnitude of the March-April pulse flow into the DHA due to the flow losses that occurred along the river.

The June-July pulse flow however occurred during the dual occurrence of scheduled aqueduct maintenance and an intense rainstorm that resulted in large amount of water reaching the Pumpback Station when the scheduled pulse flow was released. This resulted in a pulse flow that reached a higher peak and lasted longer than the normal schedule release. The pulse flow peaked at 45 cfs during the 10-day scheduled release at the end of July, while the additional water due to the rainstorm and aqueduct releases led to additional spillage throughout the month of August.

3.3 Landscape Vegetation Mapping

The re-mapping of vegetation conditions in the DHA, initially started in 2012, was finalized in 2013. Since the landscape vegetation mapping provides the base map for indicator species habitat monitoring, the ArcView shapefile from 2012 was reviewed prior to conducting the habitat assessment. During the review, it became apparent that the mapping had not been finalized. Corrections to errors in classification adjustments to polygon boundaries made during ground-truthing conducted in 2012, had not been applied to the shape files. The vegetation mapping for the entire DHA was re-evaluated in 2013, including additional ground-truthing to verify polygon classification and refine polygon boundaries as needed. Photos taken at wetland avian census points were also used to verify vegetation conditions.

The total acreage of each vegetation community type was determined using ArcMap vegetation mapping shapefiles. The latest available true-color and infra-red imagery (2011) was used along with Lidar.

Changes made during the 2013 mapping affect primarily the acreage reported for alkali marsh, wet meadow, woody riparian vegetation and barren. In addition to correcting polygons that were misclassified as alkali marsh, wet meadow areas were distinguished from alkali marsh based on the 2011 imagery that clearly illustrated stands of alkali marsh (consisting primarily of cattails) interspersed throughout wet meadow. The alkali marsh was found to follow water channels and areas of more reliable water supply. Previous mapping efforts included many of these wet meadow areas in alkali marsh polygons. In addition, alkali marsh was split into two distinct vegetation types, Tall Marsh and Short Marsh. Tall marsh consisted of dense stands of *Scirpus* (bulrush) and *Typha* (cattail) species, while Short Marsh was comprised exclusively of *Schoenoplectus americanus* and/or *Schoenoplectus maritimus.* This was done because certain bird species seem to prefer short marsh over tall marsh (and vice versa), and thus the identification of these distinct vegetation types may affect indicator species habitat mapping. In 2013, riparian forest and riparian scrub habitats were mapped, which had not been conducted since 2000. Saltcedar, which represented a portion of areas mapped as riparian forest in previous years was treated and removed in 2011. Ground-truthing efforts identified areas where the trees were, and Lidar was used to accurately delineate the tree canopies in the shape file.

Areas classified as either playa or barren were also carefully scrutinized. By definition, playa is periodically flooded. Barren denotes areas of wind-blown deposits that are not periodically flooded. The distinction is key because periodically flooded playa is important habitat for indicator species such as shorebirds, while barren areas are of much less value. Playa was separated from barren based on careful scrutiny of the 2011 imagery, and a review of various aerial photos of the DHA under various flooded conditions.

3.4 Wetland Avian Surveys

Systematic bird surveys are being conducted in the DHA in order to document bird species use, habitat associations, and breeding status. Bird survey data can be used to better understand the response of bird species including habitat indicator species, to changing habitat conditions in the DHA. While these avian surveys record all encountered, the analysis and discussion in this report will focus on results relevant to habitat indicator species.

Baseline surveys were conducted in the DHA from spring 2002 to early 2003, and again in 2005. Post-implementation bird surveys in the DHA have been conducted in 2009 and again in 2013. LADWP staff managed the project, and field surveys were conducted by LADWP Watershed Resources Specialists Debbie House and Chris Allen, and ICWD Field Program Coordinator, Jerry Zatorski.

3.4.1 Habitat Indicator Species

The concept of "habitat indicator species" for the DHA was first described in the MOU (MOU 1997). Habitat indicator species "represent the range of habitat conditions that are desired to be achieved" (Ecosystem Sciences 1999). Habitat indicator species for the DHA include all resident, migratory or wintering waterfowl, loons, grebe, cormorant, pelican, rail, wading bird, shorebird, gull and tern species (Ecosystem Sciences 1999). The habitat indicator species list includes species both common and expected to occur in the area, as well as species that are rare in the region such as Red-necked Grebe and Brant. Species rare in the region because of their migratory routes or specific ecological needs cannot be managed for or be expected to use the area, and therefore may not be useful by themselves as indicators of habitat quality.

3.4.2 Pre-project Baseline Surveys

In 2002, Ecosystem Sciences initially identified the two general survey routes for the DHA (Delta West and Delta East, Figure 2) and fixed point count stations along each route were established by LADWP staff and volunteers. Stations are a minimum of 250 meters apart, and up to 300 meters apart in very open habitat situations. The Delta West (DW) route consists of 25 stations, while the Delta East (DE) route consists of 17 stations.

The survey routes selected primarily cross through areas dominated by vegetated wetlands, but all habitat types present in the DHA are traversed by one of the two routes. The Delta West route follows the west side of the Owens River channel, and includes some of the brine pool transition area, while the Delta East route follows the east branch, and then traverses extensive wetland habitat east of the river channel, ending at the southern end of the lower east branch.

The survey schedule for the 2002-2003 baseline year was discussed and agreed upon by Ecosystem Sciences, LADWP, ICWD, and Point Reyes Bird Observatory. A total of five surveys were conducted during the first baseline year. Surveys were conducted in late-April, late-May, mid-June, mid-August, and mid-October of 2002, and at the end of January, 2003. Surveys were conducted by LADWP staff and local volunteers.

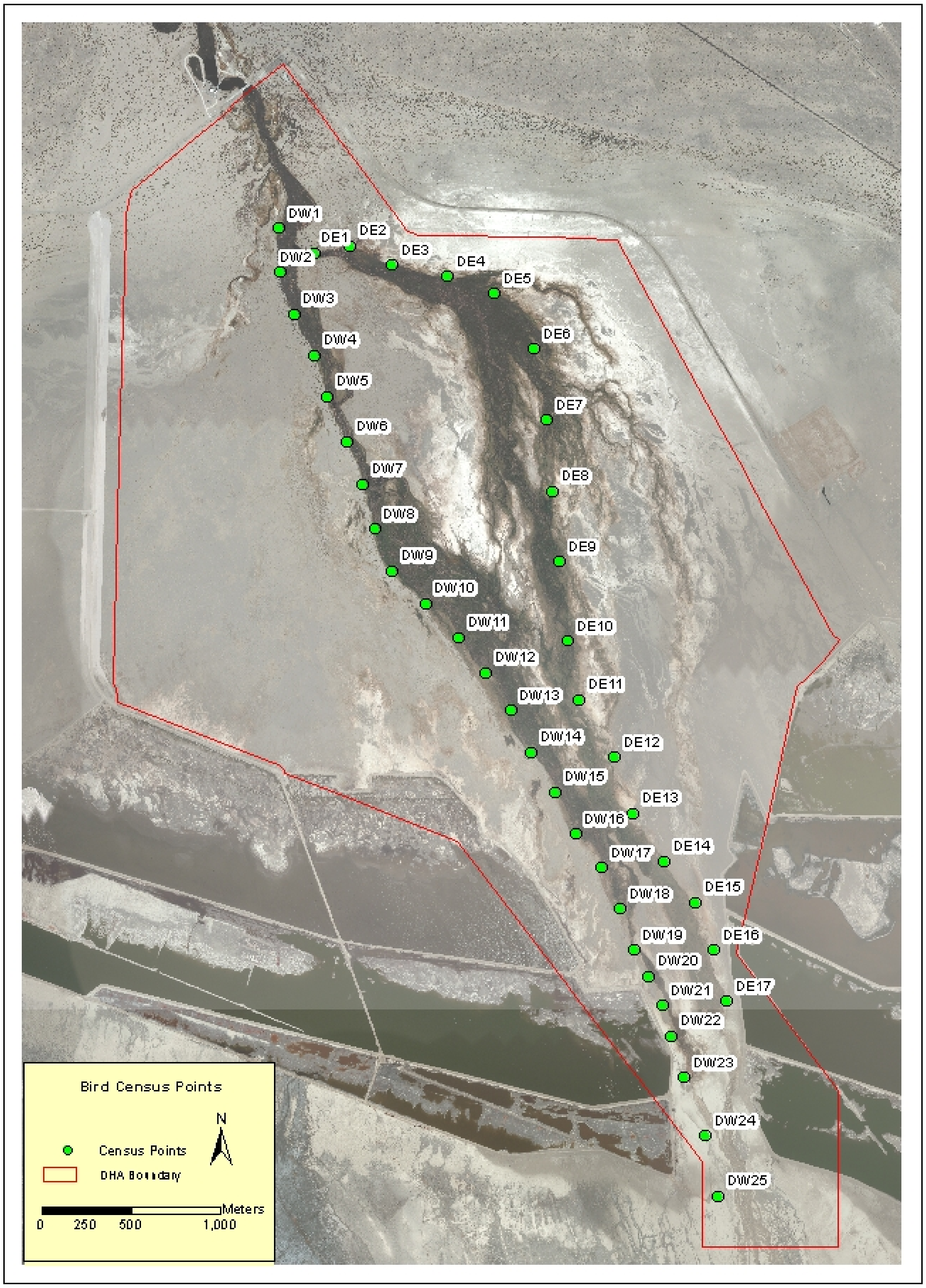
Following an evaluation of the data from the initial baseline inventory effort, LADWP staff recommended increasing the number of surveys per year in the DHA in order to increase detection of waterfowl and shorebirds during peak spring and fall migration periods. This recommendation was accepted and the schedule followed during 2005 baseline year and in subsequent years has been as follows:

- Four spring surveys at two-week intervals starting the end of March/beginning of April and ending mid-May
- Two summer surveys in June to early July
- Five fall surveys at two-week intervals starting the first week of August and ending the end of September or early October
- One to two winter surveys between November and January.

3.4.3 Post-Implementation Surveys

In 2009 and 2013, surveys were conducted by LADWP and ICWD staff following the same schedule as in 2005. The two survey routes have been completed by two people walking in opposite directions (i.e. one person surveying Delta West route north to south, while the second person surveyed the Delta East route south to north).

Delta Habitat Area



Delta Habitat Figure 2. Delta Habitat Survey Routes

3.4.4 Survey Methodology

Surveys are conducted through a combined point count and area search methodology. Fixed point count stations provide the opportunity for observers to listen for the vocalization of indicator species such as bitterns and rails, or to scan surrounding habitat areas for shorebirds, wading birds or other species. At the point count stations, observers record all species seen or heard during a 5-minute period. The area search methodology involves recording all individuals seen using the habitat area, thus observers also record species detected between points, or individuals detected between points, if the observer is certain that the individual has not been already been recorded. Distance from the point count station is recorded as being in one of four distance categories (<50 meter, 50-75 meters, 75-100 meters, >100 meters). Unlike songbirds, most of the indicator species are not highly vocal and thus are recorded primarily by visual detection. The point count data will allow for the tracking of songbird populations throughout the project period, while the use of all detections (= area search) will be better-suited for the tracking of trends in use of these areas by indicator species.

Only birds observed in or flying over the DHA were recorded. Birds observed away from the DHA, such as those flying over the Owens Lake Dust Control Area ponds were not recorded. The activity of the bird or birds and the habitat being used at initial detection were also recorded. The activities defined were: singing, calling, flying (associated with habitat), flying over (not using habitat), foraging, perching, breeding, or flushed. If the activity was recorded as "breeding", one of 10 breeding observation codes was also used to document the specific evidence of breeding seen. Examples of breeding codes include "FC" for food carry, and "MC" for material carry. The breeding observations codes used are consistent with those used by Heath and Gates (2002) during baseline bird surveys in the riverine-riparian management area of the LORP.

Surveys are started within one-half hour of local sunrise time, and generally completed within five hours. The starting point for each route is alternated each visit. Surveys were not scheduled if heavy rain or excessive winds were predicted.

3.5 Indicator Species Habitat Analysis

The California Wildlife Habitat Relationship System (CWHR) is being used to evaluate the availability of habitats for DHA Habitat Indicator Species. CWHR is a software system that contains information on life history and habitats for terrestrial vertebrates in California. CWHR contains habitat suitability values for wildlife species in California vegetation communities. CWHR has been integrated with BioView, an application that translates habitat suitability values for wildlife into data that can be used in a Geographic Information System. CWHR is operated and maintained by the California Department of Fish and Game in cooperation with the California Interagency Wildlife Task Group (CIWTG). Indicator Species Habitat Analysis was also completed in the DHA in 2009.

3.5.1 Methodology

Using CWHR, suitability values can be assigned to vegetation polygons based on three variables: vegetation community type, size and stage. CWHR provides a series of descriptions for vegetation communities found throughout the state, as well as community classification crosswalks for the various classification systems used. After determining the community type, the size and stage are evaluated. "Size" refers to plant height, age or vigor, diameter at breast height, or canopy diameter, depending on the vegetation community being assessed. "Stage" refers to canopy cover.

The 2011 aerial imagery of the LORP project area, and the 2013 vegetation mapping polygons were used to assess habitats using CWHR. Vegetation community types used for DHA mapping were cross-walked to CWHR habitats. The CWHR habitat type code was then assigned to each vegetation polygon within ArcView. A size and stage class was assigned to each polygon based on local knowledge of the area, a review of the high resolution 2011 imagery, and habitat photos taken at each bird monitoring station in 2013.

The indicator species analysis results were compared to those obtained from the 2009 analysis.

Appendix 1 provides the crosswalk used, and a description of the size classes and stages that could potentially be assigned to each polygon. The DHA vegetation types Rabbitbrush-NV Saltbush/Meadow, Eolian Scrub and Eolian-SAVE were all cross walked to as Alkali Desert Scrub (ASC) CWHR habitat type. Alkali meadow and Eolian-DISP were cross walked to Perennial Grassland (PGS). Wet meadow was equivalent to the CWHR Wet Meadow (WTM). Both Tall and Short Alkali Marsh were cross walked to Fresh Emergent Wetland (FEW). Both woody riparian categories (riparian forest and riparian shrub) were cross walked to Desert Riparian (DRI). All polygons classified as Barren in the DHA were unvegetated upland sites, some of which consisted entirely of sand deposits. All polygons mapped as “Water” were cross walked into one of two CWHR categories, Riverine (RIV) or Lacustrine (LAC). RIV is defined as intermittent or continuous flowing water or water connected to a river channel, and LAC is defined as inland depressions or dammed river channels. The majority of water polygons in the DHA represent standing water or water of very low velocity, so most water polygons were cross walked as LAC. Open water areas directly connected to the east or west branch were classified as RIV. Another vegetation category, Playa, is defined as un-vegetated areas that are periodically flooded, and this category was also cross walked as the CWHR classification of Lacustrine.

BioView was used to calculate the suitability value of each polygon for each indicator species. The output of BioView includes a separate suitability value for foraging, cover, and nesting, and both the arithmetic mean and geometric mean of the three. The arithmetic mean was used to determine habitat suitability since it would demonstrate whether there was suitable habitat for foraging, cover, or nesting. The suitability value ranges from 0 – 100, with “0” defined as not suitable. Low suitability is < or = to 33, medium suitability is 34 to 66, and high suitability values are 67-100. The CWHR Indicator Species list is very extensive and includes many species that have not been recorded in the DHA, and are not expected to occur based on the habitats currently available. The evaluation of habitat suitability was limited to those species that have been detected in the DHA during baseline or post-implementation surveys.

3.5.2 Wetland Avian Census - Data Analysis

Bird survey data was entered into a Microsoft Access database. Data entry and data verification was performed by LADWP staff. The project lead performed a final proofing of the database prior to analysis.

Habitat Indicator Species were placed into one of following categories: waterfowl, loon, grebe, cormorant, pelican, bittern, wading bird, rail, crane, shorebird, and gulls/terns. The total number of detections of each species was summed by survey and season, and the proportional abundance of all indicator species by season was calculated.

Habitat use was evaluated for each indicator species category defined above. The number of detections of birds in each category and habitat were summed over the entire year, excluding flyovers and flying birds. Habitat use data for indicator species was evaluated using Chi-squared Goodness of Fit test with the Bonferroni correction (Byers and Steinhorst 1984) to determine if indicator species use of certain habitat types was greater than expected, given the availability of a particular habitat in the DHA.
The indices of indicator species abundance, species richness, and diversity were calculated for the survey years 2005, 2009, and 2013. Differences in the mean values of these indices between seasons and years were evaluated using two-way Analysis of Variance (SigmaStat 3.5). Data was log-transformed prior to statistical analysis due to lack of normality or equal variance. Data for 2002 was not included due to the limited number of surveys conducted in that year.

3.6 Results

3.6.1 General Habitat Conditions

While the landscape vegetation mapping provides information on acreages of the different vegetation or land cover types, there are other factors, such as whether or not those land cover types are wetted or flooded that affect the quality of the habitat and indicator species usage of the DHA. Information related to the general extent of seasonal drying or flooding is thus presented in this section. This information was recorded by personnel conducting the wetland avian censuses. The general habitat conditions should be taken into consideration when evaluating the wetland avian census data, and the conditions present for habitat indicator species.

3.6.2 Baseline Wetland Avian Census: 2002-2003

Prior to implementation of the Lower Owens River Project, the DHA underwent fairly predictable variations in wetted conditions. The area was subject to seasonal inundations wherein cooler temperatures and reduced evapotranspiration rates in the winter resulted in an increase in flooding and a resultant outflow in the brine pool transition area from late fall through early spring. Increased ambient temperatures during spring and summer resulted in a period of drying from spring through early fall. Yearly weather variations affected the timing of the drying and wetting cycles. The first baseline bird survey of the Delta Habitat Area took place in late April 2002. The winter of 2001-2002 was extremely dry regionally, and the Owens Valley received less than 50% of the long-term average precipitation. Water was present in the brine pool transition area during the late April survey. By late May there was no longer outflow in the transition area. Also in late May, along the Delta West route it was noted that the area was dry south of where the east and west channels meet (approximately DW16). Along the Delta East route, some drying had also occurred; however, the larger water-filled depressions and ponds were still flooded. By August, surface water had retreated to about DW07 along the west branch and DE04 on the east branch. By October, reduced evapotranspiration demands resulted in an elevated water table and an increase in the amount of flooding over mid-summer conditions, although the transition area remained dry. The DHA was again flooded with water flowing in the transition area during the January 2003 survey due to decreased ambient temperatures and reduced evapotranspiration.

3.6.3 Baseline Wetland Avian Census: 2005 conditions

Four spring surveys were conducted in 2005 between the beginning of April and mid-May. The winter of 2004-2005 was extremely wet with the Owens Valley receiving greater than 150% of normal precipitation. During the spring of 2005, there was extensive ponding along the east side of the main channel (west branch) that attracted waterfowl and shorebirds. Water was present in the transition area through mid-May, although by the end of spring, water had receded along the east branch to approximately where DE04 is located. Water continued to recede through the summer until surface water was present to about DW05 along the main channel and DE02 along the eastern side. Surface water was more abundant by mid-October and present in the transition area again by mid-November.

3.6.4 Post-implementation Wetland Avian Census: 2009 conditions

The surveys conducted in 2009 were the first post-implementation surveys. The DHA remained wetter later into the season than was typical of pre-project conditions. Surface water was present throughout the DHA into mid-June. The mid-summer drying typical of pre-project conditions was not as extensive or dramatic in the summer of 2009 as it had been pre-project. At the beginning of August, surface water was still present as far south as DW23 along the west branch and to DE05 along the east branch, although some surface water persisted in depressions further south of this point on the east side. The first DHA pulse flow under LORP occurred in September 2009. This pulse flow was a 25 cfs release from the Pumpback Station for 10 days and was initiated on September 5. There was extensive flooding throughout the DHA during the September 15 survey as a result of the pulse flow. Water 6-10 inches deep, was encountered along most of the Delta East route during the September 15 survey and flooding was noted for areas immediately adjacent to the west branch, within the confined channel area. By October 6, most of the flooding had receded, however there was still outflow in the Brine Pool transition area. During the November 17 survey, the majority of the DHA was again flooded, likely due in part to decreased evapotranspiration demands of the vegetation within the DHA. Open water ponds existed between the east and west channels as a result of the flooding, there was outflow in the transition area, and flooding to the west of the DHA, between the west channel and the dust control cells at the south end.

3.6.5 Post-implementation Wetland Avian Census: 2013 Conditions

During the winter survey in January, observers noted very flooded conditions along the routes and a thick layer of ice in many areas. There was water present in the brine pool transistion area at this time. Conditions during the spring surveys (April through mid-May) continued to be wet with flooding throughout the DHA and water flow in the brine pool transition area. By mid-June, there was no longer flow in the brine pool transition area, however, much of the DHA was still flooded as standing water was present at least as far south as where the east and west channels rejoin (DW14 or DE11). During the fall surveys from the beginning of August through mid-October, conditions were again very wet with flooding throughout the DHA, with water flow in the brine pool transition area.

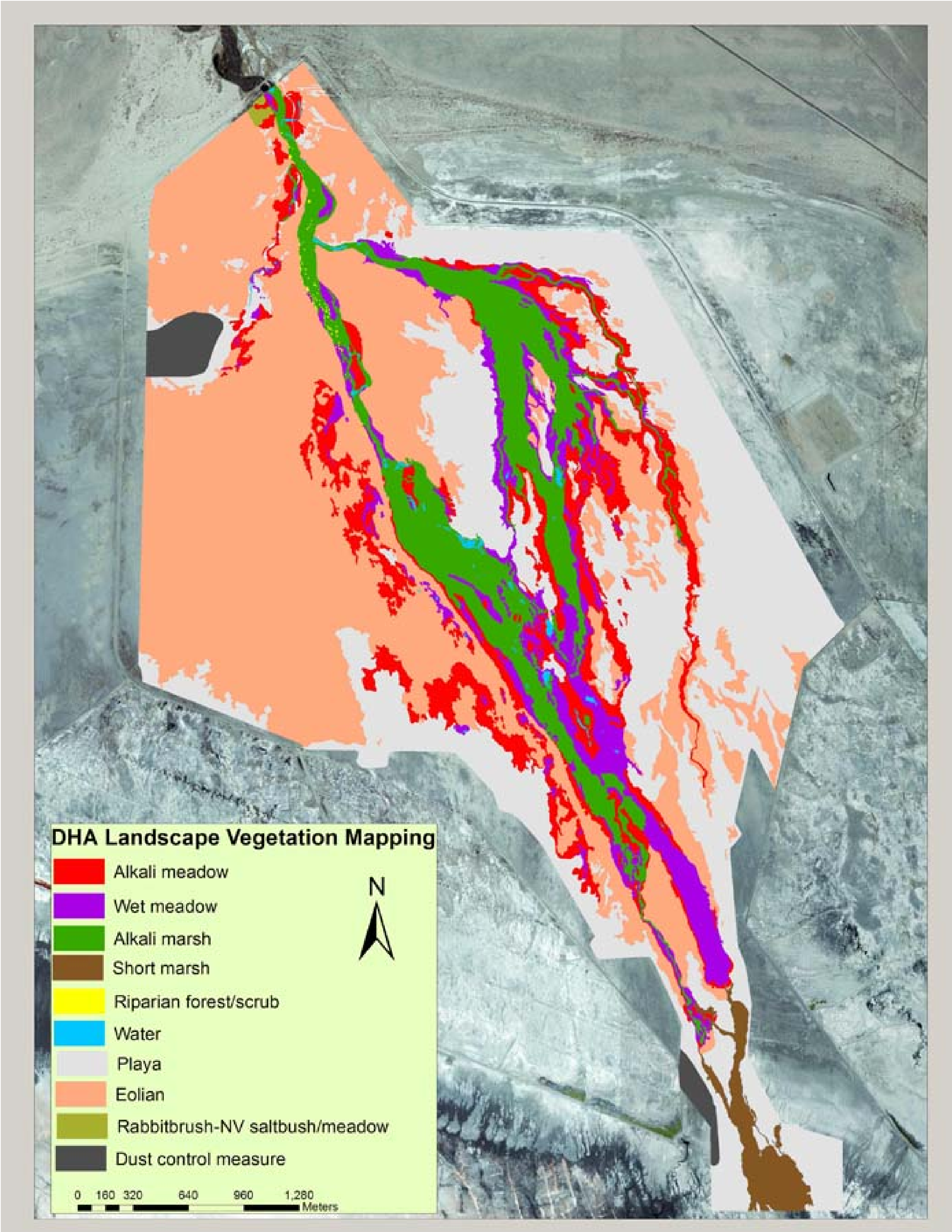
3.7 Landscape Vegetation Mapping

The Landscape Vegetation Mapping results for 2013 and for prior monitoring years are provided in Table 2. Note that the acreages of some habitat types reported for 2013 differ substantially from that reported in 2012. This is not due to habitat change between 2012 and 2013, but due to errors in reporting in 2012.

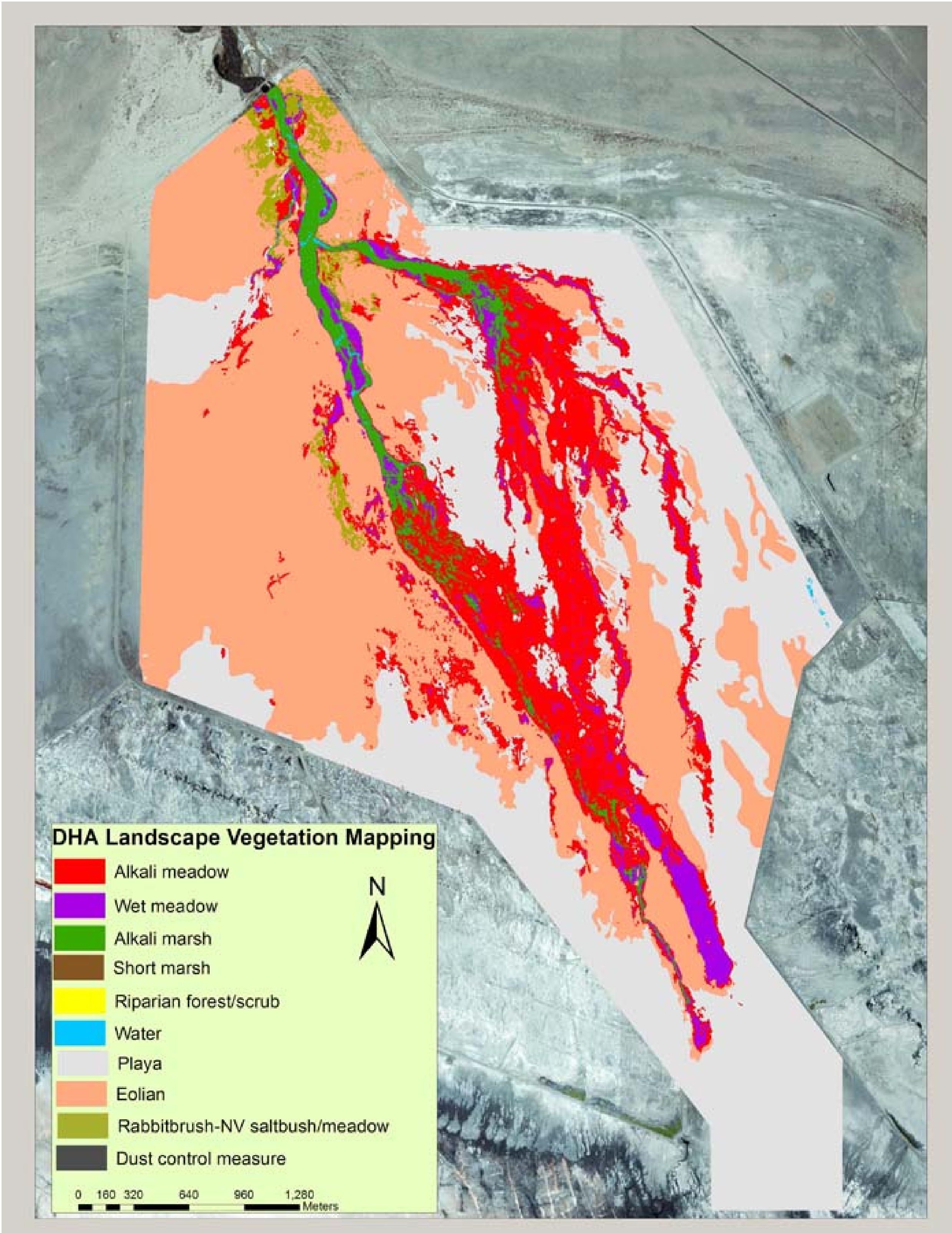
A total of 843.6 acres of vegetated wetlands were present in DHA in 2013 (Table 2, Figure 3). As compared to baseline conditions in 2005 (Figure 4), the acreage of alkali meadow has decreased, while alkali marsh habitat has shown the largest increase in acreage. This loss of alkali meadow vegetation has been largely due to type conversion to more hydric habitats such as wet meadow and alkali marsh. The most dramatic change has occurred along the east branch of the DHA, where water spreads out on the floodplain through the numerous small channels and rivulets. Type conversion has taken place in many areas along the east branch wherein alkali meadow areas have converted to wet alkali meadow, and wet alkali meadow areas have converted to alkali marsh. Similar changes have been observed along the west branch as alkali marsh has expanded southward. Alkali marsh appears to be developing in areas with the most consistent water supply, as indicated by the pattern observed during the vegetation mapping of stands of cattails following channels and rivulets. Wet meadow habitat has shown a slight increase in acreage since 2005. Riparian scrub and forest were not mapped in 2005 or 2008, thus the exact acreages of these habitats are not known for these time periods. The acreage of playa has decreased over time as vegetated wetland habitats have expanded. One large area of playa that was unvegetated playa prior to project implementation and is now vegetated is the brine pool transition area. Due to a more consistent water supply, this area has now been colonized by sparse stands of *Schoenoplectus americanus* and/or *Schoenoplectus maritimus.* The acreage of open water, which includes open-water areas both on and off the river channel, has increased slightly. Most of the open water areas mapped in DHA were small. Only one pond exists in the DHA that is over one acre in size at 1.4 acres, and three other areas greater than 0.5 acres. All other open water areas are less than 0.5 acres in size, and the majority are <0.1 acre.

Delta Habitat Table 2. Landscape Vegetation Mapping Results – Delta Habitat Area Vegetation Types and Acreages

Wetland Habitat Types	2000	2005	2008	2013
Alkali meadow	248	540.1	306.1	282.1
Wet Meadow	366	112.9	114.9	194.1
Alkali Marsh	192	97.9	292.2	365.6
Riparian Scrub				0.1
Riparian Forest	18			1.7
Water	7	4.5	2	9.5
Total wetland acres	831	755.4	715.2	843.6
Non-wetland Habitat Types	2000	2005	2008	2013
Playa	1460	1324.9	1439.6	1093
Eolian Complex	1273	1441.8	1094.9	1417.6
Eolian (barren)				
Eolian DISP				
Eolian SAVE				
Eolian scrub				
Rabbitbrush-NV Saltbush		29.1	26.9	
Rabbitbrush-NV Saltbush/meadow	7.6	29.1	29.6	3.4
Total Mapped Acreage in DHA	3571.6	3580.3	3306.2	3313.1



Delta Habitat Figure 3. Landscape Vegetation Mapping Delta Habitat Area 2013



Delta Habitat Figure 4. Landscape Vegetation Mapping Delta Habitat Area 2005 – Baseline Conditions

3.8 Wetland Avian Surveys

3.8.1 Results of 2013 Surveys

A total of 12,608 birds and 98 species, including 28 indicator species were recorded in the DHA in 2013 (Table 3).

3.8.2 Winter

One winter survey was conducted at the end of January. The fewest number of total species (26) were recorded on the winter count. Indicator species comprised approximately 27% of the species recorded, but accounted for 90% of the individuals present. Seven habitat indicator species and 1,845 habitat indicator species individuals were recorded in the DHA in winter (Tables 3, 4). The majority of the birds recorded in the DHA during this survey were indicator species of waterfowl including Snow Goose, Canada Goose and Mallard. These waterfowl were observed in the area referred to as the brine pool transition area, and at the point at which water from the DHA flows into the brine pool of Owens Lake. Small numbers of shorebirds were found at the DHA in winter including Killdeer, Greater Yellowlegs, Long-billed Curlew and Least Sandpiper. No other indicator species such as loons, grebes, cormorants, pelicans, bitterns, or wading birds were observed. Marsh Wren was the most abundant songbird species, although songbird numbers were lowest in winter, as is expected in this region.

Delta Habitat Table 3. Summary of 2013 DHA Wetland Avian Census by Season

Species	Winter	Spring	Summer	Fall
Snow Goose	1450			
Canada Goose	5			
Gadwall		33		4
Mallard	362	161	8	24
Cinnamon Teal		22		15
Northern Pintail		1		
Unidentified Teal				2
American Bittern		1	3	
Great Blue Heron		7	3	2
Great Egret		14	19	10
Snowy Egret		32	5	
Black-crowned Night-Heron		3	2	3
White-faced Ibis		79	48	138
Turkey Vulture		1		3
Bald Eagle	1			
Northern Harrier	7	13	4	18
Red-tailed Hawk	1	4	5	4
Ferruginous Hawk	1			
Virginia Rail		23	7	9
Sora		14	1	3
American Coot		9	6	1
Semipalmated Plover		4		
Killdeer	3	24	5	90
American Avocet				4
Greater Yellowlegs	7	46	1	42
Willet				2
Lesser Yellowlegs		1		1
Long-billed Curlew	2	1	1	5
Marbled Godwit				1
Western Sandpiper				5
Least Sandpiper	16	43		58
Long-billed Dowitcher				1
Wilson's Snipe		5		13
Wilson's Phalarope			3	
Unidentified Shorebird species				1
California Gull				12
Caspian Tern				1
Mourning Dove		5	4	44
Great Horned Owl				1
Common Nighthawk			1	
White-throated Swift		2	1	
Rufous Hummingbird				1
Ladder-backed Woodpecker			1	
Nuttall's Woodpecker		2		
Northern Flicker	1		1	4
American Kestrel		1	3	19
Merlin	1			
Peregrine Falcon		1		3
Prairie Falcon				1
Western Wood-Pewee		1		
Willow Flycatcher			1	
Gray Flycatcher		5		

Species	Winter	Spring	Summer	Fall
Gray Flycatcher		5		
Dusky Flycatcher		1		
Black Phoebe		2		5
Say's Phoebe	1	1		5
Ash-throated Flycatcher		6	8	2
Western Kingbird		40	26	15
Scissor-tailed Flycatcher			1	
Loggerhead Shrike	5	17	10	22
Common Raven	5	35	14	53
Horned Lark	9	2	6	158
Tree Swallow		653	41	68
Violet-green Swallow		70	1	18
Northern Rough-winged Swallow		27	3	52
Bank Swallow		2	11	37
Cliff Swallow		23	32	45
Barn Swallow		181		358
Unidentified Swallow		111	7	
House Wren		1		
Marsh Wren	59	349	232	311
Bewick's Wren	2	5	1	4
Blue-gray Gnatcatcher		2		4
Ruby-crowned Kinglet		2		
Northern Mockingbird		26	8	6
Sage Thrasher		1		
European Starling	31	40		
American Pipit	17	158		2
Orange-crowned Warbler		1		25
MacGillivray's Warbler		1		1
Common Yellowthroat		108	135	121
Yellow Warbler		3		9
Yellow-rumped Warbler		32		35
Wilson's Warbler		9		
Green-tailed Towhee		1		
Brewer's Sparrow		1		1
Vesper Sparrow		1		1
Lark Sparrow		1		
Sage Sparrow	6	1	1	2
Savannah Sparrow	3	311	211	293
Song Sparrow	15	38	20	27
Lincoln's Sparrow		2		1
White-crowned Sparrow		5		22
Western Tanager				1
Red-winged Blackbird	34	2292	733	547
Western Meadowlark	9	15		16
Yellow-headed Blackbird		786	32	85
Great-tailed Grackle			7	
Brown-headed Cowbird		8	8	24
Bullock's Oriole			1	4
House Finch			1	
Lesser Goldfinch		1		17
Total birds	2053	5930	1683	2942
Average # birds/survey	2053	1482.5	841.5	588.4

3.8.3 Spring

Four spring surveys were conducted between the beginning of April through mid-May. The highest number of total species (73) were recorded in spring. Indicator species comprised approximately 27% of the species recorded, but accounted for only 9% of the individuals present. Twenty indicator species and 523 habitat indicator species individuals were recorded in the DHA in spring, including waterfowl, bitterns, wading birds, rails, and shorebirds (Tables 3 and 4). The most abundant waterfowl species was Mallard. The most abundant wading bird species were White-faced Ibis and Snowy Egret. Both Virginia Rail and Sora were present. Greater Yellowlegs, Least Sandpipers and Killdeer were the most numerous shorebirds. No other indicator species such as loons, grebes, cormorants, pelicans were observed. Songbird abundance and species richness was also high in spring, as breeding species such as Common Yellowthroat, Savannah Sparrow and Yellow-headed Blackbird arrive on territories, and migrants move through the region.

3.8.4 Summer

Two summer surveys were conducted between mid-June and July 1. A total of 47 species were recorded in summer. Indicator species comprised approximately 27% of the species recorded, but accounted for only 7% of the individuals present. There were 14 indicator species and 112 individuals recorded in the DHA in summer, including waterfowl, bitterns, wading birds, rails and shorebirds (Tables 3 and 4). Wading birds were the most abundant indicator species group and the most abundant wading bird species were White-faced Ibis and Great Egret. Only small numbers of waterfowl and shorebirds used the area in summer. No other indicator species such as loons, grebes, cormorants, pelicans were observed. The most abundant songbird breeding species were Marsh Wren, Common Yellowthroat, Savannah Sparrow and Red-winged Blackbird. Nesting was not confirmed for any indicator species. One Killdeer was suspected to have an active nest, however the nest was not located.

3.8.5 Fall

There were five fall surveys conducted between the beginning of August through mid-October. The second highest number of total species (70) for the year were recorded in fall. Indicator species comprised approximately 30% of the species recorded, but accounted for only 15% of the individuals present. Twenty-three indicator species and 447 individuals were recorded in the DHA in fall, including waterfowl, wading birds, rails, shorebirds, and gulls and terns (Tables 3 and 4). Shorebirds were the most abundant indicator species group. As was the case in spring, Greater Yellowlegs, Least Sandpipers and Killdeer were the most numerous shorebirds. The most abundant waterfowl species were Mallard and Cinnamon Teal. The most abundant wading birds were White-faced Ibis. No other indicator species such as loons, grebes, cormorants, pelicans were observed. Songbird abundance and species richness was second highest in fall, as some breeding species remained on territories, and fall migrants moved through the region.

Delta Habitat Table 4. Seasonal Abundance of Habitat Indicator Species Groups

Winter	**2005**	**2009**	**2013**	**Spring**	2005	2009	2013
Waterfowl	6	452	1817	Waterfowl	628	249	217
Loons				Loons			
Grebes				Grebes		1	
Cormorants				Cormorants			
Pelicans				Pelicans			
Bitterns		1		Bitterns	11	13	1
Wading Birds		1		Wading Birds	18	219	135
Rails	1	17		Rails	26	74	46
Cranes	1	1		Cranes			
Shorebirds	1	1	28	Shorebirds	273	131	124
Gulls/terns				Gulls/terns			
Total Indicator Species	**9**	**473**	**1845**	**Total Indicator Species**	**956**	**687**	**523**
Summer	**2005**	**2009**	**2013**	**Fall**	**2005**	**2009**	**2013**
Waterfowl	8	33	8	Waterfowl	2	42	45
Loons				Loons			
Grebes				Grebes			
Cormorants				Cormorants			
Pelicans				Pelicans			
Bitterns	1	10	3	Bitterns		3	
Wading Birds	1	5	77	Wading Birds	23	16	153
Rails	1	22	14	Rails	8	51	13
Cranes				Cranes			
Shorebirds	8	10	10	Shorebirds	2	48	223
Gulls/terns				Gulls/terns		52	13
Total Indicator Species	**19**	**80**	**112**	**Total Indicator Species**	**35**	**212**	**447**

3.9 Habitat Use

The indicator species groups showed different habitat use patterns (Table 5). Waterfowl were observed primarily in areas of alkali marsh, water and playa. The number of observations in water and playa were significantly higher than expected given the availability of these habitat types and the number of observations. The overwhelming majority of observations of waterfowl using playa habitat occurred in the in the winter when a large flock of Snow Geese and Mallard were observed in the brine pool transition area. In other seasons, most waterfowl were found in close association with small off-river ponds in the east part of the DHA. Rails were detected primarily in alkali marsh, water and wet meadow, and showed a preference for alkali marsh and water. Wading birds are preferentially selecting for alkali meadow, wet meadow, and water, while avoiding playa. The most abundant wading bird in the DHA is White-faced Ibis and flocks were frequently encountered from late spring through early fall feeding in flooded alkali and wet meadow habitats, or at the margins of ponds. Shorebirds have been observed in meadow habitats, but the number of observations in water and playa are significantly higher than expected. The most frequently encountered shorebirds were Killdeer, Greater Yellowlegs, and Least Sandpipers. Killdeer used dry and flooded playa areas, while Least Sandpipers used wet or inundated playa areas. Greater Yellowlegs used inundated playa habitats, but were also frequently encountered using small ponds surrounded by vegetation. All of the indicator species groups are preferentially selecting for open water habitats, which occur in the DHA as small scattered ponds.

Delta Habitat Table 5. Habitat Use Data for Indicator Species Groups - 2013

	Waterfowl			Rails			Wading Birds			Shorebirds		
Habitat	Obs	Exp	Sign	Obs	Exp	Sign	Obs	Exp	Sign	Obs	Exp	Sign
Alkali meadow	3	173.8	-	1	6.4	-	61	23.8	+	10	28.4	-
Wet meadow	12	119.6	-	9	4.4	NS	106	16.4	+	32	19.5	NS
Alkali marsh	48	225.2	-	52	8.4	+	9	30.9	-	14	36.8	-
Riparian forest/shrub		1.1	-		0.0	-	1	0.2	NS	2	0.2	NS
Water	143	5.9	+	10	0.2	+	86	0.8	+	55	1.0	+
Playa	1734	673.3	+		25.0	-	3	92.3	-	194	110.0	+
Eolian Barren		109.3	-		4.1	-		15.0	-	3	17.9	-
Eolian Scrub		552.4	-		20.5	-		75.7	-	3	90.3	-
Dune (Eolian SAVE)		79.3	-		2.9	-		10.9	-	4	13.0	-
Total	1940			72			266			317		

3.9.1 Indicator Species Habitat - CHWR Results

The total acreage of CWHR-classified habitat in 2013 was compared to that mapped in 2009 (Table 6, Figure 5, 6, and 7). As compared to 2009, there was a minor decrease in Alkali Scrub (ASC) habitat in 2013, and a dramatic decrease in areas classified as Barren (BAR) habitat (Table 6, Figure 5). Many areas classified as BAR in 2009 were actually playa based on soil type and flooding regime, and thus were classified as LAC in 2013. ASC has little value for the indicator species and BAR has little value for most, so a decrease in these habitats translates to an increase in valuable habitat for each species. Desert Riparian (DRI) habitat remains a small component of the DHA vegetation. Small willows along the marsh edge are growing larger and dead willows (that died during the initial LORP flooding) are re-sprouting. Riparian tree willow habitat is primarily used by passerines and other bird species that are not on the indicator species list; however, riparian trees and shrubs are used by indicator species such as some of the wading birds species. There was a moderate increase in Fresh Emergent Wetland (FEW) habitat. Fresh emergent wetland, consisting primarily of dense stands of cattails in the DHA, has been consistently spreading, following the water channels. There was a dramatic increase in Lacustrine (LAC), because much of the area mapped as BAR in 2009, was mapped as playa in 2013, based on soil type and water regime. Under current conditions, there are large areas of intermittently flooded playa, and smaller areas of playa that are consistently flooded, all of which are classified as LAC under CWHR. There is little Riverine (RIV) habitat along the west or east branches due to the low velocities in the channels, and dense cattails and bulrush. There has been little change in RIV habitat. Perennial grassland (PGS) has increased since 2009. The habitat provides important foraging habitat for many of the indicator species, particularly when flooded. There has been a moderate increase in WTM (wet meadow) since 2009 as it continues to respond to current water management of the DHA.

The total acreage of suitable habitat for each indicator species analyzed was determined for 2009 and 2013 (Figure 8). The acreage of low, medium and high suitability habitat for indicator species in the DHA was determined for 2013 (Figure 9). As previously stated, the species analyzed using CWHR was shortened to include only those species that occur regularly in the DHA. In Figure 8, species within the same indicator species group with the same total suitable acreage were combined to enhance readability.

As determined by CWHR, suitable habitat has increased since 2009 for all species evaluated except gulls and terns, and most shorebird species (Figure 8). For most ducks and geese, suitable habitat more than doubled. According to the CWHR model, FEW (marsh), PGS (perennial grassland) and WTM (wet meadow) generally provides medium to high habitat quality for ducks and geese, and those habitats seem to be increasing. Overall, LAC provides medium to low habitat quality for these species, however permanently flooded off-river ponds that were classified as LAC are high suitability habitats.

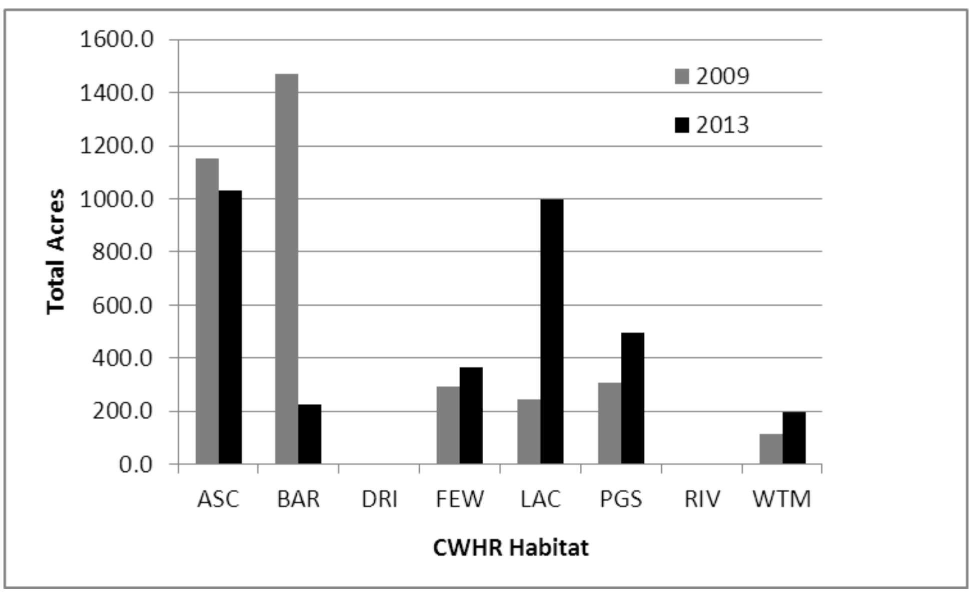
Figure 9 demonstrates the quantity habitat in each suitability ranking available for each species. All available habitat for Canada Goose and Northern Pintail was ranked as high quality. Most of the habitat for American Wigeon was high quality. Cinnamon Teal, which has occurred regularly in the DHA, generally in small numbers, has primarily low quality habitat, while Green-winged Teal and Blue-winged Teal, which are rarely found in the DHA, have primarily medium quality habitat. Mallard and Gadwall, which regularly occur in the DHA, have equal portions of high and medium habitat. Habitat for all bittern and wading bird species increased significantly. Least and American Bittern have a large portion of low quality habitat and a smaller portion of high quality habitat available. According to the CWHR model those two species prefer FEW (marsh), but will use LAC and RIV (open water). For herons and egrets, available habitat more than doubled. Great Egret, Snowy Egret and Great Blue Heron have primarily high quality habitat, while Black-crowned Night Heron has primarily low quality habitat. The increase in Virginia Rail and Sora habitat was less significant than the others. However, the CWHR model indicates that they prefer FEW and WTM and, both of these habitats have increased since 2009, and are continuing to increase. According to the CWHR model, all habitats available for those two species are high quality. Habitat for American Avocet, Black-necked Stilt, Semi-palmated Plover, Lesser Yellowlegs, Long-billed and Short-billed Dowitcher, Long-billed Curlew, Marbled Godwit, and Western and Least Sandpipers has decreased since 2009. Several of those species received medium to high values from the CWHR model for BAR habitat. The model probably gives BAR such a high value because that is what shorebirds primarily use on the coast. However, in the DHA, they prefer playa, which translates to the CWHR habitat of LAC. According to the CWHR model for these shorebird species, LAC, FEW, RIV, and WTM are in general medium quality habitats. In the DHA, most of the habitats available for American Avocet, Black-necked Stilt, Long-billed Curlew, Marbled Godwit, Western and Least Sandpiper, and the Dowitchers are high quality, while habitats available for Semi-palmated Plover are low quality, and habitats for Lesser Yellowlegs are medium quality. Since 2009, the acreage of suitable habitat for Greater Yellowlegs, Willet, Killdeer, and Wilson’s Snipe has increased. Almost all available habitat for Killdeer is high quality. Most of the habitat available for Willet is high quality, and the majority of habitat available for Greater Yellowlegs is medium quality. Available habitat for Wilson’s Snipe more than doubled in 2013 because of the increase in LAC, but the majority of it is low quality. Wilson’s Phalarope had the largest quantity of suitable habitat in 2013. Almost half of the suitable habitat for this species is low quality, but the remaining portion is primarily high quality. The large portion of low quality habitat is accounted for due to the rating of PGS and ASC as low quality habitat of this species, and these are two habitat types that form a large proportion of the DHA. The CWHR model gave FEW and WTM a high quality rating for Wilson’s Phalarope, and a large portion of the DHA includes those habitats.

3.10 Comparison of Wetland Avian Census Data with CWHR results – 2009 versus 2013

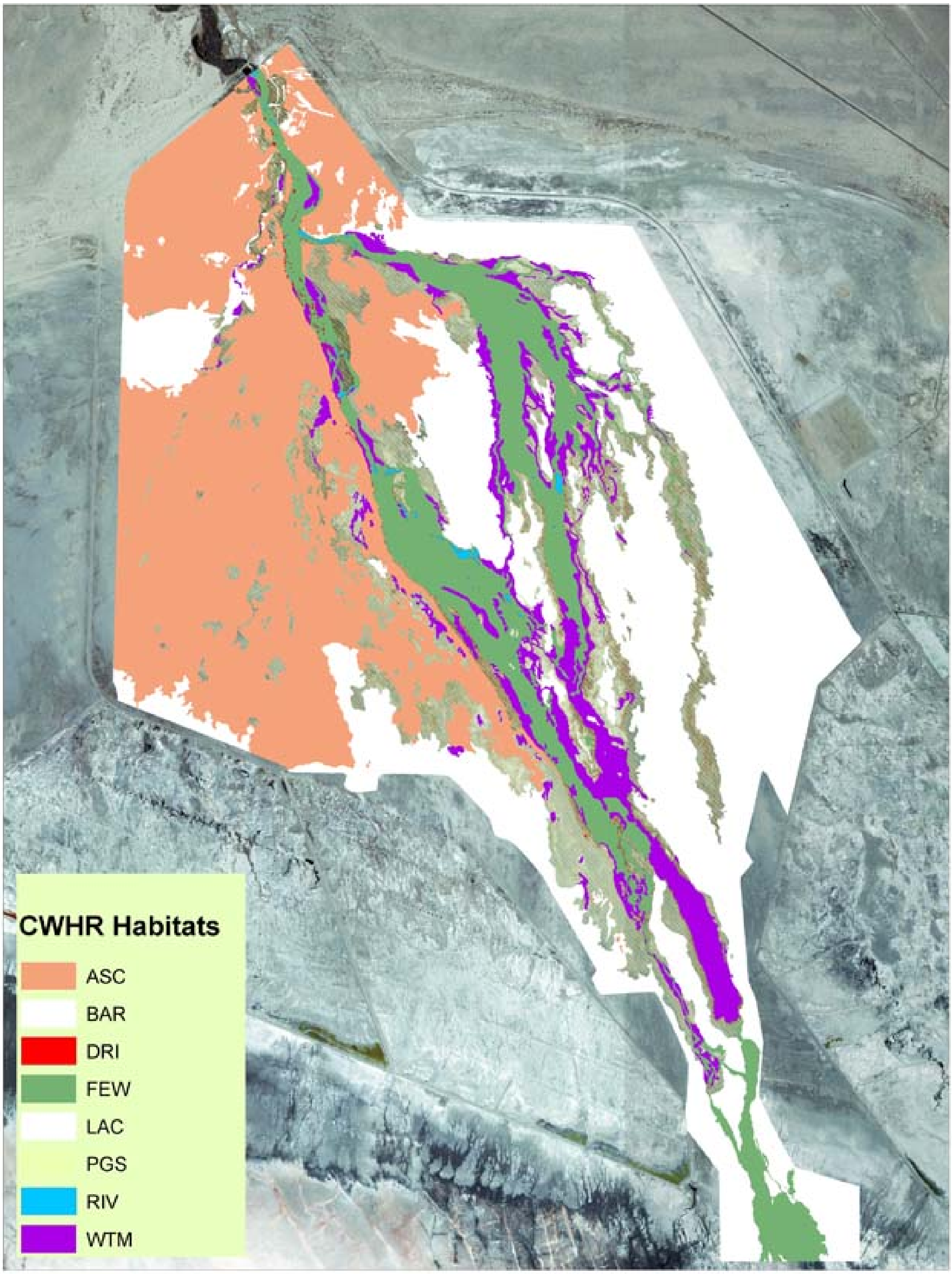
Use of the DHA by indicator species in 2009 was compared to 2013 to see if changes in suitable habitat acreage were reflected in use of the DHA by the species or species group. There was an increase in the number of Snow Geese, Mallard/Gadwall in 2013 over 2009, which corresponds to the increase in suitable habitat as determined by CWHR. Bittern detections were fewer in 2013 despite the apparent increase in suitable habitat. The use by wading birds increased, as did total habitat acreage. Fewer rails were detected despite a slight increase in habitat. The correspondence with shorebird numbers was variable. Killdeer and Greater Yellowlegs both showed increases in use and habitat. American Avocet/Black-necked Stilt showed a decline in suitable habitat and use. More Western/Least Sandpipers were observed in 2013, although CWHR determined a decrease in suitable habitat. Use of gulls/terns was less, as was the amount of suitable habitat.

Delta Habitat Table 6. Comparison of CWHR Habitat Acreages – 2009 vs. 2013

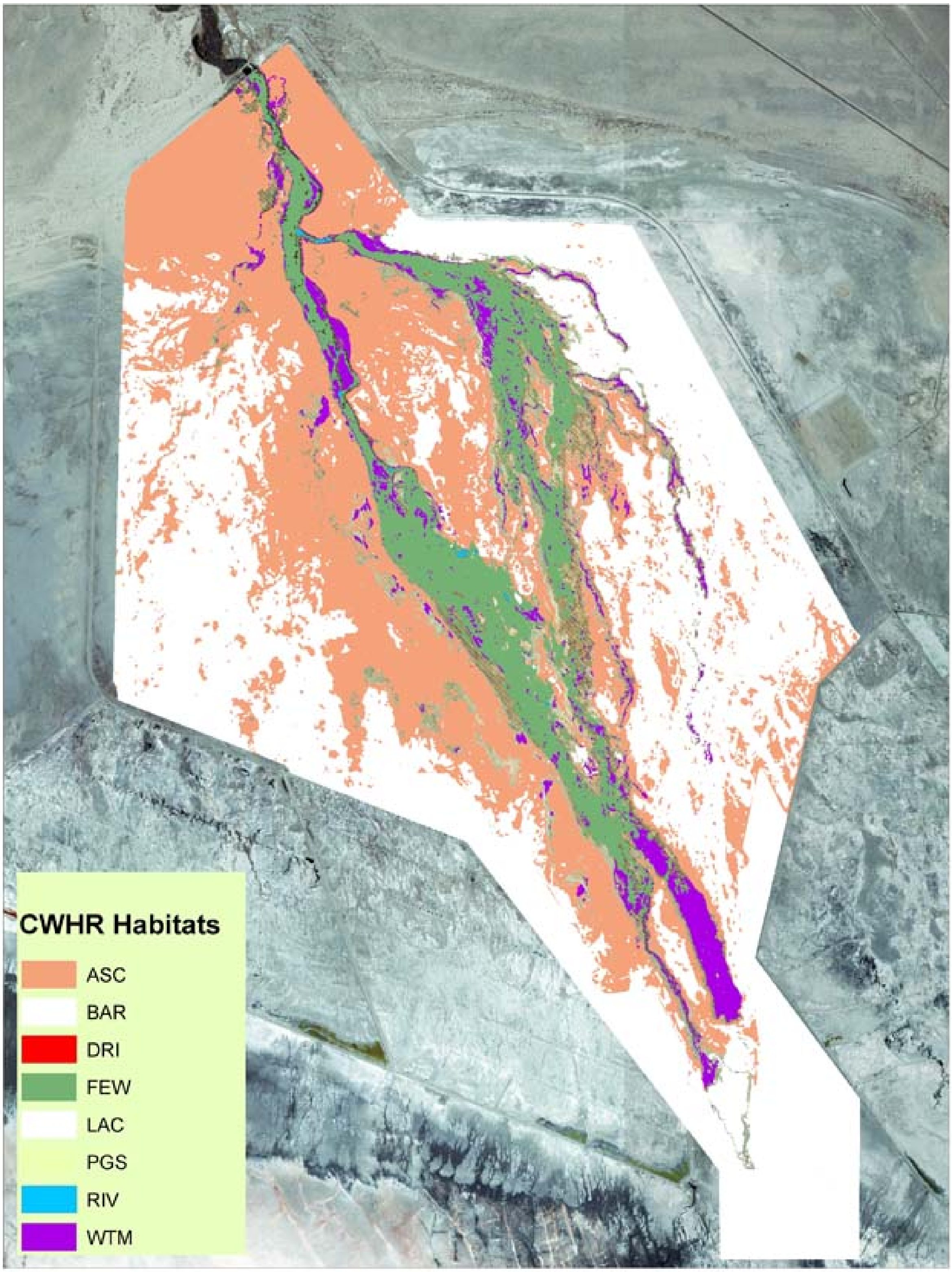
CWHR Habitat	2009	2013
ASC	1151.4	1028.9
BAR	1472.0	223.6
DRI		1.9
FEW	292.2	365.6
LAC	245.0	997.0
PGS	306.1	496.7
RIV	2.1	5.6
WTM	114.9	194.1



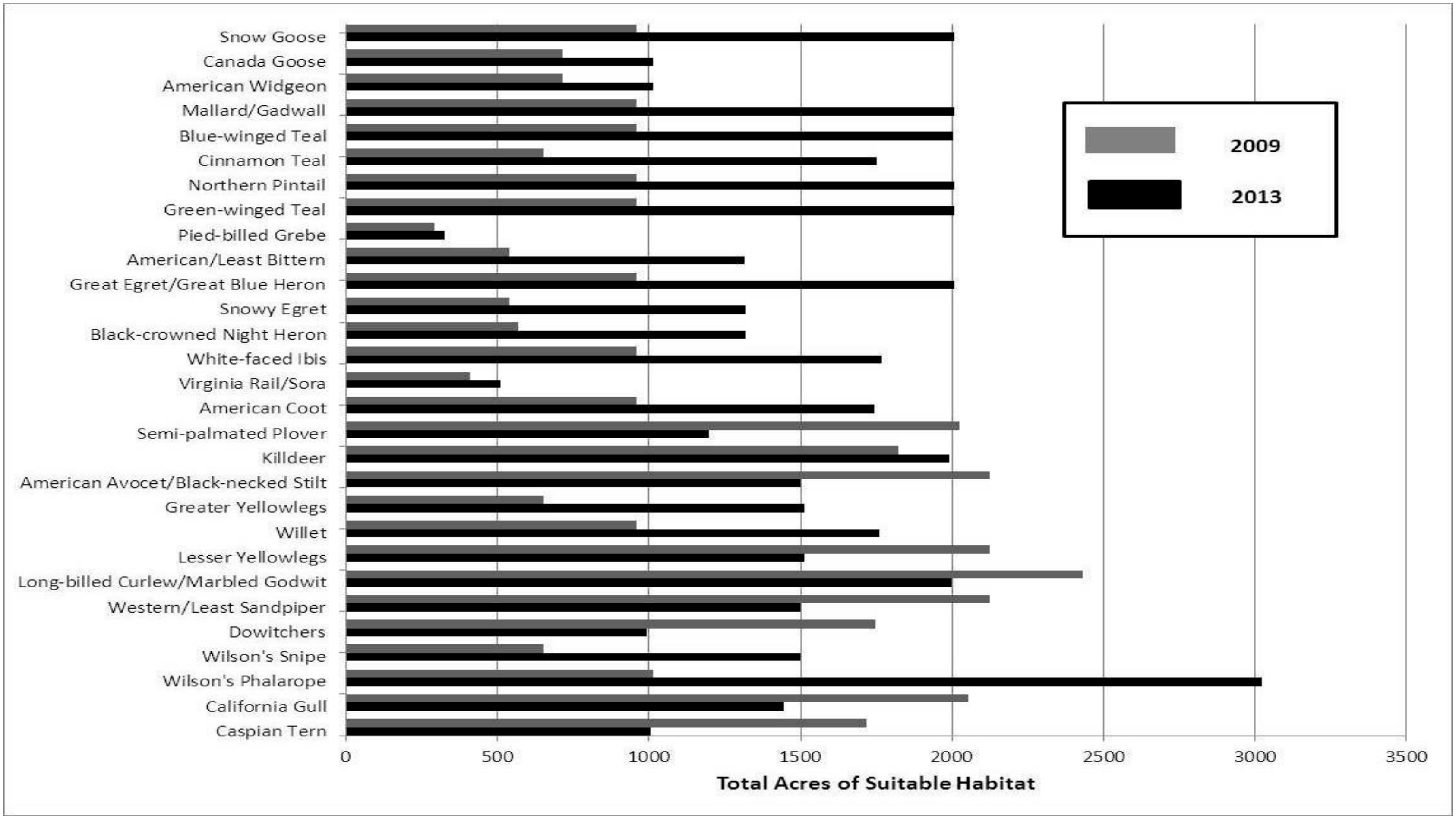
Delta Habitat Figure 5. Acreages of CWHR Habitats – 2009 vs. 2013



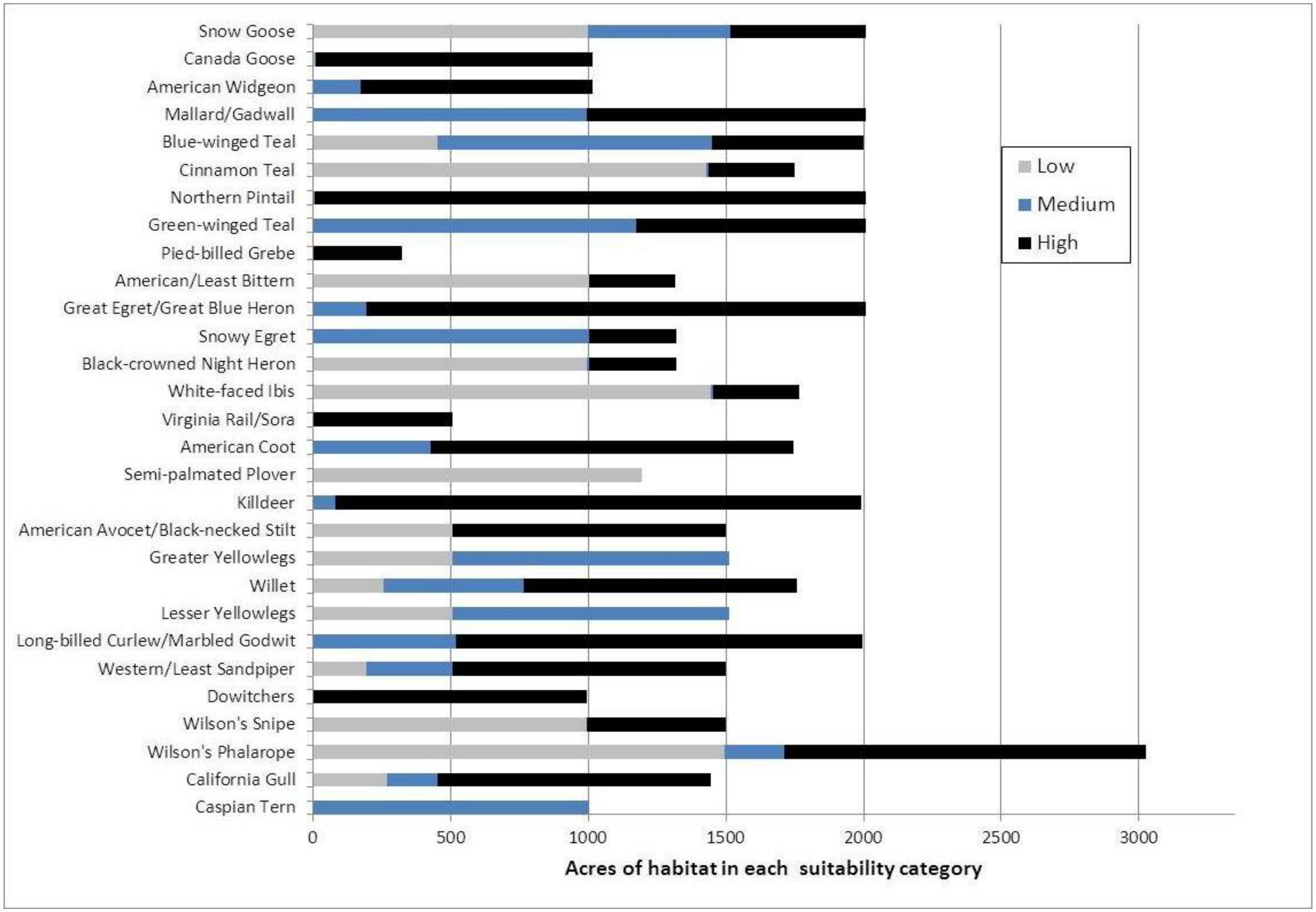
Delta Habitat Figure 6. CWHR Habitats in DHA - 2013



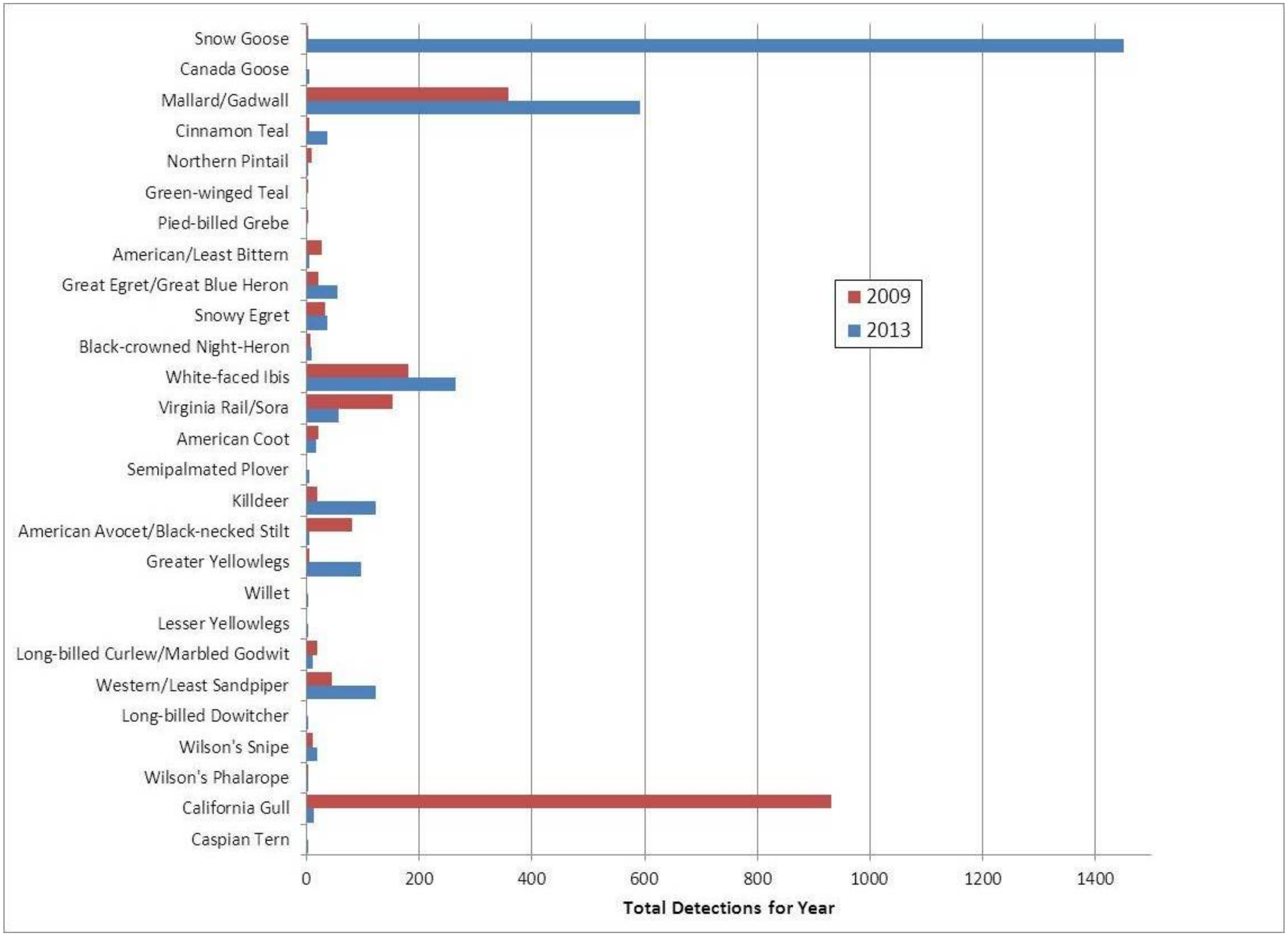
Delta Habitat Figure 7. CWHR Habitats in DHA – 2009



Delta Habitat Figure 8. Total acreage of Suitable Habitat for Indicator Species – 2009 vs. 2013



Delta Habitat Figure 9. Acreage of Habitat in each Suitability Category – 2013



Delta Habitat Figure 10. Total Detections of Indicator Species – 2009 vs. 2013

3.11 Comparison with Previous Years Data

Mean indicator species abundance has generally been highest in spring lower in summer and fall in all years (Figure 11). The mean abundance of indicator species in spring 2013 was lower than either 2005 or 2009. In addition, the abundance of indicator species in spring 2013 was not statistically different from other seasons in 2013. Mean indicator species abundance in summer and fall have shown numerical but not statistical increases since project implementation (Figure 11).

Spring indicator species richness has not shown much change since project implementation (Figure 12). Species richness in summer and fall has increased over baseline in both years of post-implementation surveys.

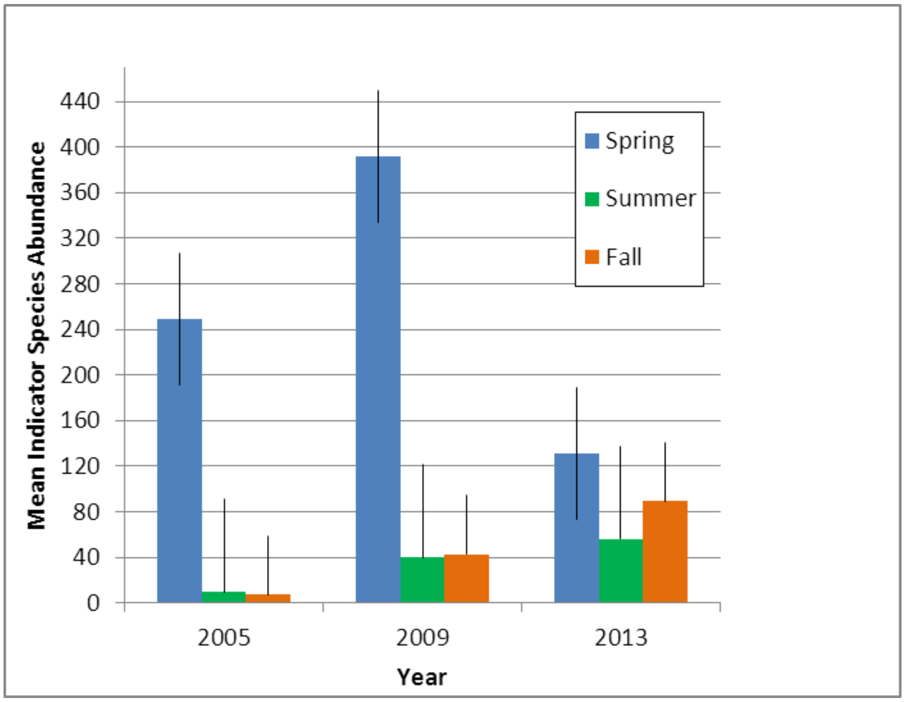
Mean indicator species diversity has shown numerical, but not statistically significant increases since project implementation (Figure 13). These numerical differences are most notable in the summer and fall diversity values.

Table 4 shows the total number of individuals detected each season, by indicator species group, for each of the survey periods. The main indicator species group using the DHA in winter is waterfowl although some shorebird use was also observed in 2013. While many waterfowl and some shorebird species winter in Owens Valley, many of the other indicator species, are in general, of low abundance in the region in winter. More use by indicator species in winter has been observed since project implementation.

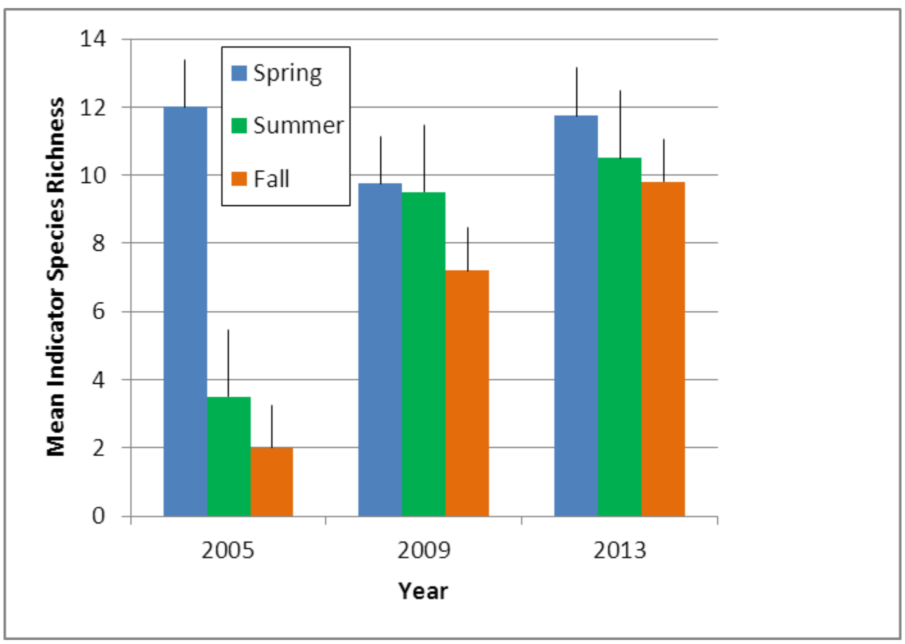
The use of the DHA has been consistently highest in spring, both pre- and post-project. Indicator species groups that use the DHA in spring include waterfowl, wading birds, shorebirds and rails. More indicator species were observed in spring 2005 (pre-project) than during either post-project spring survey period. Spring conditions in 2005 were very flooded in the DHA, and the region experienced an above average precipitation year, as discussed previously. The fewest number of indicator species in spring were in 2013. During spring 2013, water releases to the DHA were below normal due to a change in the release point of the pulse flow as noted above. The winter of 2012-2013 was an extremely dry year in the region and the second dry year in a row.

Use of the DHA by indicator species decreases in mid-summer as migration slows, and few indicator species breed in the DHA. Indicator species use in mid-summer has increased over baseline in response to the water releases that has resulted in flooding of wetland habitats later into the summer months. During summer 2013, water releases to DHA were above normal.

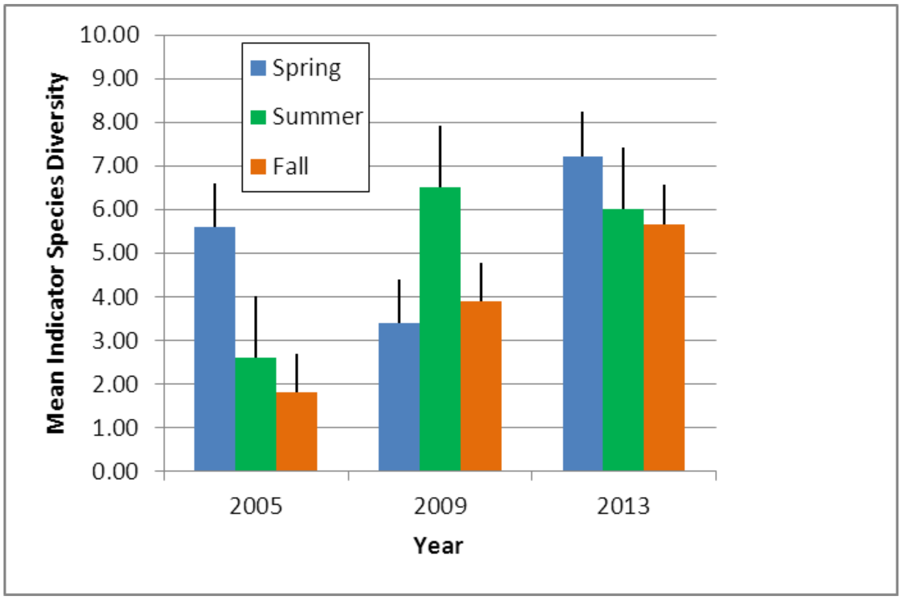
Indicator species use generally increases again during fall migration. The increased water availability in August through October has resulted in notable increase in use by indicator species during this time period since project implementation. Under pre-project conditions, the DHA was very dry by August. Flow management has resulted in much wetter conditions through fall and increased use by several indicator species groups, most notably wading birds. During fall 2013, flows to the DHA were above normal and the highest number of fall indicator species were recorded.



Delta Habitat Figure 11. Mean Indicator Species Abundance, Plus Standard Error



Delta Habitat Figure 12. Mean Indicator Species Richness, Plus Standard Error



Delta Habitat Figure 13. Mean Indicator Species Diversity, Plus Standard Error

3.12 Discussion

The more consistent supply of water to the DHA, especially through the summer and fall months, has led to changes in the vegetation conditions, including an increase in more mesic vegetation types. Throughout many areas of the DHA, dense alkali marsh or wet meadow have replaced areas formerly occupied by alkali meadow. In other areas, once unvegetated playa is now covered by sparse emergent vegetation. Habitats consistent with the needs of the indicator species, based on habitat use data, and the CHWR model including open water, playa, wet meadow, alkali marsh, and alkali meadow are being maintained under LORP.

While conditions consistent with the needs of habitat indicator species appear to be maintained or enhanced in the DHA currently, the increase in alkali marsh may become a concern. If marsh continues to increase in extent, the diversity of habitats may decrease, open water habitats may decline, and open, meadow habitats used by indicator species, especially when flooded, may decrease. While the DHA supports a large expanse of wetland vegetation, use of the area by habitat indicator species is likely limited by the lack of open water habitat. Open water habitats were used by all indicator species more than expected based on the availability of this habitat any decrease in open water habitat would be expected to have a negative effect on use of the area by many of the habitat indicator species.

The documentation of the acreage of the habitat using landscape vegetation mapping and CWHR provides information primarily on the quantity of habitat available, but limited information on the quality of the habitat. For example, in the DHA, alkali meadow and wet meadow are vegetation types used by wading birds such as egrets, herons and ibis. While some wading birds may forage in meadow habitats when dry, the value of the habitat and usage by indicator species will increase greatly when that habitat is flooded. Neither the landscape vegetation mapping or CWHR account for or track periodic flooding of meadow habitats.

Habitat indicator species in the DHA have responded in particular to the additional water available in summer and fall. Less of a response has been seen with regard to spring use of the DHA by habitat indicator species, a time of year when the DHA experienced flooding pre-project as well.

There has been no recent documentation of the conditions of the DHA during pulse flow events, such as photos or other imagery. The only information that provides a record of the change in extent of flooding in the DHA over time has been the field observations taken during wetland avian censuses. Documentation of conditions of the DHA at various times of the year through aerial photos or other means would aid in the evaluation of indicator species habitat and avian census data.

Intermittently flooded playa habitats are of high value to many indicator species, especially shorebirds, and some playa habitat has been lost as vegetation has encroached. The current goal for DHA includes maintaining 755 acres of vegetated wetlands, but does not consider acreage or condition of playa as it relates to indicator species. Maintaining areas of periodically flooded playa will be necessary to provide habitat for habitat indicator species such as shorebirds.

The DHA appears to benefit indicator species most when the area is flooded and most of the use in the DHA by indicator species is during migratory periods of spring and fall. The timing and magnitude of the pulse flows should be re-evaluated to determine if these are still optimum for the goals of maintaining and enhancing habitat for indicator species in DHA. For example, the winter pulse flow may not be needed if the DHA is already flooded and water is flowing into the brine pool. In winter, evapotranspiration decreases the indicator species in the region declines, and thus the pulse flow may not be necessary to maintain habitat. Water flow to the brine pool should be maintained as waterfowl are regularly seen using the delta outflow area during winter. If a winter pulse flow is not necessary to maintain habitat for indicator species, consideration should be given to shifting the water use to another time of year when it might provide more benefit to habitat indicator species given environmental conditions, and the seasonal patterns of abundance of indicator species.

3.13 Appendix. DHA vegetation crosswalk to CWHR habitats and CWHR size and stage categories

Herbaceous		
CHWR_Habitats	**Habitat Description**	**DHA Mapped VEG_NAME**
PGS	Perennial Grassland	Alkali Meadow
PGS	Perennial Grassland	Eolian DISP
WTM	Wet Meadow	Wet Alkali Meadow
FEW	Fresh Emergent Wetland	Tall Marsh
FEW	Fresh Emergent Wetland	Short Marsh
SIZE_CLASSES		
Code	**Descriptor**	**Description**
1	Short herb	< 12" tall at maturity
2	Tall herb	> 12.1" tall at maturity
STAGES		
Code	**Descriptor**	**Average Cover**
S	Sparse	2 - 9.9%
P	Open	10 - 39.9%
M	Moderate	40 - 59.9
D	Dense	> 60%

Shrub Habitats		
CHWR_Habitats	**Habitat Description**	**DHA Mapped VEG_NAME**
ASC	Alkali Desert Scrub	Eolian Scrub
ASC	Alkali Desert Scrub	Eolian SAVE
ASC	Alkali Desert Scrub	Rabbitbrush-NV Saltbush/Meadow
SIZE_CLASSES		
Code	**Descriptor**	**Description**
1	Seedling Shrubs	Seedlings
2	Young shrub	< 1% crown decadence
3	Mature shrub	1 - 24.9 % crown decadence
4	Decadent shrub	> 25 % crown decadence
STAGES		
Code	**Descriptor**	**Average Cover**
S	Sparse	10 - 24.9%
P	Open	25 - 39.9%
M	Moderate	40 - 59.9%
D	Dense	> 60%

Riparian Woody Vegetation		
CHWR_Habitats	**Habitat Description**	**DHA Mapped VEG_NAME**
DRI	Desert Riparian	Riparian Forest
DRI	Desert Riparian	Riparian Scrub
SIZE_CLASSES		
Code	**Descriptor**	**Crown Diameter/DBH**
1	Seeding tree	DBH < 1"
2	Sapling tree	< 15 feet; DBH 1 - 5.9"
3	Pole tree	15 - 29.9 feet; DBH 6 - 10.9"
4	Small tree	30 - 44.9 feet; DBH 11 - 23.9"
5	Med/large tree	> 45 feet; DBH > 24"
6	Multilayer tree	A distinct layer of size class 5 trees over a distinct layer of size 4 and/or 3 trees, and total tree canopy of layers >/=60%
STAGES		
Code	**Descriptor**	**Average Cover**
S	Sparse	10 - 24.9%
P	Open	25 - 39.9%
M	Moderate	40 - 59.9%
D	Dense	> 60%

Off-river wetted areas		
CHWR_Habitats	**Habitat Description**	**DHA Mapped VEG_NAME**
LAC	Lacustrine	Playa
	Lacustrine	Water
SIZE_CLASSES		
Code	**Descriptor**	**Description**
1	Limnetic	Deep water beyond light penetration (no stage code)
2	Submerged	Ponds that are shallow enough to allow light penetration
3	Periodically Flooded	Unvegetated areas that are periodically flooded
4	Shore	Water's edge with less than 2% vegetation
STAGES		
Code	**Descriptor**	**Substrate**
O	Organic	Algae, duckweed or plant material present
M	Mud	Mud substrate
S	Sand	Sandy substrate
G	Gravel/cobble	Substrate of gravel or cobble
R	Rubble/boulders	Substrate of rubble or boulders
B	Bedrock	Not on LORP

River		
CHWR_Habitats	**Habitat Description**	**DHA Mapped VEG_NAME**
RIV	Riverine	Water
SIZE_CLASSES		
Code	**Descriptor**	**Description**
1	Open Water	Water greater than 2 meters in depth
2	Submerged	Area of permanent water between "open water" and shore
3	Periodically Flooded	Unvegetated areas that are periodically flooded
4	Shore	Seldom-flooded areas with < 10% vegetative cover
STAGES		
Code	**Descriptor**	**Substrate**
O	Organic	Algae, duckweed or plant material present
M	Mud	Mud substrate
S	Sand	Sandy substrate
G	Gravel/cobble	Substrate of gravel or cobble
R	Rubble/boulders	Substrate of rubble or boulders
B	Bedrock	Shouldn't be on LORP!

CHWR_Habitats	Habitat Description	DHA Mapped VEG_NAME
BAR	Barren	Barren
BAR	Barren	Eolian

3.14 References

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4.0 LAND MANAGEMENT

4.1 Land Management Summary

The 2013 Lower Owens River Project (LORP) land management monitoring efforts continued with the evaluation of irrigated pastures, monitoring utilization across all leases, range trend monitoring on five of the leases inside the LORP management area, rare plant monitoring, and streamside monitoring for woody establishment. The LORP area is currently experiencing its second year of extreme drought. Effects from this are a decrease in irrigated pasture condition due to reduced availability of irrigation water. Despite the drought, ranch lessees were able to keep their utilization levels within the allowable use levels in 2012-13. Range trend results indicate that in most areas where plant communities are dependent on groundwater to some degree, trends have either remained static or slightly decreased. 2013 marks the fifth year examining the benefits of excluding rare plants from livestock grazing. Results showed a decline of plant populations in ungrazed sites. Streamside monitoring results showed very light use by livestock and elk in 2013 and high survivorship of young tree willows monitored in 2012. However, sustained high summer flows have negatively impacted approximately one third of the juvenile trees monitored.

Pasture utilization for all leases within the LORP was below the allowable levels of use established for both riparian (up to 40%) and upland (up to 65%) areas. Use on the Blackrock Lease was lower than most other leases in the project area remaining well below all grazing standards with the lessee removing the majority of livestock prior to the end of the grazing season. The Twin Lakes Lease had a prescribed burn on the riparian sections of the Lower Blackrock Riparian and Upper Blackrock fields, totaling 190 acres. Islands Lease has started to show signs of stressed meadow vegetation and aquatic vegetation spreading due to prolonged inundation from flow regulations for the LORP project. Use in the Thibaut Field on the Thibaut Lease was below the allowable standard, due to a decreased stocking rate and improving distribution of livestock. An arson fire burned approximately 525 acres of riparian pasture on the Lone Pine Lease in late February, resulting in approximately 80-90% of the riparian forest being destroyed. The meadows have recovered over the summer but the most of the trees have not. There is some re-sprouting from the base of the trees. Dry conditions have persisted throughout the past two years and grazing pressure on the riparian pastures will increase if a normal or above normal winter does not occur for the 2013-14 grazing season.

Irrigated pastures in the Islands, Lone Pine and Delta Leases were all rated in 2013. The results reflect a below normal precipitation year with many leases rating at the minimum irrigated pasture score of 80%. All irrigated pastures in the LORP will be evaluated again in 2014.

2013 marks the fifth year collecting rare plant trend plot data for *Sidalcea covillei* (Owens Valley Checkerbloom), and *Calochortus excavates* (Inyo County Star Tulip) for the LORP. The objective of the study was to monitor impacts of grazing exclusion on Owens Valley checkerbloom. Results show an increase in numbers over time in grazed sites and a decrease in numbers over time in ungrazed sites. Additionally, external factors during a given year may be confounding the results of the study. Because of this, it is recommended to continue this study a few more years. Additional data will be useful to further illustrate trends of Owens Valley checkerbloom and Inyo County star tulip within the LORP area.

The Streamside Monitoring Protocol underwent further modifications this year with an inclusion of sampling juvenile tree heights and the selection of two additional sites where tree willow establishment is actively occurring. Total juvenile tree counts changed little from 2012 to 2013, browsing decreased in the spring and remained static over the summer. Summer flow management however has impacted many of the plots. Approximately 33% (465 individuals) of all juvenile tree willows were partially submerged for 2-3 months on eight of the study plots. These sustained high summer flows visibly stressed trees and enabled the expansion of tule and cattails onto the gravel and sand bars and adjacent floodplains, placing the young willows in direct competition with emergent wetland plant species.

4.2 Introduction

The land use component of this report is composed of project elements related to livestock grazing management. Under the land management program, the intensity, location, and duration of grazing is managed through the establishment of riparian pastures, forage utilization rates, and prescribed grazing periods (described in Section 2.8.1.3 and 2.8.2 LORP EIR 2004). Other actions include protection of rare plant populations, establishment of off-river watering sources (to reduce use of the river and off-river ponds for livestock watering) and the monitoring of utilization and rangeland trend on the leases. In 2010, an additional monitoring component (Streamside Monitoring) was added to note woody establishment that may be occurring in the LORP following project implementation.

Grazing management plans developed for the LORP leases modified grazing practices in riparian and upland areas on seven LADWP leases in order to support the 40 LORP goals as written in the EIR. The seven leases within the LORP planning area are: Intake, Twin Lakes, Blackrock, Thibaut, Islands, Lone Pine, and the Delta. LORP-related land use activities and monitoring that took place in 2013, are presented by lease in Section 4.10, LORP Ranch Leases.

4.2.1 Utilization

The *Lower Owens River Monitoring Adaptive Management and Reporting Plan* (Ecosystem Sciences 2008), developed as part of the LORP Plan, identifies grazing utilization standards for upland and riparian areas. Utilization is defined as the percentage of the current year's herbage production consumed or destroyed by herbivores. Grazing utilization standards identify the maximum amount of biomass that can be removed by grazing animals during specified grazing periods. LADWP has developed height-weight relationship curves for native grass and grass-like forage species in the Owens Valley using locally-collected plants. These height-weight curves are used to relate the percent of plant height removed with the percent of biomass removed by grazing animals. Land managers can use these data to document the percent of biomass removed by grazing animals and determine whether or not grazing utilization standards are being exceeded. The calculation of utilization (by transect and pasture) is based on a weighted average. Therefore, species that only comprise a small part of available forage contribute proportionally less to the overall use value than more abundant species. Utilization data collected on a seasonal basis (mid- and end-points of a grazing period) will determine compliance with grazing utilization standards, while long-term utilization data will aid in the interpretation of range trend data and will help guide future grazing management decisions.

4.2.2 Riparian and Upland Utilization Rates and Grazing Periods

Under the *Lower Owens River Monitoring Adaptive Management and Reporting Plan* (Ecosystem Sciences, 2008), livestock are allowed to graze in riparian pastures during the grazing periods prescribed for each lease (see Sections 2.8.2.1 through 2.8.2.7 LORP EIR 2004). Livestock are to be removed from riparian pastures when the utilization rate reaches 40% or at the end of the grazing period, whichever occurs first. The beginning and ending dates of the lease-specific grazing periods may vary from year-to-year depending on conditions such as climate and weather, but the duration remains approximately the same. The grazing periods and utilization rates are designed to facilitate the establishment of riparian shrubs and trees.

In upland pastures, the maximum utilization allowed on herbaceous vegetation is 65% annually if grazing occurs only during the plant dormancy period. Once 65% is reached, all pastures must receive 60 continuous days of rest for the area during the plant “active growth period” to allow seed set between June and September. If livestock graze in upland pastures during the active growth period (that period when plants are “active” in putting on green growth and seed), maximum allowable utilization on herbaceous vegetation is 50%. The utilization rates and grazing periods for upland pastures are designed to sustain livestock grazing and productive wildlife through efficient use of forage. Riparian pastures may also contain upland habitat. If significant amounts of upland vegetation occur within a riparian pasture or field, upland grazing utilization standards will also apply to these upland habitat types. Livestock will be removed from a riparian pasture when either the riparian or the upland grazing utilization standards are met. Typically riparian utilization rate of 40% is reached before 65% use in the uplands occurs. Because of this pattern, utilization is not quantitatively sampled in adjacent upland areas, but use is assessed based on professional judgment. If utilization appears greater than 50% then utilization estimates using height weight curves will be implemented on the upland areas in the riparian field.

4.2.3 Utilization Monitoring

Monitoring methodologies are fully described in Section 4.6.2 of the *Lower Owens River Monitoring Adaptive Management and Reporting Plan* (Ecosystem Sciences, 2008).

Utilization is compliance monitoring and involves determining whether the utilization guidelines set forth in the grazing plans are being adhered to. Similar to precipitation data, utilization data alone cannot be used to assess ecological condition or trend. Utilization data is used to assist in interpreting changes in vegetative and soil attributes collected from other trend monitoring methods.

These standards are not expected to be met precisely every year because of the influence of annual climatic variation, livestock distribution, and the inherent variability associated with techniques for estimating utilization. Rather, these levels should be reached over an average of several years. If utilization levels are consistently 10% above or below desired limits during this period then adjustments should be implemented (Holecheck and Galt, 2000; Smith et al., 2007).

Utilization monitoring is conducted annually. Permanent utilization transects have been established in upland and riparian areas of pastures within the LORP planning area. An emphasis has been placed on establishing utilization monitoring sites within riparian management areas. Each monitoring site is visited prior to any grazing in order to collect ungrazed plant heights for the season. Sites are visited again mid-way through the grazing period (mid-season) and again at the conclusion of the grazing period (end-of-season).

All of the end-of-season utilization data are presented in table format in Section 4.10 results of land use by lease.

4.3 Range Trend

4.3.1 Overview of Monitoring and Assessment Program

A description of monitoring methods, data compilation, and analysis techniques can be found in the *2008 LORP Monitoring, Adaptive Management and Reporting Plan*. More detailed discussion of the Range Trend methods and considerations for interpretation can be found in previous LORP Annual Monitoring reports. Descriptions of the range trend monitoring sites and their locations on the leases can be found in the individual lease monitoring narratives and maps in this section. Nested frequency and shrub cover data are presented for each lease and are presented as range trend transect data tables for each sampling transect and sampling year.

Range trend monitoring for 2013 involves the quantitative sampling of the following attributes: nested frequency of all plant species and line intercept sampling for shrub canopy cover. Photo documentation of the site conditions is included as part of range trend monitoring.

Because frequency data is sensitive to plant densities and dispersion, frequency is an effective method for monitoring and documenting changes in plant communities (Mueller-Dombois and Ellenberg, 1974; Smith et al., 1986; Elzinga, Salzer et al., 1988; BLM 1996; Heywood and DeBacker, 2007). For this reason frequency data is the primary means for evaluating trend at a given site. Based on recommendations for evaluating differences between summed nested frequency plots (Smith et al., 1987 and Mueller-Dombois and Ellenberg, 1974), a Chi-Square analysis with a Yate's correction factor was used to determine significant differences between years. Analysis compared 2013 data to the prior sampling period. The 2013 results were compared to all sampling events during the baseline period to determine if results in 2013 were ecologically significant or remained within the typical range of variability observed for that particular site.

The ecological site on the LORP where the majority of land management monitoring transects are located is the Moist Floodplain ecological site (MLRA 29-20). The site describes axial-stream floodplains. Moist Floodplain sites are dominated by *Distichlis spicata* (saltgrass), plant symbol DISP and to a lesser extent *Sporobolus airoides* (alkali sacaton), plant symbol SPAI and *Leymus triticoides* (creeping wildrye), plant symbol LETR5. Only 10% of the total plant community is expected to be composed of shrubs and the remaining 10% forbs. This ecological site does not include actual river or stream banks. Stream bank information is available from the Rapid Assessment Survey (RAS) reports and the Streamside Monitoring Report. These monitoring data from 2013 will be presented in this section of the 2013 LORP Annual Report.

Saline Meadow ecological sites (MLRA 29-2) are the second most commonly encountered ecological sites on the LORP range trend sites. These sites are located on fan, stream, lacustrine terraces, and may also be found on axial stream banks. Potential plant community groups are 80% perennial grass with a larger presence of alkali sacaton than Moist Floodplain sites. Shrubs and trees comprise up to 15% of the community while forbs are only 5% of the community at potential. Saline Bottom (MLRA 29-7) and Sodic Fan (MLRA 29-5) ecological sites were also associated with several range trend sites. These are more xeric stream and lacustrine terrace sites. Saline Bottom ecological sites still maintain up to 65% perennial grasses, the majority of which is alkali sacaton, while shrubs compose up to 25% of the plant community, and forbs occupy the remaining 10%. Sodic Fan ecological sites are 70% shrubs, primarily *Atriplex torreyi* (Nevada saltbush), plant symbol ATTO, with a minor component of alkali sacaton of up to 25% and 5% forbs.

During the preproject period, a range of environmental conditions were encountered including “unfavorable” growing years when precipitation in the southern Owens Valley was less than 50% of the 1970-2009 average, “normal” years, when precipitation was 50-150% of average, and “favorable” conditions when precipitation was greater than 150% of average. Many of the monitoring sites responded to the variability in precipitation during the baseline period. This provided the Watershed Resources staff an opportunity to sample across a broad amplitude of ecological conditions for these sites, which contributed to a robust baseline dataset. Data from the Lone Pine rain gauges are used to determine the growing conditions for each sampling year on the Islands, Lone Pine, and Delta Leases. Precipitation data from Independence are used for the Thibaut and Blackrock Leases, and data from the Intake will be used for the Intake, Twin Lakes, and the northern portion of the Blackrock Leases.

Adaptive management recommended that a modified range trend schedule was implemented beginning 2012. This schedule will ensure that there will be some monitoring across the landscape annually, increasing the probability of documenting the influence of significant changes in climate or management on the various ecological sites in the LORP area.

Land Management Table 1. Revised Range Trend Monitoring Schedule for the LORP

2012	2013	2014	2015	2016	2017
Twin Lakes	Blackrock	Thibaut	Intake	Blackrock	Thibaut
Lone Pine	Delta	Islands	Twin Lakes	Delta	Islands
	Intake Lease		Lone Pine		

4.4 Irrigated Pastures

Monitoring of irrigated pastures consisted of Irrigated Pasture Condition Scoring following protocols developed by the (NRCS, 2001). Irrigated pastures that score 80% or greater are considered to be in good to excellent condition. If a pasture rates below 80%, changes to pasture management will be implemented.

All irrigated pastures were monitored in 2013. Pastures that scored 80% or below will be monitored in 2014. The results of the monitoring will be presented in a table format by lease in Section 4.9. Irrigated pasture condition scoring for all pastures will take place again in 2016.

4.5 Fencing

No new fence construction occurred within the LORP project boundaries in 2012-13. Some repairs to an exclosure did occur along with general maintenance.

4.6 Rare Plants

The LORP EIR identified approximately 44 miles of new fencing to be built in the project area to improve grazing management and help meet the LORP goals. The new fencing consisted of riparian pastures, upland pastures, riparian exclosures, rare plant exclosures, and rare plant management areas. New rare plant exclosures were constructed on Blackrock Lease and Thibaut Lease (see sections 2.8.1.4, 2.8.2.2, and 2.8.2.3 of the Final LORP EIR June 23, 2004). Fence construction began in September 2006 and was completed in February 2009 with the total fence miles constructed being approximately 50 miles. The Blackrock Lease has two 0.25-acre rare plant exclosures built in the Robinson and Little Robinson Pastures and two riparian exclosures were constructed in the White Meadow Riparian and Wrinkle Riparian Fields. The rare plant exclosures were designed to evaluate the effect of grazing on *Sidalcea covillei* (Owens Valley checkerbloom), plant symbol SICO2 and *Calochortus excavatus* (Inyo County star-tulip), plant symbol CAEX2.

Within the LORP there are 15 trend plots within four rare plant populations on two separate ranch leases, Blackrock and Thibaut. Target species are Owens Valley checkerbloom and Inyo County star-tulip. Owens Valley checkerbloom is a state endangered species, endemic to the Owens Valley. It occurs in alkali meadows. Owens Valley checkerbloom is not a State or federally listed but is considered a California Species of Special Concern (CSSC) and rare in its range. A mesic species, Inyo County star-tulip occurs in alkali meadows and seeps, transitioning into chenopode scrubland.

The plots were monitored for five years to evaluate population trends. If trends are static or suggest that grazing is beneficial, the exclosure fencing will be removed following the fifth year of monitoring. In contrast, if trends in data support that exclosures are needed to protect these populations of Owens Valley checkerbloom and Inyo County star-tulip, then LADWP will construct additional exclosures (or a practical variation thereof) and monitoring will continue as needed (see section 6.6 LORP Annual Monitoring Report 2009).

4.6.1 Rare Plant Monitoring Methods

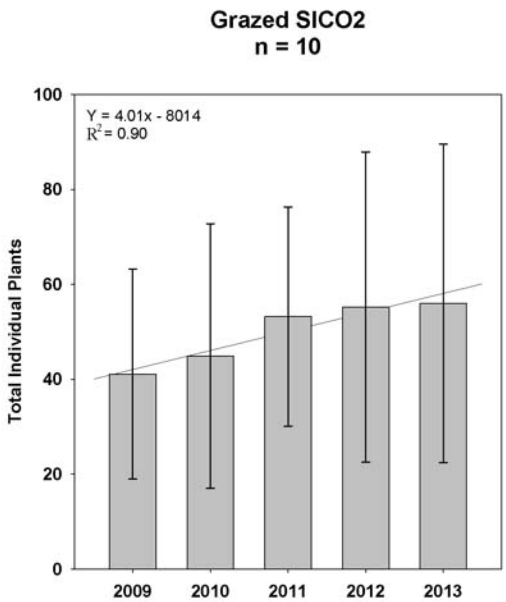
The LORP rare plant trend plots were established inside and outside of exclosures to measure change between grazed and ungrazed plots. Plots are permanently located by driving a piece of rebar into the center of the plot and taking a GPS point of the location. Plots can then be relocated using a hand-held GPS unit and a metal detector. Two 50-meter measuring tapes are used to delineate the plot into four sections with a diameter of 7.24 meters (3.62 meter radius) for a total plot size that is 1/100 of an acre. Target species are flagged with a pin flag to aid in accurately identifying all individuals within the plot. Photos are taken in all cardinal directions depicting the plot area containing flagged plants. One measuring tape is then attached to the rebar in the center of the plot to record the distance of individuals within a radius of 3.62 meters. A compass is used to record the bearing of individuals from the center of the plot. By measuring the distance and bearing from the center of the plot, individual plants can then be accurately measured overtime. Data on recruitment, persistence, phenology and if the plants are grazed, are collected. General observational notes on site condition and other environmental factors are also recorded.

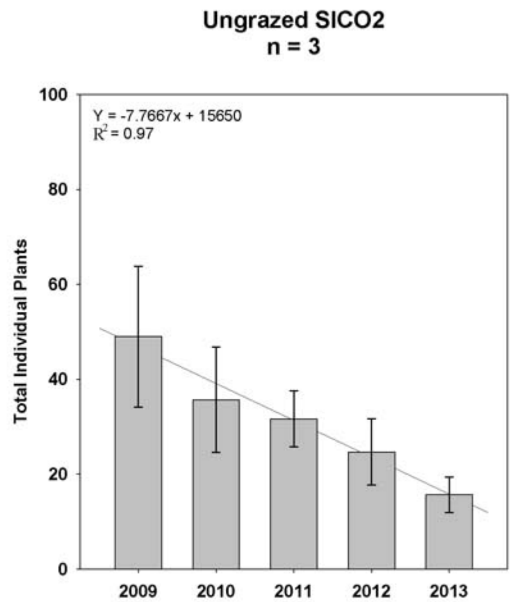
2013 marks the fifth year collecting trend plot data within the LORP. Data was compiled into a comprehensive database to analyze population trend over time.

4.6.2 Rare Plant Summary

Monitoring Results

A two-way repeated measures ANOVA was performed to determine if there is a measurable difference in population trend overtime between grazed and ungrazed trend plots. Results of the test show that there is no statistically significant difference between grazed and ungrazed sites ($F=0.74$, $P=0.41$) but that there is an effect of different levels of grazing depending on the year ($F=2.89$, $P=0.03$). Visually depicting the data showed an increasing trend over time in grazed sites and a decreasing trend over time in ungrazed sites (Figures 1-2). Additionally, external factors during a given year may be confounding results for the individual trend plots. Looking specifically at individual plots, we were able to formulate ideas on trend for Owens Valley checkerbloom. Because of generally low numbers of Inyo County star-tulip within the plots, size of the trend plots, and observer variability in detecting plants, a statistical analysis was not performed on Inyo County star-tulip.





***Total Plants for all sites**

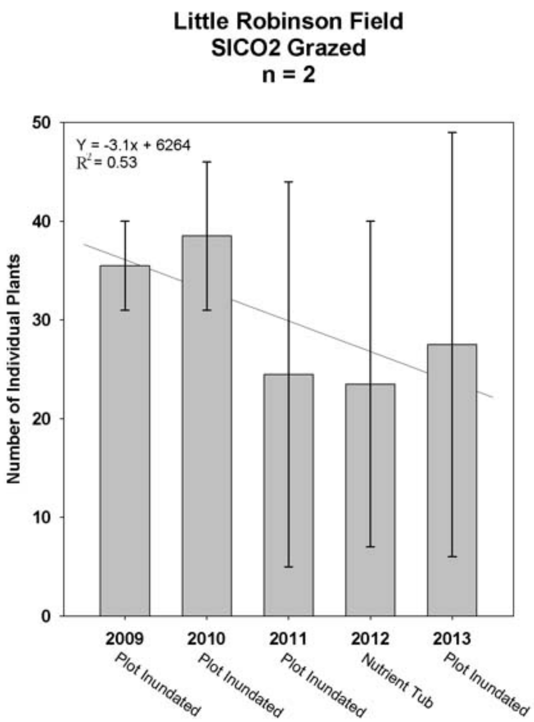
Land Mgmt. Figure 1. All Age Classes Combined **Land Mgmt Figure 2. All Age Classes Combined**

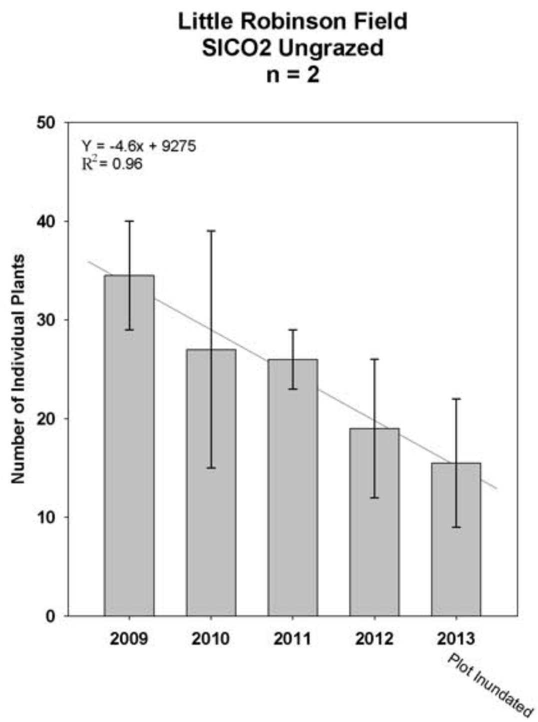
Little Robinson Pasture, Blackrock Lease

This pasture contains an Owens Valley checkerbloom population. Trend plots Little Robinson 1EX and Little Robinson 2EX occur within an exclosure; trend plots Little Robinson 1C and Little Robinson 2C are adjacent to the exclosure and are grazed. Trend in the grazed plots are static while the trend in the ungrazed plots is decreasing (Figures 3-4).

This site illustrates the effect of different types of grazing for a given year. Factors that have additionally influenced these plots are inundation of trend plots due to stock water diversions and a nutrient tub within a trend plot site. Looking at the figures and raw data table, Little Robinson 2C has been inundated 4 of the 5 years of this study. Additionally, a nutrient tub, which provides supplement for livestock, was placed within the plot sometime in 2011 and was removed after the 2012 monitoring season. Based on observational data, the inundation of the site is favoring mesic, wetland species, such as sedge, Baltic rush, and creeping wildrye, which may be out-competing Owens Valley checkerbloom. The nutrient tub placement may have had an effect due to the density of cattle congregating within the plot, compacting the soil and overgrazing the site. By removing the nutrient tub in 2012, it appears that the trend may be increasing as observed in Figure 3. Little Robinson 1EX and 2EX may be experiencing the same issues from inundation.

These confounding environmental factors make it difficult to isolate the grazing effect on this rare plant population. However, because both grazed and ungrazed plots have been inundated at some time during this study and trend is slightly decreasing in the ungrazed plots, we may be able to deduce that some level of grazing is beneficial.





*Total Plants, all age classes combined

Land Mgmt Figure 3. Grazed, Little Robinson Field   **Land Mgmt Figure 4. Ungrazed, Little Robinson Field**

Land Management Table 2. Rare Plant Raw Data

Plot Number	Year	Species	Seedling	Juvenile	Mature	Total
Little Robinson 1C (Grazed)	2009	Owens Valley checkerbloom	0	12	28	40
	2010		1	0	45	46
	2011		16	11	17	44
	2012		12	0	28	40
	2013		36	0	13	49
Little Robinson 2C (Grazed)	2009*	Owens Valley checkerbloom	0	12	19	31
	2010*		3	0	28	31
	2011*		4	1	0	5
	2012^		0	0	7	7
	2013*		5	0	1	6
Little Robinson 1EX (Ungrazed)	2009	Owens Valley checkerbloom	0	0	40	40
	2010		0	0	39	39
	2011		0	0	29	29
	2012		3	0	23	26
	2013*		13	0	9	22
Little Robinson 2EX (Ungrazed)	2009	Owens Valley checkerbloom	0	6	23	29
	2010		0	0	15	15
	2011		8	0	15	23
	2012		1	0	11	12
	2013*		6	0	3	9

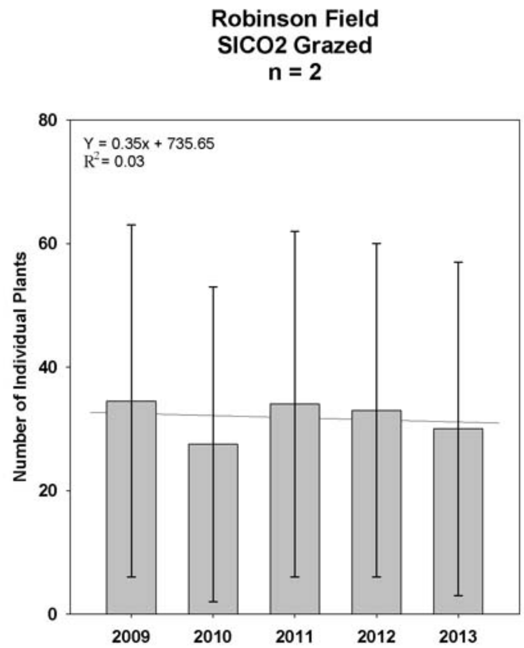
**Plot inundated*
^Nutrient tub in plot

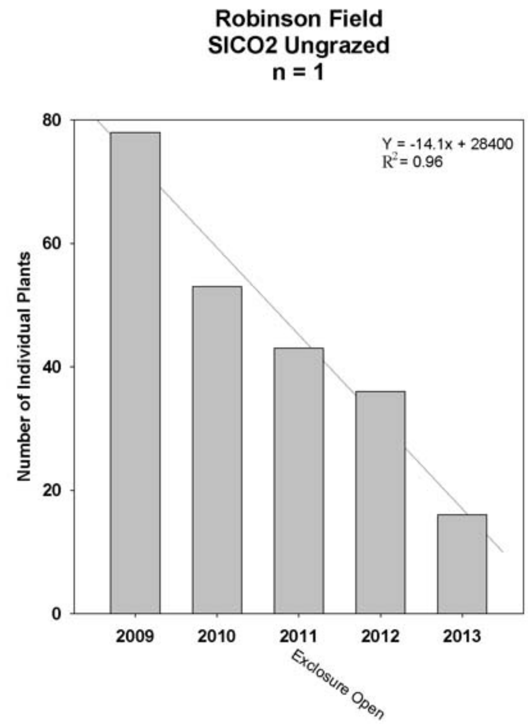
Robinson Field, Blackrock Lease

This pasture contains an Owens Valley checkerbloom population and an Inyo County star-tulip population. Trend plots Robinson 1EX and Robinson 2EX occur within an exclosure containing both Owens Valley checkerbloom and Inyo County star-tulip. Two Owens Valley checkerbloom trend plots (Robinson 1C and Robinson 2C) along with one Inyo County star-tulip trend plot (Robinson 3C) are outside the exclosure within the same pasture. Trend in the grazed plots are static while trend in the ungrazed site is decreasing (Figures 5-6).

This site is possibly another example of the effect of different types of grazing for a given year. The exclosure for the ungrazed plot was left open in 2011 only to be discovered during the monitoring season of 2012. Observational data suggests that the exclosed site is becoming overgrown and decadent, indicating an exclosure effect. Treating 2009 as baseline, or pre-exclosure conditions, the precipitous decline may be attributed to the lack of grazing (i.e. disturbance). This may explain the decrease in trend for the ungrazed plot.

Because trend is static in the grazed plots and decreasing in the ungrazed plot, it appears that grazing is maintaining the population.





***Total Plants, all age classes combined**

Land Mgmt Figure 5. Grazed, Robinson Field

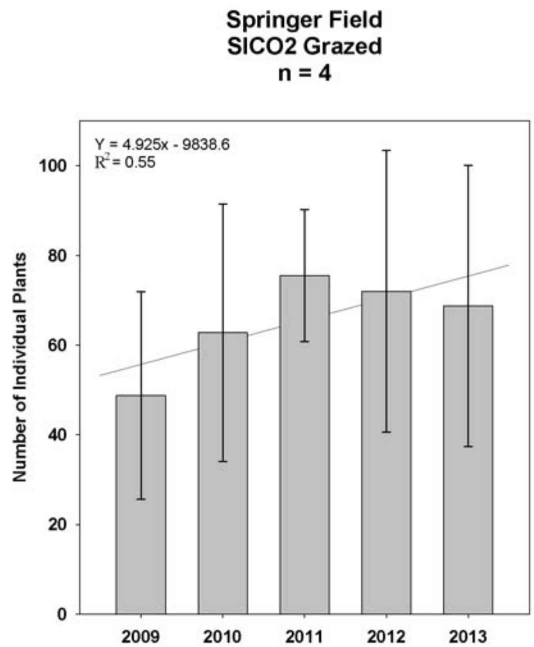
Land Mgmt Figure 6. Ungrazed, Robinson Field

Land Management Table 3. Rare Plant Raw Data

Plot Number	Year	Species	Seedling	Juvenile	Mature	Total
Robinson 1C (Grazed)	2009	Inyo County star-tulip	0	0	12	12
	2010		0	0	38	38
	2011		0	0	30	30
	2012		0	0	2	2
	2013		1	0	2	3
Robinson 1C (Grazed)	2009	Owens Valley checkerbloom	0	0	6	6
	2010		0	0	2	2
	2011		4	0	2	6
	2012		1	0	5	6
	2013		1	0	2	3
Robinson 2C (Grazed)	2009	Inyo County star-tulip	0	0	0	0
	2010		0	0	2	2
	2011		0	0	6	6
	2012		0	0	1	1
	2013		0	0	0	0
Robinson 2C (Grazed)	2009	Owens Valley checkerbloom	0	4	59	63
	2010		1	0	52	53
	2011		22	6	34	62
	2012		12	0	48	60
	2013		7	0	50	57
Robinson 3C (Grazed)	2009	Inyo County star-tulip	0	0	1	1
	2010		0	0	11	11
	2011		0	0	18	18
	2012		0	0	13	13
	2013		0	0	13	13
Robinson 1EX (Ungrazed)	2009	Inyo County star-tulip	0	0	2	2
	2010		0	0	11	11
	2011		0	0	2	2
	2012*		0	0	0	0
	2013		0	0	0	0
Robinson 1EX (Ungrazed)	2009	Owens Valley checkerbloom	0	43	35	78
	2010		17	0	36	53
	2011		13	8	22	43
	2012*		13	0	23	36
	2013		7	0	9	16
Robinson 2EX (Ungrazed)	2009	Inyo County star-tulip	0	0	23	23
	2010		2	0	23	25
	2011		0	1	30	31
	2012*		0	0	1	1
	2013		5	0	20	25
**Gate open – Exclosure grazed*						

Springer Pasture, Blackrock Lease

This pasture contains an Owens Valley checkerbloom population with four trend plots; Springer 1C, Springer 2C, Springer 1EXC, and Springer 2EXC, all of which are grazed. Trend across all plots is static (Figure 7). This pasture is consistently grazed year round by both cattle and horses and receives irrigation water from Stevens Ditch. Because of the consistent grazing regime and that trend has remained static to slightly increasing, it appears that the level of grazing is not negatively impacting the Owens Valley checkerbloom population.



***Total Plants, all age classes combined**

Land Management Figure 7. Grazed, Springer Field

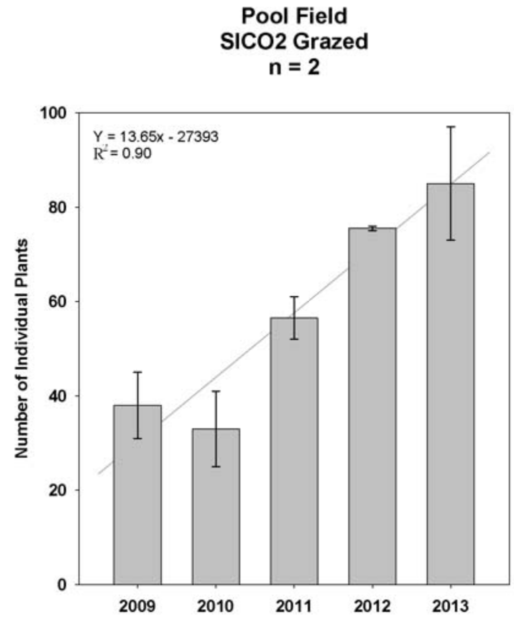
Land Management Table 4. Rare Plant Raw Data

Plot Number	Year	Species	Seedling	Juvenile	Mature	Total
Springer 1C (Grazed)	2009	Owens Valley checkerbloom	0	74	31	115
	2010		15	0	131	146
	2011		9	31	9	108
	2012		41	0	119	160
	2013		28	0	128	156
Springer 2C (Grazed)	2009	Owens Valley checkerbloom	0	13	24	37
	2010		3	0	49	52
	2011		7	17	33	57
	2012		27	0	44	71
	2013		7	0	59	66
Springer 1EXC (Grazed)	2009	Owens Valley checkerbloom	0	2	5	7
	2010		0	0	16	16
	2011		6	44	42	92
	2012		6	0	10	16
	2013		1	0	8	9
Springer 2EXC (Grazed)	2009	Owens Valley checkerbloom	0	23	13	36
	2010		0	0	37	37
	2011		3	13	29	45
	2012		17	0	24	41
	2013		15	0	29	44

Thibaut Pasture, Thibaut Lease

This pasture contains an Owens Valley checkerbloom and Inyo County star tulip population. Trend for both Pool Field 1 and Pool Field 4 are increasing (Figure 8).

The plots are located within the Rare Plant Management Area and are grazed by horses and mules, which are excluded from grazing from March 1 to September 30. This is to allow the rare plants to complete their life cycle (see section 2.8.2.3 of Final LORP EIR June 23, 2004). Because plant numbers are increasing over time it appears that Owens Valley checkerbloom favors some level of seasonal grazing. The positive trend may also be attributed to the irrigation regime from an irrigation/stock water ditch located between the trend plots. No actual data has been collected on soil moisture at the plots but observational data does not indicate that the plots have ever been inundated or drying out and that the management regime of the ditch has remained consistent.



***Total Plants, all age classes combined**

Land Management. Figure 8. Grazed Pool Field

Land Management Table 5. Raw Data

Plot Number	Year	Species	Seedling	Juvenile	Mature	Total
Pool Field 1 (Ungrazed)	2009	Owens Valley checkerbloom	N/A	N/A	N/A	N/A
	2010		1	0	24	25
	2011		15	5	32	52
	2012		34	0	42	76
	2013		45	0	52	97
Pool Field 1 (Ungrazed)	2009	Inyo County star-tulip	N/A	N/A	N/A	N/A
	2010		0	0	12	12
	2011		0	0	4	4
	2012		2	0	7	9
	2013		4	0	8	12
Pool Field 4 (Ungrazed)	2009	Owens Valley checkerbloom	N/A	N/A	N/A	N/A
	2010		3	0	38	41
	2011		9	12	40	61
	2012		31	0	44	75
	2013		28	0	45	73
Pool Field 4 (Ungrazed)	2009	Inyo County star-tulip	N/A	N/A	N/A	N/A
	2010		0	0	4	4
	2011		0	0	2	2
	2012		0	0	1	1
	2013		0	0	3	3

4.6.3 Rare Plant Conclusions/Recommendations

The objective of the project was to monitor impacts of grazing exclusion on Owens Valley checkerbloom. Based on 5 years of data, the trend in exclosed plots appears to be decreasing across all sites. Using the Pool Field and Springer pastures as an example, some level of disturbance, grazing (per the LORP EIR grazing prescriptions) and improved irrigation water management, may contribute to maintaining stable populations of Owens Valley checkerbloom and Inyo County star tulip.

It is recommended to continue this study a few more years, particularly because the Robinson exclosure was left open in 2011. Additional data will be useful to further illustrate trends of Owens Valley checkerbloom and Inyo County star tulip within the LORP area.

4.7 Discussion Range Trends in 2013

Stewart, Blackrock, and the Delta Lease Range Trend transects were read in August along with transects located along the former 'dry reach' from Twin Culverts to the north section of the Blackrock Lease which included floodplain transects on the Thibaut Lease. Range Trend transects were read again this year on the Lone Pine Lease inside the burn area of the Lone Pine Fire.

2013 was the second year where precipitation remained well below average. Impacts thus far from the drought vary depending upon location. When all ecological sites are consolidated, 38% of the transects remained static, 23% of the transects showed a significant increase in frequency by species, and 37% of the transects had a decrease in frequency by species. On Moist Floodplain ecological sites, 36% of the sites showed no change from 2012 to 2013, 42% of the sites showed a significant decline in a variety of plant species, though not all these declines are attributable to diminished seasonal precipitation. Continued significant declines of Nevada saltbush along multiple locations on the former dry reach of the Lower Owens are a result of the rising water table as the river continues to aggrade. Alkali sacaton abundance declined on four sites and was static on the remaining sites. This is likely an effect of two different factors, the first from lack of moisture from the drought conditions, second rising water tables on the floodplain, submerging the root zone. Saltgrass significantly increased on four sites and declined on three. Emergent vegetation and plants associated with highly saturated soils made significant increases on sites in close proximity to the river in 2013, again likely related to the aggrading river and sustained high summer flows. Similar to 2012, in 2013, the only real evidence of drought was the continued decrease in *Bassia hyssopifolia* (Fivehorn smotherweed). On the eight Saline Meadow sites, half of the transects indicated no changes for all species. Two sites indicated a significant increase in the abundance of alkali sacaton. While on one site there was a decline in alkali sacaton. One site also indicated a decline of saltgrass. The single Sandy Terrace site showed no change in frequency for the plant communities sampled. Of the three Sodic Fan sites sampled, one remained static, both alkali sacaton and saltgrass increased on the two other sites.

Land Management Table 6. Changes in Plant Frequencies

Percentage of significant changes in plant frequencies where D= decrease, I=increase, and STATIC (no change)	
Moist floodplain (42 sites)	
STATIC (no change)	36%
SPAI (D)	10%
DISP (D)	7%
DISP (I)	10%
LETR (I)	2%
LETR (D)	5%
ATTO (I)	2%
ATTO (D)	7%
BAHY (D)	7%
SCAM6 (I)	2%
SUMO (D)	2%
JUBA (D)	2%
TYLA (I)	2%
HECU (D)	2%
ANCA10 (I)	2%
Saline Meadow (8 sites)	
STATIC (no change)	50%
SPAI (I)	25%
SPAI (D)	12.5%
DISP (D)	12.5%
Sandy Terrace (1 site)	
STATIC (no change)	100%
Sodic Fan (3 sites)	
STATIC (no change)	33%
SPAI (I)	33%
DISP (I)	33%

4.8 Streamside Monitoring for Woody Species

In response to adaptive management recommendations by the MOU consultants, LADWP implemented a streamside monitoring program in 2010. The objective of the monitoring effort was to document establishment of woody vegetation in the riparian corridor of the LORP, browsing activity, and streamside conditions that were being missed in other monitoring activities. This streamside monitoring effort was to be conducted twice a year for the first 3 years (if needed) to establish baseline conditions, and then once annually at 3-year intervals until the completion of all project monitoring in 2022. Scheduling has since changed where monitoring continues annually instead of every three years and additional sites demonstrating high numbers of juvenile tree willows are included into the project. The timing of the monitoring is designed to be completed in the spring and late summer/early fall to correspond with livestock rotation. The complete streamside monitoring protocol can be found in Land Management Appendix 4 in the *2010 Final Lower Owens River Project Annual Report*.

From 2010 to 2012, a count and classification (juvenile, mature, decadent, dead) of inundated 'in channel' trees at base flow level from the transect edge, across to the other side of the river was incorporated into the protocol. The objective for this was to track survivability of older pre-LORP trees which colonized the bottom of the channel prior to the return or augmentation of flows throughout the LORP. These existing trees presently serve as the primary seed source for tree establishment. In 2013, counting of the in channel trees was discontinued because of the low degree of repeatability caused by poor cross channel visibility. With the availability of new aerial imagery in the summer of 2014, trends for in-channel trees will be compared by examining changes between 2009 imagery and the 2014 imagery.

A refined classification of browsing was integrated into the protocol in 2012. Previously, a tree was recorded as browsed or not. Research has demonstrated that juvenile riparian trees can typically withstand light leader browsing (<30%) before overall growth of the tree becomes suppressed (Guillet and Bergstrom, 2006; Lucas et. al., 2004; Conroy and Svejcar, 1991; Shaw, 1992; Platts, personal communication, 2012). Changes to the protocol evaluated browsing intensity as either no leaders browsed (0%), less than 25% leaders browsed, or greater than 25% of leaders browsed for trees less than 6 feet in stature. Browsing levels were further divided into trees less than 6 feet and trees greater than 6 feet based on the idea that trees that exceed 6 feet will be able to grow to their natural heights because they will have grown above the browse line. To monitor highlining of mature trees greater than 6 feet, the same classes of leader use were applied to leaders below the browse line which was typically less than 6 feet. The final modification to the streamside monitoring for woody species regeneration was the dropping of belt transects which showed little potential to glean any understanding of woody riparian establishment and survivability on the LORP, the criteria used to eliminate plots were those which had no seedling or juvenile willow or cottonwood trees. The only plots which remained were plots with more than one seedling or juvenile tree and all plots inside of the livestock grazing/browsing exclosures. The result of this was that 12 original plots remained while 20 plots were dropped. Using results from previous RAS surveys that identified locations with woody recruitment, additional locations were surveyed for their potential as long-term study plots for the project. All plots located within grazing exclosures were sampled this year and will continue to be sampled in the future. There were 31 belt transects sampled this fall, two transects were dropped because of the absence of tree willows (BLK_5b) and non-representative substrate (BLK_12b). Two new belt transects containing large numbers of juvenile tree willows were added to the program (TWN_5a and BLK_17a). Similar to 2012, in 2013 all identification of trees appeared to be more accurate than counts completed in the spring because all trees had broken dormancy, improving the probability of locating young juveniles with full, mature foliage amongst cattails and tules. Therefore, long-term survivorship of trees will be compared between years from fall counts.

In the fall of 2013, the Streamside Monitoring project incorporated an additional metric of sampling the height of all woody riparian species which are less than 6 feet tall and then making note of tree taller than 6 feet. Heights will be sampled in the fall.

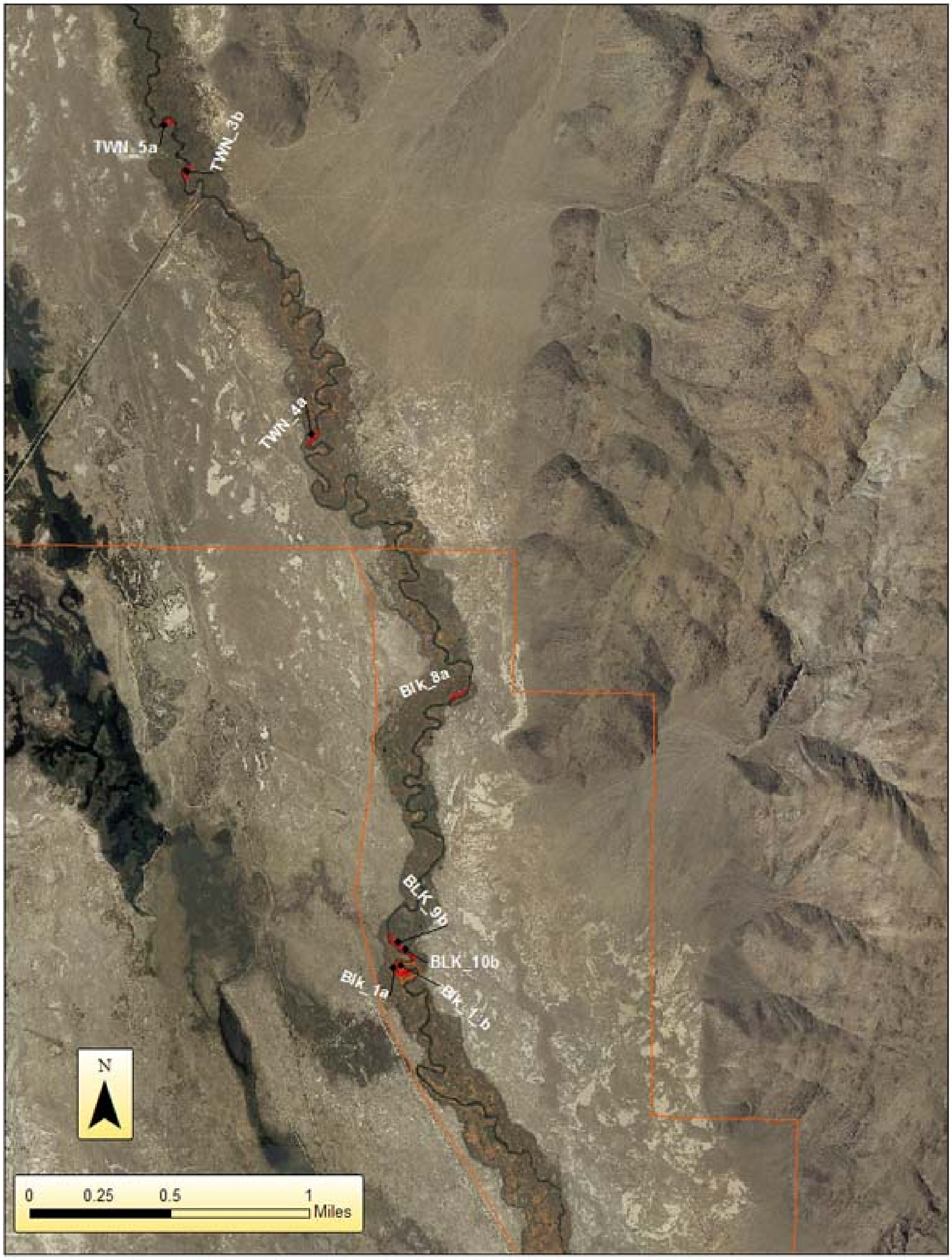
The Streamside Monitoring study examines the interactions between the combined browsing of elk and livestock and interaction of elk alone on woody riparian juvenile and mature trees. In this study a juvenile tree is defined as a tree >1year and a <3-inch DBH (Diameter at Breast Height), with the exception of coyote willow which in this project is considered to be a shrub willow. The distinction between trees used solely by elk versus elk and cattle combined is done by sampling plots in May immediately after most livestock have left the river and revisiting the same sites again in late September, allowing for a 4-5 month period when only Tule Elk are present on the river. We are also, to a lesser extent, able to use livestock exclosures to make similar spatial comparisons on the few exclosure sites which support tree willows. The study also examines intensity of highlining or browsing accessible leaders by large ungulates on mature trees. There are several avian species which require the lower branches of mature riparian tree species for nesting. This study will also look at long-term trends overtime as it relates to the survivability of tree willows both in the belt transect along the stream bank and inside the channel.

It is important to point out that all sites in this study which contain willows were not randomly selected. These locations were intentionally chosen because of their potential to provide a greater understanding: 1) of willow survivability over time, 2) riparian tree susceptibility to different levels of browsing/highlining, and 3) what influences livestock, beaver, and elk may play upon young willow stands during the dormant and growing season. The following results cannot be extrapolated to represent conditions typical to the entire 124 miles of riverbank which comprises the Lower Owens River.

The following section presents results at the transect level, organized by lease and further broken down to pasture. Data presented in the following sections were collected during two periods in 2013, the first between May 15-25 and the second between September 10-25, for ease in presenting data these periods will be referred to as Spring 2013 and Fall 2013, respectively.

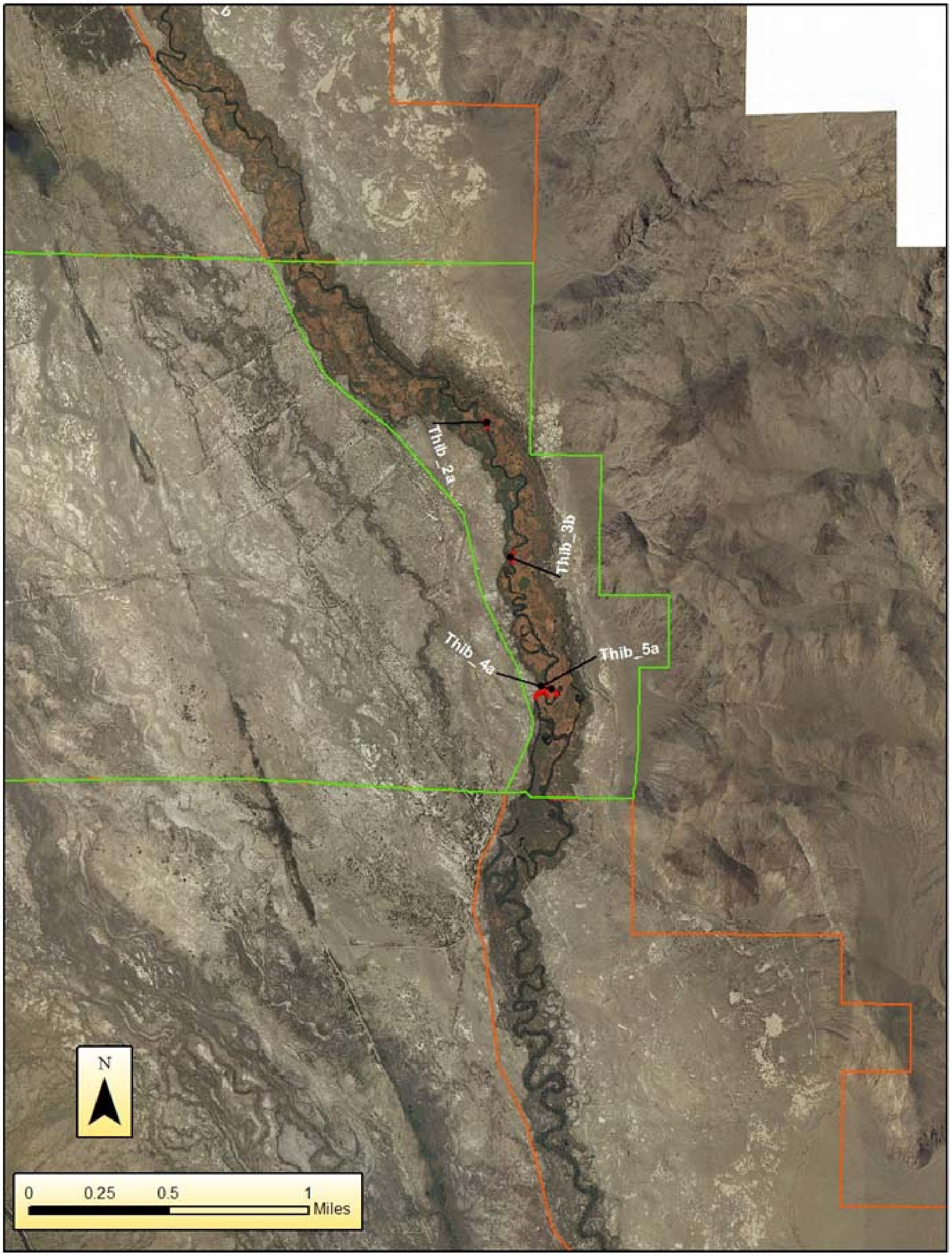
4.9 Results by Transect and Lease

The following four large scale overview maps present the locations of the individual streamside monitoring transects within the broader context of the LORP Project Area.



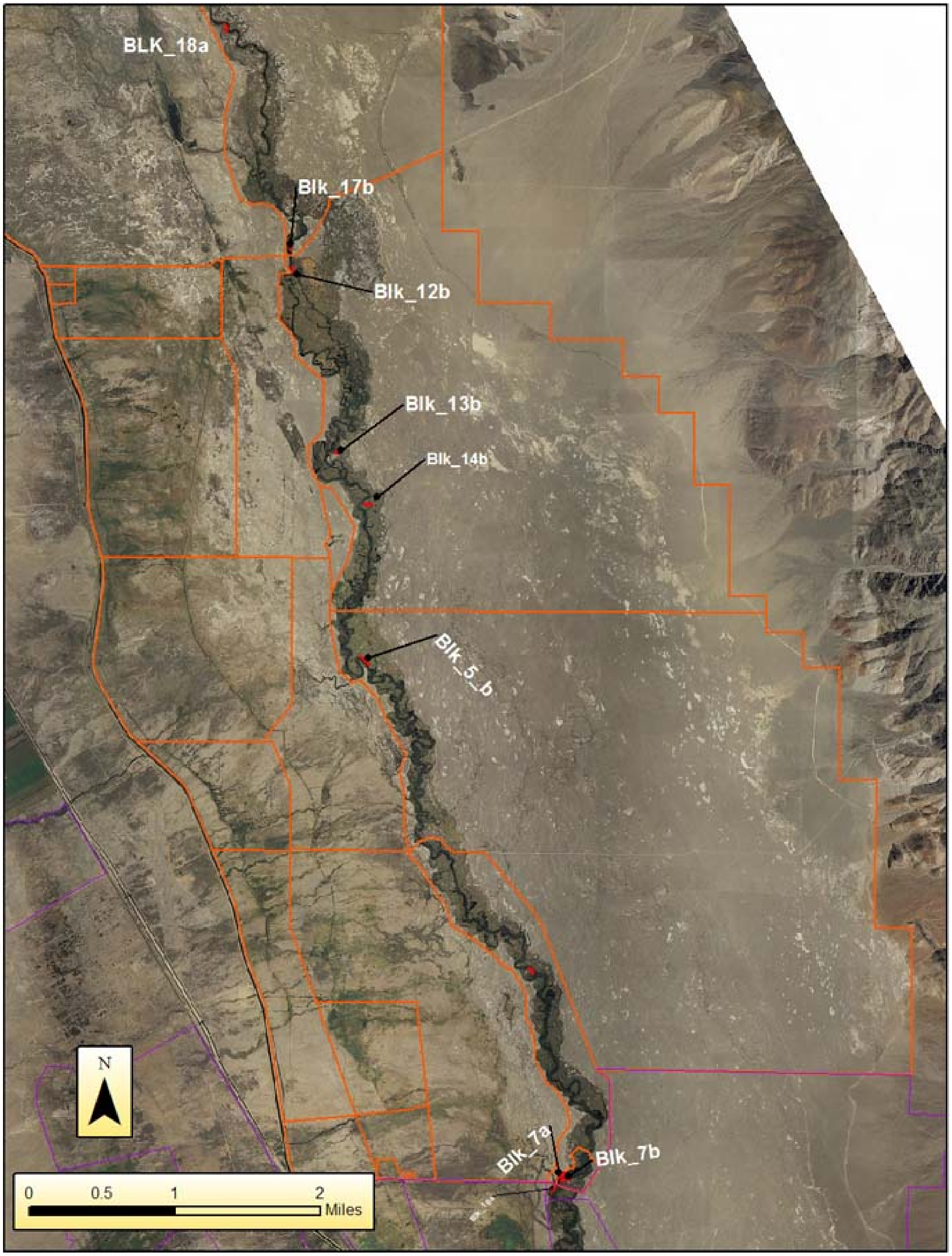
Land Management Figure 9. Twin Lakes Transects and Upper Blackrock Transects

Twin Lakes Transects (TWN_3b, TWN_4a, and TWN_5a) and Upper Blackrock Transects (BLK_1a, BLK_1b, BLK_10b, BLK_9b, and BLK_8a).



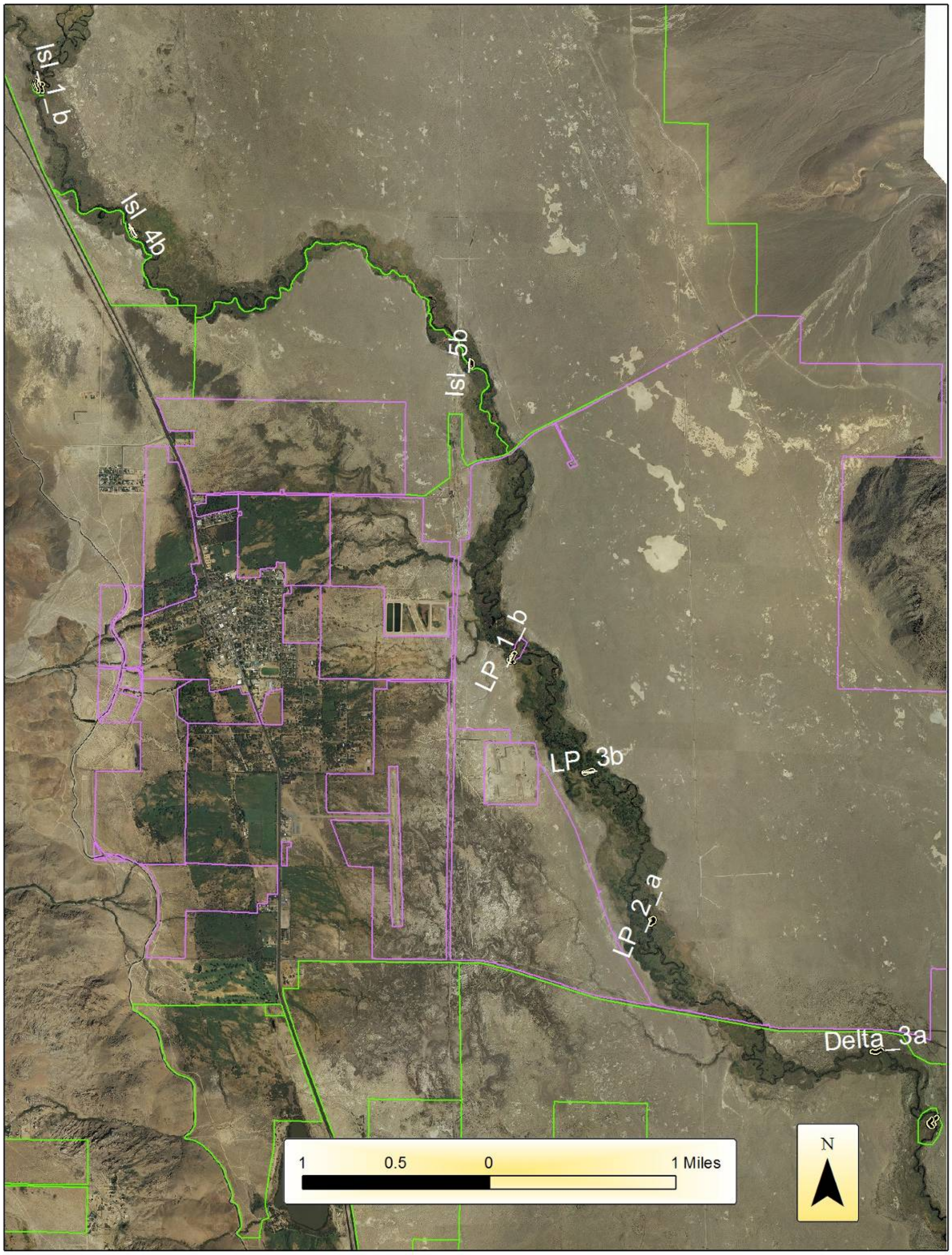
Land Management Figure 10. Thibaut Transects

Thibaut Transects (Thib_2a, Thib_3b, Thib_4a, Thib_5a).



Land Management Figure 11. Lower Blackrock Transects and Upper Island Transect

Lower Blackrock Transects (BLK_18a, BLK_17b, BLK_12b, BLK_13b, BLK_14b, BLK_5b, BLK_7a, BLK_7b) and (BLK_16a).



Land Management Figure 12. Island Transects, Lone Pine Transects, and Delta Transects

Island Transects (Isla_1a, Isl_1b, Isl_4b, and Isl_5b); Lone Pine Transects (LP_1a, LP_1b, LP_3b, and LP_2a); and Delta Transects (Delta_3a, Delta_1a, and Delta_1b).

4.9.1 Twin Lakes Lease

TWN_3b location

TWN_3b was established in late April of 2012 and is located on the east side of the river in the Lower Blackrock Riparian Field on the Twin Lakes Lease. The belt transect includes a gravel bar where most of the tree willows were located. The site contains two tree willow species; *Salix gooddingii* (Goodding's willow) plant symbol SAGO and *Sailix laevigata (*red willow), plant symbol SALA3. Seedlings were observed for the second year on the gravel bar. As with most of the transects in the upper reach of the LORP, cattail encroachment up the banks continues in response to both the augmented flows needed to meet flow requirements downstream as well as aggradation of the river itself. No browsing was observed during the summer period. In 2012, it was estimated that 90% of juvenile tree willows on the site are resprouts from beaver chiseling. In early spring of 2013, a prescribed burn took place in the area and burned most of the juvenile trees on the gravel bar. Twenty one juvenile trees resprouted this summer, and the mean height reached 0.72m. There were 3 additional seedling tree willows identified on the plot this year.

TWN_3b Fall Tree Willow Counts

	2012	2013
Seedling	13	3
Juvenile	19	21
Total		24

TWN_3b Mean Height (m) for All Tree Willows Less than 6 feet

	Fall 2013
TWN_3b *n=24*	0.72m

TWN_3b Comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% Leader Use	<25% Leader Use	>25% Leader Use
Spring 2012	44%	44%	13%
Fall 2012	100%	0%	0%
Spring 2013			100% (burned)
Fall 2013	100%	0%	0%

TWN_4a

TWN_4A is located on the west bank in the Lower Blackrock Riparian Field. Forty one juvenile tree willows were counted in the fall of 2013. The plot was heavily browsed in May of 2013 with more than 25% of an individual tree's leaders removed from 86% of the young trees. Beaver are active in this area as well. Augmented summer flows contributed to substantial cattail expansion on this site in 2012 and 2013. The gravel bar which supports all of the young trees was submerged by approximately 25cm of water at the time of reading the plot in September 2013. All young trees were visibly stressed from prolonged inundation; long term survivability of these trees is unlikely.

TWN_4a

TWN_4a - Fall Tree Willow Counts

Tree Willow Spp.	2012	2013
Juvenile	43	38
Mature	1	1

TWN_4a - Comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% Leader Use	<25% Leader Use	>25%Leader Use
Spring 2012	0%	0%	0%
Fall 2012	100%	0%	0%
Spring 2013	5%	9%	86%
Fall 2013	100%	0%	0%

TWN_4a Mean Height (m) for All Tree Willows Less than 6 feet

	Fall 2013
TWN_4a *n=37*	0.88m

TWN_5a

TWN_5a is located north of the Black Rock Ditch outlet on the west side of the river. This is a new plot established this fall. There were approximately 230 juvenile tree willows. The trees appeared to be Goodding's willow. This site was inside the prescribed burn this spring. Mean height on the plot was 81cm. There was no browsing observed this fall.

TWN_5a Fall Tree Willow Counts

	2013
Seedling	
Juvenile	230
Mature	
Decadent	1
Dead	

TWN_5a Mean Height (cm) for All Tree Willows Less than 6 feet

	Fall 2013
TWN_5a *n=225*	88 cm

4.9.2 Blackrock Lease

White Meadow Riparian Field

BLK_1a

BLK_1a is located inside the White Meadow Exclosure and is characterized as wet meadow with some woody vegetation; the site is dominated by *Leymus triticoides* (creeping wildrye), plant symbol LETR5. There was no use in the exclosure by livestock. The water's edge consists of living and dead cattails and banks are covered by litter. There is no floodplain developed within the transect location. Downstream from the transect there is a vegetated point bar. No seedlings or juvenile trees have been detected inside the belt transect. There is an established Salix exigua (coyote willow), plant symbol SAEX stand inside and outside the exclosure. Beaver are present on the site and actively consuming willow. Because this site and its parallel transect on the east side, BLK_1b, are inside the exclosure they will continue to be read.

From south to north, BLK_1a, BLK_1b, BLK_10b, and BLK_9b.

BLK_1a Fall Counts for Tree Willow

	2012	2013
Seedling		
Juvenile		
Mature	2	3
Decadent		
Dead		

Downed SAGO by Beaver, BLK_1b

BLK_1b

BLK_Belt1b is also in the White Meadow exclosure on the east side and is characterized as marsh dominated by cattails along the water's edge, with abundant *Schoenoplectus americanus* (common threesquare), plant symbol SCAM and creeping wildrye. The bank on the east side of the river was noted as vegetated or root stabilized but also has saltcedar slash. Species documented along this transect included common threesquare, *Typha latifolia* (Broadleaf cattail), plant symbol TYLA; creeping wildrye; *Juncus balticus* (Baltic rush), plant symbol JUBA; *Juncus torreyi* (Torrey's rush*),* plant symbol JUTO; *Muhlenbergia asperifolia* (Scratchgrass), plant symbol MUAS; *Distichlis spicata* (saltgrass), plant symbol DISP; and *Tamarix ramosissima* (saltcedar). This area is in the exclosure thus, adjacent livestock use has no influence on current vegetated conditions. One juvenile Goodding's willow is in the plot. There was no browsing in the plot; however, similar to the other bank, beaver are actively consuming both the mature and juvenile willows.

Downed Goodding's Willow Juvenile from Beaver, BLK_1b, September 18, 2013

BLK_1b Tree Willows, and Saltcedar Counts

Tree Willow	2012	2013
Seedling		
Juvenile	1	1
Mature	4	2
Decadent		1
Dead		
TARA	2012	2013
Juvenile	1	

BLK_1b Narrowleaf Willow Length (cm)

	2013
SAEX	120cm

BLK_10b

BLK_10b is located just upstream of BLK_1b, outside the exclosure on a long flood plain which receives occasional flooding when flows exceed 40cfs. The plot is comprised of common threesquare, cattails, creeping wildrye, Baltic and Torrey's rush, scratchgrass, saltgrass, and saltcedar. Because of sustained above average flows, cattails have replaced areas previously occupied by Baltic rush. Spring browsing of willows on this transect was high, 71% of juvenile trees had >25% of leaders removed.

BLK_10b Fall Counts for Tree Willow and Saltcedar

Tree Willow	**2012**	**2013**
Seedling	2	
Juvenile	29	27
Mature		
Decadent		1
Dead		
TARA	2012	2013
Juvenile	7	1

BLK_10b comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% Leader Use	**<25% Leader Use**	**>25% Leader Use**
Spring 2012	42%	47%	11%
Fall 2012	68%	25%	7%
Spring 2013	17%	13%	71%
Fall 2013	100%	0%	0%

BLK_10b Mean Height (cm) for All Tree Willows Less than 6 feet

	Fall 2013
BLK_10b *n=26*	111cm

BLK_9b

BLK_9b is located just upstream of BLK_10b, outside the exclosure along the same flood plain and is flooded when flows exceed 40cfs. The plot conditions are similar to those described for BLK_10b above. More than 50% of the juvenile trees were submerged for the past two months. Spring browsing of willows in 2013 was less than spring 2012 browse levels.

BLK_9b Fall Counts for Tree Willow and Saltcedar

Tree Willow	**2012**	**2013**
Seedling	8	0
Juvenile	21	39
Mature	2	2
Decadent		
Dead	1	

BLK_9b comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% Leader Use	**<25% Leader Use**	**>25% Leader Use**
Spring 2012	38%	25%	38%
Fall 2012	97%	3%	0%
Spring 2013	64%	7%	29%
Fall 2013	100%	0%	0%

BLK_9b Mean Height (cm) for All Tree Willows Less than 6 feet

	Fall 2013
BLK_9b *n=39*	64cm

BLK_8a

The majority of BLK_8a is within a densely vegetated point bar consisting of common threesquare, cattails, and creeping wildrye. Browsing on the site was high this spring. No browsing occurred in the summer. Vigor of the trees was poor this fall likely a result of being partially submerged during the extended augmented flows this summer and heavy use by livestock during the late spring. The Freemont cottonwood that was present last year, died this summer as a result of flows.

BLK_8a

BLK_8a Fall Counts for Tree Willow and Saltcedar

Tree Willow	2012	2013
Juvenile	13	13
TARA		
Juvenile	7	0
POFR		
Juvenile	1	0

BLK_8a comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% Leader Use	<25% Leader Use	>25% Leader Use
Spring 2012	61%	2%	37%
Fall 2012	100%	0%	0%
Spring 2013	0%	0%	100%
Fall 2013	100%	0%	0%

BLK_8a Mean Height (cm) for All Tree Willows Less than 6 feet

	Fall 2013
BLK_8a *n=13*	84cm

Reservation Riparian Field

BLK_18a

BLK_18a was established this fall (2013) based on findings provided by the Rapid Assessment Survey conducted in early August. At least one year ago a significant recruitment event occurred on this sandy point bar resulting in the establishment of more than 500 juvenile trees. With sustained high flows site is aggrading and is gradually being colonized by cattails (see photo). Approximately 150 saltcedar seedlings were pulled while reading the plot.

BLK_18a

BLK_18a Cattail colonization of sandbar.

BLK_18a Fall Counts for Tree Willow and Saltcedar

Tree Willow	2013
Juvenile	518
Decadent	2
Dead	1

BLK_18a comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% Leader Use	<25% Leader Use	>25% Leader Use
Fall 2013	100%	0%	0%

BLK_18a Mean Height (cm) for All Tree Willows Less than 6 feet

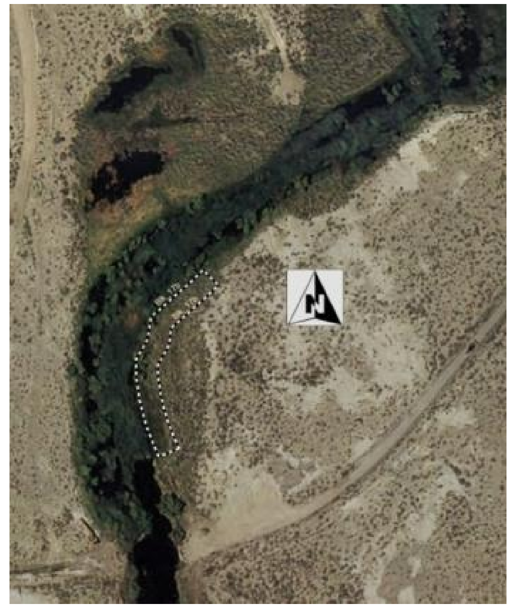
	Fall 2013
BLK_18a *n=518*	38cm

BLK_17b

BLK_17b is located on the east side and upstream from the Mazourka Gauging Station on a small floodplain. The floodplain has high cover, dominated by saltgrass, creeping wildrye, Baltic and Torrey's Rush, *Ericameria nauseosa* (Rubber rabbitbrush), plant symbol ERNA10, and *Prosopis pubescens* (screwbean mesquite), plant symbol PRPU; are declining on the site, likely in response to a rising water table. Cattails are expanding on this site also likely due to the rising water table. Beaver impacted the site by removing 56% of the juvenile tree willows on the lower section of the plot which contributed to the decreased number of juvenile trees observed this fall.

BLK_17b Fall Tree Counts

Tree Willow Spp.	2012	2013
Juvenile	74	44
Mature	7	
Decadent		3
TARA		
Juvenile	7	0
ELAN		
Mature	4	3
Decadent		1
PRPU		
Juvenile	12	25
Mature	7	6



BLK_17b

Beaver Use, BLK_17b, 2013

BLK_17b comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% leader use	<25% leader use	>25% leader use
Spring 2012	74%	14%	11%
Fall 2012	100%	0%	0%
Spring 2013	99%	0%	1%
Fall 2013	44%	0%	56%

BLK_17b Mean Height (cm) for all Tree Willows Less than 6 Feet

	Fall 2013
Tree Willow *n=38*	77cm

North Riparian Field
BLK_12b

BLK_12b was dropped in 2013. Recruitment on the site was occurring on a breeched dike which was heavily scoured this summer. In addition the substrate was imported coarse gravel and was not representative of conditions natural to the river.

BLK_13b

BLK_13b is located in the North Riparian pasture along a gravel bar of an abandoned oxbow which receives water during seasonal habitat flows and subsequent flows intended to meet the 40cfs requirements downstream. Herbaceous cover is high, consisting of beardless wild rye, saltgrass, and scratchgrass. In the lowest area of the oxbow cattails are present, larger juvenile trees are present within the cattails. These likely established before the colonization by cattails. Most trees were inundated throughout the summer in 2013.

BLK_13b

BLK_13b Fall Counts for Tree Willow and Saltcedar

Tree willow spp.	2012	2013
Seedling	6	
Juvenile	104	103
TARA		
Seedling	1	
Juvenile	9	8
Mature	2	

BLK_13b comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% leader use	<25% leader use	>25% leader use
Spring 2012	88%	7%	5%
Fall 2012	95%	4%	1%
Spring 2013	100%	0%	0%
Fall 2013	100%	0%	0%

BLK_13b Mean Height (cm) for All Tree Willows Less than 6 Feet

	Fall 2013
Tree Willow *n=103*	129 cm

BLK_14b

BLK_14b is situated along an abandoned oxbow which is inundated during flows exceeding 70cfs. The site is dominated by a gradient of cattails, transitioning to juncus and rushes then to scratchgrass, saltgrass, and creeping wildrye. Browsing this spring and fall was nominal. Seedlings which were observed last year were recorded this year as juveniles. This site was submerged for at least two 2.5 months this summer, trees showed visual signs of stress (photo below).

BLK_14b

BLK_14b, note water and muddy soils and yellowing of willow leaves from prolonged inundation.

BLK_14b Fall Counts for Tree Willow and Russian Olive (ELAN)

Tree willow spp.	2012	2013
Seedling	39	
Juvenile	174	249
Mature	2	3
Decadent	1	1
Dead	3	
ELAN		
Juvenile		8

BLK_14b comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% leader use	<25% leader use	>25% leader use
Spring 2012	89%	4%	7%
Fall 2012	96%	3%	1%
Spring 2013	96%	0%	4%
Fall 2013	100%	0%	0%

BLK_14b Mean Height (cm) for all Tree Willows Less than 6 Feet

	Fall 2013
Tree Willow *n=249*	74 cm

BLK_14b Length (cm) for SAEX

	Fall 2013
SAEX	120 cm

BLK_5b

DROPPED

BLK_5b is located, South Riparian Field was dropped in 2013. The site had no juvenile tree willows.

BLK_15a

BLK_15a is located in the South Riparian Field on the west side between a gravel bar and the river's edge. The majority of *Salix sp.* are growing in the gravel bar which has very low vegetative cover (<10%). Evidence of beaver was noted in the fall of 2012. Use was minimal on site. Seedlings recorded last year survived to juveniles in 2013.

BLK_15a

BLK_15a fall counts for tree willow spp.

Tree willow spp.	2012	2013
Seedling	12	0
Juvenile	59	76
Mature	10	9
Decadent	1	1
Dead	2	0

BLK_15a comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

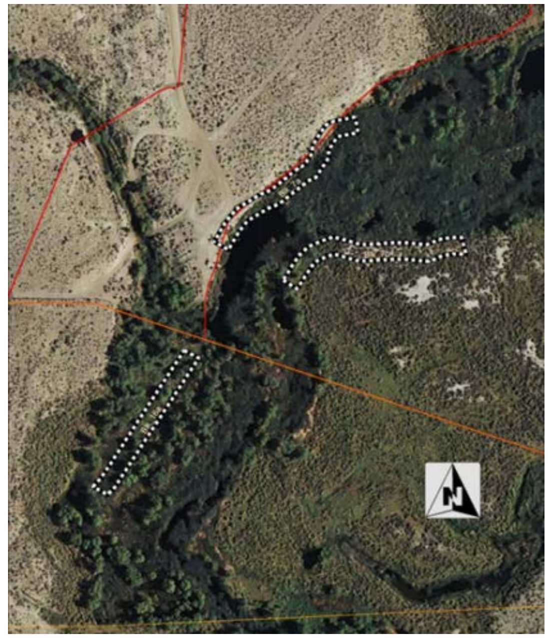
	0% leader use	<25% leader use	>25% leader use
Spring 2012	100%	0%	0%
Fall 2012	87%	10%	3%
Spring 2013	80%	2%	17%
Fall 2013	99%	1%	0%

BLK_15a Mean Height (cm) for all Tree Willows Less than 6 Feet

	Fall 2013
Tree Willow *n=76*	66 cm

BLK_7a

BLK_Belt7a is located within the George's Creek Exclosure along a steep bank on the western side of the Lower Owens River. This area along the water's edge was primarily marsh with a dense well established corridor of narrowleaf willow. The water's edge is dominated by cattails. The bank in this area is primarily vegetated or litter covered. Species along the transect included cattails, yerba mansa, narrowleaf willow, Baltic rush, tules, greasewood, American licorice, scratchgrass, threesquare bulrush, and saltgrass. Narrowleaf willow is the dominant species on this transect and the only *Salix sp.* on the transect. No browsing of coyote willow was noted.



BLK_7a, BLK 7b (top left and right), BLK 16a bottom left.

BLK_7a Length (m) for SAEX

	Fall 2013
SAEX	95.95m

BLK_7b

BLK_Belt7b was classified as marsh and woody vegetation, is dominated by cattails and Goodding's willow along the water's edge. The bank in this area was primarily vegetated with some root stabilized soil. Species recorded along the water's edge included tules and cattails, yerba mansa, threesquare bulrush, creeping wildrye, Goodding's willow, Baltic rush, and saltgrass. The plot is in a large grazing exclosure, there was no use by wildlife in the plot. There was only one Goodding's willow juvenile recorded in May 2012.

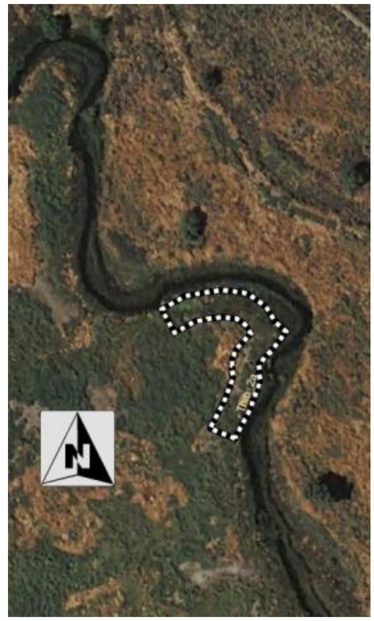
BLK_7b Fall Counts for Tree Willow and Saltcedar (TARA)

Tree willow spp.	2012	2013
Seedling		
Juvenile	1	
Mature	9	4
Decadent	6	12
Dead		
TARA		
Juvenile	2	
Mature		1

4.9.3 Thibaut Lease

THIB_2a

THIB_2a is located in the Thibaut exclosure on the west side of the river. Establishment occurred on a vegetated point bar. There were six dead juvenile trees observed on the site, these trees were likely impacted from the protracted high flows in 2012. No browsing was observed in the spring and fall of 2012 or 2013. Flows during the summer of 2013 left over 90% of the trees submerged (see photo below). The decrease in trees on this plot is attributed to high summer flows.



THIB_2a

THIB_2a, Fall 2013

THIB_2a Fall Counts for Tree Willow

Tree willow spp.	2012	2013
Seedling		
Juvenile	34	29
Mature		
Decadent		
Dead	6	

THIB_2a comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% leader use	<25% leader use	>25% leader use
Spring 2012	100%	0%	0%
Fall 2012	100%	0%	0%
Spring 2013	100%	0%	0%
Fall 2013	100%	0%	0%

THIB_2a Mean Height (cm) for all Tree Willows Less than 6 Feet

	Fall 2013
Tree Willow *n=9*	99cm

THIB_3b

THIB_3b is located on a point bar on the east side of the river. The coyote willow and saltcedar establishment are occurring on an exposed gravel bar with low herbaceous cover. All saltcedar observed were pulled by hand this fall. Some browsing by deer or elk was observed this spring. This site will be dropped in 2014.

THIB_3b

THIB_3b fall Counts for Tree Willow and Saltcedar (TARA)

Tree willow spp.	**2012**	**2013**
Seedling		
Juvenile		
Mature	9	5
Decadent		
Dead		
TARA		
Juvenile	9	

THIB_3b comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% leader use	<25% leader use	>25% leader use
Spring 2012	91%	0%	9%
Fall 2012	100%	0%	0%
Spring 2013	Na	Na	Na
Fall 2013	100%	0%	0%

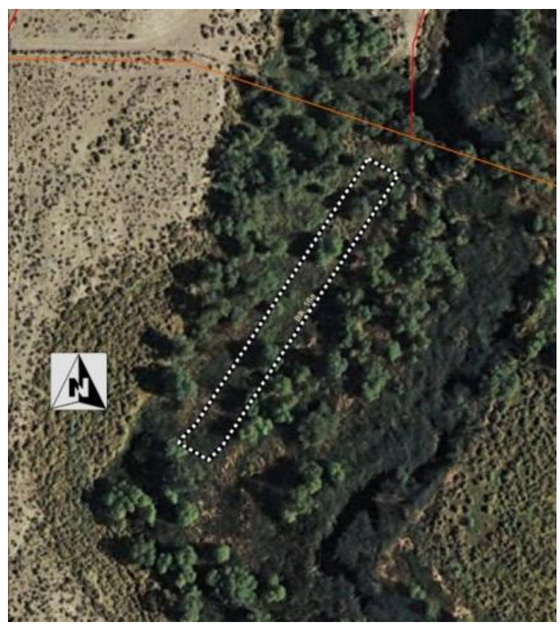
THIB_3b Length (m) for SAEX

	Fall 2013
SAEX	5.5

4.9.4 Islands Lease

BLK_16a

BLK_16a is located on a depositional confluence of George's Creek and the Owens River in the northern most section of the River Field on the Islands Lease. The floodplain receives water during high seasonal habitat flows as well as sediment loads from Georges Creek. An active beaver dam is contributing to periodic flooding of the area. The plot is within a riparian gallery forest. Juvenile *Salix sp.* on the plot are occupying newly created niches from tamarisk removal efforts beneath the forest canopy. There is a large diversity of *Salix sp.* on the plot and a high number of juveniles. For two consecutive summers, evidence of elk was observed on the plot and recent browsing of juvenile trees was recorded in the browsing results.



BLK_16a

BLK_16a Fall Counts for Tree Willow and Saltcedar (TARA)

Tree willow spp.	2012	2013
Seedling	4	
Juvenile	31	27
Mature	6	7
Decadent	2	
Dead		
FOPU		
Juvenile	4	3
TARA		
Juvenile		2
Mature	3	

BLK_16a comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% leader use	<25% leader use	>25% leader use
Spring 2012	100%	0%	0%
Fall 2012	61%	4%	35%
Spring 2013	100%	0%	0%
Fall 2013	48%	29%	23%

BLK_16a Mean Height (cm) for all Tree Willows Less than 6 Feet

	Fall 2013
Tree Willow *n=26*	83cm

ISL_1a

ISL_1a is located in an exclosure on the Islands lease on the west side of the river. There were no trees on the banks of the river within the study plot.

ISL_1b

ISL_1b parallels ISL_1a on the east side of the river inside an exclosure.

ISL_1a (left) and ISL_1b (right)

ISL_1b Fall Counts for Tree Willow

Tree willow spp.	2012	2013
Seedling		
Juvenile		1
Mature		1
Decadent		
Dead		

ISL_1b comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% leader use	<25% leader use	>25% leader use
Spring 2012	100%	0%	0%
Fall 2012	100%	0%	0%
Spring 2013	100%	0%	0%
Fall 2013	100%	0%	0%

ISL_1b Mean Height (cm) for all Tree Willows Less than 6 Feet

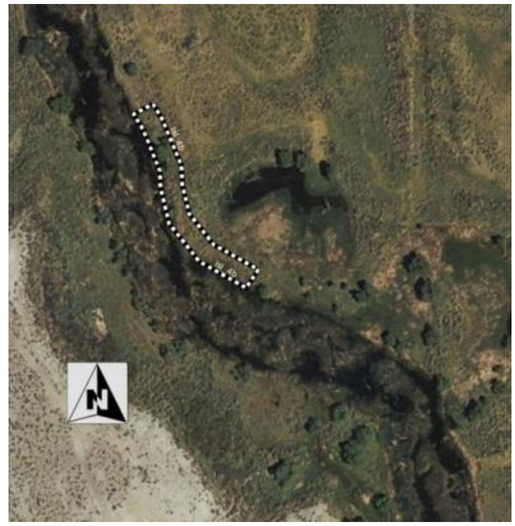
	Fall 2013
Tree Willow *n=1*	135cm

ISL_1b Length (cm) for SAEX

	Fall 2013
SAEX	86 cm

ISL_4b

ISL_4b is located along the east bank of the Owens River in the River Field. Willow establishment on this site is confined to a sediment filled abandoned oxbow in the center of the transect which receives additional water during seasonal habitat flows and augmentation discharges. Most young trees on the site were submerged for at least 2.5 months this summer. Trees were visibly stressed from the prolonged flooding. Browsing during the spring of 2013 was much lower than what occurred in 2012. However, use was then shifted to heavy summer browsing by elk during the summer of 2013.



ISL_4b

ISL_4b Fall Counts for Tree Willow

Tree willow spp.	2012	2013
Seedling		
Juvenile	35	30
Mature	3	3
Decadent		
Dead	1	

ISL_4b comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% leader use	<25% leader use	>25% leader use
Spring 2012	7%	5%	88%
Fall 2012	100%	0%	0%
Spring 2013	78%	4%	19%
Fall 2013	33%	3%	63%

ISL_4b Mean Height (cm) for all Tree Willows Less than 6 Feet

	Fall 2013
Tree Willow *n=29*	57cm

ISL_5b

ISL_5b is located away on the east side of the Owens River in the Depot Riparian Field on the Islands Lease. Juvenile tree willows on the site are confined to a heavily vegetated point bar which receives water when flows exceed baseflows. Tree willows were amongst three-square, cattails and tules. Similar to 2012, trees were in the water during the augmentation flow period this summer. Summer browsing of juvenile trees was high this year with leaders browsed and other trees rubbed.

ISL_5b

ISL_5b Fall Counts for Tree Willow, saltcedar (TARA), and Desert Olive (FOPU)

Tree willow spp.	2012	2013
Seedling		
Juvenile	17	17
Mature	5	6
Decadent	1	
Dead	1	
FOPU		
Mature	1	
TARA	2	1
Juvenile		
Mature		

ISL_5b comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% leader use	<25% leader use	>25% leader use
Spring 2012	87%	0%	0%
Fall 2012	100%	0%	0%
Spring 2013	36%	45%	18%
Fall 2013	20%	0%	80%

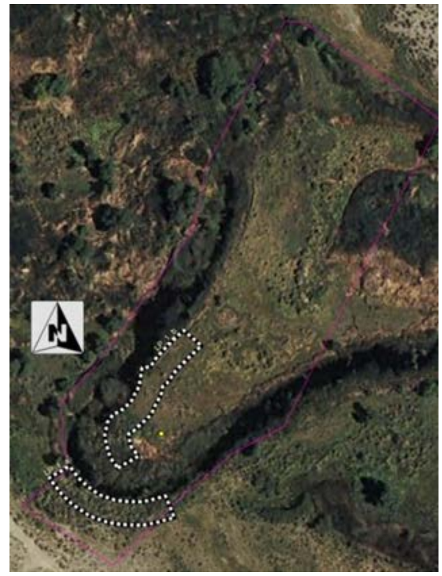
ISL_5b Mean Height (cm) for all Tree Willows Less than 6 Feet

	Fall 2013
Tree Willow *n=5*	159cm

4.9.5 Lone Pine Lease

LP_1a

LP_1a is the western plot of the parallel plot complex within the fenced exclosure on the River Field on the Lone Pine Lease. The plot traverses an outer bend of the river and is heavily vegetated with cattails and tules on the water's edge transitioning to beardless wild rye and alkali sacaton up on the banks. There were no living willows on the banks although there are two mature Gooding's willow straddling the water's edge. This plot was burned in the 2013 Lone Pine Fire.



LP_1b

LP_1b follows the outer edge of a point on the river. Vegetation cover and litter are high. The only recruitment observed for the site were juvenile sprouts from larger coyote willow shrubs.

LP_1b Fall counts for Tree Willow

Tree willow spp.	2012	2013
Seedling		
Juvenile		
Mature	4	1
Decadent	2	
Dead	1	

LP_1b comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% leader use	<25% leader use	>25% leader use
Spring 2012	8%	92%	0%
Fall 2012	100%	0%	0%
Spring 2013	Na	Na	Na
Fall 2013	Na	Na	Na

LP_1b Length (m) for SAEX

	Fall 2013
SAEX	24.00m

Before the Lone Pine Fire, September 2012

After the Lone Pine Fire, March 2013

Land Management Figures 13. Before and After Lone Pine Fire-LP1b

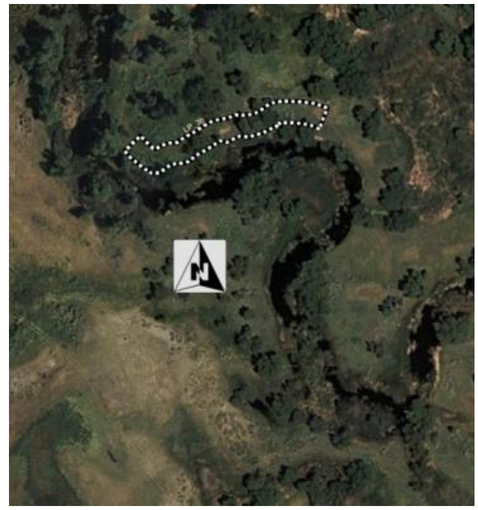
After the Lone Pine Fire, May 2013

After the Lone Pine Fire, September 2013

Land Management Figures 14. After Lone Pine Fire-LP1b

LP_3b

LP_3b is located in a wooded section on the east side of the Owens River in the River Field. The site was densely vegetated with beardless wild rye, saltgrass, and sacaton. Nevada saltbush and rubber rabbitbrush are also on the plot. The plot was burned in the Lone Pine Fire (Photo 24). Heavy browsing of resprouts occurred during the 2013 summer by Tule elk.



LP_3b

LP_3b Fall Counts for Tree Willow

Tree willow spp.	2012	2013
Seedling		
Juvenile		
Resprout		9
Mature	7	1
Decadent	3	
Dead		

LP_3b comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% leader use	<25% leader use	>25% leader use
Spring 2012	38%	38%	25%
Fall 2012	100%	0%	0%
Spring 2013	na	na	na
Fall 2013	29%	0%	71%

LP_3b Mean Height (cm) for all Tree Willows Less than 6 Feet

	Fall 2013
Tree Willow (resprouts) *n=5*	138cm

Before the Lone Pine Fire, September 2012

After the Lone Pine Fire, March 2013

Land Management Figures 15. Before and After Lone Pine Fire-LP3b

After the Lone Pine Fire, May 2013

After the Lone Pine Fire, September 2013

Land Management Figures 16. After Lone Pine Fire-LP3b

LP_2a

LP_2a was located on a heavily vegetated point, and is characterized as primarily woody with some marsh. The site was burned in the Lone Pine fire, some elk browsing of resprouts occurred this summer.

LP_2a

LP_2a Fall Counts for Tree Willow

Tree willow spp.	2012	2013
Seedling		
Juvenile	1	
Resprout		8
Mature	10	1
Decadent	5	
Dead		
TARA		
Resprout	1	1

LP_2a comparison between fall and spring browsing of willow leaders within three browse classes (0% leaders browsed, less than 25% leaders browsed or greater than 25% leaders browsed) for trees less than six feet in height.

	0% leader use	<25% leader use	>25% leader use
Spring 2012	0%	0%	100%
Fall 2012	33%	33%	33%
Spring 2013	na	na	na
Fall 2013	25%	75%	0%

LP_2a Mean Height (cm) for all Tree Willows Less than 6 Feet

	Fall 2013
Tree Willow (resprouts) *n=8*	112 (cm)

LP_2a Length (cm) for SAEX

	Fall 2013
SAEX	60cm

Before the Lone Pine Fire, September 2012

After the Lone Pine Fire, March 2013
Land Management Figures 17. Before and After Lone Pine Fire-LP2A

After the Lone Pine Fire, May 2013

After the Lone Pine Fire, September 2013

Land Management Figures 18. After Lone Pine Fire-LP2A

4.9.6 Delta Lease

DELTA_3a

Delta_3a is located on the Delta Lease on the west side of the river along an inside bend. The plot traverses a fairly vertical bank with no active floodplain. Vegetation cover is dense shrub with some perennial grass. Three Coyote seedlings were growing amongst the cattails in the plot. There was no browsing in the spring or fall on the site. This site will be dropped in 2014.

DELTA_3a

DELTA_3a Fall Counts for Tree Willow

Tree willow spp.	2012	2013
Seedling		
Juvenile		
Resprout		
Mature	1	1
Decadent	1	1
Dead		
TARA		
Juvenile	1	

DELTA_3a Length (m) for SAEX

	Fall 2013
SAEX	25.20 (m)

DELTA_1a and DELTA_1b

DELTA_1a spans the outside bend of the river in the Delta Grazing exclosure and Delta_1b traverses the inside bend of the river. Both plots are marsh with common reed (*Phragmites australis*) and tules being the predominant species at the water's edge. Saltgrass and saltbush dominate the adjacent wet meadow. The streambank was characterized mostly as vegetated or litter. The banks are fairly steep and there is no active floodplain on the two plots. Both of these plots are within a livestock grazing exclosure. There was no browsing on either plot.

DELTA_1a (left) and DELTA_1b (right)

DELTA_1a Fall Counts for Tree Willow

Tree willow spp.	2012	2013
Seedling		
Juvenile		
Resprout		
Mature	1	1

DELTA_1a Length (m) for SAEX

	Fall 2013
SAEX	25.20 m

DELTA_1b fall counts for saltcedar (TARA)

TARA	2012	2013
Seedling		
Juvenile	1	1
Resprout		
Mature		

DELTA_1b Length (m) for SAEX

	Fall 2013
SAEX	91.5 m

4.9.7 General Results

In total, across all plots, there was a decrease of 56 juvenile trees from 2012 to 201. Given the predation of approximately 30 juvenile trees by beaver (BLK_17B) and the assumption that counts are not exact, numbers have remained relatively static. However, over time as these tree willow sites mature, numbers are expected to decline. On most sites tree establishment is not equally distributed across the 1000 m^2 of the belt transect. Typically, tree willow establishment is highly concentrated on point bars or confined to zones which may have at one time exhibited conditions conducive to seed germination and establishment.

TWN_5a, 230 juvenile tree willows are relegated within red circle

The site illustrated in the photo above contains 230 juvenile trees inside the red circle. That same area would occupy 2-3 mature trees nearing 100% canopy cover. On the left inside bend (where the arrow is pointing) is a single mature tree willow to provide reference for what the potential foliar area of a mature tree is.

Land Management Table 7. Mean Heights (cm) for Tree Willows, Fall 2013

Mean heights (cm) for tree willows, fall 2013.	
Plot	**2013**
BLK_10B	109
BLK_13B	129
BLK_14B	74
BLK_15A	66
BLK_16A	83
BLK_17B	77
BLK_18A	38
BLK_1B	120
BLK_8A	84
BLK_9B	64
ISL_1B	135
ISL_4B	57
ISL_5B	159
LP_2A	112
LP_3B	138
THIB_2A	99
TWN_3B	72
TWN_4A	88
TWN_5A	81
Total Mean (cm)	**94**

Sampling for mean tree height will help in determining if declines in tree densities are a natural process. Under natural conditions an inverse relationship should occur with a decline in overall tree densities in a given area compared to an increase in mean tree height.

The biological definition of recruitment refers to seedlings that have germinated this year (germinants). This growth stage of a plant is usually its most vulnerable and is prone to high mortality (Leck,M. et. al., 2008). What is more useful for assessing long term condition of the Lower Owens River with regards to woody riparian trees would be the examination of recruitment sites over subsequent years and shifting the focus to the survivorship of seedlings identified from the first recruitment event. Cooper used the concept of establishment defined as the survivorship of seedlings after three growing seasons (Cooper et. al, 1999).

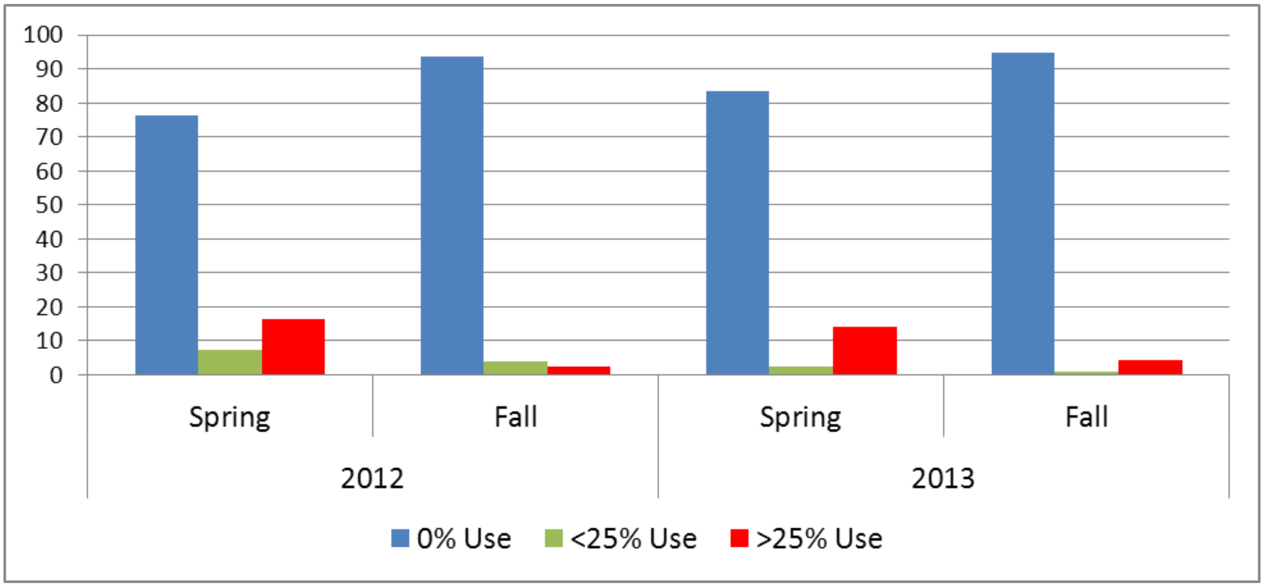
Land Management Table 8. Juvenile and Seedling Tree Willows

JUVENILE AND SEEDLING TREE WILLOWS BETWEEN FALL 2012 COUNTS AND 2013			
PLOT		**2012**	**2013**
BLK_10B	juvenile	29	27
	seedling	2	
BLK_13B	juvenile	104	103
	seedling	6	
BLK_14B	juvenile	174	249*
	seedling	39	
BLK_15A	juvenile	59	76*
	seedling	12	
BLK_16A	juvenile	31	27
	seedling	4	
BLK_17B	juvenile	74	44†
BLK_1B	juvenile	1	1
BLK_7B	juvenile	1	
BLK_8A	juvenile	13	13
BLK_9B	juvenile	21	39*
	seedling	8	
ISL_1B	juvenile		1
ISL_4B	juvenile	35	30
ISL_5B	juvenile	16	17
LP_2A	juvenile	1	
THIB_2A	juvenile	34	29
TWN_3B	juvenile	19	21
	seedling	13	3
TWN_4A	juvenile	43	38
TOTAL	juvenile	713	657
	seedling	84	3
BLK_18A 2	juvenile	(new)	518
TWN_5A	juvenile	(new)	230

Increase in 2013 juvenile counts likely result of 2012 seedling survival.
†Heavy beaver presence on transect.
Shaded cells indicate trees were inundated for at least 2.5 months of the growing season in 2013.

This study also examines woody riparian establishment on sites by conducting density counts of trees, categorizing these trees by growth stage (seedling, juvenile, mature, decadent, and dead) and revisiting these sites under a meaningful timeline to track changes of trees and identify if individuals have progressed into the next growth stage. There were a total of 84 seedlings (germinants) over all plots in 2012, this year (2013) there were only three seedlings found across all plots and those seedlings were relegated to a single plot, TWN_3b. This lack of germinant tree willows on the plots is consistent with observations throughout the summer on the river and the lack of germination following seeding efforts on the Lone Pine burn. On four of the six sites which had seedlings in 2012 (BLK_14b, 39 seedlings; BLK_15a, 12 seedlings; BLK_9b, 8 seedlings; TWN_3b, 13 seedlings) however, there was an increase in juvenile trees in 2013 which suggests that many of the seedlings observed in 2012 progressed to the next growth stage.

Excessive browsing can inhibit potential heights of trees and shrubs, decrease leader densities, and in some cases completely alter the species composition of riparian zones (Belsky et al, 1999; Boggs and Weaver, 1992; Green et al, 1995). Lacking successful willow recruitment, riparian systems can develop unbalanced age class distributions eventually leading to the die off of willow stands (Kauffman, 1987). Moderate spring and fall forage utilization (36%-55%) has shown to have little impact on red willow and coyote willow survivorship and the tree's ability to reach full growth potential, while heavy utilization (56%-75%) and summer long use can retard both growth and seedling densities (Shaw, 1992). The single finding common to all studies of livestock impacts on riparian areas is that no two situations are similar (Kauffman and Krueger, 1984; Kovalchik and Elmore, 1992). This known variability serves to emphasize the need for continued study of livestock impacts on the Lower Owens River. Successful stand establishment on the Owens River is thought to require browsing intensities where less than 25% of juvenile leaders are browsed annually (Platts, pers comm). Similar to 2012, browsing of willow leaders were estimated both in May and in September of 2013 to gain a better understanding browsing intensity and what impacts were caused by livestock and elk, or elk alone on willow sites on the Lower Owens River.



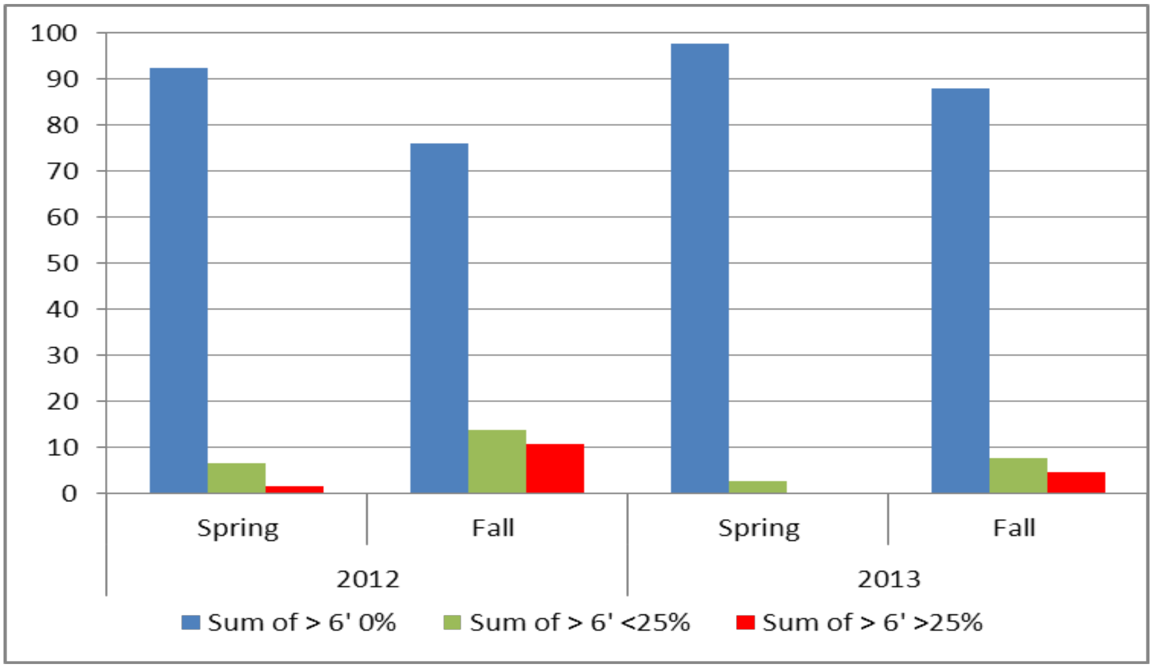
Land Management Figure 19. Comparison Between Spring and Fall Sampling (Juvenile) This comparison is between fall and spring 2012 and 2013 of the percent browsed tree willow leaders on trees less than 6 feet tall (juvenile) for all sites accessible to livestock and/or elk. Use estimates exclude beaver impacts.

Across the entire project area, spring browsing intensity declined in 2013 when compared to 2012. Critical leader use (>25% of browsed leaders) for trees less than 6 feet in height declined from 17% during the December-May grazing period (Spring) in 2012 to 14% in 2013. No use of leaders (0%) increased in 2013 from 76% to 83% and <25% of leader use declined from 7% to 2% in the spring of 2013.

Fall estimates, which examines all browsing occurring between May and September showed little change between years, no use (0%) of leaders increased from 94% in 2012 to 95% in 2013, <25% leader use decreased from 4% to 1% and >25% leader use increased by 1% from 3% to 4% in 2013. Similar to 2012 browsing during the summer months was concentrated on the Lone Pine (LP_3b) and Islands Lease (BLK_16a, ISL_4b, and ISL_5b); use was exclusively by Tule Elk on those plots.

The final component of the streamside monitoring effort was to look at the browsing of leaders on trees greater than 6 feet in height to gain a better understanding of the alteration of tree understory structure (highlining) of mature riparian trees. Heavy browsing of established, mature trees can alter tree willow volume and structure in riparian areas and decrease the abundance of nesting passerine birds (Taylor, 1986). Both the Least Bell's Vireo and the Southwestern Willow Flycatcher require a dense willow understory for nesting, as nests typically are located between 1.5 to 4.5 feet above ground (Franzreb, 1989).

Results from highlining on adult trees in 2013 shared the same pattern as it did in 2012. Browsing intensifies during the summer; however, this repeating trend was not as strong as it was in 2012. It should be noted that there was no heavy use of leaders (>25%) on any sites during the spring of 2012.



Land Management Figure 20. Comparison Between Spring and Fall Sampling (Greater than 6 feet).

This comparison is between fall and spring 2012 percent leader use by class (0% leader use, <25% leader use, and >25% leader use) for tree willows greater than 6 feet in height across all belt transects.

The only recorded highlining which occurred on the entire river is confined to the Islands Lease (ISL_4b and ISL_5b). Although Tule Elk are present throughout LORP project area, summer highlining up river seems to have a less obvious impact on the river.

Discussion

The inclusion this year to select two additional sites (BLK_18a and TWN_5a) containing willow populations where establishment has occurred in the last several years created an opportunity to document substantial numbers of juvenile tree willows, browsing during different seasons, and age class distributions. Browsing of juvenile tree willows by livestock decreased in 2013 when compared to 2012 while browsing by elk slightly increased in 2013. Browsing across the entire project area is slight with high use levels confined to only a few locations.

Elk are browsing mature trees and less so juveniles in the summer. These impacts on the river are concentrated on the Lone Pine and Islands Lease. In these two areas, elk herds remain on the floodplain throughout the year, and in particular the summer; herds to the north will move back and forth from the river to saline meadows and irrigated pastures west of the river during the summer. ISL_4b which was browsed heavily by livestock in the spring of 2012 (>25% leader use = 88%) was browsed heavily by elk in the summer of 2013 (>25% leader use = 63%).

As stated in the 2012 LORP annual monitoring report, there is strong evidence pointing to a correlation between increased grazing intensity of perennial grasses in the floodplain and increased browsing of nearby juvenile willows. However, plant community structure, and timing also influences browsing intensity. Limited access to the river in Reach 1 and Reach 2 appear to facilitate high use of juvenile trees by livestock even when perennial grass use is under 40% on the floodplain. Reach 1 and 2 are incised along much of the river and stream banks still remain populated with dense stands of Nevada saltbush. The most accessible locales in Reach 1 and Reach 2 for water are along the point bars and serve to funnel livestock onto the gradually sloping banks which transition to gravel and sand bars. These point bars are the same locations which have young tree willow recruitment. In 2013 several of these locations were browsed heavily in the spring (BLK_10b *>25% leader use*= 70%; BLK_8a *>25% leader use*= 100%; TWN_4a *>25% leader use* = 86%). Despite high browsing, grazing levels were within acceptable use levels. These same pastures were grazed in the spring of 2012 but browsing intensity was considerably less (BLK_10b *>25% leader use*= 11%; BLK_8a *>25% leader use*= 37%; TWN_4a *>25% leader use* = 0%). Both springs in 2012 and 2013 were dry so livestock pressure was not more widely distributed onto adjacent uplands in 2012. Cattle were observed on these sites in early May 2013 but were not present during sampling in May of 2012. The most plausible explanation was that livestock were removed from the river pastures much earlier in 2012, prior to the emergence of leaves on the willows. Based on these observations, two recommendations are to:

1) Remove livestock from the river before juvenile willows break dormancy in the spring on sites which have experienced heavy use in prior years and

2) Conduct prescribed burns along the river channel and floodplain which, will remove dense shrub communities and provide more access points to the river by livestock and reducing the ‘funnel effect’.

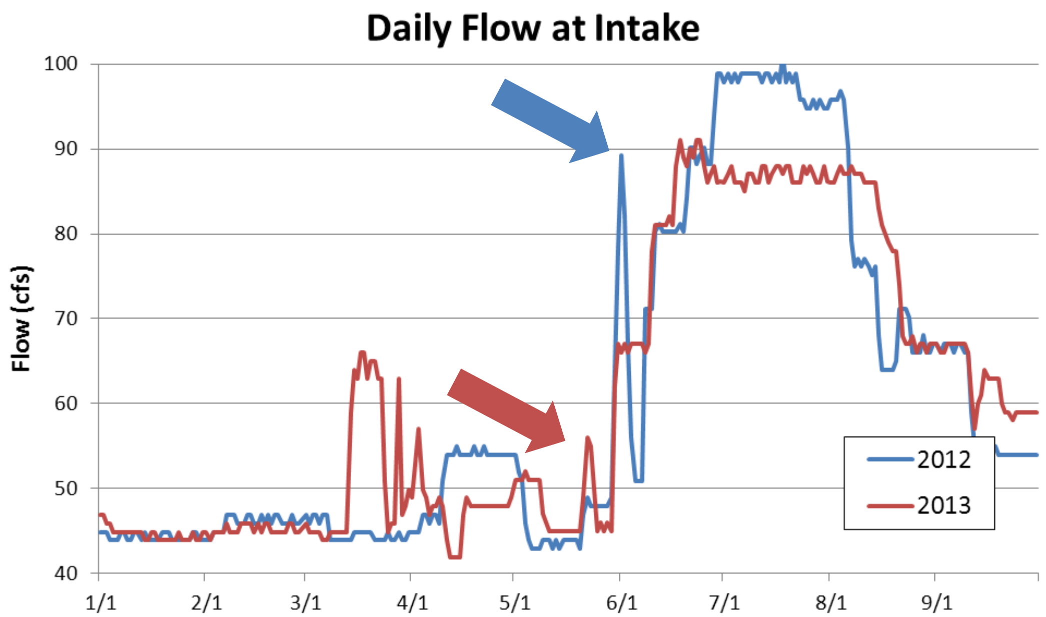
The two management recommendations above may help specific locations in the short term. Current flow management, however, is having a far greater impact on these same juvenile tree willow stands, and if not abated will eventually eliminate the stands, regardless of changes in timing of use by livestock or manipulating community plant structure thru fire. An estimated 33% (465 juvenile trees distributed across TWN_4a, THIB_2a, THIB_3b, BLK_8a, BLK_9b, BLK_14b, BLK_15a, and ISL_4b) of all juvenile trees sampled in 2013 were submerged during the summer flows for a period of 2-3 months. Most of these young trees showed visible signs of stress.

Land Management Table 9. Flows Summary for 2010-2013

Peak seasonal habitat flows, mean post-seasonal habitat flows, and mean sustained high summer flows based on Intake measuring station for 2010, 2011, 2012, and 2013.			
Year	Peak Flow	Mean post flow	Mean sustained high flow
2010	200cfs	70cfs 7/6-9/30	71cfs 82 days
2011	200cfs	72cfs 7/1-9/30	77cfs 67 days
2012	89cfs	77cfs 6/1-9/30	97cfs 40 days
2013	56cfs	77cfs 6/1-9/30	87cfs 60 days

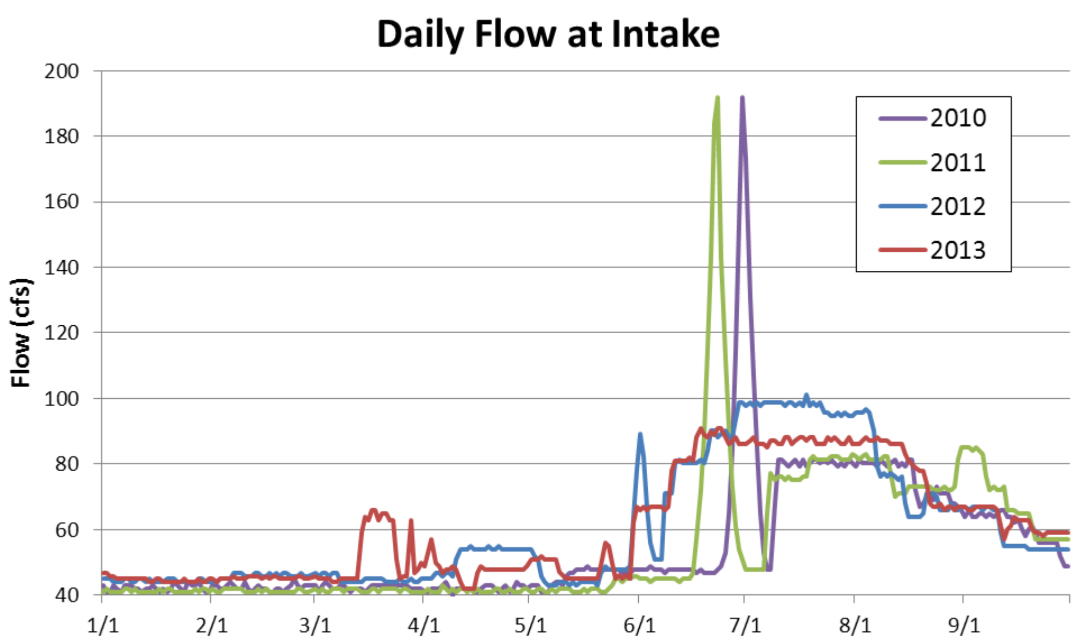
Seasonal habitat flows are synchronized with seed fly of desirable tree willow species in an effort to facilitate widespread germination events by extending favorable soil moisture conditions up the banks of the river. As elegant as this strategy may sound, it has little impact compared to the post-seasonal habitat flow strategy. Most of the juvenile trees currently sampled were established in 2010 or 2011, likely following the 200cfs seasonal habitat flows released during above average precipitation years (see Figure 3). Peak seasonal habitat flows released in 2012 and 2013 occurred during drought years and were significantly lower (89 cfs, June 1, 2012 and 56cfs, May 22, 2012). In an effort to meet required 40 cfs baseflow throughout the river, post-seasonal habitat flows in 2012 and 2013 exceeded the seasonal habitat flow (Figure 2, and Table 9). During 2012 there was a 40-day period beginning on June 28 where mean flow was 97cfs, well above the 89cfs seasonal habitat flow for that year. In 2013, mean flow for the four month period (June 1-September 30) was 21cfs over the peak seasonal habitat flow.

THIB_2a, note high water mark on SAGO trunk.
Photo taken 9/19/2013



Land Management Figure 21. Hydrographs for Lower Owens River at the Intake

Hydrographs for Lower Owens River at the Intake measuring station from January 1 to September 30, 2012 and 2013. Arrows indicate seasonal habitat flows.



Land Management Figure 22. Hydrographs for Lower Owens River at the Intake

Hydrographs for Lower Owens River at the Intake measuring station from January 1 to September 30, 2012, 2010, 2011, 2012, and 2013.

The sustained high summer flows in 2012 and 2013 would have literally drowned out any seeds that germinated and which may have been present after seed fly. Willow seed viability is short lived, less than 2-10 days (Densmore and Zasada, 1983) which would imply that seed germination events that may have occurred in response to the seasonal habitat flow would have subsequently been submerged during the increased summer base flows. Further, the heights of willow seedlings observed in August rarely exceed 3 inches; rising waters in June would have rapidly placed germinants below the waterline.

The increased summer flows in 2012 and 2013 have not only worked to eliminate willow recruitment for those two years but are also effectively drowning out older juvenile willows established in 2010 and 2011 following the two 200cfs seasonal habitat flows during those two years. The mean post-seasonal habitat summer flows in 2012 and 2013 both exceeded mean summer flows for 2010 and 2011. Under a natural flow regime, summer flows during extreme drought would not exceed flows during above average years. But on the Lower Owens River despite extreme drought conditions, flows for the last two years still managed to exceed those during the wet years of 2010 and 2011 (Land Management Figure 22 and Table 9.)

The sustained high summer flows of 97cfs/40 days in 2012 and 87cfs/60 days in 2013 submerged 33% of juvenile trees as mentioned earlier. A 2-year study conducted on the San Joaquin River National Wildlife Refuge (Partners, 2008) found that mature/young Gooding's willow (*Salix goodingii*) were tolerant of flooding during the growing season for a single year but after two years mortality rates increased to 14%. In the same study, Arroyo willow were moderately tolerant to flooding, but after a second year they experienced a mortality level of 35%.

In addition to direct impacts of flows resulting in the submergence of germinants and the prolonged flooding of juvenile tree willow stands, a secondary impact of flooding is via cattail and tule expansion which can impact tree willow survivorship. Sustained high flows experienced over the past two years have facilitated the expansion of cattails and tules out onto the floodplains and over point bars which support tree willows. Tree willows and cattails/tules are competing for the same resources. Gooding's willow is not shade tolerant (Howe, W.H. and Knoff, F., 1991) and with a mean height in 2013 of 94cm, juvenile trees were frequently found below the surrounding cattails and tules.

Browsing of willows by elk and livestock in discrete locations is influencing tree vigor and survivability to varying levels. What needs to take precedence however, is addressing the current flow management strategy which is having a much larger impact on willow vigor and survivability across the majority of the project area. If flow management continues as it has during the last several years then most of the sites currently monitored will either be permanently flooded or out-competed by tules and cattails as the aggradation/eutrophication of the Lower Owens River expands further onto the floodplain.

4.10 LORP Ranch Leases

The following sections are presented by ranch lease. The discussion will include an introduction describing the lease operations, pasture types, a map of the lease, and utilization results from 2012-13, a summary of range trend results at the lease level and a presentation of range trend results by transect. The tables refer to plant species by plant symbol. Refer to Appendix 1, which contains a list of the plant species, scientific names, common names, plant symbol, and functional group assignment for species encountered on the range trend transects.

4.10.1 Intake Lease (RLI-475)

The Intake Lease is used to graze horses and mules employed in a commercial packer operation. The lease is comprised of three fields: Intake, Big Meadow Field, and East Field (approximately 102 acres). The Intake Field contains riparian vegetation and an associate range trend transect. The Big Meadow Field contains upland and riparian vegetation; however, it is not within the LORP project boundaries. There are no utilization or range trend transects in the Big Meadow Field due to a lack of adequate areas to place a transect that would meet the proper range trend/utilization criteria. Much of the meadow in the Big Meadow Field has been covered with dredged material from the LORP Intake. The East Field consists of upland and riparian vegetation. The Big Meadow and Intake Fields were not used by livestock during the construction of the Intake structure, which lasted until the 2008-09 grazing season. There are no irrigated pastures on the Intake Lease. There are no identified water sites needed for this pasture and no riparian exclosures planned due to the limited amount of riparian area within the both pastures.

The following table presents the summarized utilization data for each field for the current year.

End of Grazing Season Utilization on the Intake Lease, RLI-475, 2013

Field	Utilization	Transect	Utilization
Intake Field*	0%	*STEWART_01	0%

**Riparian Utilization, 40%*

Summary of Utilization

Utilization for the Intake Lease in 2013 was well below the allowable 40% utilization standard.

Summary of Range Trend Data and Conditions

STEWART_01 is located in the riparian Intake Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, which corresponds to the Moist Floodplain ecological site. The site was sampled for the first time in 2009. The site appears stable with both alkali sacaton (SPAI) and saltgrass (DISP) abundant on the site. Nevada saltbush (ATTO) frequency decreased slightly yet canopy cover for the same species has doubled. Bassia was not present on the plot in 2013.

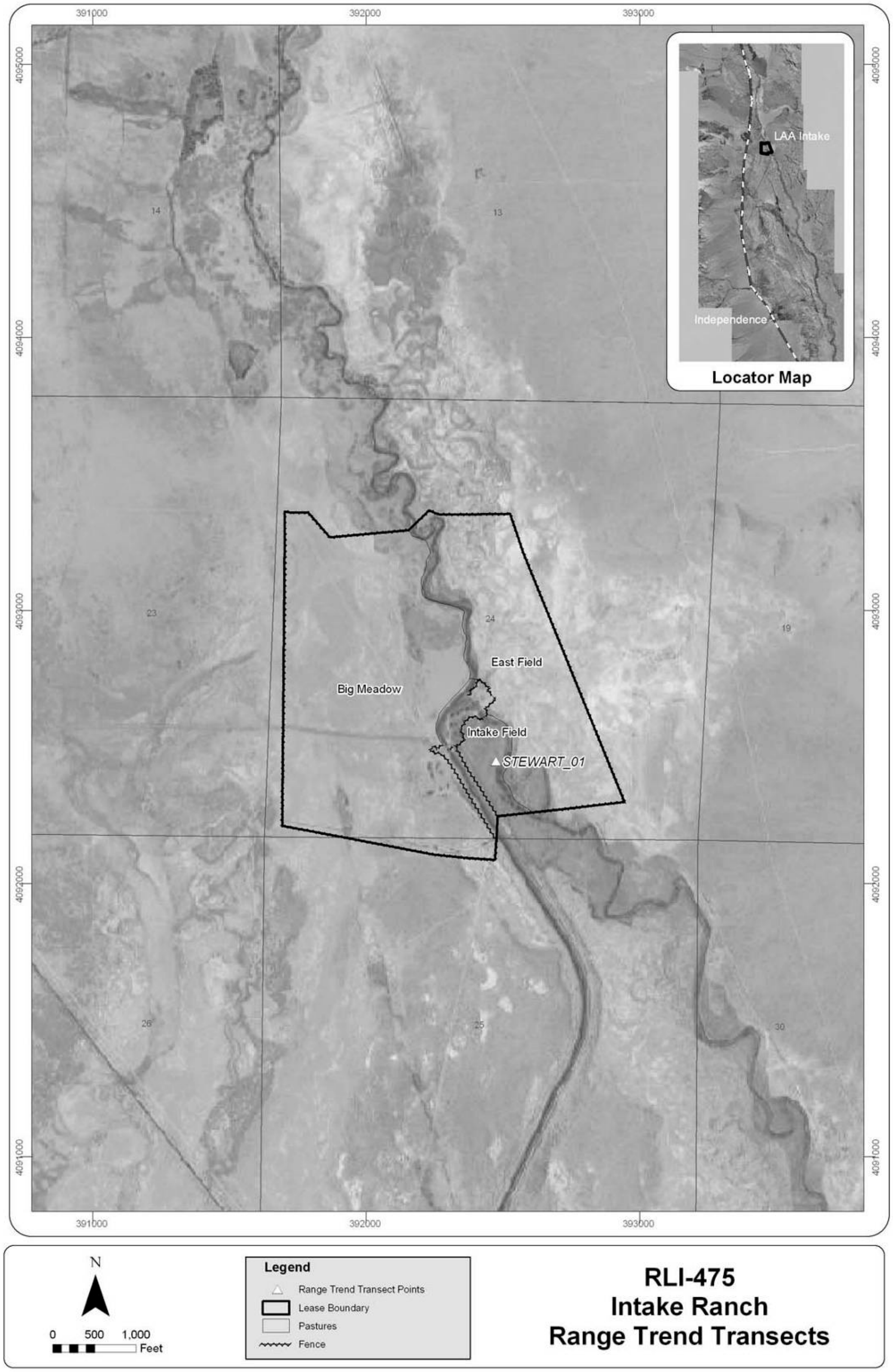
Frequency (%), STEWART_01

Life Forms	Species	2009	2010	2013
Annual Forb	COMAC	0	5	0
Perennial Forb	GLLE3	2	3	0
Perennial Graminoid	DISP	133	134	136
	JUBA	11	8	12
	SPAI	47	46	38
Shrubs	ATTO	4	11*	7
	ERNA10	2	0	0
Nonnative Species	BAHY	18	4**	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs STEWART_01

Species Code	2009	2010	2013
ATTO	7.6	6.4	13.0
ERNA10	0.2	0.5	0
Total	7.7	6.9	13.0



Land Management Figure 23. Intake Lease RLI-475, Range Trend Transects

4.10.2 Twin Lakes Lease (RLI-491)

The Twin Lakes Lease is a 4,912-acre cow/calf operation situated just south of the Los Angeles Aqueduct Intake. It includes a reach of the Owens River that lies mainly north of Twin Lakes, which is located at the southern end of the Twin Lakes Lease. Of the 4,912 acres, approximately 4,200 acres are used as pastures for grazing; the other 712 acres are comprised of riparian/wetland habitats and open water. In all but dry years, cattle usually graze the lease from late October or early November to mid-May.

There are four pastures on the Twin Lakes Lease within the LORP boundary: Lower Blackrock Riparian Field, Upper Blackrock Field, Lower Blackrock Field, and the Holding Field. The Lower Blackrock Riparian, Upper Blackrock Riparian, and Lower Blackrock Fields contain both upland and riparian vegetation. The Holding Field contains only upland vegetation. There are no irrigated pastures on the Twin Lakes Lease. Range trend and utilization transects exist in all fields except the Holding Field. Range Trend transects were not read on this lease in 2013.

The following table presents the summarized utilization data for each field for the current year.

End of Grazing Season Utilization on the Twin Lakes Lease, RLI-491, 2013

Field	Utilization
Lower Blackrock Field	13%
Lower Blackrock Riparian Field*	Burned
Upper Blackrock Field*	Burned

*Riparian Utilization 40%**

Riparian Management Areas

Utilization was 13% in the Lower Blackrock Field well below the allowable standard of 40%. The Lower Blackrock Riparian and Upper Blackrock field had not been scheduled for a range burn in 2012 but, the opportunity arose and the riparian sections in both fields were burned in March. There was a total of 190 acres burned resulting in complete utilization of the fields. Livestock did utilize the fields prior to the burn but, had not exceeded utilization rates.

Upland Management Area

Upland utilization was well below the allowable standard of 65% in all fields

Fencing

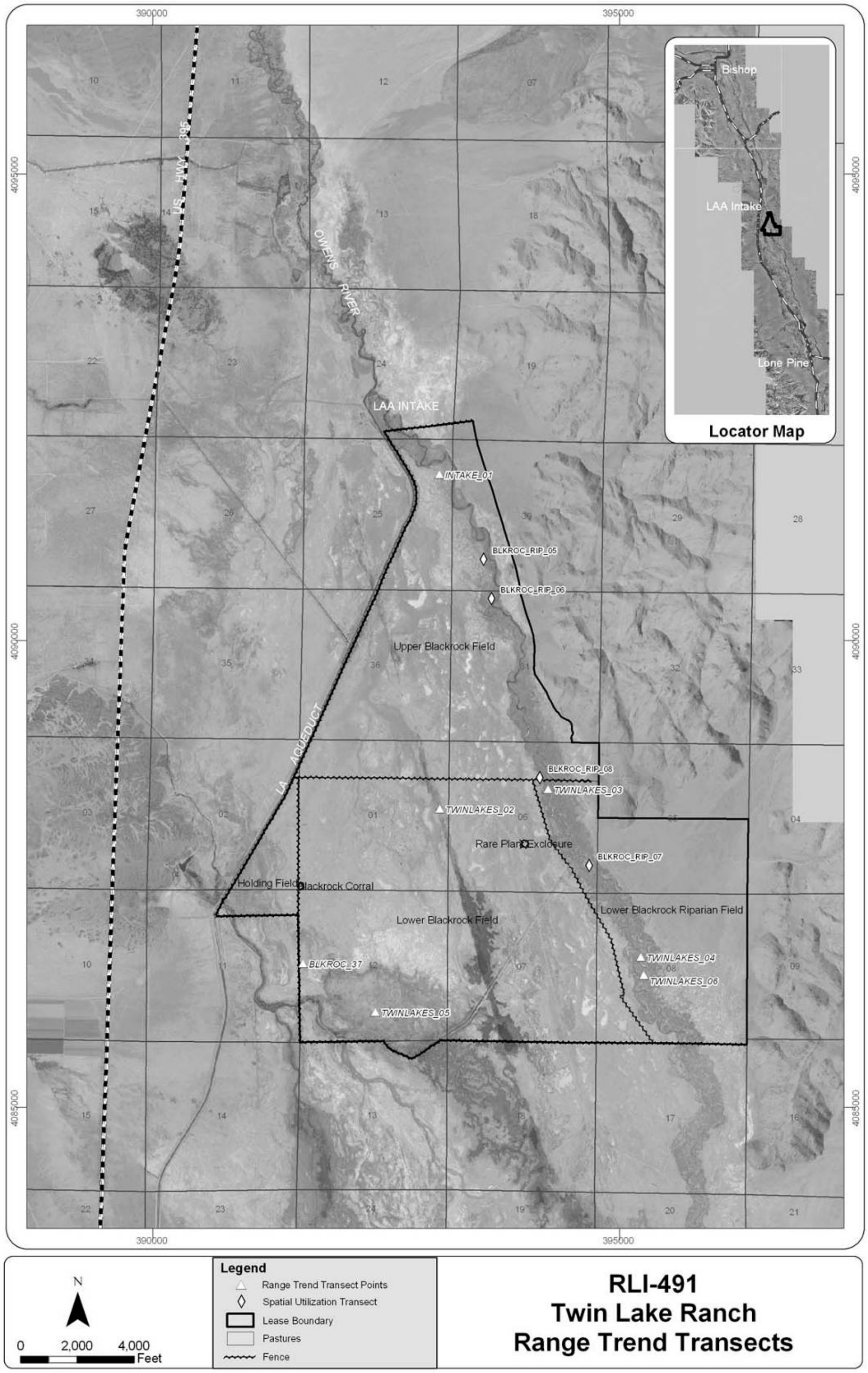
There was no new fencing constructed on the lease in 2013.

Salt and Supplement Sites

Supplement is composed of a liquid mix that is put in large tubs with rollers that the cattle consume. These tubs are placed in established supplement sites and are used every year.

Burning

A range burn was conducted in March resulting in 190 acres of riparian pasture being burned. This burn was not scheduled in 2012 but, the location had previously been selected by Watershed Resources staff. The purpose of the burn was to remove existing saltcedar slash piles and shrubs that had encroached in to existing perennial grass meadows. Prior to the burn, California Department of Forestry (CDF) and LADWP prepared fire breaks and created buffers around existing riparian vegetation, resulting in complete fire containment, with very little loss to riparian vegetation. Overall the burn resulted in the improvement of the meadow habitat on the Twin Lakes lease.



Land Management Figure 24. Twin Lake Lease RLI-491, Range Trend Transects

4.10.3 Blackrock Lease (RLI-428)

The Blackrock Lease is a cow/calf operation consisting of 32,674 acres divided into 24 management units or pastures. Blackrock is the largest LADWP grazing lease within the LORP area. The pastures/leases on the Blackrock Lease provide eight months of fall through spring grazing, which can begin any time after 60 continuous days of rest. A normal grazing season begins in early to mid-October and ends in mid-May or June.

There are twenty pastures on the Blackrock Lakes lease within the LORP boundary: South Blackrock Holding, White Meadow Field, White Meadow Riparian Field, Reservation Field, Reservation Riparian Field, Little Robinson Field, Robinson Field, East Robinson Field, North Riparian Field, Russell Field, Locust Field, East Russell Field, South Riparian Field, West Field, Wrinkle Field, Wrinkle Riparian Field, Spring Field, Wrinkle Holding, Horse Holding, and North Blackrock Holding. Twelve of these pastures are monitored using range trend and utilization. The other eight pastures are holding pastures for cattle processing or parts of the actual operating facilities.

Summary of Utilization

The following tables present the summarized utilization data for each field for the current year.

End of Grazing Season Utilization on the Blackrock Lease, RLI-428, 2013

Fields	Utilization
North Riparian Field*	35%
Horse Holding	0%
Wrinkle Riparian Field*	29%
Locust Field	32%
Reservation Field	30%
Robinson Field	25%
Russell Field	26%
White Meadow Field	19%
White Meadow Riparian Field*	21%
Wrinkle Field	22%
South Riparian Field*	19%
West Field	36%

**Riparian utilization 40% **

Riparian Management Area

Riparian use in all fields was below the 40% utilization limit. All riparian fields were measured during mid-season. Livestock were then removed by the lessee from all fields. By moving the livestock immediately after mid-season measurements there was no need for end-of-season measurements. All upland fields remain in good condition and did not reach 65% for the grazing season.

Upland Management Areas

Fields in the upland portions of the Blackrock Lease remained well below upland utilization standard of 65%.

Summary of Range Trend Data and Condition Blackrock Lease

There are twenty-six range trend sites on the Blackrock Lease. Monitoring site photos are presented in Appendix 3 – Section 3. Fourteen are located on Moist Floodplain ecological sites. Six of these sites are located along the historical ‘dry reach’ of the river (BLKROC_10, 11, 14, 15, 16, and 17). The similarity index for these six sites ranged between 4-47% averaged across all sampling periods.

The similarity index on BLKROC_11 averaged 47% across the entire baseline period indicating the site is in fair condition. All other sites in the former dry reach averaged less than 20%, indicating the sites are in poor condition. The similarity index for BLKROC_11 is higher due to persistence of perennial grasses at the site. At other dry reach sites, there was a loss of perennial grasses on the floodplain resulting from Los Angeles Aqueduct diversions.

The similarity indices for Moist Floodplain sites, which were not dried by Aqueduct diversions, have historically received perennial flow, ranged from 45-80%. Similarity indices for the eight sites located on Saline Meadow ecological sites ranged from 10-86%. With the exception of BLKROC_01 and BLKROC_02, the remaining six sites were in good to excellent condition. The three range trend sites on Sodic Fan, BLKROC_09, BLKROC_51, and BLKROC_44, have been in good condition while the one Sandy Terrace site BLKROC_49, is in fair condition. In general there have been no departures outside of the typical range of variability observed since monitoring has begun on all sites with the exception of a spike in sacaton on BLKROC_19 and increases Nevada saltbush on BLKROC_16. Therefore similarity to site potentials in 2010 are likely very similar to what was calculated during the baseline period.

Significant changes in 2013 frequency beyond what had previously been observed during the baseline period occurred on two of the 24 sites (Table 5). This was an increase in beardless wildrye on BLKROC_21 and an increase cattail on BLKROC_18.

Significant increases when compared to 2010 on Moist Floodplain sites for saltgrass occurred two sites and decreased on two sites, alkali sacaton decreased on two sites, Nevada saltbush decreased on three sites, bassyia decreased on three sites, beardless wildrye increased on one site and decreased on another, Mohave seablite decreased on one site, Baltic rush decreased on one site and cattail increased on one site.

Significant changes on Saline Meadow sites in 2013 compared to 2010 were a decrease in saltgrass on one site, and an increase in alkali sacaton on two sites and a decrease on one site.

Significant changes on Sodic Fan sites in 2013 compared to 2010 were an increase in saltgrass one site and an increase in alkali sacaton on another site.

Significant Changes in Frequency for Blackrock Transects Between 2010 and 2013

	No Change	DISP	SPAI	ATTO	BAHY	LETR	SUMO	JUBA	TYLA
Moist Flood Plain									
BLKROC_10*	↔								
BLKROC_11*	↔								
BLKROC_14*	↔								
BLKROC_15*		↑		↓	↓		↓		
BLKROC_16*					↓				
BLKROC_17*	↔								
BLKROC_13		↓**						↓	
BLKROC_18		↑	↓	↓					↑**
BLKROC_19			↓						
BLKROC_20					↓	↓			
BLKROC_21						↑**			
BLKROC_22				↓					
BLKROC_23	↔								
SALINE MEADOW									
BLKROC_01	↔								
BLKROC_02	↔								
BLKROC_03	↔								
BLKROC_05		↓	↑						
BLKROC_06			↑						
BLKROC_07			↓						
BLKROC_39	↔								
SODIC FAN									
BLKROC_51			↑						
BLKROC_09		↑							
BLKROC_44	↔								
SANDY TERRACE									
BLKROC_49	↔								

**Sites located along historical dry reach, ** Sites where change extends outside historical ranges for the transect. $\alpha<0.05$, ↑=increase, ↓=decrease,↔=no change*

<u>Description of Monitoring Transects by Pasture</u>

White Meadow Riparian Field

BLKROC_10

BLKROC_10 is located in the White Meadow Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The transect is located within the historical dry reach of the river. The similarity index has ranged between 6-25% during baseline period. Utilization estimates have not been conducted during the past three years because of the dense stands of bassia has prevented access by livestock. An increase in Nevada saltbush and bassia frequency outside baseline parameters were detected during the monitoring year 2009 but in 2010 frequency for both species decreased. Nevada saltbush continues to have a high frequency when compared to 2002-2007, which coincided with the pre-watering years. As waters raise, the soil profile along the floodplain, Nevada saltbush has responded with only 2.8 m of canopy cover in 2003 to 59.7 m of cover in 2010 and is now beginning to decline in 2013. Nevada saltbush density has also declined. The site has begun to show an increase in saltgrass while sacaton has remained stable as well as the perennial forb, mallow (MALE3). Fire would not improve the site, because of the small perennial grass component in the area.

Frequency (%), BLKROC_10

Life Forms	Species	2002	2003	2004	2007	2009	2010	2012	2013
Annual Forb	ATTR	0	4	0	0	0	0	0	0
	CHBR	0	2	3	0	0	0	0	0
	CHIN2	0	14	28	0	0	0	0	0
	MENTZ	0	14	0	0	0	0	0	0
Perennial Forb	HECU3	0	0	0	0	0	0	0	0
	MALE3	0	3	7	11	21	20	27	18
	SUMO	0	0	0	0	10	0	0	0
	STPI	0	0	4	0	0	0	0	0
Perennial Graminoid	DISP	0	3	0	0	0	0	2	7
	SPAI	0	12	18	18	21	22	17	18
Shrubs	ARTRW8	0	0	0	0	0	0	0	0
	ATTO	2	6	14	25	92	74	74	65
	SAVE4	0	0	0	0	0	3	0	0
	ARTR2	0	2	0	2	2	3	0	0
Nonnative Species	AMARA	0	6	0	0	3	0	0	0
	BAHY	0	3	64	0	47	24	2	4
	DESO2	0	0	1	0	4	0	0	0
	SATR12	0	0	48	0	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_10

Species Code	2003	2004	2007	2009	2010	2012	2013
ATTO	2.8	5.2	16.4	52.9	59.7	51.8	46.2
ERNA10	1.0	0.8	0	0	0	0	0
ARTR2	1.2	1.3	2.0	2.5	0	0	0
ATTR	0	0	0	0	2.3	0	0
Total	4.9	7.3	18.3	55.4	62.0	51.8	46.2

BLKROC_11

BLKROC_11 is located in a riparian management area in the White Meadow Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The transect is located within the historical dry reach of the river. The similarity index has ranged between 36-64% during the baseline period. Inkweed, Nevada saltbush, and bassia frequency increased in 2009 and have subsequently stabilized with the exception of inkweed which did decrease in 2010 but remained within levels typically seen for the site. Perennial grass frequency did not change in 2013. Nevada saltbush remains higher than pre-implementation of LORP flows.

Frequency (%), BLKROC_11

Life Forms	Species	2002	2003	2004	2007	2009	2010	2012	2013
Annual Forb	ATPH	0	0	2	0	0	0	0	0
	ATSES	0	5	0	0	0	0	0	0
	ATTR	0	19	7	0	2	0	0	0
	CHENO	0	1	0	0	0	0	0	0
	CHIN2	0	0	3	0	0	0	0	0
	GILIA	0	9	0	0	0	0	0	0
	MENTZ	0	2	0	0	0	0	0	0
Perennial Forb	MALE3	0	3	4	4	0	0	0	0
	SUMO	32	28	42	49	76	66	20	10
Perennial Graminoid	DISP	114	107	112	103	110	110	105	106
	SPAI	22	39	41	36	42	40	29	33
Shrubs	ATTO	37	95	101	53	70	72	21	22
	ERNA10	3	10	16	8	5	6	0	0
Nonnative Species	BAHY	0	42	38	0	59	44	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_11

Species Code	2003	2004	2007	2009	2010	2012	2013
ATTO	13.6	16.5	18.3	18.9	18.7	28.3	27.6
ERNA10	3.2	5.0	8.1	3.1	2.6	1.6	1.1
SUMO	10.5	4.9	13.4	16.2	6.1	2.3	na
Total	27.3	26.4	39.7	38.2	27.4	32.1	28.7

BLKROC_14

BLKROC_14 is located within the historical dry reach of the Owens River in the White Meadow Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index for this site ranged between 9% and 25% during the baseline period. The site is in poor condition when compared to its corresponding ecological site description. Nevada saltbush significantly increased in 2009 and saltgrass significantly decreased to 0 in 2009 and remained so in 2010, in 2013 saltgrass frequency began to increase again. Nevada saltbush is increasing on the site with canopy cover increasing from 8.8 m to 31.3 m. These increases are likely a result from rewatering this portion of the Owens River. In 2010 frequency for bassia was at its highest seen on the site since 2004 (prior to the 2008 burn) but has subsequently dropped. Utilization was not sampled on this transect due to the lack of measurable forage.

Frequency (%), BLKROC_14

Life Forms	Species	2002	2003	2004	2007	2009	2010	2012	2013
Annual Forb	ATTR	0	0	5	0	0	0	0	0
	CHENO	0	0	0	0	0	0	0	0
	CHIN2	0	3	3	0	0	0	0	0
Perennial Forb	HECU3	0	5	0	0	0	0	0	0
	MALE3	0	4	4	6	7	0	7	10
	SUMO	0	0	0	0	4	0	0	0
Perennial Graminoid	DISP	14	21	14	10	0	0	7	13
Shrubs	ATTO	0	4	8	11	24	27	24	24
Nonnative Species	BAHY	0	14	67	0	2	71**	3	4
	DESO2	0	0	2	0	0	0	0	0
	SATR12	0	20	90	0	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_14

Species Code		2003	2004	2007	2009	2010	2012	2013
ATTO		8.8	0.4	10.1	27.3	34.4	42.8	31.3

White Meadow Field

BLKROC_01

BLKROC_01 is located on an upland site in the White Meadow Field. The soils are mapped as the Division-Numu Complex, 0-2% slopes soil series, which corresponds to a Saline Meadow ecological site. The similarity index at the monitoring site has ranged between 12-18% during the baseline period. Herbaceous production for the site is much lower than potential, while shrub production is much higher than typical for a Saline Meadow site at its potential. In 1968-69, this entire area was scraped to store runoff. This type of activity significantly altered the area’s ability to resemble a Saline Meadow in high ecological condition. Frequency trend was static in 2013 when compared to baseline years.

Frequency (%), BLKROC_01

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Perennial Forb	HECU3	7	4	8	2	16	10	4
	MALE3	20	26	21	26	21	13	6
	PYRA	0	3	2	1	0	0	0
	SEVE2	0	0	0	0	16	0	0
Perennial Graminoid	DISP	39	59	69	52	57	49	53
	JUBA	27	39	35	24	21	18	20
	SPAI	0	4	3	4	4	4	4
Shrubs	ATTO	29	36	35	36	13	17	12
	ERNA10	65	61	57	53	52	47	32

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_01

Species Code	2003	2004	2007	2009	2010	2013
ATTO	12.6	3.5	12.2	3.8	4.6	3.0
ERNA10	26.1	11.4	20.6	10.5	13.2	12.7
Total	38.7	14.8	32.7	14.3	17.7	15.7

BLKROC_39

BLKROC_39 is located on an upland site in the White Meadow Field. The soils are Division-Numu Complex, 0 to 2% slopes, which corresponds to the Saline Meadow ecological site. The similarity index ranged between 55-64% during the baseline period. However, based on ocular estimates, production is far less than typical for a Saline Bottom site. The site was scraped during the wet winter of 1968-69. The loss of the 'A horizon' during this period has likely contributed to the poor productivity of the site. Frequency in 2012 did not depart from previous sampling periods and has not shifted beyond baseline frequency values.

Frequency (%), BLKROC_39

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Perennial Forb	NIOC2	0	0	3	0	4	6	0
	SUMO	7	12	5	8	4	6	4
Perennial Graminoid	DISP	104	94	88	87	98	95	85
	JUBA	7	0	0	0	0	0	0
Shrubs	ALOC2	5	8	11	13	13	12	14
	ATCO	3	9	3	9	13	8	0
	ATTO	17	3	3	3	0	0	4
	ERNA10	0	4	0	1	0	0	0
	SAVE4	3	0	4	4	3	5	5
Nonnative Species	BAHY	0	2	0	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_39

Species Code	2003	2004	2007	2009	2010	2013
ALOC2	0.1	0.2	0	0	1.0	0
ATCO	0.1	0.5	0.4	1.7	6.4	0
ATTO	3.4	1.9	2.4	1.3	0.0	0.6
ERNA10	0.1	0	0.3	0	0.3	0.3
SAVE4	1.4	0	0.1	0	1.2	0.7
SUMO	0.2	0.4	0.5	0.4	0.6	0
Total	5.3	3.0	3.6	3.5	9.5	1.6

Reservation Field

BLKROC_02

BLKROC_02 is located in the Reservation Field, which is designated as an upland pasture. The soils are mapped as Manzanar-Winnedumah Association, 0-2% slopes soil series, which corresponds to the Saline Meadow ecological site. The similarity index has varied widely during the baseline period ranging between 28-55%, largely because of fluctuations in alkali sacaton production. The site is dominated by shrubs and may not be able to reach site potential unless shrub densities are reduced. There was no significant change in frequency in 2013 when compared to 2007, 2009 and 2010. The general trend for the area is static. Cover has remained static since 2003.

Frequency (%), BLKROC_02

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Annual Forb	ATTR	0	3	0	0	0	0	0
Perennial Forb	GLLE3	7	2	5	4	7	8	7
Perennial Graminoid	DISP	53	49	55	49	55	48	57
	JUBA	3	11	6	6	4	8	6
	LECI4	0	4	1	2	2	3	3
	SPAI	71	95	92	91	86	78	82
Shrubs	ATTO	43	35	41	30	27	20	26
	ERNA10	12	27	13	16	22	19	13
Nonnative Species	BAHY	0	5	0	0	0	0	0
	SATR12	0	0	1	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_02

Species Code	2003	2004	2007	2009	2010	2013
ATTO	22.3	10.3	13.4	9.7	8.3	9.2
ERNA10	6.0	25.1	3.4	6.4	5.4	4.9
Total	28.3	35.4	16.9	16.1	13.7	14.1

BLKROC_03

BLKROC_03 is located in the Reservation Field on the Shondow Loam 0-2% slopes soil series. The transect is on a Saline Meadow ecological site in an upland pasture. The site has ranged between 63%-72% similarity to the site's potential, placing the area in good to excellent condition. The site produces large quantities of alkali sacaton. Frequency results indicate the site has been relatively stable over the past five monitoring periods with the exception of an increase in rubber rabbitbrush cover. Saltgrass has decreased steadily over all years. Increases in frequency, cover, and density for rubber rabbitbrush have markedly risen during the past three sampling periods. As mentioned in 2009, because this site is experiencing an increase in shrub abundance while maintaining high grass cover, this area should be considered a candidate for a prescribed burn in the near future before sacaton cover starts to be replaced by even greater amounts of rubber rabbitbrush. Presently, the site is in excellent condition but not stable due to the rising abundance of woody species.

Frequency (%), BLKROC_03

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Annual Forb	CHHI	0	18	6	0	0	0	0
Perennial Forb	GLLE3	0	0	0	0	1	0	0
Perennial Graminoid	ARPU9	0	0	0	2	0	0	0
	DISP	53	47	59	42	36	18	14
	JUBA	0	0	0	0	2	0	0
	SPAI	100	112	117	122	128	122	124
Shrubs	ATTO	0	0	0	1	2	2	0
	ERNA10	0	6	7	4	17	8	13
Nonnative Species	LASE	0	3	3	0	0	0	0
	POMO5	0	2	0	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_03

Species Code	2003	2004	2007	2009	2010	2013
ATTO	0.0	0.0	0.3	0.0	0.0	0
ERNA10	1.5	1.3	5.3	9.5	9.8	16.4
Total	1.5	1.3	5.6	9.5	9.8	16.4

BLKROC_44

BLKROC_44 is located in an upland site in the Reservation Field. The soils are Manzanar-Winnedumah Association, 0-2% slopes, which corresponds to the Sodic Fan ecological site. Similarity index has ranged between 62-87%. There was no significant difference between 2010 and 2013; however, JUBA has not been present on the site since 2009. The site is static and in good condition. Manzanar-Winnedumah soils will not support large amounts of perennial grass; therefore, burns on the soil types should not occur if the goal is to increase perennial grass production.

Frequency (%), BLKROC_44

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Annual Forb	ATPH	0	1	0	0	0	0	0
	ATSES	0	35	0	0	0	0	0
	CORA5	0	1	0	0	0	0	0
Perennial Forb	SUMO	3	7	7	8	15	15	9
Perennial Graminoid	DISP	104	96	104	113	114	102	108
	JUBA	20	14	16	7	11	0	0
	SPAI	80	87	83	83	82	82	93
Shrubs	ATTO	32	70	83	28	35	20	20
	ERNA10	17	30	32	10	24	32	30
Nonnative Species	BAHY	0	1	0	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_44

Species Code	2003	2004	2007	2009	2010	2013
ATTO	19.4	11.9	10.7	10.7	9.6	9
ERNA10	7.7	6.0	11.4	10.1	8.7	10.4
SUMO	1.4	0.9	1.8	0.2	0.6	0
Total	28.5	18.8	23.9	21.0	19.0	19.4

BLKROC_49

BLKROC_49 is located in an upland site in the Reservation Field. The soils are Mazourka Hard Substratum-Mazourka-Eclipse Complex, 0-2% slopes, which corresponds to the Sandy Terrace ecological site. The similarity index ranged between 14%-38% during the baseline period. The poor similarity index was a result of having too much saltgrass and alkali sacaton in the plant community composition. Sandy Terrace ecological sites are shrub dominant sites with low annual aboveground biomass production. The ecological site description does not account for instances with large abundances of perennial grasses. There were no significant changes in frequency values.

Cover (m) Shrubs BLKROC_49

Species Code	2003	2004	2007	2009	2010	2013
ATCO	0.4	0	0.2	0.7	0.2	0.5
ERNA10	1.1	1.1	2.3	1.7	0.6	1.4
MACA2	0	0.6	0	0	0	0
SAVE4	1.0	0.6	1.9	1.4	1.2	1.0
Total	2.5	2.3	4.4	3.8	2.0	2.9

Frequency (%), BLKROC_49

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Annual Forb	ERIAS	0	3	0	0	0	0	0
	PSRA	0	0	2	0	1	0	0
Perennial Forb	MACA2	0	0	0	0	0	3	0
	OENOT	0	3	0	0	0	0	0
	STEPH	5	2	17	0	0	0	0
	STPA4	0	0	0	6	3	0	0
Perennial Graminoid	DISP	78	56	63	53	52	45	57
	SPAI	29	24	25	27	29	31	22
Shrubs	ATCO	20	15	19	21	30	24	19
	ATPA3	3	4	1	0	1	6	5
	ATTO	0	0	0	0	0	0	0
	ERNA10	14	10	7	4	10	16	15
	SAVE4	3	0	4	2	4	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

BLKROC_51

BLKROC_51 is located in an upland site in the Reservation Field. The soils are Winnedumah Silt Loam, 0-2% slopes, which corresponds to the Sodic Fan ecological site. The similarity index for the site during baseline period ranged between 46-78%. The site has a higher grass component and lower shrub component than expected for Sodic Fan site, thus lowering the similarity index. The only significant change in frequency was an increase in sacaton. Saltgrass is exhibiting a downward trend on the site.

Frequency (%), BLKROC_51

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Perennial Forb	GLLE3	32	2	12	27	8	5	7
	SUMO	0	0	0	2	0	0	0
Perennial Graminoid	DISP	100	85	70	114	73	58	51
	SPAI	34	21	27	45	18	43	36
Shrubs	ALOC2	0	0	0	1	0	0	3
	ATTO	15	56	42	38	8	3	4
	ERNA10	9	2	0	11	1	5	4
	SAVE4	0	0	0	0	0	0	2

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_51

Species Code	2003	2004	2007	2009	2010	2013
ATTO	25.9	6.2	11.8	7.9	4.6	5.4
ERNA10	2.1	0.5	4.1	4.1	3.3	5.3
SAVE4	0.0	0.0	0.4	0.3	0.0	0
Total	28.0	6.8	16.3	12.3	7.9	10.6

Reservation Riparian Field

BLKROC_15

BLKROC_15 is in a riparian management area, located in the Reservation Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The site is located on the historical 'dry reach' of the Owens and has not begun to show signs of recovery since the return of flows in December 2006. The similarity index is poor for the site ranging between 8-11%. Tamarisk slash was burned at the site in the winter months of 2008 and subsequently invaded by bassia in 2010 with frequency at its highest seen on the site. Although there were no statistically significant changes from 2010 compared to 2013, there appears to be several general trends when looking at estimates across all sampling periods. There is a disappearance of all annual forbs that is a result of the increased canopy cover of Nevada saltbush and bassia. Saltgrass had slowly decreased on the site but has since increased in 2013. Shrub cover has more than doubled on the site. Similar to other sites along the rewatered riparian corridor litter has increased while bare soil has decreased.

Frequency (%), BLKROC_15

Life Forms	Species	2003	2004	2005	2007	2009	2010	2013
Annual Forb	ATTR	0	0	16	0	0	0	0
	CHIN2	14	4	29	0	0	0	0
	ERAM2	0	0	5	0	0	0	0
	GITR	0	0	4	0	0	0	0
	LEFL2	0	0	3	0	0	0	0
	MEAL6	0	0	21	0	0	0	0
	NADE	0	0	1	0	0	0	0
Perennial Forb	SUMO	15	18	39	31	32	37	18**
Perennial Graminoid	DISP	25	21	19	14	3	11	24*
Shrubs	ATTO	48	35	80	29	47	58	39*
	SAVE4	2	9	2	6	5	8	13
Nonnative Species	BAHY	6	2	17	0	23	35	0*
	DESO2	0	3	10	0	0	0	0
	SATR12	0	1	2	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_15

Species Code	2003	2004	2005	2007	2009	2010	2013
ATTO	25.4	15.1	19.3	32.9	34.8	39.9	54.7
SAVE4	10.1	8.0	6.6	7.6	9.1	9.8	4.7
SUMO	1.8	1.2	0.9	20.3	23.7	32.2	Na
Total	37.3	24.3	26.8	60.8	67.6	81.9	59.4

BLKROC_16

BLKROC_16 is located in a riparian management area on the Reservation Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. Similar to BLKROC_17, BLKROC_15, BLKROC_14, BLKROC_10 and BLKROC_11 the site is on the historical 'dry reach' of the Owens River. The similarity index is poor for the site ranging between 6-10%. The site is shrub dominated with no perennial grass component. Frequency of Nevada saltbush and bassia increased in 2010, both species exceeding what has been previously observed for the site. Resulting from the rewatering adjacent to the site, Nevada saltbush increased from 5.2 m in 2005 to 44.5 m in 2010 to 46.3 in 2013. Greasewood disappeared in 2013, possibly because of a rising water table. Litter has increased while bare soil has decreased.

Frequency (%), BLKROC_16

Life Forms	Species	2003	2004	2005	2007	2009	2010	2013
Annual Forb	ATSES	4	0	0	0	0	2	0
	ATTR	0	0	18	0	0	0	0
	CHIN2	13	16	37	0	0	0	0
	CRYPT	0	0	3	0	0	0	0
	ERAM2	0	0	0	0	0	0	0
	ERIOG	10	0	0	0	0	0	0
	ERMA2	0	11	23	0	0	0	0
	GITR	0	0	20	0	0	0	0
Perennial Forb	MACA2	0	0	59	0	0	0	0
	SUMO	0	0	7	0	0	1	0
Shrubs	ATCO	7	0	3	4	9	8	9
	ATTO	19	23	33	31	39	55	51
	SAVE4	5	12	6	8	11	6	15
Non-native Species	BAHY	3	7	4	0	17	40	0**
	SATR12	11	41	44	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_16

Species Code	2003	2004	2005	2007	2009	2010	2013
ATCO	0.4	0.5	0.0	0.0	0.4	3.8	0
ATTO	6.5	2.9	5.2	16.8	44.2	44.5	46.3
SAVE4	11.0	10.4	9.8	13.3	12.4	14.9	0
Total	17.9	13.8	15.0	30.1	56.9	63.2	46.3

BLKROC_17

BLKROC_17 is located in a riparian management area on the Reservation Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index ranged between 3-5% for the site. Similar to other sites on the historical 'dry reach' of the Owens River, BLKROC_17 has not begun to respond from returned river flows. The site is shrub dominated (Nevada saltbush) with little to no perennial grass component. Frequency did not differ between 2010 and 2013. Canopy cover of Nevada saltbush increased substantially in 2010 and decreased slightly in 2013.

Frequency (%), BLKROC_17

Life Forms	Species	2003	2004	2005	2007	2009	2010	2013
Annual Forb	ATSES	12	0	8	0	0	5	0
	ATTR	3	0	31	0	0	0	0
	CHIN2	13	10	40	0	0	0	0
	CHLE4	0	0	1	0	0	0	0
	CRCI2	0	0	4	0	0	0	0
	ERIOG	0	0	0	0	0	3	0
	ERWI	0	0	7	0	0	0	0
	GITR	0	0	32	0	0	0	0
	LEFL2	0	0	54	0	0	0	0
	MEAL6	0	0	29	0	0	0	0
Perennial Forb	HECU3	0	0	0	0	0	0	2
Perennial Graminoid	HOJU	0	0	2	0	0	0	0
Shrubs	ATTO	70	34	74	45	49	54	52
Nonnative Species	BAHY	0	0	0	0	0	5	0
	DESO2	0	0	6	0	0	0	0
	SATR12	9	10	6	0	3	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_17

Species Code	2003	2004	2005	2007	2009	2010	2013
ATTO	37.5	5.7	5.6	28.0	37.7	69.3	66.1

Robinson Field

BLKROC_04

BLKROC_04 is located on an upland site within the Robinson Pasture. The soil series is Manzanar Silt Loam, 0-2% slopes and is a Saline Meadow ecological site. Similarity index during the baseline period ranged between 52-74%. The site has a high diversity of perennial grasses and low shrub composition. In 2009, Baltic rush and creeping wildrye frequency significantly increased while alkali sacaton significantly decreased when compared to 2007, neither of these changes were significantly different from baseline sampling ranges (2002-2004). However, these increases were short-lived and in 2010 creeping wildrye and Baltic rush decreased to levels typically observed for the site and continued to increase again in 2013. Alkali sacaton frequency decreased while saltgrass remained static on the site. Short term trends have fluctuated with 2013 appearing to be wetter than 2010 but when factored into what has previously been observed on the site, current trends remain within historic ranges.

Frequency (%), BLKROC_04

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Annual Forb	CHHI	0	2	0	0	0	0	0
	COMAC	0	23	0	0	0	3	0
	HEAN3	0	8	0	4	6	12	0
Perennial Forb	ANCA10	12	18	17	22	22	16	21
	HECU3	0	0	0	1	3	0	0
	MALE3	14	3	8	10	1	0	1
	PYRA	41	50	44	23	28	15	18
Perennial Graminoid	CADO2	5	18	0	5	0	0	0
	CAREX	0	0	0	0	14	1	12
	DISP	83	77	70	76	62	62	65
	JUBA	88	113	93	73	95	89	98
	LETR5	27	65	43	48	70	26	35
	SPAI	70	30	73	59	27	56	42
Shrubs	ALOC2	5	0	0	0	2	1	1
	ATTO	0	5	0	0	4	3	0
	ERNA10	0	3	2	2	3	2	6
Nonnative	BAHY	0	12	6	0	20	30	1
	POMO5	0	2	0	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_04

Species Code	2003	2004	2007	2009	2010	2013
ALOC2	0.0	0.0	0.0	0.0	0.4	0
ATTO	0.3	0.0	0.0	0.7	0.1	0
ERNA10	3.4	2.8	5.6	7.9	2.3	5.8
Total	3.6	2.8	5.6	8.6	2.9	5.8

North Riparian Field

BLKROC_22

BLKROC_22 is located in a riparian management area in the North Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. Similarity index has been at 57% for 2006-07. There were no significant departures in frequency when compared to previous years and the site remains static.

Frequency (%), BLKROC_22

Life Forms	Species	2006	2007	2009	2010	2013
Perennial Forb	SUMO	3	6	2	5	3
Perennial Graminoid	DISP	124	111	125	132	123
	SPAI	4	4	3	2	5
Shrubs	ALOC2	4	4	10	9	8
	ATTO	21	7	19	20	7*
	ERNA10	5	4	11	8	2
Nonnative Species	BAHY	11	0	9	1	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_22

Species Code	2006	2007	2009	2010	2013
ALOC2	3.3	2.3	0	5.0	0
ATTO	11.4	9.9	9.6	5.5	9.1
ERNA10	8.0	9.1	6.9	7.0	3.9
SUMO	0.9	0.5	0.6	0.1	0
Total	23.6	21.9	17.1	17.6	13.6

South Riparian Field

BLKROC_13

BLKROC_13 is in a riparian management area located in the South Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity of the site to potential is high, ranging from 76-83% during the time period of 2002-2007. Saltgrass frequency declined significantly in 2013. Creeping wildrye (LETR5) has increased since 2004 and continues to increase in 2013. The relative abundance of creeping wildrye when compared to the total plant community is still minor with cover for the grass ranging from trace to 4%.

Frequency (%), BLKROC_13

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Annual Forb	HEAN3	0	0	0	1	2	7	3
Perennial Forb	ANCA10	7	5	11	13	13	16	14
	GLLE3	0	0	0	0	0	0	1
Perennial Graminoid	DISP	129	139	128	128	121	120	103*
	JUBA	22	6	13	22	19	19	0*
	LETR5	7	0	0	14	20	23	30
	SPAI	34	40	36	37	34	28	23
Shrubs	ATTO	0	12	5	8	1	5	3
	ERNA10	0	0	4	3	0	0	3

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_13

Species Code	2003	2004	2007	2009	2010	2013
ATTO	4.0	3.1	8.7	7.6	8.1	6.0
ERNA10	0.0	0.4	2.4	2.5	2.8	4.2
Total	4.0	3.5	11.1	10.1	10.9	10.2

BLKROC_23

BLKROC_23 is in a riparian management area located in the South Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index ranged between 78-79%. The site is in excellent condition with a minimal shrub component. Frequency values have not varied significantly over the five sampling periods with the exception of Nevada saltbush in 2010.

Frequency (%), BLKROC_23

Life Forms	Species	2006	2007	2009	2010	2013
Annual Forb	ATSES	18	0	0	0	3
Perennial Graminoid	DISP	139	133	139	135	127
	SPAI	25	28	28	24	35
Shrubs	ATTO	0	0	0	32	1
Nonnative Species	BAHY	4	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_23

Species Code	2006	2007	2009	2010	2013
ATTO	1.0	0.8	0.6	1.6	1.3
ERNA10	0	0	0	0	0.2

Russell Field

BLKROC_05

BLKROC_05 is located on an upland site in the Russell Field. The soil series is Manzanar Silt Loam, 0-2% slopes. The site is a Saline Meadow ecological site. The similarity index ranged between 75-88% during the baseline period, indicating that the site is in excellent condition. Frequency results appear static. Shrub cover (rubber rabbitbrush) and density at the study plot continues to show a gradual decline in 2010.

Frequency (%), BLKROC_05

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Annual Forb	ATPH	0	3	0	0	0	0	0
	ATSES	0	11	0	2	0	0	0
	CLEOM2	0	16	0	0	0	0	0
	COMAC	0	17	0	3	0	0	0
	HEAN3	3	11	0	6	0	2	0
Perennial Forb	GLLE3	0	0	0	0	0	0	4
	PYRA	32	45	37	5	8	3	10
	SICO2	0	2	0	0	0	0	0
Perennial Graminoid	DISP	49	63	49	49	78	52	55
	JUBA	7	14	14	10	10	6	9
	LECI4	0	0	0	0	4	0	0
	LETR5	0	0	0	0	0	4	4
	SPAI	124	125	115	123	111	131	124
Shrubs	ATTO	0	2	0	0	0	4	0
	ERNA10	7	4	1	0	1	0	0
Nonnative Species	BAHY	0	0	0	11	3	0	0
	POMO5	0	4	0	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_05

Species Code	2003	2004	2007	2009	2010	2013
ERNA10	7.6	6.3	2.1	0.8	0.5	0.3

Wrinkle Field

BLKROC_07

BLKROC_07 is located on an upland site in the Wrinkle Field. The soil series is Manzanar Silt Loam, 0-2% slopes and is a Saline Meadow ecological site. The similarity index ranged between 79-93% during the baseline sampling period indicating the site is in excellent condition. Frequency values remain static. Shrub cover and density appear to be stable on the site.

Frequency (%), BLKROC_07

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Annual Forb	2FORB	0	0	0	0	0	0	6
	ATPH	0	32	0	0	0	18	0*
	CLOB	0	9	0	0	0	6	0
	ERPR4	0	0	0	3	0	0	0
Perennial Forb	SUMO	0	0	0	0	3	0	0
Perennial Graminoid	DISP	70	59	71	61	75	73	78
	JUBA	17	6	12	1	4	6	1
	SPAI	92	68	64	76	84	67	76
Shrubs	ATTO	5	0	0	0	0	2	1
	ERNA10	5	4	3	3	4	5	4
Nonnative Species	POMO5	0	0	0	9	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_07

Species Code	2003	2004	2007	2009	2010	2013
ATTO	0	0	0.5	0.2	0.3	0
ERNA10	3.6	2.9	3.0	1.9	1.6	2.6
SUMO	0	0.4	0.7	0.3	0	0
Total	3.6	3.2	4.2	2.3	1.9	2.6

Locust Field

BLKROC_06

BLKROC_06 is located on an upland site in the Locust Field. The soil series is Manzanar Silt Loam, 0-2% slopes and the ecological site is a Saline Meadow. The similarity index ranged between 73-85% during the baseline sampling period indicating the site is in excellent condition. Frequency values have remained static.

Frequency (%), BLKROC_06

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Annual Forb	ATPH	0	30	0	0	0	19	0*
	CHHI	0	8	0	0	0	0	0
	CLEOM2	0	3	0	0	0	0	0
	COMAC	0	26	0	0	0	5	0
Perennial Forb	ANCA10	5	4	4	2	4	2	2
	PYRA	19	4	0	2	1	0	0
Perennial Graminoid	DISP	73	80	75	77	66	70	69
	JUBA	17	26	37	27	13	9	16
	SPAI	95	78	71	76	76	85	80
Shrubs	ATTO	0	8	9	4	10	6	2
	ERNA10	20	19	6	8	9	14	9
	SAEX	0	0	0	2	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_06

Species Code	2003	2004	2007	2009	2010	2013
ATTO	3.3	0.7	1.0	2.1	1.3	3.1
ERNA10	17.3	9.1	9.9	9.5	9.8	6.9
SAEX	2.3	7.5	3.3	0.7	0.1	0.5
SALIX	0.0	0.6	0.0	0.0	0.0	0
Total	23.0	18.0	14.2	12.3	11.2	10.5

Wrinkle Riparian Field

BLKROC_18

BLKROC_18 is a riparian management area located in the Wrinkle Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index has ranged between 53-75%. Saltgrass frequency decreased significantly between 2007 and 2009 and continued to drop in 2010 to a level beyond what has been seen on the site previously, in 2013 values rose to the highest seen on the site. Conversely, sacaton increased beyond the historical range for the site in 2010 and has since decreased in 2013.

Utilization by Weighted Average and Species, BLKROC_18

	Weighted Average	DISP	SPAI
2007	29%	28%	30%
2008	21%	18%	25%
2009	39%	40%	37%
2010	46%	59%	18%

Frequency (%), BLKROC_18

Life Forms	Species	2003	2004	2005	2007	2009	2010	2013
Annual Forb	ATSES	3	0	0	0	0	0	0
	ATTR	0	0	0	0	0	0	0
	CHLE4	0	0	5	0	0	0	0
	GITR	0	0	4	0	0	0	0
Perennial Forb	GLLE3	3	6	9	4	1	4	0
Perennial Graminoid	DISP	119	104	114	118	102	86	120**
	SPAI	4	16	20	12	21	37	8
	TYLA	0	0	0	0	3	3	17**
Shrubs	ATTO	33	12	24	19	20	13	0**
	ERNA10	1	2	10	1	0	5	6
Nonnative Species	BAHY	14	10	45	0	0	0	0
	SATR12	0	0	3	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_18

Species Code	2003	2004	2005	2007	2009	2010	2013
ATTO	17.0	3.5	5.5	29.1	15.2	11.1	3.8
ERNA10	4.9	2.8	3.5	5.7	4.0	5.5	6.6
Total	21.9	6.3	9.0	34.8	19.2	16.6	10.4

BLKROC_19

BLKROC_19 is located in a riparian management area in the Wrinkle Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index on the site has ranged between 71-79%. Saltgrass frequency decreased in 2010 when compared to 2009 and has continued to decrease in 2013. Sacaton frequency rose to its highest level since sampling has begun in 2010 and has subsequently decreased in 2013, although its contribution to the total plant community is not significant. All other plant frequencies were static. Shrub cover has increased over time at the site.

Frequency (%), BLKROC_19

Life Forms	Species	2003	2004	2005	2007	2009	2010	2013
Annual Forb	ATSES	4	0	0	0	0	0	0
	ATTR	0	0	2	0	0	0	0
	CHLE4	0	0	6	0	0	0	0
	GITR	0	0	5	0	0	0	0
Perennial Graminoid	DISP	139	147	139	127	143	132	122
	JUBA	13	20	6	26	21	14	24
	LETR5	3	0	1	0	0	0	0
	SPAI	9	8	12	10	10	26	9**
Shrubs	ATTO	0	6	31	24	18	12	15
	ERNA10	0	3	5	0	3	3	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_19

Species Code	2003	2004	2005	2007	2009	2010	2013
ATPO	0.7	0	0	0	0	0	0
ATTO	3.6	1.5	2.9	8.8	13.6	11.8	8.1
ERNA10	2.0	2.1	0.9	1.8	3.1	4.5	3.2
Total	6.3	3.6	3.8	10.6	16.7	16.3	11.2

BLKROC_20

BLKROC_20 is located in the Wrinkle Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index has ranged between 63-74% for the site. Creeping wildrye continued to increase beyond baseline parameters in 2010 but then dropped significantly in 2013. Nevada saltbush cover and density have steadily increased since 2005 until 2013 where a decrease in cover occurred.

Frequency (%), BLKROC_20

Life Forms	Species	2003	2004	2005	2007	2009	2010	2013
Annual Forb	ATTR	0	0	7	0	0	0	0
Perennial Graminoid	DISP	127	147	143	126	123	123	118
	LETR5	18	29	30	31	59	70	27**
	SPAI	5	4	5	5	5	0	1
Shrubs	ATTO	6	2	27	19	18	15	9
	ERNA10	0	1	1	0	3	1	1
Nonnative Species	BAHY	5	0	6	0	16	33	0**

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_20

Species Code	2003	2004	2005	2007	2009	2010	2013
ATTO	8.8	6.8	17.0	27.1	30.3	27.9	9.6
ERNA10	8.6	8.3	6.4	6.5	6.4	11.8	7.2
SAVE4	0.0	0.1	0.0	0.3	0.7	0.4	1.3
SUMO	0.1	0	0	0	0	0	0
Total	17.5	15.3	23.4	33.8	37.3	40.1	18.1

BLKROC_21

BLKROC_21 is in a riparian management area located in the Wrinkle Riparian Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. Similarity index has ranged between 58-68% during the baseline period. The site's shrub component is greater than what would be expected for a Moist Floodplain site at its potential. In general plant frequency did not differ in 2013 from 2010 with the exception of a significant increase in creeping wildrye.

Frequency (%), BLKROC_21

Life Forms	Species	2003	2004	2005	2007	2009	2010	2013
Annual Forb	ATSES	3	0	0	0	0	0	0
	ATTR	0	0	2	0	0	0	0
Perennial Forb	SUMO	4	0	3	0	0	0	0
Perennial Graminoid	DISP	135	133	142	136	130	131	126
	LETR5	0	2	5	5	8	6	66**
	SPAI	1	4	3	1	4	3	0
Shrubs	ATTO	23	13	42	10	10	3	7
	ERNA10	3	1	0	1	0	0	6

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period.*

Cover (m) Shrubs BLKROC_21

Species Code	2003	2004	2005	2007	2009	2010	2013
ATTO	29.4	20.2	29.0	23.7	16.8	15.7	11.3
ERNA10	2.2	4.3	3.0	8.0	1.2	0.0	0.8
SUMO	2.2	0.0	0.2	0.0	0.0	0.0	0
Total	33.7	24.5	32.2	31.7	18.0	15.7	12.1

Horse Holding Field

BLKROC_09

BLKROC_09 is located on an upland site in the Horse Holding Field, on the Winnedumah Fine Sandy Loam 0-2% slopes soil unit. The transect is located on a Sodic Fan ecological site, the similarity index for the transect ranged between 56-82% during the baseline period. The decline in similarity index occurred in response to a decline in Nevada saltbush. Saltgrass frequency in 2013 increased to its highest level. There is a declining trend in Nevada saltbush.

Frequency (%), BLKROC_09

Life Forms	Species	2002	2003	2007	2009	2010	2013
Annual Forb	2FORB	0	2	0	0	0	0
	COMAC	0	2	0	0	0	0
	ERAM2	0	0	2	0	0	0
Perennial Forb	APCA	0	0	4	0	0	3
	ASTER	0	0	0	0	0	0
	GLLE3	2	7	1	4	2	1
	STEPH	0	0	0	0	0	0
Perennial Graminoid	DISP	114	102	85	99	104	124*
	JUBA	56	55	57	65	65	59
	LECI4	0	0	4	0	0	0
	LETR5	5	5	7	10	9	5
	SPAI	87	66	80	68	69	74
Shrubs	ATTO	34	46	16	24	15	9
	ERNA10	26	36	39	44	36	44
	MACA17	0	0	4	1	0	0
	PSAR4	0	3	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs BLKROC_09

Species Code	2003	2007	2009	2010	2013
ATTO	25.2	9.1	8.9	2.9	0.6
ERNA10	10.1	9.5	10.3	8.8	8.8
Total	35.3	18.7	19.2	11.7	9.4

Irrigated Pastures

There are no irrigated pastures on the Blackrock Lease.

Stockwater Sites

All the wells for the Blackrock lease have been drilled and have been fitted for solar pumps and necessary plumbing for the troughs. The lessee will be responsible for water troughs and installation. There are also three other stockwater sites that have been developed as part of the *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 Owens Valley Committee, and Carla Scheidlinger*, (MOU), which required additional mitigation (1600 Acre-Foot Mitigation Projects). The “North of Mazourka Project” will provide stockwater in the Reservation Field and the “Well 368/Homestead Project” will provide stockwater in the Little Robinson Field and East Robinson Field.

Fencing

There was no new fencing constructed on the lease in 2013.

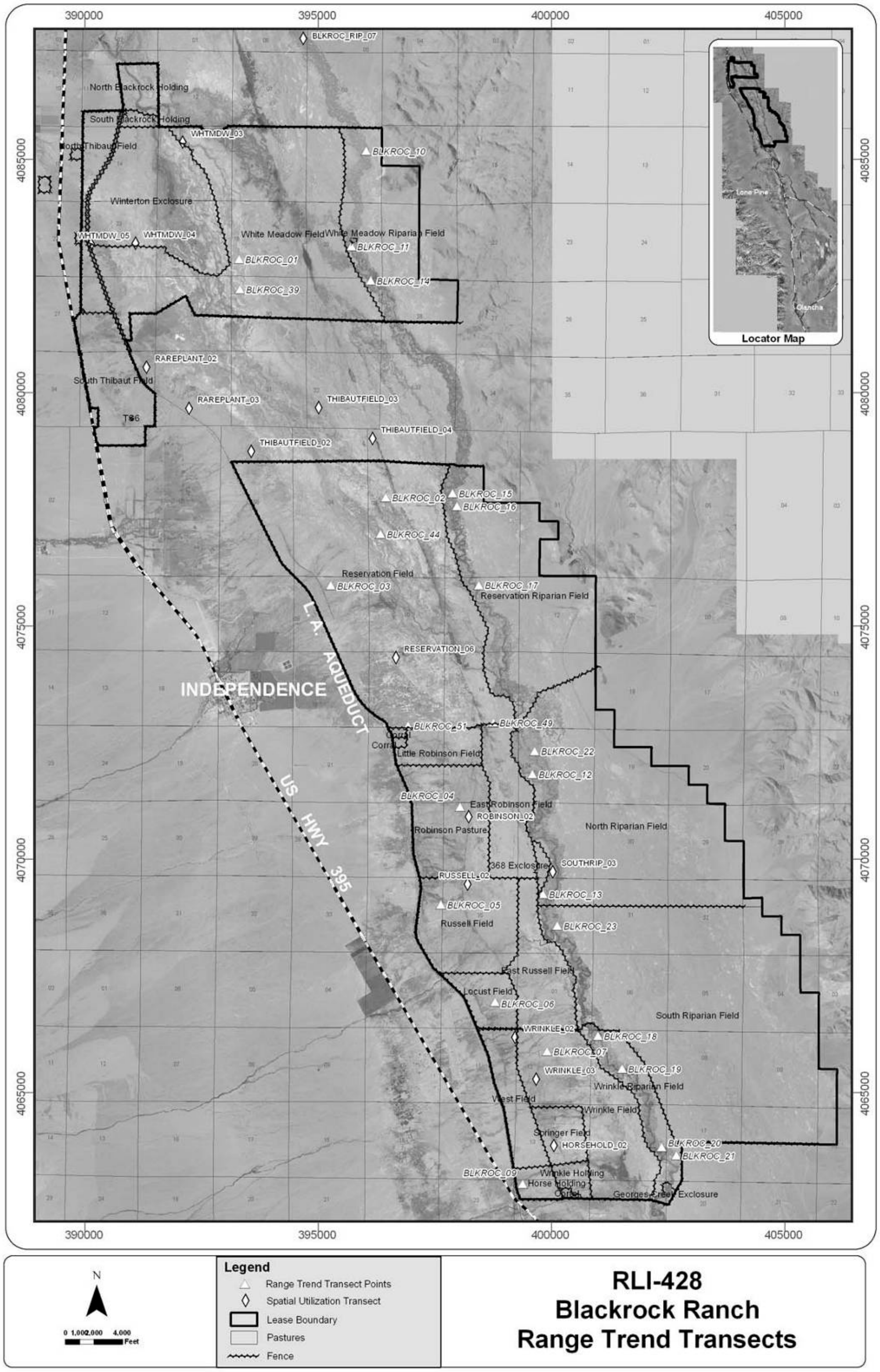
Burning

There was one range improvement burn conducted by the lessee that was approximately 100 acres. This was only a portion of the total 204 acres prepared by the lessee. The lessee plans on completing the burn in the winter of 2014.

Slash pile burning, along the river, is planned for the Blackrock Lease in 2014, and will be done by Inyo County. Several range burn sites have also been identified for 2014; these sites are still being evaluated for vegetation composition and acreage.

Salt and Supplement Sites

Many of the supplement sites located on the Blackrock Lease have been in place for many years and are located in upland management areas. Some of these sites have been moved in order to adapt to the installation of new fencing. These new locations were selected as to better distribute cattle within and near the newly created riparian pastures.



Land Management Figure 25. Blackrock Lease RLI-428, Range Trend Transects

4.10.4 Thibaut Lease (RLI-430)

The 5,259-acre Thibaut Lease is utilized by three lessees for wintering pack stock. Historically, the lease was grazed as one large pasture by mules and horses. Since the implementation of the LORP and installation of new fencing, four different management areas have been created on the lease. These areas are the Blackrock Waterfowl Management Area, Rare Plant Management Area, Thibaut Field, and the Thibaut Riparian Exclosure. Management differs among these areas. The Blackrock Waterfowl Management Area can be grazed every other year. During the wetted cycle of the Blackrock Waterfowl Management Area management has a utilization standard of 40%. While in dry cycles the utilization standard is 65%. The irrigated pasture portion located in Thibaut Field was assessed using irrigated pasture condition scoring and the upland portions of the field were evaluated using range trend and utilization transects. The Rare Plant Management Area is evaluated using range trend and utilization transects. The Riparian Exclosure has been excluded from grazing for 11 years.

Summary of Utilization

The following table presents the summarized utilization data for each field for the current year.

End of Grazing Season Utilization for Fields on the Thibaut Lease, RLI-430, 2013

Fields	Utilization
Rare Plant Management Area	20%
Thibaut Field	4%
Waterfowl Management Area	0%

Upland Management Areas

The end-of-season use in the Thibaut lease was well below the allowable upland standards. Grazing restrictions were reinstated in the Waterfowl Management Area for the 2012-13 grazing season. However the Waterfowl Management area was not flooded due to current drought conditions. The remaining fields had a temporary utilization standard of 50% for the 2012-13 grazing season that was not met. Conditions were good due to decreased stocking rates and the utilization of a stockwater location for feeding which improved livestock distribution.

Summary of Range Trend Data and Conditions

2012 was an off-year for Range Trend analysis on the Thibaut lease. However, there were four transects read in the Thibaut Riparian pasture.

Significant Changes in Frequency for Thibaut transects Between 2010 and 2013

	No Change	DISP	JUBA	ATTO	BAHY	HECU	MALE
Moist Flood Plain							
THIBAUT_04*				↑			
THIBAUT_05*	↔						
THIBAUT_06*						↓	
THIBAUT_07*	↔						

**Sites located along historical dry reach, ** Sites where change extends outside historical ranges for the transect. α<0.05, ↑=increase, ↓=decrease,↔=no change*

Thibaut Riparian Exclosure

THIBAUT_04

THIBAUT_04 is in a riparian management area in the Thibaut Riparian Exclosure. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. This site is located in the historical 'dry reach' of the Owens River. Similarity indices were consistently at 3%, with community composition dominated by Nevada saltbush and nonnative bassia and Russian thistle. Low precipitation during the winters of 2012 and 2013, have prevented bassia from germinating on the site. Nevada saltbush cover expanded from 10m in 2003, to 48m in 2010, but have subsequently decreased to 23m in 2013. Nevada saltbush appears to be dying off as a result of a rising water table. Many of the shrubs were exuding large amounts of sap in 2012 and 2013. Shrubs that exhibit these signs most are located in the lower regions of the flood plain, presumably closer to the rising water table. Livestock are currently excluded from the Thibaut Riparian Pasture.

Frequency (%), THIBAUT_04

Life Forms	Species	2002	2003	2004	2007	2009	2010	2012	2013
Annual Forb	ATTR	0	0	15	0	0	0	0	0
	CHHI	0	7	5	0	0	0	0	0
Perennial Forb	MALE3	0	0	5	0	0	0	0	0
Perennial Gramanoid	DISP	0	0	0	0	0	0	0	1
Shrubs	ATTO	9	13	19	37	43	48	16	38**
Nonnative Species	BAHY	0	2	30	0	0	58	0	0
	SATR12	0	10	15	0	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Shrubs THIBAUT_04

Species Code	2003	2004	2007	2009	2010	2012	2013
ATTO	10.2	6.7	34.6	46.8	48.2	25.4	22.9

THIBAUT_05

THIBAUT_05 is in a riparian management area in the Thibaut Riparian Exclosure. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0 to 2% slopes, which corresponds to the Moist Floodplain ecological site. This site is located in the historical 'dry reach' of the Owens River. The similarity index was 3% during baseline sampling. Frequency in 2009 indicated an increase *Heliotropium curassavicum* (salt heliotrope), plant symbol HECU3 and *Malvella leprosa* (alkali mallow), plant symbol MALE3; two native perennials. This increase has continued into 2013, with salt heliotrope occupying the largest amount of live plant cover on the site. The increase of these early seral forbs and the presence of some trace amounts of perennial saltgrass are encouraging signs that return flows may be initiating successional changes on the site. As with all other floodplain areas in the former dry reach, bassia covered the site in 2008. No new growth of bassia was noted in 2013. Unlike most riparian transects in the former dry-reach section Nevada saltbush occupies a small niche in the plant community within the Thibaut_05 macroplot. Livestock are currently excluded from the Thibaut Riparian Exclosure.

Frequency (%), THIBAUT_05

Life Forms	Species	2002	2003	2004	2005	2007	2009	2010	2012	2013
Annual Forb	CHHI	0	0	0	1	0	0	0	0	0
	CHIN2	0	6	3	0	0	0	0	0	0
Perennial Forb	HECU3	0	0	0	2	2	24	37	89	103
	MALE3	0	0	0	0	0	10	28	38	38
Perennial Graminoid	DISP	0	0	0	0	4	3	0	0	0
Shrubs	ATTO	0	7	3	4	2	1	0	0	0
Nonnatives	AMAL	0	0	0	2	0	0	0	0	0
	BAHY	0	19	9	42	0	2	29	6	0
	DESO2	0	0	16	6	0	0	0	0	0
	TARA	0	0	3	0	0	0	0	0	0
	SATR12	0	16	24	19	0	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Shrubs THIBAUT_05

Species Code	2003	2004	2005	2007	2009	2010	2012	2013
ATTO	0.5	0.5	0.3	1.4	0	0	0	0
TARA	0.0	0.0	0.4	0.0	0	0	0	0
Total	0.5	0.5	0.7	1.4	0	0	0	0

THIBAUT_06

THIBAUT_06 is in the Thibaut Riparian Exclosure, soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index during baseline sampling ranged between 10-16%. The site is located within the historical dry reach of the river. Tamarisk slash piles were burned at this site in 2008. As with all other floodplain areas in the former dry reach, bassia covered the site in 2008. No new growth of bassia was noted in 2009, but the site remained covered by decadent stands of this invasive weed. In 2013 bassia disappeared from the site. Frequency results in 2009 and 2010 indicate that return flows may be initiating changes at the site; salt heliotrope and saltgrass significantly increased compared to previous years in 2009 and remained at similar levels in 2010. In 2013 saltgrass continues to expand while salt heliotrope declined to 2010 levels.

Frequency (%), THIBAUT_06

Life Forms	Species	2003	2004	2005	2007	2009	2010	2012	2013
Annual Forb	ATRIP	0	0	1	0	0	0	0	0
	ATSES	0	3	9	0	0	0	0	0
	ATTR	5	1	3	0	0	0	0	0
	CHENO	2	0	0	0	0	0	0	0
	CHHI	0	0	4	0	0	0	0	0
	CHIN2	0	0	3	0	0	0	0	0
	GITR	0	0	5	0	0	0	0	0
	MEAL6	0	14	72	0	0	0	0	0
Perennial Forb	HECU3	1	0	0	0	51	46	69	47*
Perennial Graminoid	DISP	2	2	2	3	15	14	28	39
	SPAI	2	3	3	5	4	2	1	6
Shrubs	ATTO	11	8	9	3	0	1	2	0
Nonnative	BAHY	0	2	1	0	10	88	16	0**
	DESO2	0	19	3	0	0	0	0	0
	SATR12	17	60	52	0	0	0	5	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Shrubs THIBAUT_06

Species Code	2003	2004	2005	2007	2009	2010	2012	2013
ATTO	0.7	1.1	1.8	11.1	1.7	2.4	4.3	4.5

THIBAUT_07

THIBAUT_07 is in a riparian management area in the Thibaut Riparian Exclosure. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The site is located within the historical dry reach of the Lower Owens River. Similarity index was 5% during the baseline sampling period. Slash piles were burned adjacent to the transect but not directly on the transect. Nevada saltbush frequency dropped significantly on the site when compared to 2004-2010. Cover reflects a similar pattern.

Frequency (%), THIBAUT_07

Life Forms	Species	2003	2004	2005	2007	2009	2010	2012	2013
Annual Forb	2FORB	0	1	0	0	0	0	0	0
	ATSES	2	24	81	0	0	0	0	0
	ATTR	26	15	49	0	0	0	0	0
	GITR	0	0	3	0	0	0	0	0
Perennial Forb	HECU3	1	0	1	0	0	0	0	0
	MALE3	7	2	0	9	2	0	6	12
Perennial Graminoid	DISP	3	3	0	4	0	0	0	0
Shrubs	ATTO	7	16	20	8	18	17	7	1
Nonnative	BAHY	12	34	37	0	0	95	3	0
	DESO2	0	15	34	0	0	0	0	0
	SATR12	16	47	45	0	0	0	3	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (%) Shrubs THIBAUT_07

Species Code	2003	2004	2005	2007	2009	2010	2012	2013
ATTO	1.1	1.3	1.0	5.0	14.5	17.0	7.1	2.5

<u>Irrigated Pastures</u>

Irrigated Pasture Condition Scores 2011-13

Pasture	2011	2012	2013
Thibaut Field	82%	81%	78%

The northern portion of the Thibaut Pasture (85 acres) comprises the area managed as irrigated pasture for the Thibaut Lease. A result of the completion of the waterfowl management area to the north and the rare plant field to the south is a grazing corridor, which puts heavy pressure on the irrigated pasture. Grazing prescriptions were reinstated for the waterfowl management area this year. This put pressure on the irrigated portion of the lease decreasing its irrigated pasture condition rating to 78%.

LADWP Watershed Resources staff recommends that livestock be moved out of the area periodically during the grazing season to allow the area to rest. This may be achieved by supplemental feeding further south in the Thibaut Field, electric fencing, or turning the livestock out in the southern end of Thibaut Field instead of the corral area. This irrigated pasture will be re-evaluated in the 2013-14 grazing season.

<u>Stockwater Sites</u>

There is one developed water site in the Thibaut Field, which consists of a flowing well that has a stockwater well drilled next to it, located in the uplands east of the irrigated pastures in the Thibaut Field. Currently, the flowing well is still creating a small puddle area for livestock and wildlife. The lessee has also installed a trough near the well.

<u>Fencing</u>

There was no new fence constructed on the lease in 2013.

<u>Rare Plant Management Area Thibaut</u>

This pasture contains both Owens valley Checkerbloom and Inyo County star tulip populations. Trend plots for Rare Plant Management Area 1 and Rare Plant Management Area 4 are within an exclosure that is restricted from grazing from early March through early October per the LORP EIR during the rare plants' flowering, fruiting, and seeding period. The pasture was grazed with end-of-season utilization at 38%. In 2012, phenology included individuals that were vegetative to individuals that were in flower.

Rare Plant Management Area, Thibaut Lease

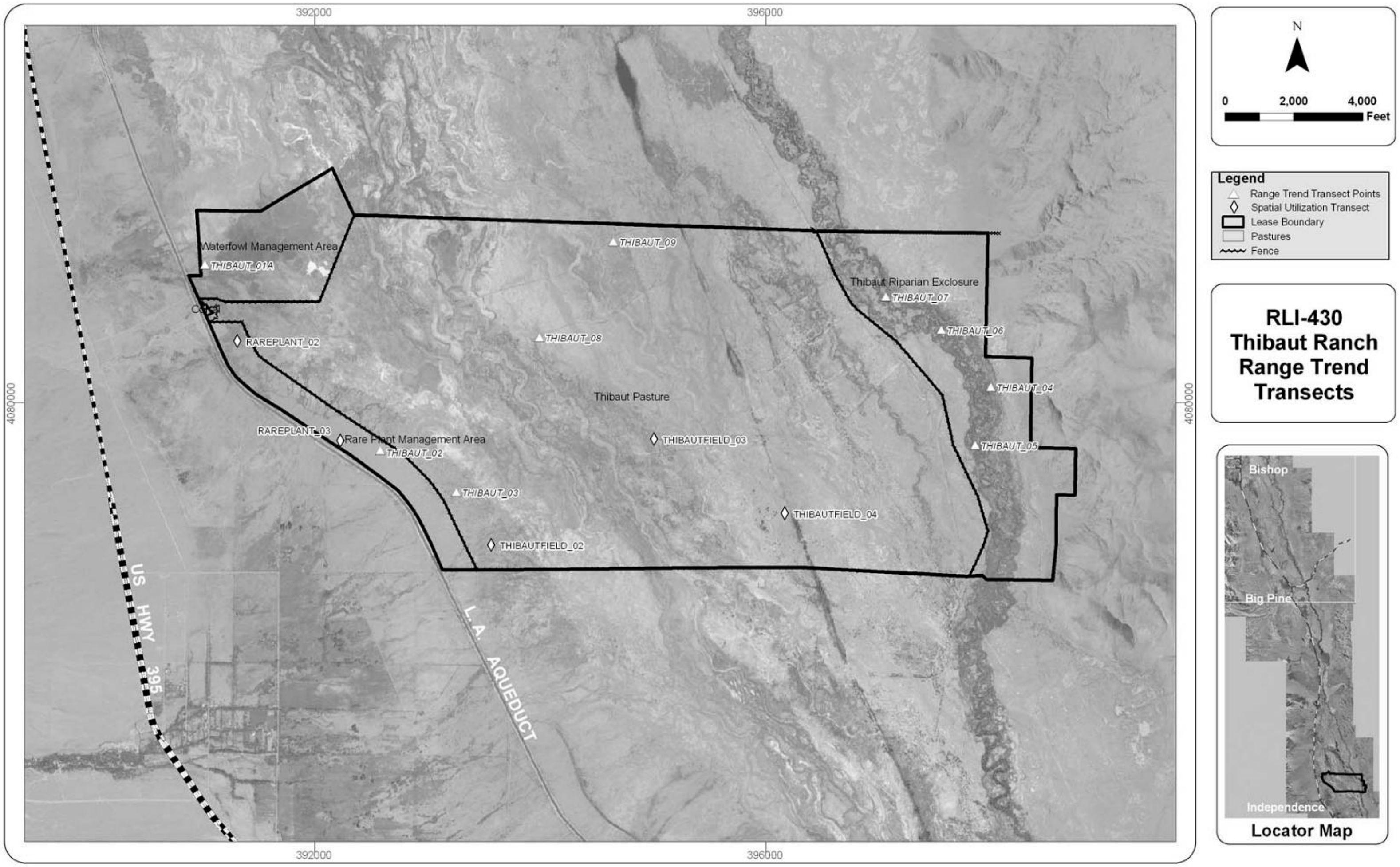
Plot Number	Year	Species	Seedling	Juvenile	Mature	Total
Rare Plant Management Area 1	2009	*Inyo County star tulip*	0	0	3	3
	2010		0	0	12	12
	2011		0	0	4	4
	2012*		2	0	7	9
Rare Plant Management Area 1	2009	*Owens Valley checkerbloom*	0	9	21	30
	2010		1	0	24	25
	2011		15	5	32	52
	2012*		34	0	42	76
Rare Plant Management Area 4	2009	*Inyo County star tulip*	0	0	2	2
	2010		0	0	4	4
	2011		0	0	2	2
	2012*		0	0	1	1
Rare Plant Management Area 4	2009	*Owens Valley checkerbloom*	0	7	32	39
	2010		0	0	38	38
	2011		9	12	40	61
	2012*		31	0	44	75
**Some grazing by elk or livestock.*						

<u>Salt and Supplement Sites</u>

Hay is spread in locations of the lessees choosing using a truck or a trailer pulled by a truck. Feeding areas had been changed during the 2012-13 grazing season resulting in decreased utilization in the Thibaut Field.

<u>Burning</u>

There are no burns planned for the Thibaut lease in 2014.



Land Management Figure 26. Thibaut Lease RLI-430, Range Trend Transects

4.10.5 Islands Lease (RLI-489)

The Islands Lease is an 18,970-acre cow/calf operation divided into 11 pastures. In some portions of the lease, grazing occurs year round with livestock rotated between pastures based on forage conditions. Other portions of the lease are grazed October through May. The Islands Lease is managed in conjunction with the Delta Lease. Cattle from both leases are moved from one lease to the other as needed throughout the grazing season.

There are eight pastures located within the LORP boundary of the Islands Lease:

- Bull Field
- Reinhackle Field
- Bull Pasture
- Carasco North Field
- Carasco South Field
- Carasco Riparian Field
- Depot Riparian Field
- River Field

<u>Summary of Utilization</u>

The following tables present the summarized utilization data for each pasture for the current year.

End of Grazing Season Utilization for Fields on the Islands Lease, RLI-489 2013

Fields	Utilization
Carasco Riparian Field*	21%
Depot Riparian Field*	36%
Lubkin Field	6%
River Field *	17%
South Field	19%

**Riparian utilization 40%*

<u>Riparian Management Areas</u>

The Depot Riparian Field and River Field had exceeded utilization rates in the 2011-12 grazing season. In 2012-13 they were below the allowable standard of 40%. The use on the west side of the river, specifically the Islands was low. The Carasco Riparian Field and South Field were well below the utilization standards. Supplement was observed in a few locations on the floodplain in the Depot Riparian and River Fields. Overall, supplement had been moved off of the floodplains in all fields, having a direct result in the decreased utilization in the River Field and Depot Riparian Field.

All fields on the lease were in good condition except the large meadow portion of the River Field located southeast of the Alabama Gates. This location had been previously burned by LADWP in an effort to remove perennial shrubs, saltcedar slash, and improve forage production. This burn was successful meeting the previously mentioned goals. Despite the beneficial effects of the burn, the prolonged inundation from flow augmentation, has had a negative effect on this area. Currently a shift in vegetation composition has been occurring, accompanied by visually stressed perennial grasses and spreading of aquatic vegetation such as bull rush, that thrive in flooded and saturated locations. Continued inundation of this area will result in the loss of meadow habitat and the creation of marsh.

Upland Management Areas

All upland pastures are well below the allowable 65% utilization rate.

Summary of Range Trend Data in Islands Exclosure

2013 was an off year for Range Trend on the Islands Lease, sites will be read in 2014.

Irrigated Pastures

The B and D Pastures located near Reinhackle Spring were rated in 2013 and received an irrigated pasture condition score of 90%. These pastures will be rated again in 2016.

Irrigated Pasture Condition Scores 2011-13

Pasture	2011	2012	2013
B Pasture	X	90%	90%
D Pasture	X	90%	90%

X indicates no evaluation made.

Stockwater Sites

There are two stockwater sites located 1-1.5 miles east of the river in the River Field uplands near the old highway. These wells were drilled in 2010 and are now operational. The lessee has not yet installed the water troughs at the wells.

Fencing

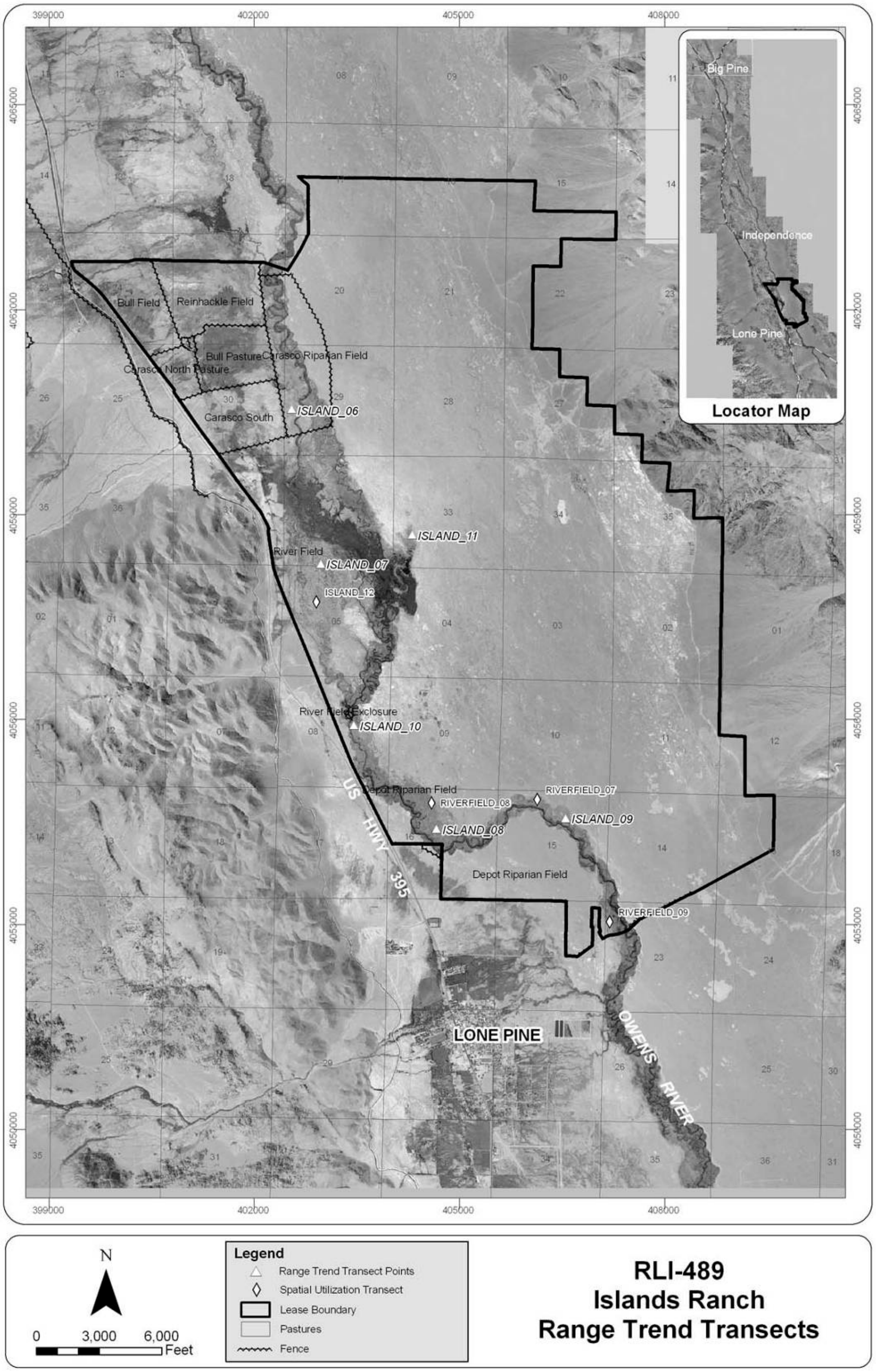
There was no new fence constructed on the lease in 2013. An old section of fence located on the east side of the Owens River across from the Carasco Riparian Field was removed by the lessee during the winter of 2013.

Salt and Supplement Site:

Cake blocks and molasses tubs that contain trace minerals and protein are distributed for supplement on the lease. The blocks and tubs are dispersed randomly each time and if uneaten they are collected to be used in other areas.

Burning

There are currently no range burns planned for the lease for 2014.



Land Management Figure 27. Islands Ranch RLI-489 Range Trend Transects

4.10.6 Lone Pine Lease (RLI-456)

The Lone Pine Lease is an 8,274-acre cow/calf operation divided into 11 pastures and adjacent private ranch land. Grazing on the lease occurs from January 1 to March 30 and then again in late May to early June. In early June the cattle are moved south to Olancha and then driven to Forest Service Permits in Monache.

There are 11 pastures on the Lone Pine Lease located within the LORP project boundary:

- East Side Pasture
- Edwards Pasture
- Richards Pasture
- Richards Field
- Johnson Pasture
- Smith Pasture
- Airport Field
- Miller Pasture
- Van Norman Pasture
- Dump Pasture
- River Pasture

Summary of Utilization

The following tables present the summarized utilization data for each pasture for the current year.

End of Grazing Season Utilization for Pastures on the Lone Pine Lease, RLI-456, 2013.

Pastures	Utilization
Johnson Pasture	Waived%
River Pasture - Lone Pine*	Burned

*Riparian utilization 40%**

Riparian Management Area

Utilization was waived in the Johnson Pasture during the 2012-13 grazing season to provide the lessee a location to move livestock, due to the Lone Pine Fire, that burned the River Pasture at the end of February. Livestock entered the River Riparian pasture a few weeks prior to the fire. By doing this, much of the summer's production had not yet been harvested by the cattle. This provided a large fuel source for the fire which burned extremely hot and fast. Over 90% (525 acres) of the River Field was burned with a loss of several cattle and much of the riparian forest.

The end of the current growing season has resulted in a recovered forage base, with ungrazed heights reaching or exceeded previous year's measurements. There will be no grazing restrictions for the lessee during the 2013-14 grazing season. A more in depth discussion of the fires effects will be provided in the range trend and woody recruitment portions of the report.

Summary of Range Trend Data

On February 24, 2013, approximately 525 acres in the River Pasture on the Lone Pine Lease were burned. The fire consumed nearly all of the Owens River floodplain on the Lone Pine Lease and was halted north of the Keeler Bridge. The Lone Pine range trend transects were read in 2012. Six of these transects were inside the blackline of the Lone Pine Fire. Although these transects were not scheduled to be read again until 2015, the plots were revisited in August 2013, in order to document post fire response. Sites with some pre-burn shrub cover (Lone Pine_03, Lone Pine_04, Lone Pine_02) declined to zero cover following the fire. Plant vigor was examined by comparing ungrazed perennial grass heights from this year's burned sites to previous year's plant heights for the same species (Table 10). Plant heights appear to show no consistent response to the fire. Saltgrass has its greatest mean height on LP_07 in 2013 and its lowest plant height on LP_04 in 2013. Sacaton is similar in its lack of any obvious relationship to fire and plant heights. Plant frequency of alkali sacaton (SPAI) made significant declines on two sites and remained static on all others. At LONEPINE_06 frequency declined to the lowest level observed since sampling began in 2003. LONEPINE_06 is located inside a livestock grazing exclosure the large amount of accumulated litter (fine fuel) likely contributed to increased fire temperatures and killed subsurface intercalary meristems, reducing the plants ability to expand during the subsequent growing season. Saltgrass shows no consistent pattern in post fire recovery. Its rhizomatous root structure likely served to benefit the plant in occupying vacant niches during the subsequent growing season if rhizomes were deep enough to avoid impacts from the fire. The appearance of yerba mansa (*Anemopsis californica*) on Lonepine _08 is evidence of postfire recovery. The plant is an aggressive occupier of impacted saturated areas such as post burn locales or heavily grazed areas. The arrival of Chairmaker's bulrush (*Schoenoplectus americanus*) is an indication of changes in surface hydrology.

Land Management Table 10.

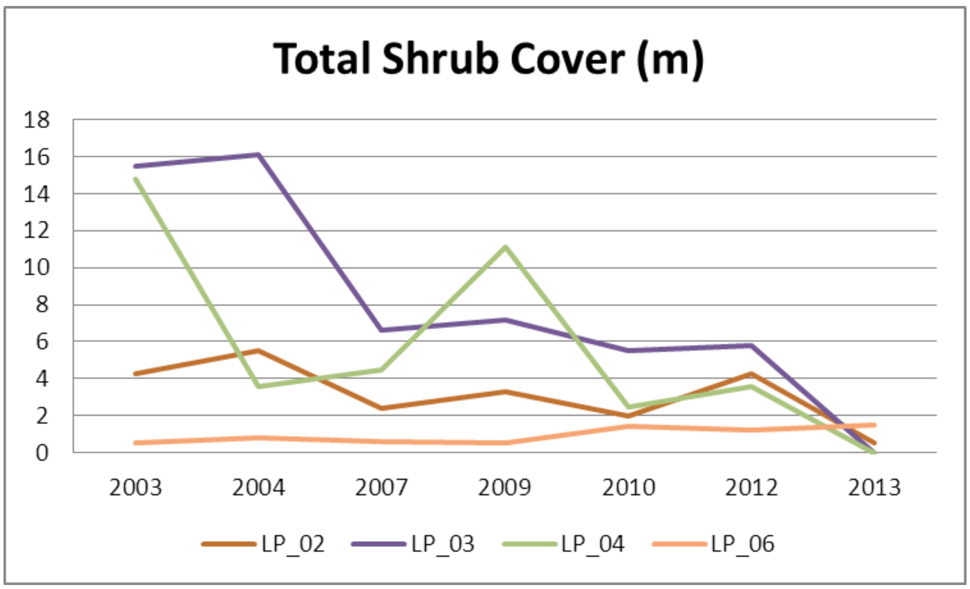
Mean end of growing season plant heights (cm) between 2005 and 2013 for saltgrass (DISP) and alkali sacaton (SPAI) on four rangetrend transects.

		2005	2006	2007	2008	2009	2010	2011	2012	2013
LP_01	DISP	16	25		33				28	20
LP_03	DISP	16	27		34					27
LP_04	DISP		17	20	19	17	17	19	18	14
LP_07	DISP			22			20	17	20	25
LP_01	SPAI					31				49
LP_03	SPAI	106	115	105	106	98	101			99

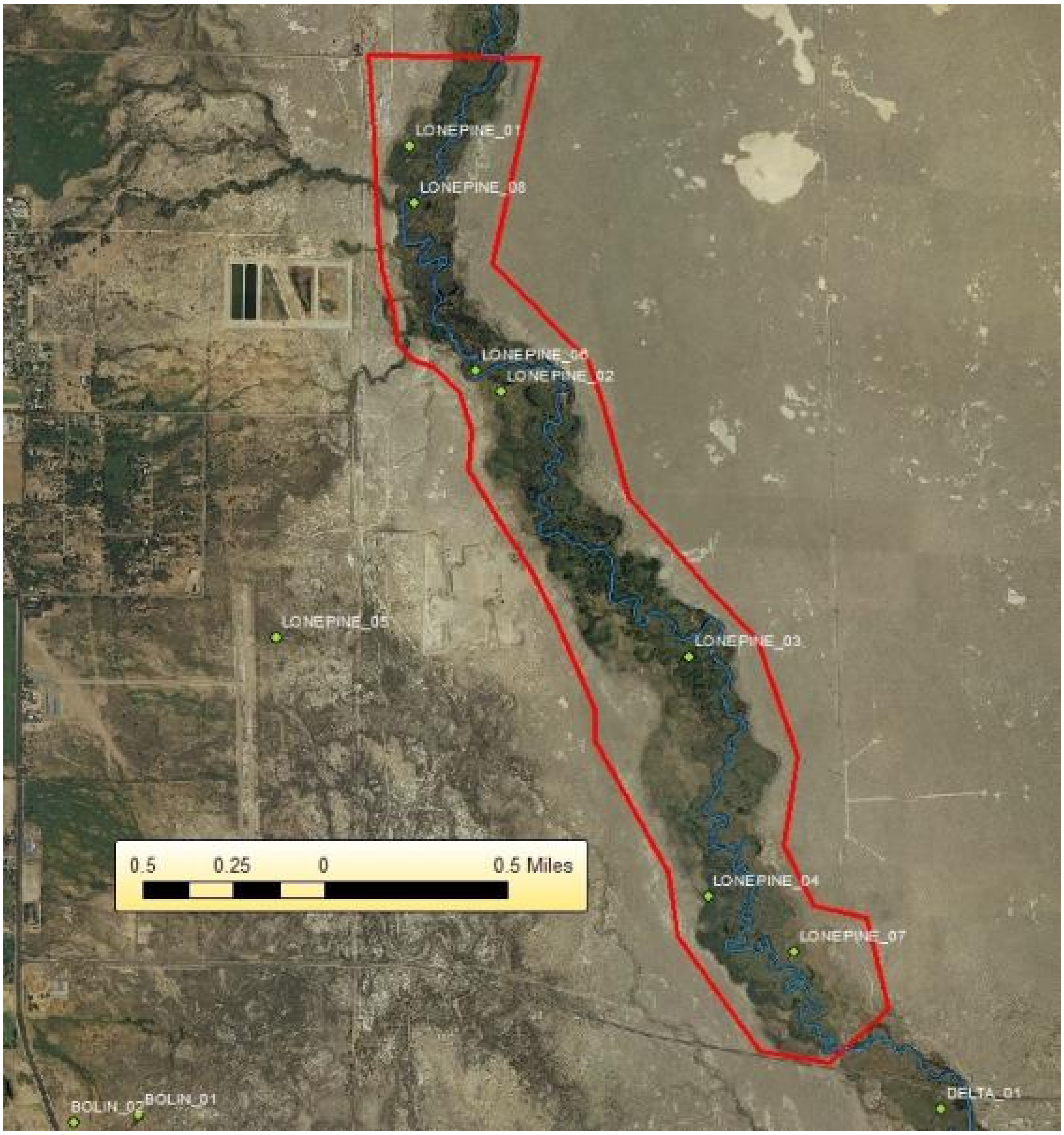
Land Management Table 11. Significant changes in plant frequencies for Lone Pine transects between 2012 and 2013.

	Static	DISP	SPAI	ATTO	BAHY	LETR5	ANCA10	SCAM6	JUBA
Moist Flood Plain									
LONEPINE_01 (unburned in 2013)		↑							
LONEPINE_02		↓	↓						
LONEPINE_03						↓			↓
LONEPINE_04	↔								
LONEPINE_06		↑	↓**						
LONEPINE_07	↔								
LONEPINE_08							↑**	↑**	

*** Sites where change extends outside historical ranges for the transect.*
α<0.1, ↑=increase, ↓=decrease,↔=no change



Land Management Figure 28. Total shrub cover for selected transects on the Lone Pine Lease between 2003-2013.



Land Management Figure 29. Approximate area of Lone Pine Wildfire, February 24, 2013

LONEPINE_01

This site is in a riparian management area on the west side of the Owens River, just north of Lone Pine Creek in the River Pasture. The soil series associated with the transect is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes, and is on a Moist Floodplain ecological site. During the baseline period from 2002-07, similarity index has ranged between 76% and 79%. Annual aboveground production at this riparian site has exceeded typical quantities found in the Moist Floodplain ecological site description. This site supports four perennial graminoid species and is dominated by saltgrass (*Distichlis spicata* [DISP]). The overall biomass of shrubs is typical for a Moist Floodplain ecological site. No nonnative species were detected at the site. Creeping wildrye (LETR) significantly increased in 2009 and continues to remain stable. Saltgrass increased on the site in 2013. The upper two thirds of the transect was not burned in the Lone Pine fire of 2013.

Frequency (%), LONEPINE_01

Life Forms	Species	2002	2003	2004	2007	2009	2010	2012	2013
Annual Forb	HEAN3	0	0	0	0	2	0	0	0
Perennial Forb	ANCA10	0	0	0	0	2	0	0	0
Perennial Graminoid	DISP	143	133	155	147	136	139	135	150**
	JUBA	5	4	0	25	13	16	18	10
	LETR5	12	29	18	32	50	47	48	49
	SPAI	10	13	17	19	14	15	10	12
Shrubs	ATTO	2	4	7	3	3	0	0	0
	ERNA10	0	0	4	0	0	0	0	0

** indicates a significant difference, α≤0.1, **≤0.05*

Cover (%) Shrubs LONEPINE_01

Species Code	2003	2004	2007	2009	2010	2012	2013
ATTO	7.1	5.2	4.7	1.8	3.0	3.2	2.9
ERNA10	2.2	2.6	2.1	0.0	0.1	0.7	0.6
SUMO	0.1	0.0	0.8	0.0	0.0	0	0
Total	9.5	7.8	7.5	1.8	3.0	3.8	3.5

LONEPINE_02

This site is in a riparian management area on the west side of the Owens River, east of the Lone Pine Dump in the River Pasture. The soil series is Torrifluvents-Fuvaquentic Endoaquolls complex, 0-2% slopes, and is on a Moist Floodplain ecological site. The similarity index ranged between 65% and 87% from 2002 to 2007. The site is in excellent condition. The site is grass-dominated with saltgrass comprising the bulk of the biomass. Saltgrass frequency significantly increased in 2009, outside its historic range from 2002-07 and in 2010-13 returned to levels typically observed on the site. This site was burned in 2013, which have contributed to the decline in alkali sacaton seen this year. No nonnative species were detected at the site.

Frequency (%), LONEPINE_02

Life Forms	Species	2002	2003	2004	2007	2009	2010	2012	2013
Perennial Graminoid	DISP	146	125	142	143	164	141	152	132**
	JUBA	9	13	20	17	14	15	15	14
	LETR5	0	0	0	3	0	1	4	1
	SPAI	65	78	65	64	52	65	69	48**
Shrubs	ATTO	0	0	3	0	0	0	0	0
	ERNA10	0	1	4	3	1	2	3	0

** indicates a significant difference, α≤0.1, **≤0.05*

Cover (m) Shrubs LONEPINE_02

Species Code	2003	2004	2007	2009	2010	2012	2013
ATTO	2.2	2.2	0.6	0.9	0.0	1.0	0.0
ERNA10	2.1	3.3	1.8	2.4	2.0	3.3	0.5
Total	4.3	5.5	2.4	3.3	2.0	4.3	0.5

LONEPINE_03

This site is in a riparian management area on the west side of the Owens River in the River Pasture. The soil series is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes, and is on a Moist Floodplain ecological site.

The similarity index has ranged between 74% and 87% during sampling periods between 2002-07, indicating the site is in excellent condition. Site production has exceeded the expected based on the ecological site description in all years of sampling. The site is grass-dominated with saltgrass comprising the bulk of the biomass and creeping wildrye closely reaching the potential described for the site at 13% in 2007. Frequency for creeping wildrye increased significantly in 2009 and remained significantly higher in 2010 when compared to all sampling periods during the baseline period. There were no changes in frequency for all species between 2009-10 and 2012. Following the fire in the early spring of 2013 there appears to be an increase in creeping wildrye and Baltic rush. Overall shrub cover was reduced to zero by the fire. No nonnative species were detected at the site.

Frequency (%), LONEPINE_03

Life Forms	Species	2002	2003	2004	2007	2009	2010	2012	2013
Annual Forb	HEAN3	0	2	1	0	0	0	5	0
Perennial Forb	ANCA10	0	0	0	3	0	7	10	7
	GLLE3	12	0	7	0	5	3	2	3
	HECU3	0	0	0	0	0	0	0	2
	MALE3	7	3	5	2	5	3	0	5
	PYRA	7	0	0	0	0	0	0	0
Perennial Graminoid	DISP	151	148	152	152	142	137	137	130
	JUBA	39	59	52	41	43	34	42	29*
	LETR5	34	33	31	34	52	48	54	26**
	SPAI	9	0	10	5	4	4	5	0
Shrubs	ATTO	14	2	13	0	1	3	0	0
	ERNA10	0	0	2	0	4	1	0	0

** indicates a significant difference, α≤0.1, **≤0.0*

Cover (m) Shrubs LONEPINE_03

Species Code	2003	2004	2007	2009	2010	2012	2013
ATTO	13.5	13.4	6.0	0.8	4.9	5.6	0
ERNA10	2.0	2.7	0.6	2.7	0.6	0.2	0
SAVE4	0.0	0.0	0.0	3.6	0.0	0	0
Total	15.5	16.1	6.6	7.2	5.5	5.8	0

LONEPINE_04

This site is in a riparian management area on the west side of the Owens River in the River Pasture. The transect is located at the edge of the floodplain and currently incorporates a portion of the transition zone to upland vegetation. The soil series is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes at the beginning of the transect and transitions to the Mazourka-Eclipse complex, 0-2% slopes. The transition in ecological sites is from a Moist Floodplain ecological site to a Sodic Terrace ecological site. Because of the mixed soils and associated ecological sites found across the transect evaluating trend for this site will concentrate on changes on trend rather than how well the site matches ecological site descriptions.

The similarity index has ranged widely between 59% and 73% from 2002-07. When compared to the Moist Floodplain ecological site description, the site has less than the expected biomass of forage species such as creeping wild rye and Baltic rush. This is explained by the transition from mesic conditions on the Moist Floodplain to more xeric conditions of the uplands which results in a decreasing abundance of creeping wildrye, Baltic rush, and riparian trees and the disproportionate amount of alkali sacaton which can better thrive in both the mesic and xeric transitional zones. The site is grass-dominated with saltgrass and alkali sacaton comprising the bulk of the biomass. The shrub component of the site is dominated by rubber rabbitbrush. As flows on the Lower Owens continue, soil moisture may rise towards the upland zone of the transect and future changes in species composition may be observed. However, frequency data indicates that there is an inverse trend, with decreasing saltgrass, and increasing alkali sacaton which is a typical gradient in zones moving from wet to dry areas. No nonnative species were detected at the site. There were no changes in frequency from 2010 to 2012. Alkali sacaton is trending back to pre-2007 levels. This site was burned, which reduced shrub cover to zero in 2013.

Frequency (%), LONEPINE_04

Life Forms	Species	2002	2003	2004	2007	2009	2010	2012	2013
Annual Forb	2FORB	0	0	1	0	0	0	0	0
	ATPH	0	29	12	0	0	10	0	0
Perennial Forb	ANCA10	5	7	8	8	7	6	6	4
	MACA2	0	0	0	0	0	2	0	0
	NIOC2	3	0	0	2	2	0	0	0
	STEPH	5	0	11	0	5	0	0	0
	SUMO	3	4	6	2	3	0	0	0
Perennial Graminoid	DISP	105	101	114	97	88	77	87	88
	JUBA	15	18	25	11	15	15	23	14
	SPAI	48	63	56	69	79	84	72	60
Shrubs	ATCO	0	0	4	0	0	0	0	0
	ATTO	0	2	0	0	0	0	0	0
	ERNA10	0	2	0	0	0	0	0	0
	MACA17	0	0	0	4	0	0	0	1
Nonnative Species	BAHY	0	0	0	0	2	0	0	0

** indicates a significant difference, α<0.1, **<0.05 when compared to prior sampling period.*

Cover (m) Shrubs LONEPINE_04

Species Code	2003	2004	2007	2009	2010	2012	2013
ATCO	0.1	0.5	0	0	0	0.4	0
ATTO	0	0	0	10.0	0.2	0	0
ERNA10	2.3	2.1	4.5	1.1	1.0	1.4	0
SUMO	12.4	1.0	0	0	1.3	1.9	0
Total	14.8	3.6	4.5	11.1	2.5	3.6	0

LONEPINE_06

This site is in a riparian management area on the east side of the Owens River in the River Pasture. This monitoring transect is located inside a riparian exclosure, constructed in February 2009. Over time the site will be used as a non-grazed reference site. The soil series is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes on a Moist Floodplain ecological site.

The similarity index has ranged between 66% and 84% between 2003 and 2007. Site production has varied during the baseline period from above to below the expected based on the ecological site description. Compared to the potential outlined in the ecological site description, this site lacks the forb and woody riparian species component. The forage base is dominated by saltgrass and alkali sacaton. Other forage species such as creeping wild rye and Baltic rush are lacking at this site. One nonnative species, Bassia, has been detected at the site. There was a significant decrease in salt grass in 2012 and then a rise in frequency in 2013. Alkali sacaton decreased significantly on the site in 2013 (see earlier discussion). Shrub cover was reduced to zero as a result of the 2013 fire. The exclosure was completed in February 2009.

Frequency (%), LONEPINE_06

Life Forms	Species	2003	2004	2005	2007	2009	2010	2012	2013
Perennial Forb	ANCA10	0	0	0	5	3	0	0	0
Perennial Graminoid	DISP	124	136	132	149	145	147	130	145*
	JUBA	0	0	0	0	0	0	0	0
	SPAI	25	28	29	16	20	16	16	3**
Nonnative Species	BAHY	0	0	5	0	0	3	0	3

** indicates a significant difference, α≤0.1, **≤0.05*

Cover (m) Shrubs LONEPINE_06

Species Code	2003	2004	2005	2007	2009	2010	2012	2013
ATTO	0.5	0.6	0.4	0.5	1.4	1.2	1.5	0
SUMO	0.1	0.3	0.2	0	0	0	0	0
Total	0.5	0.8	0.6	0.5	1.4	1.2	1.5	0

LONEPINE_07

This site is in a riparian management area on the east side of the Owens River in the River Pasture. This site was first established in the summer of 2007. The soil series is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes on a Moist Floodplain ecological site.

The similarity index was 60% in 2007. Site production was similar to that expected based on the ecological site description. There is little diversity of perennial graminoids as the only species detected was saltgrass while other forage species such as alkali sacaton and creeping wild rye are lacking on the transect but are present in the area. The biomass of forbs and riparian woody species is less than expected as compared to the desired plant community. No nonnative species were detected at the site. Baseline utilization is not available for this site since it was not established until the summer of 2007. Between 2007 and 2013 frequency has not changed significantly on the site.

Frequency (%), LONEPINE_07

Life Forms	Species	2007	2009	2010	2012	2013
Perennial Graminoid	DISP	150	157	160	151	140

** indicates a significant difference, α≤0.1, **≤0.05*

No shrubs present on site. The site was burned in 2013.

LONEPINE_08

This site is in a riparian management area on the east side of the Owens River in the River Pasture. This site was first established in the summer of 2011. The soil series is Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes on a Moist Floodplain ecological site. The spike in yerba mansa is in response to areas opened up by the 2013 fire.

Frequency (%), LONEPINE_08

	Species	2012	2013
Annual Forb	2FORB	**0**	4
	HEAN3	**0**	7
Perennial Forb	ANCA10	**3**	83**
	NIOC2	**3**	0
Perennial Graminoid	CADO2	**0**	1
	DISP	**155**	144*
	SCAM6	**0**	22**

Irrigated Pastures

The irrigated pastures within the LORP project area for the Lone Pine Lease are the Edwards, Richards, Smith, Old Place and Van Norman Pastures. All of the pastures were rated in 2013 and were above the required minimum irrigated pasture condition score of 80%, despite a dry year and lack of irrigation water.

Irrigated Pasture Condition Scores 2011-13

Pasture	2011	2012	2013
Edwards	X	X	84
Richards	X	X	84
Van Norman	X	X	84
Smith	X	X	84
Old Place	X	X	84

X indicates no evaluation made

Stockwater Sites

One stockwater well was drilled on the Lone Pine Lease located in the River Pasture uplands. The approximate location is two miles east of the river on an existing playa. The lessee had made an effort to install a trough but, the well had a silting problem that plugged the pipes and floats. Watershed Resources staff and pump mechanics have assessed the condition of the well and it has been determined that the well is not operable. A new well location is going to be selected and a new well will be drilled.

Fencing

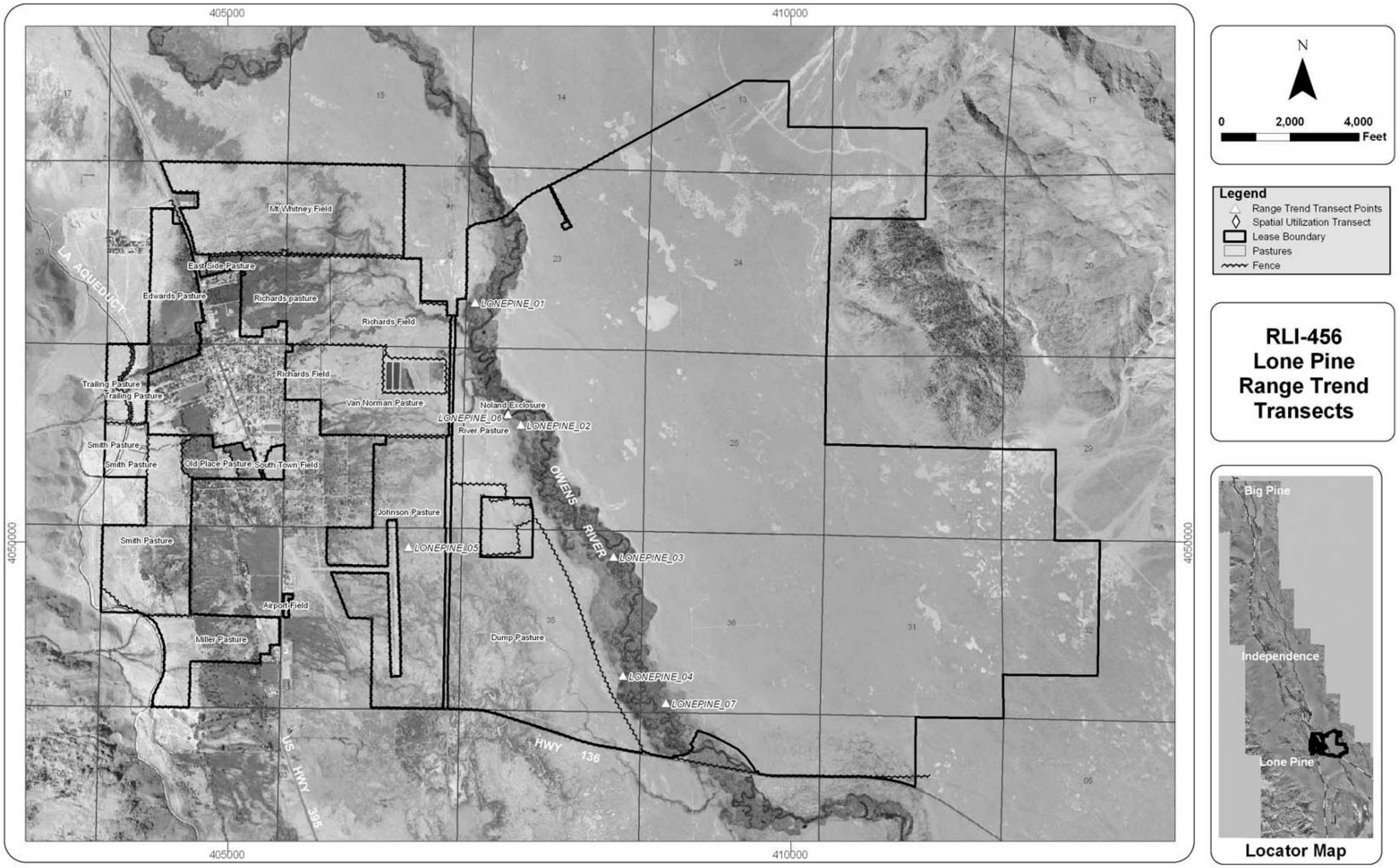
There was no new fencing constructed on the lease during 2013. Repairs have been made to the existing exclosure due to the fire in February.

Salt and Supplement Site:

All supplement tubs were situated outside of the flood plain,

Burning

There may be a burn conducted on the north end of Lone Pine in an effort to create a fire break. The burn will be conducted by California Department of Forestry. Some of the area is salt grass meadow and will benefit forage production.



Land Management Figure 30. Lone Pine Lease RLI-456, Range Trend Transects

4.10.7 Delta Lease (RLI-490)

The Delta Lease is a cow/calf operation and consists of 7,110 acres divided into four pastures. There are four fields located with the LORP project boundary: Lake Field, Bolin Field, Main Delta Field, and the East Field. Grazing typically occurs for 6 months, from mid-November to April. Grazing in the Bolin Field may occur during the growing season. The Delta and Islands Leases are managed as one with state lands leases.

Grazing utilization is currently only conducted in the Main Delta Field which contains the Owens River. The Lake Field is evaluated using irrigated pasture condition scoring. The East Field, located on the upland of Owens Lake, supports little in the way of forage and has no stockwater.

<u>Summary of Utilization</u>

The following tables present the summarized utilization data for each field for the current year.

End of Grazing Season Utilization for Fields on the Delta Lease, RLI-490, 2013

Fields	Utilization
Main Delta Field*	31%
Bolin Field	26%

*Riparian utilization 40%**

<u>Riparian Management Areas</u>

Utilization in the Main Delta was 31%, below the allowable 40% standard. The data at the transect level showed that use was fairly even throughout, with slightly less utilization in the northern portion of the Main Delta Field.

<u>Upland Management Areas</u>

The Bolin Field was below the upland utilization standard of 65% and the field maintained good condition.

<u>Summary of Range Trend Data and Conditions</u>

Range trend transects on the Delta Lease are located on Moist Floodplain ecological sites. Monitoring site photos are presented in Appendix 3 – Section 7. The similarity index averaged at each transect, over the four baseline sampling periods ranged between 48-70%. All sites lack a diversity of perennial grasses, and are dominated by saltgrass. The presence of alkali sacaton appears to follow a gradient with decreasing abundance following a decrease in elevation. Soil salinity appears to increase along this same gradient as soils transition from stream deposition to lacustrine deposition from the Owens Dry Lake. Alkali sacaton and beardless wildrye are both known to not have as high a tolerance for saline soils as saltgrass (USDA, NRCS 2009). These variables may be influencing species composition on the Moist Floodplain zones on the Delta Lease. There were no significant changes in plant frequencies between 2010 and 2013 with the exception of a decline in saltgrass on DELTA_02 which dropped below all previous levels.

Significant changes in plant frequencies for Delta transects between 2009 and 2013.

	No Change	DISP	JUBA	ATTO	BAHY
Moist Flood Plain					
DELTA_01	↔				
DELTA_02		↓**			
DELTA_03	↔				
DELTA_04	↔				
DELTA_05	↔				
DELTA_06	↔				
DELTA_07	↔				

*** Sites where change extends outside historical ranges for the transect.*
α<0.1, ↑=increase, ↓=decrease,↔=no change

DELTA_01

DELTA_01 is located in the Delta Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index varied between 67-72% during the baseline period. The site is dominated by saltgrass with a small alkali sacaton component. The site has remained static during all six sampling periods.

Frequency (%), DELTA_01

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Annual Forb	CORA5	0	0	0	0	0	0	2
Perennial Forb	ANCA10	5	12	5	7	11	9	10
	NIOC2	10	5	7	4	3	8	5
	SUMO	7	0	1	0	0	0	0
Perennial Graminoid	DISP	156	152	149	152	155	151	150
	JUBA	0	7	11	10	9	6	6
	LETR5	0	1	0	0	0	0	0
	SPAI	3	0	13	11	16	11	10
Shrubs	ATTO	2	5	1	5	0	0	0
Nonnative Species	BAHY	0	0	2	0	2	1	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs DELTA_01

Species Code	2003	2004	2007	2009	2010	2013
ATTO	3.1	1.8	3.9	1.1	0.2	0.1
SUMO	0.9	0.8	0.2	0.1	0.0	0
Total	4.0	2.7	4.1	1.2	0.2	0.1

DELTA_02

DELTA_02 is located in a grazing exclosure in the Delta Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes which corresponds to the Moist Floodplain ecological site. Similarity index ranged between 59-66% during the baseline period. Plant frequencies in 2013 did not change when compared to 2010 with the exception of saltgrass. Rubber rabbitbrush cover appears to be trending downwards. Frequency values in 2010 did not statistically differ from the five prior sampling periods. Because the transect is now within an exclosure, utilization was not sampled in 2009-10.

Utilization by Weighted Average and Species, Delta_02

	Weighted Average	DISP	SPAI
2007	52%	48%	70%
2008	49%	49%	

Frequency (%), DELTA_02

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Perennial Graminoid	DISP	109	118	131	103	115	114	89**
Shrubs	ATTO	10	13	0	0	4	8	8
	ERNA10	10	9	12	0	1	4	3
Nonnative Species	BAHY	0	3	0	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs DELTA_02

Species Code	2003	2004	2007	2009	2010	2013
ATTO	16.3	9.7	10.1	8.3	3.8	11.6
ERNA10	16.0	12.3	11.7	10.8	8.9	6.6
SUMO	0.4	0.0	0.0	0.0	0.0	0.0
Total	32.6	22.0	21.8	19.0	12.8	18.1

DELTA_03

DELTA_03 is located in the Delta Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, which corresponds to the Moist Floodplain ecological site. The site is predominantly saltgrass. Frequency values did not vary from 2007-13.

Utilization by Weighted Average and Species, Delta_03

	Weighted Average	DISP	SPAI
2007	59%	59%	57%
2008	51%	50%	69%
2009	54%	54%	
2010	71%	71%	

Frequency (%), DELTA_03

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Perennial Forb	SUMO	15	15	19	0	15	22	12
Perennial Graminoid	DISP	114	118	129	104	119	112	122
	SPAI	5	0	0	1	0	0	2
Shrubs	ATTO	12	13	8	0	8	8	2
	ERNA10	0	0	0	0	2	0	0
	SAVE4	0	0	10	0	0	0	1
Nonnative Species	BAHY	0	1	0	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs DELTA_03

Species Code	2003	2004	2007	2009	2010	2013
ATTO	11.0	7.7	10.9	7.3	4.8	5.2
ERNA10	0.7	0.4	1.1	0.8	0.8	0.4
SAVE4	6.6	6.3	5.9	5.9	5.1	4.0
SUMO	17.2	5.2	3.7	9.5	11.3	5.1
Total	35.4	19.7	21.7	23.4	21.9	14.7

DELTA_04

DELTA_04 is located in the Delta Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. Similarity index ranged between 63-71% during the baseline period. The site has remained relatively stable since vegetative sampling began, there were no significant changes in frequency values between 2007-10.

Frequency (%), DELTA_04

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Annual Forb	ATPH	0	7	0	0	4	4	0
Perennial Forb	SUMO	0	7	0	0	1	0	5
Perennial Graminoid	DISP	139	128	150	103	115	124	116
	SPAI	0	5	6	0	0	0	0
Shrubs	ATTO	3	2	6	0	0	4	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs DELTA_04

Species Code	2003	2004	2007	2009	2010	2013
ATTO	3.6	2.3	3.1	5.3	6.1	1.7
SAVE4	0.3	0.6	0.2	0.2	0.9	0
SUMO	1.9	0.9	1.8	2.6	1.4	1.3
Total	5.9	3.8	5.1	8.1	8.3	3

DELTA_05

DELTA_05 is located in the Delta Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes, which corresponds to the Moist Floodplain ecological site. The similarity index ranged between 66-72% during the baseline period. The site has remained relatively stable since vegetative sampling began and there were no significant changes in frequency values between 2007-13.

Frequency (%), DELTA_05

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Annual Forb	HEAN3	0	2	0	0	0	0	0
Perennial Forb	ANCA10	0	0	1	3	8	4	7
	NIOC2	7	0	2	0	0	2	6
	SUMO	14	2	23	19	16	20	11
Perennial Graminoid	CADO2	0	2	5	0	0	0	0
	CAREX	0	0	0	0	4	0	0
	DISP	155	146	163	135	144	146	135
	JUBA	9	9	12	13	23	23	13
	SCAM6	0	0	0	0	0	5	3
Shrubs	ATTO	0	6	5	0	1	0	0
Nonnative Species	BAHY	0	1	3	0	1	0	0
	LASE	0	10	0	0	0	0	0

** indicates a significant difference, $\alpha<0.1$, **<0.05 compared to previous sampling period*

Cover (m) shrubs DELTA_05

Species Code	2003	2004	2007	2009	2010	2013
ATTO	6.5	3.4	4.8	5.9	6.1	2.6
ERNA10	0	0	0.6	1.2	1.0	0
SUMO	12.7	7.2	6.9	6.7	9.4	3.2
Total	19.2	10.6	12.2	13.8	16.6	5.8

DELTA_06

DELTA_06 is located in the Delta Field. The soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, which corresponds to the Moist Floodplain ecological site. The similarity index ranged between 54-73% during the baseline period, this variation is a result of annual fluctuations in saltgrass production. Saltgrass frequency followed a similar decline in 2003 but has remained stable for all other sampling periods. There were no significant changes in frequency values between 2007-13.

Frequency (%), DELTA_06

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Annual Forb	ATPH	0	0	0	0	5	0	0
Perennial Forb	ANCA10	9	5	5	7	6	10	7
	HECU3	9	7	8	2	0	0	0
	NIOC2	0	0	0	0	0	1	3
	SUMO	15	14	27	6	18	17	18
Perennial Graminoid	DISP	122	94	120	125	120	105	101
	JUBA	17	12	14	12	11	9	5
Shrubs	ATTO	3	4	0	2	2	0	1
	ERNA10	0	3	0	0	0	0	0
	SAVE4	0	1	15	0	4	3	2
Nonnative Species	BAHY	0	5	0	0	0	0	0
	XAST	0	2	0	0	0	0	0

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs DELTA_06

Species Code	2003	2004	2007	2009	2010	2013
ATTO	8.2	4.5	5.9	4.9	4.0	1.0
ERNA10	0.4	0.6	0.6	0	0	0
SAVE4	8.3	6.6	6.5	8.7	8.0	7.7
SUMO	9.4	3.9	10.6	7.0	7.6	7.9
Total	26.2	15.6	23.6	20.6	19.6	16.5

DELTA_07

DELTA_07 is located in the Delta Field, soils are Torrifluvents-Fluvaquentic Endoaquolls Complex, 0-2% slopes which corresponds to the Moist Floodplain ecological site. The similarity index during the baseline period ranged between 35-60%, responding to declines in saltgrass production on the site. This site has remained static.

Frequency (%), DELTA_07

Life Forms	Species	2002	2003	2004	2007	2009	2010	2013
Perennial Forb	SUMO	32	16	15	12	15	18	9
Perennial Graminoid	DISP	114	93	116	102	121	121	107

** indicates a significant difference, α<0.1, **<0.05 compared to previous sampling period*

Cover (m) Shrubs DELTA_07

Species Code	2003	2004	2007	2009	2010	2013
SUMO	25.1	10.3	27.0	32.8	33.1	17.9

Irrigated Pastures

The Lake Field is located west of U.S. Highway 395 north of Diaz Lake. This irrigated pasture was evaluated in 2013 and received a score of 74%. This is below the allowable score of 80%. The reason for the decreased condition of this pasture is due to drought conditions that impeded water distribution over the field. Watershed Resources staff do not believe that changes are necessary at this time. A normal precipitation year will improve pasture conditions. This pasture will be re-evaluated in 2014.

Irrigated Pasture Condition Scores 2011-13

Pasture	**2011**	**2012**	**2013**
Lake Field	X	X	74

X indicates no evaluation made

Stockwater Sites

The Bolin Field was supposed to receive a stockwater site supplied by the Lone Pine Visitors Centers well in 2010. After a more in-depth analysis of water availability was undertaken, it was ascertained that there was not an adequate amount of water to sustain both uses. The resulting analysis has stockwater being supplied from a diversion that runs from the LAA. The status of this stockwater situation has not changed in 2013.

Fencing

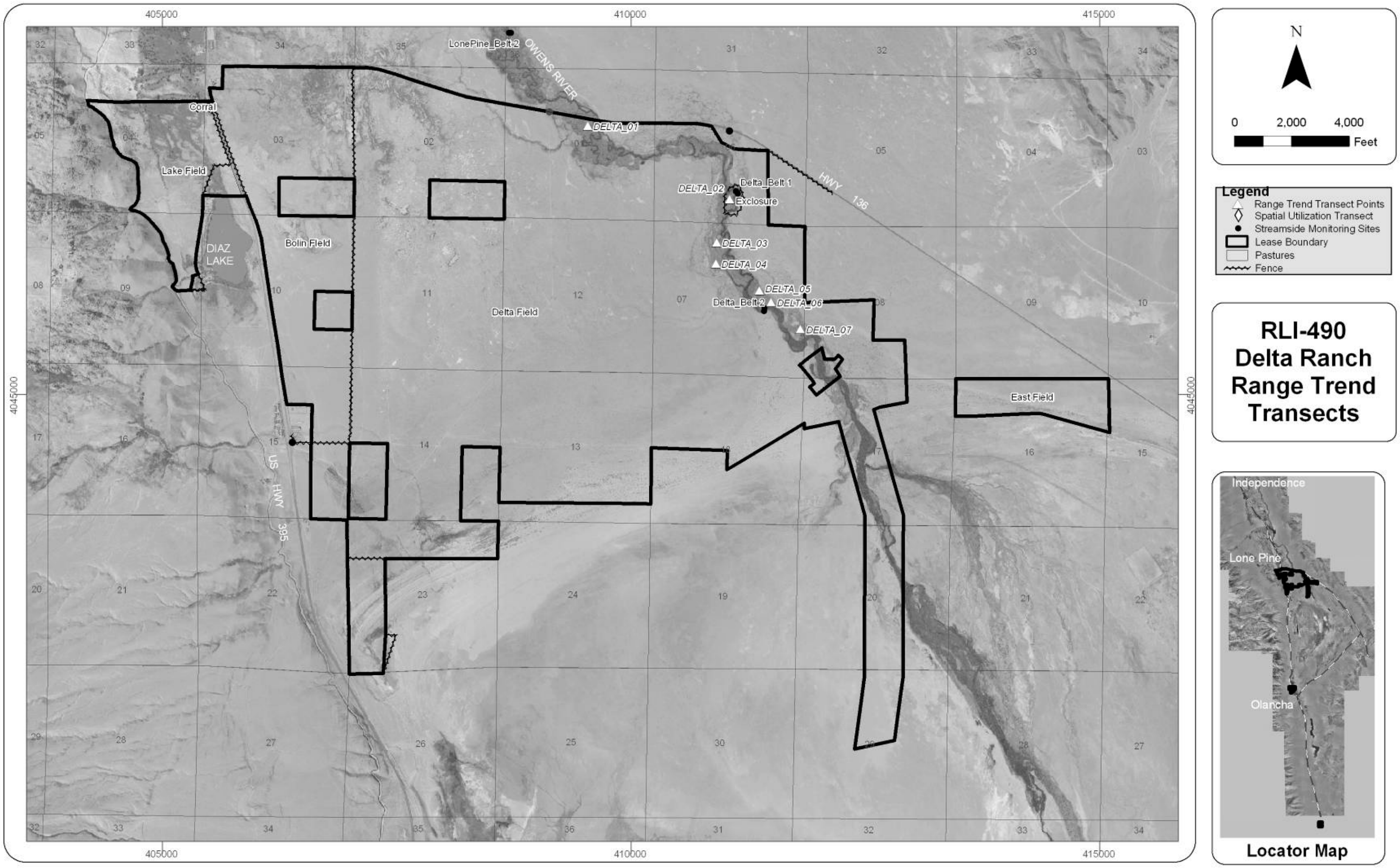
There was no new fencing on the lease for 2013.

Salt and Supplement Sites

Cake blocks that contain trace minerals and protein are distributed for supplement on the lease. The blocks are dispersed randomly each time and if uneaten they biodegrade within one grazing season. There are also supplement tubs that are used in established supplement sites.

Burning

There are no planned burns for this lease during 2014.



Land Management Figure 31. Delta Lease RLI-490, Range Trend Transects

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4.12 *Land Management Appendix 1. Species Encountered Along 40 cfs Base Flow During Spring 2012 Streamside Monitoring.*

Plant Code	Species Name	Common Name
ANCA10	*Anemopsis californica*	yerba mansa
ATTO	*Atriplex torreyi*	saltbush
BAHY	*Bassia hysopifolia*	bassia/smotherweed
DISPS2	*Distichlis spicata*	saltgrass
EQAR	*Equisetum arvense*	field horsetail
FOPU	*Forestiera pubescens*	stretchberry
GLLE3	*Glycyrrhiza lepidota*	licorice
HECU3	*Heliotropis curvassum*	salt heliotrope
JUBA	*Juncus balticus*	Baltic rush
LELA	*Lepidium latifolium*	broadleaf pepperweed
LETR5	*Leymus triticoides*	creeping wildrye
SAEX	*Salix exigua*	narrowleaf willow
SAGO	*Salix gooddingii*	Goodding's willow
SALA3	*Salix laevigata*	red willow
SAVE4	*Sarcobatus vermiculatus*	greasewood
SCAC	*Schoenoplectus acutus*	tule
SCAM	*Schoenoplectus americanus*	common threesquare
SCMA	*Schoenoplectus maritimus*	cosmopolitan bulrush
SPAI	*Sporobolus airoides*	alkali sacaton
TARA	*Tamarix ramossissima*	saltcedar
TYDO	*Typha domingensis*	southern cattail
TYLA	*Typha latifolia*	broadleaf cattail

5.0 RAPID ASSESSMENT SURVEY

Lower Owens River Project
2013 Rapid Assessment Survey

Observations


LORP Monitoring - Rapid Assessment Data Sheet

Lower Owens River Project
Summary of Rapid Assessment Survey Observations

A survey of the Lower Owens River Project (LORP) area, referred to as the Rapid Assessment Survey or RAS, is conducted annually beginning in August. This year, between August 1 and August 12, Inyo County and LADWP staff spent a total of 64 person-days (Inyo 42, LADWP 12) walking more than 225 miles along the wetted edges of the water features in the LORP. These areas include the Lower Owens River, Blackrock Waterfowl Management Area (BWMA), Off-River Lakes and Ponds (OLP), and the Delta Habitat Area (DHA). The observations recorded during this exercise are presented in this report.

The primary purpose of the RAS is to detect and record the locations of problems that can negatively affect the LORP. These are impacts that require physical maintenance such as repairing a damaged or cut fences, trash pickup, tamarisk slash pile removal, and herbicide treatment of noxious weeds.

Project managers and scientists also use RAS data as rough indicators of basic trends in the ecological development of the riparian and riverine environments, especially when RAS data is compiled with information gathered from other LORP studies. For example, RAS observations of woody recruitment can be considered along with river-edge belt transects, designed to look in greater detail at woody recruitment. The combined observations can help project scientists understand how woody recruitment is taking place, and if it is persisting.

The observations made during the RAS effort are categorized by type and Observation Code in Table 1, and the number of observations by impact type and LORP area are presented in Table 2.

Table 1. Catalog of impacts recorded by the RAS

Observation Code	Observation Type	Description
WDY	Woody Recruitment	This year's cohort of willow and cottonwood seedlings
TARA	Saltcedar	*Tamarisk* spp., seedlings or resprouts from previously treated plants
ELAN	Russian Olive	*Elaeagnus angustifolia*, seedlings and juveniles (height <2m)
NOX	Noxious Weeds	Any of twenty-one species of locally invasive plants, mainly perennial pepperweed
BEA	Beaver	Sightings or evidence of beaver in the LORP
ELK	Elk	*Cervus canadensis* ssp. *nannodes*, sightings or evidence of tule elk
FEN	Fence	Reports of damaged riparian or exclosure fencing
GRZ	Grazing	Evidence of off-season grazing, or non-compliance with grazing plan
REC	Recreational Impacts	Evidence of recreational activity and any adverse associated impacts
ROAD	Road	Unauthorized roads or road/trail building activities or roads causing impacts
TRASH	Trash	Large refuse or dumping
SLASH	Slash	Substantial new piles of recently cut saltcedar slash
OBSTR	Obstructions	Obstructions to river flow
DFish	Dead Fish	Dead fish

Other	Other	Other impacts

Table 2. Summary of observations collected by category and area; including Blackrock Waterfowl Management Area (BWMA); Off-River Lakes and Ponds (OLP); and the Delta Habitat Area (DHA).

Observation Code	Observation Type	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	BWMA	OLP	DHA	Total Obs.
WDY	**Woody Recruitment**	3	47	25	1	3	7	5	6	0	**97***
TARA	**Saltcedar Plants (Tamarisk)**	11	152	88	13	17	55	83	15	21	**455**
ELAN	**Russian Olive Recruitment**	1	3	2	0	0	0	3	4	0	**13**
NOX	**Noxious Weeds (Lepidium)**	14	14	1	0	0	0	4	0	0	**33**
BEA	**Beaver**	2	2	1	0	0	0	0	0	0	**5**
ELK	**Elk**	0	1	0	0	6	4	1	0	5	**17**
FEN	**Fence**	0	2	2	0	0	2	0	0	0	**6**
GRZ	**Grazing**	0	1	2	0	0	1	1	0	0	**5**
REC	**Recreation Impacts & Use**	0	2	7	0	2	11	1	1	1	**25**
ROAD	**Road**	0	0	1	0	3	0	0	0	0	**4**
TRASH	**Trash**	1	1	2	0	3	5	0	0	0	**12**
SLASH*	**Slash**	0	0	0	0	0	0	0	0	0	**0**
DFISH	**Dead Fish**	0	0	0	0	0	2	0	0	0	**2**
OBST	**Obstructions**	0	3	0	0	1	3	0	0	0	**7**
OTHER	**Other**	3	3	0	0	0	0	0	0	0	**6**

* Includes approximately 51 instances of clonal recruitment of Salix Exigua (SAEX)

River-reaches and LORP units

Table 3

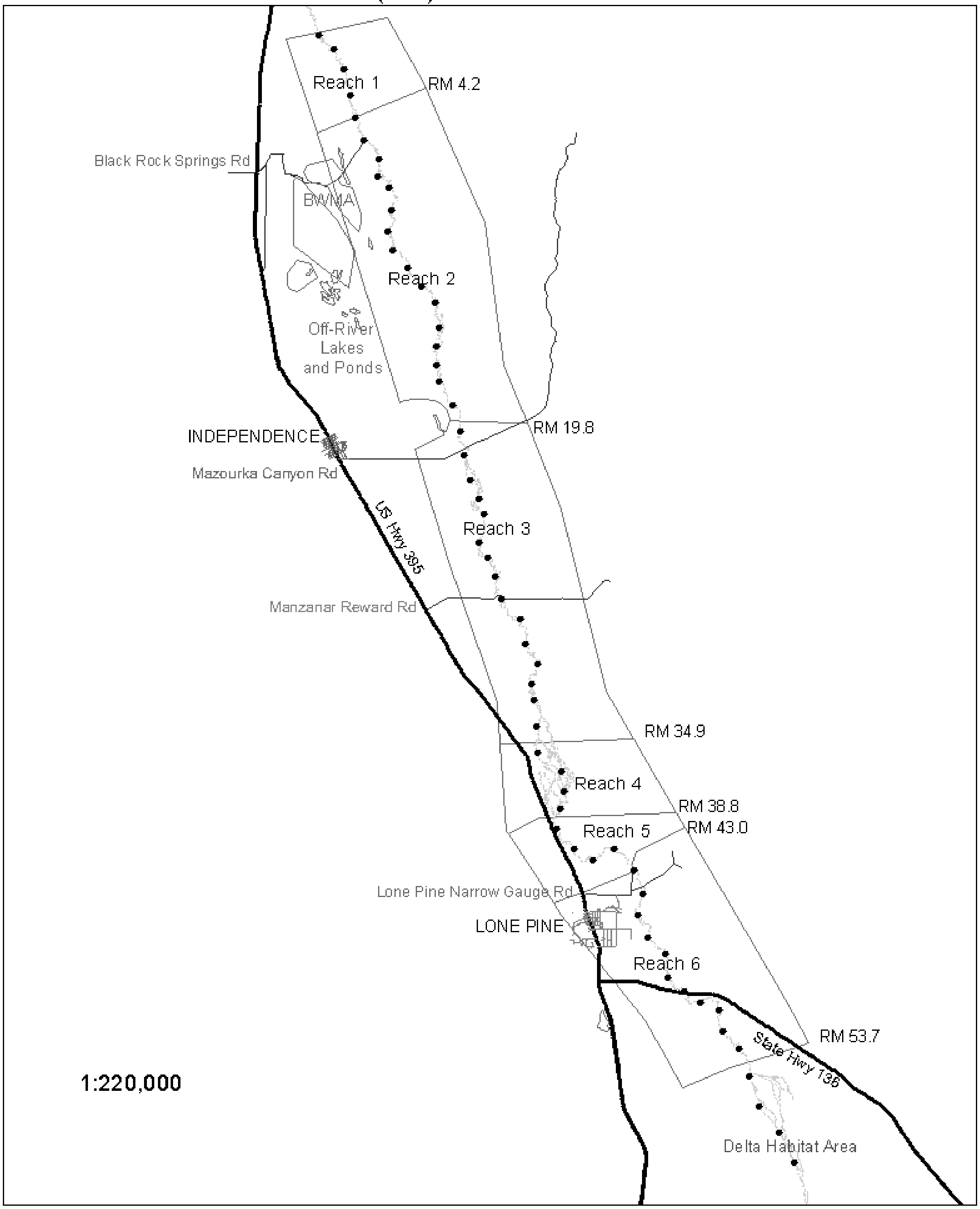
The Lower Owens River is divided up in to six river-reaches. These river segments are defined by valley form, channel/floodplain morphology, and hydrologic variables (Table 3, and "River-reaches and river-miles map"). For the RAS summary, these reaches offer a convenient way to describe a position on the river, and they serve as a common reference for RAS observations taken year to year. Further, individual observations in the river-riparian corridor are often referenced to the nearest tenth of a river-mile (RM). The Lower Owens River Intake is river-mile 0.0, the pumpback station is at river-mile 53.1, the Delta Habitat Area begins at river-mile 53.7, and the river fades into the Owens Lake playa near river-mile 62.0.

When comparing the number of observations found per river-reach, or when looking at the distribution of observations along the length of the river, it is important to note that the lengths of the reaches are unequal. For example, about 90% of woody recruitment observations made in 2013 were recorded in river-reaches 2 and 3, which together encompass about half of river-miles in the entire river-riparian corridor.

Table 3. River reaches: comparison of reach length, and river type.

	Percent of river length	Total River-miles (RM)	Mile Markers	Description
Reach 1	7%	4.2	0 to 4.2 RM	Wet Incised Floodplain
Reach 2	25%	15.6	4.2 to 19.8 RM	Dry Incised Floodplain
Reach 3	24%	15.1	19.8 to 34.9 RM	Wet Incised Floodplain
Reach 4	6%	3.9	35.0-38.8 RM	Aggraded Wet Floodplain
Reach 5	7%	4.2	38.8 to 43.0 RM	Wet Incised Floodplain
Reach 6	17%	10.7	43.0 to 53.7 RM	Graded Wet Floodplain
Delta Habitat Area (DHA)	13%	8.3	53.7 to 62.0 RM	Delta

River Reaches and River Miles (RM)



Revisited Sites

Maps 2 & 7

Returning to sites observed in a previous year to look for persistence in vegetation, or a change in the character of an impact, is part of the RAS. This year observers returned to specific sites where woody recruitment and evidence of beaver were recorded in 2012, and noted the presence or absence of the subject impact. A total of 56 sites were revisited. The results from these revisits are found in this report in corresponding category sections.

Summary of Observations by Category

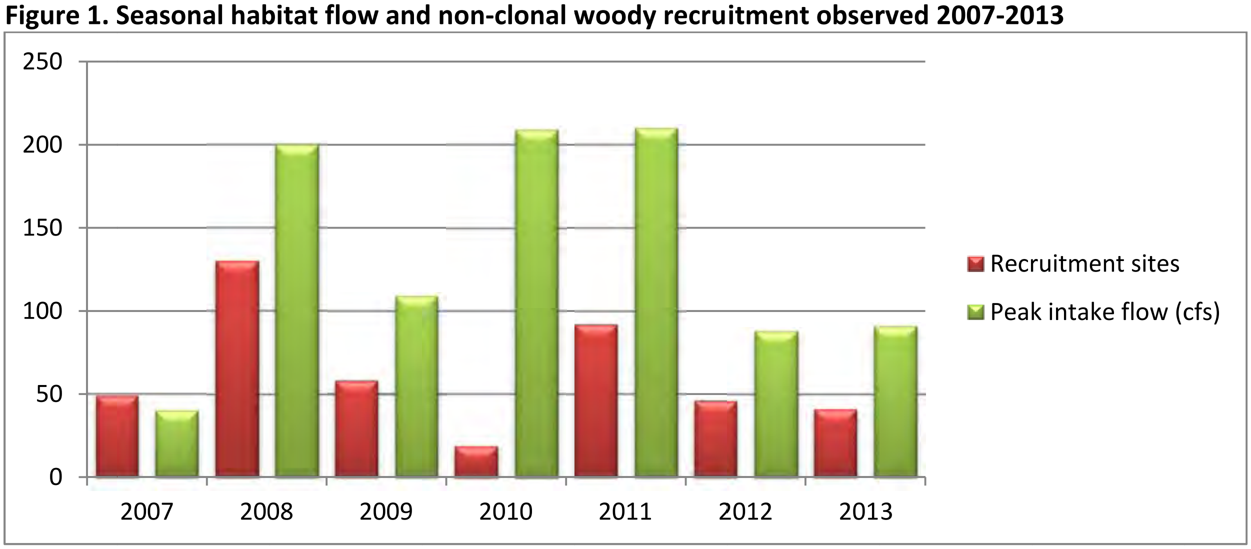
Woody Recruitment (Observation Code: WDY)

Figure 1; Tables 5-7; Map 1

Willow and Cottonwood provide the structural diversity and varied natural habitats that are essential to attracting many of the riverine/riparian avian habitat indicator species, which are indicators of the project's success. A central focus of the RAS has been to identify areas where new trees and shrubs were developing in the newly wetted areas of the LORP. Much attention is given to training field staff on how to locate, identify, and record willow and cottonwood seedlings and juvenile plants that is part of this year's cohort.

The 2013, observers located 35 tree willow recruits, 5 shrub willow recruits, and one cottonwood recruit found off-river. All of the willow was located in the river-riparian corridor or DHA. The amount of woody recruitment recorded in 2013 was down about 10% from 2012, and less than all prior years except 2010 (Figure 1).

Figure 1. Seasonal habitat flow and non-clonal woody recruitment observed 2007-2013



Year	2007	2008	2009	2010	2011	2012	2013
Recruitment sites (does not include SAEX clonal recruitment)	49	130	58	19	92	46	41
Recruitment sites (all recruitment including clonal SAEX)	49	135	71	31	144	69	97
Peak seasonal habit flow, released from intake (cfs)	40 base	200	109	209	210	88	91

The 2008 seasonal habitat flow was released in the winter (February 13, 2008)

The RAS is conducted in August to be able to detect seedlings that may have germinated as the result of the annual LORP seasonal habitat flow (SHF), which is timed to accompanying willow seedfly. This year's RAS was conducted about nine weeks after the SHF, so it is likely that seedlings that developed in response to the flow would have reached a stage of maturity that favored detection.

Notes:

- Tree willow recruitment (SAGO, SALA3, SALIX) was found at 35 sites, and shrub willow seedlings (SAEX) at 5 sites. One cottonwood recruit was located along Goose Lake return ditch (OLP). Shrub willows that developed clonally were also recorded during the RAS.
- Reach 2 had almost four times as many recruits as any other reach (Table 5). This distribution is unlike that observed in 2012, when reaches 4 and 5 had the greatest number of recruitment sites per river-mile.
- Most recruitment was recorded on a riverbank (n: 16), with remaining recruitment found in the floodplain (n: 7), channel to bank (n: 9), channel to bank to floodplain (n: 4), channel (n: 4), and upland (n: 1). (Table 7).
- In terms of the numbers of recruits present at each of the sites, 17 sites had 1-5 seedlings, 14 sites had 6-25 seedlings, and at 10 sites more than 26 seedlings were found. (Table 6)

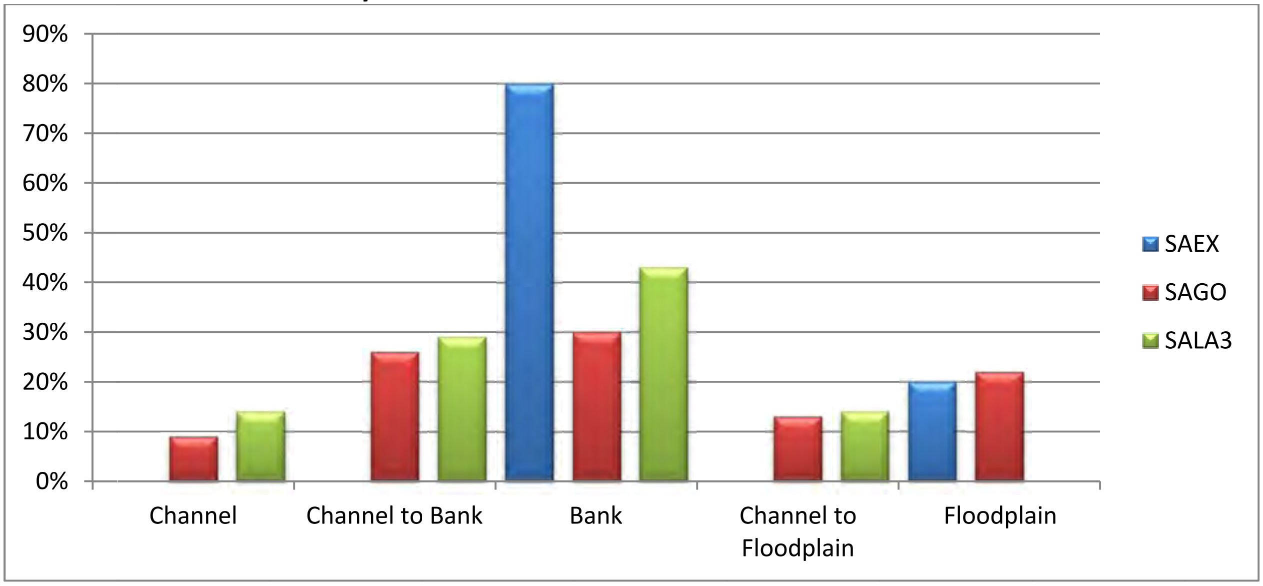
Table 5. No. of recruitment sites, by species and location &number of recruitment sites/RM/ reach

Species Code	Common Name/ Scientific Name	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	DHA	BWMA	OLP	Total
SAEX	Narrow leaf willow/ *Salix exigua*	1	0	4	0	0	0	0	0	0	**5**
SAGO	Black willow/ *Salix gooddingii*	0	18	3	0	1	1	0	0	0	**23**
SALA3	Red willow/ *Salix leevigata*	0	7	0	0	0	0	0	0	0	**7**
SALIX	Tree species, hybrid, or unknown willow	0	4	1	0	0	0	0	0	0	**5**
POFR2	Fremont Cottonwood/ *Populus fremontii*	0	0	0	0	0	0	0	0	1	**1**
Total number of Observations		**1**	**29**	**8**	**0**	**1**	**1**	**0**	**0**	**1**	**41**
Number of Observations per River-Mile (tree willow)		**0.2**	**1.9**	**0.5**	**0**	**0.2**	**0.1**				

Table 6. Population of plants present at an individual recruitment site

Species Code	Common Name	1 to 5	6 to 25	26 to 100	>100	Total
SAEX	Narrow leaf willow	1	3	1	0	**5**
SAGO	Black willow	10	7	2	4	**23**
SALA3	Red willow	4	2	0	1	**7**
SALIX	Hybrid, or unknown willow	1	2	2	0	**5**
POFR2	Fremont Cottonwood	1	0	0	0	**1**
Total number of recruits by population		**17**	**14**	**5**	**5**	**41**

Table 7. Distribution of woody recruitment relative to landforms



Species Code	Common Name	Channel	Channel to Bank	Bank	Channel to Floodplain	Floodplain	Upland	Off-river*
SAEX	Narrow leaf willow	–	–	80%	–	20%	–	–
SAGO	Black willow	9%	26%	30%	13%	22%	–	–
SALA3	Red willow	14%	29%	43%	14%	–	–	–

* A single cottonwood was found near an off-river pond

Woody Recruitment Revisits

Map 2

Woody recruitment sites found in 2012 were revisited in 2013. Of the 46 sites revisited 85% of last year's cohort was relocated.

Table 8. Revisit sites: persistence of woody recruitment identified in 2012

	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Total	% of total
Present	1	25	12	–	1	–	39	85
Absent	0	4	2	–	1	–	7	15

Saltcedar (Observation Code: TARA)

Tables 9, 10, 11; Map 3

Saltcedar (*Tamarix* spp.) is found throughout the LORP, and is the most abundant noxious weed in the project area. In 2013, resprouts, seedlings, as well as mature plants were recorded, for a total of 454 sites (Table 8). This represents about a 20% increase in TARA observations over 2012 (n: 380). The actual number of records may be low, as one observer in the BWMA area commented that TARA was wide-spread in one of the basins, but did not record locations.

Notes:

- TARA observations in the BWMA and Off-river Lakes and Ponds units increased 70% over last year. The increase was most apparent in the BWMA, OLP, and the river adjacent to these features in river reach 2. Plant abundance categories around the wetlands and lakes and ponds were larger: 30% of the TARA located in the BWMA and off-river was classified as having populations of between 26 and >100 plants, while on the river this same class represented 6%, and no large groupings were recorded in the DHA. (Table 11).

Table 9. Total number of observation sites and age class of TARA by location; observations per RM

Age Class	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	DHA	BWMA	OLP	Total
Seedlings	3	60	8	3	5	3	0	14	2	**98**
Resprouts	1	12	40	4	7	31	7	1	1	**104**
Mature	7	79	39	6	5	20	11	63	12	**243**
Age Not Recorded	0	1	1	0	0	1	2	5	0	**10**
Total number of Observation Sites	**11**	**152**	**88**	**13**	**17**	**55**	**20**	**83**	**15**	**454**
Number of Observation/RM	**2.6**	**9.7**	**5.8**	**3.3**	**4.0**	**5.1**	**2.5**			

Table 10. Abundance at observation sites, by LORP unit, or river-reach

Location	Abundance (number of plants per site)				
	1 to 5	**6 to 25**	**26 to 100**	**>100**	**Total no. of sites**
BWMA-Drew	11	3	1	0	**15**
BWMA-Thibaut	4	13	3	1	**21**
BWMA- Waggoner	15	1	5	7	**28**
BWMA-Winterton	11	5	0	3	**19**
Delta Habitat Area	18	2	0	0	**20**
Off River - Billy	0	0	1	0	**1**
Off River - Goose	2	3	1	8	**14**
Reach 1	7	4	0	0	**11**
Reach 2	103	31	15	3	**152**
Reach 3	75	9	3	1	**88**
Reach 4	11	2	0	0	**13**
Reach 5	16	1	0	0	**17**
Reach 6	53	2	0	0	**55**
Total number of plants, by abundance	**326**	**76**	**29**	**23**	**454**

Table 11: Percent of TARA in specific abundance categories by area

Location	Abundance (number of plants per site)			
	1 to 5	**6 to 25**	**26 to 100**	**>100**
BWMA-OLP	44%	26%	11%	19%
River	79%	15%	5%	1%
DHA	90%	10%	0%	0%

Notes (continued):

- In 2012 river-reach 4, a short section of the river, had the greatest number of TARA sites per mile. The saltcedar control program made considerable progress in this reach and now this area is one of the least infested. (Table 9)
- In 29 instances, seedlings were recorded and then removed, however these records are still represented in the data and tables in this report.

Russian olive (Observation Code: ELAN)

Table 12; Map 4

Although Russian olive (Elaeagnus angustifolia) is not listed as a noxious weed in California, the California Invasive Plant Council considers this species highly invasive in riparian systems. All mature ELAN plants in the area surveyed during the RAS have been recorded. The focus now is to document juvenile ELAN, due to concerns about the potential for invasion of this species in the project area. At this time ELAN does not appear to be spreading in the areas surveyed during the RAS; however, for surveillance purposes all ELAN recruitment (plants <1m) is recorded.

Note:

- The amount of ELAN recruitment, observed in the wetted areas of the LORP, dropped from 24 sites in 2012, to 13 sites in 2013.

Table 12. Abundance at observation sites, by LORP unit, or river reach

	Abundance (number of plants/location)				
Location	**1 to 5**	**6 to 25**	**26 to 100**	**>100**	**Total no. of sites**
BWMA-Drew	0	0	0	0	**0**
BWMA-Thibaut	1	0	0	0	**1**
BWMA- Waggoner	2	0	0	0	**2**
BWMA-Winterton	0	0	0	0	**0**
Delta Habitat Area	0	0	0	0	**0**
Off River - Billy	2	1	0	0	**3**
Off River--Goose	1	0	0	0	**1**
Reach 1	1	0	0	0	**1**
Reach 2	3	0	0	0	**3**
Reach 3	2	0	0	0	**2**
Reach 4	0	0	0	0	**0**
Reach 5	0	0	0	0	**0**
Reach 6	0	0	0	0	**0**
ELAN, total number of sites					**13**

Noxious Weeds (Observation Code: NOX)

Table 13; Map 5

Other than tamarisk, perennial pepperweed (*Lepidium latifolia*, LELA2) was the only noxious species reported within the LORP this year. In 2012, infestations that had been recorded in prior years, and had been treated that year, were not recorded. Last year's goal was to identify only new infestations. This year, all observations of *Lepidium* were recorded as requested by the Inyo County Agricultural Commissioner's office.

Notes:

- Thirty-three populations of LELA2 were recorded in 2013.
- The Inyo County Agricultural Commissioner's office was provided coordinates for all pepperweed sites detected during the 2013 RAS, and spray crews were dispatched.

Table 13. Abundance categories of LELA2 by location

	Abundance categories (number of plants/location)				
Location	**1 to 5**	**6 to 25**	**26 to 100**	**> 100**	**Total**
BWMA - Thibaut	0	2	0	0	**2**
BWMA – Waggoner	2	0	0	0	**2**
Reach 1	4	5	2	3	**14**
Reach 2	2	2	6	4	**14**
Reach 3	1	0	0	0	**1**
Reach 4	0	0	0	0	**0**
Reach 5	0	0	0	0	**0**
Reach 6	0	0	0	0	**0**
Total number of populations	**9**	**9**	**8**	**7**	**33**

Beaver Activity (Observation Code: BEA)

Map 7

Beaver activity and evidence was noted at 5 locations; down from 13 in 2012.

Note:

- No sign of beaver activity was noted anywhere below the top section of reach 3.

Dead Fish (Observation Code: DFISH)

Map 6

Note:

- Two dead carp and a scattering of fish waste were found upstream of the pumpback station, in the area where a fish kill was recorded a month prior.

Elk (Observation Code: ELK)

Map 6

Notes:

- Evidence of elk, or direct sightings, were noted at 17 locations; down from 30 in 2012. In 2012, Elk were seen in the Delta and in the Islands area in reach 3 and 4. In 2013, two observations were made in the BWMA and in the adjacent river area in reach 2. All remaining observations were in the DHA, or just east and north of Lone Pine.
- Browsing on woody vegetation was recorded at one location; down from 11 in 2012. Abrasion to tree bark, an indication of antler rub, was noted at seven locations.

LORP Riparian Fence (Observation Code: FEN)

Map 9

Staff surveyed exclosure fencing as well as riparian fence.

Notes:

- Three records were made of damage to fence.
- In 2012 and 2013, a recommendation was made to replace fencing and replacing older pass-through bordering the road at the Manzanar Reward river bridge.
- No exclosure fence was damaged, other than an enclosure in the Lone Pine area that was cut as the result of fire suppression activities.

Grazing Management (Observation Code: GRZ)

Map 9

Notes:

- Four cattle feed stations were found along the river in reach 2, 3 and 6.
- Cattle were seen in the area, and trampled streamside vegetation was noted in reach 3.

Recreation (Observation Code: REC)

Map 8

Twenty-five impacts associated with recreation, as evidenced by litter, fire rings and such, were recorded in the LORP in all river reaches except reach 4. Recreation evidence was most abundant near roads. Rec evidence was also found in BWMA and the DHA; areas that did not have recorded rec use in 2012.

Notes:

- Litter was the most frequently observed evidence of river recreation use (n: 21).
- Most evidence was found in the Lone Pine area and just north of the Islands in reach 3.
- Evidence of continued incompatible ORV use was found in the Lone Pine area.

Roads (Observation Code: ROAD)

Map 9

All roads, or vehicle trails that were not present in 2005, or changes in roads were recorded. There were four observations involving two locations.

Notes:

- One road observation was north of Manzanar Reward Road on the east side of the river and involved vehicular traffic across a wet floodplain.
- The other observations noted a road that provides access to the floodplain in the Lone Pine area, north of Lone Pine Depot Road. This road is believed to have been present prior to 2005, and no new impacts were noted.

Trash (Observation Code: TRASH)

Map 9

Observers were asked to record large trash items. Furniture, appliances, and building materials were recorded at 12 locations. This is up from 4 observations made in 2012.

Note:

- A couch, recorded repeatedly over the past five years, had not been removed.

Tamarisk Slash (Observation Code: SLASH)

Notes:

- No new saltcedar slash was observed, except for small quantities of cuttings placed on existing slash piles.
- Piles of tule slash, generated by experiments in tule control were located and points taken.

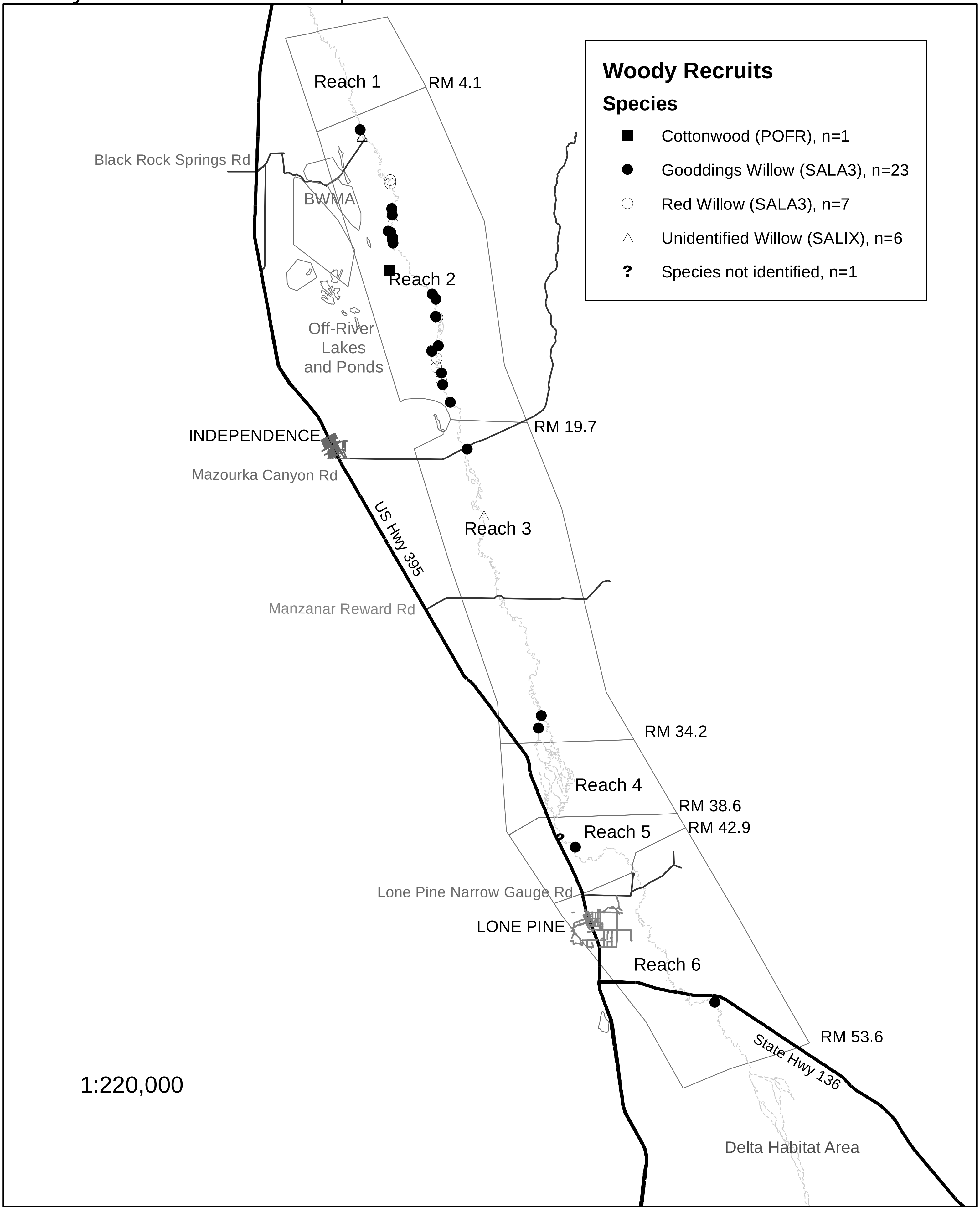
River Obstructions (Observation Code: OBST)

Map 9

Note:

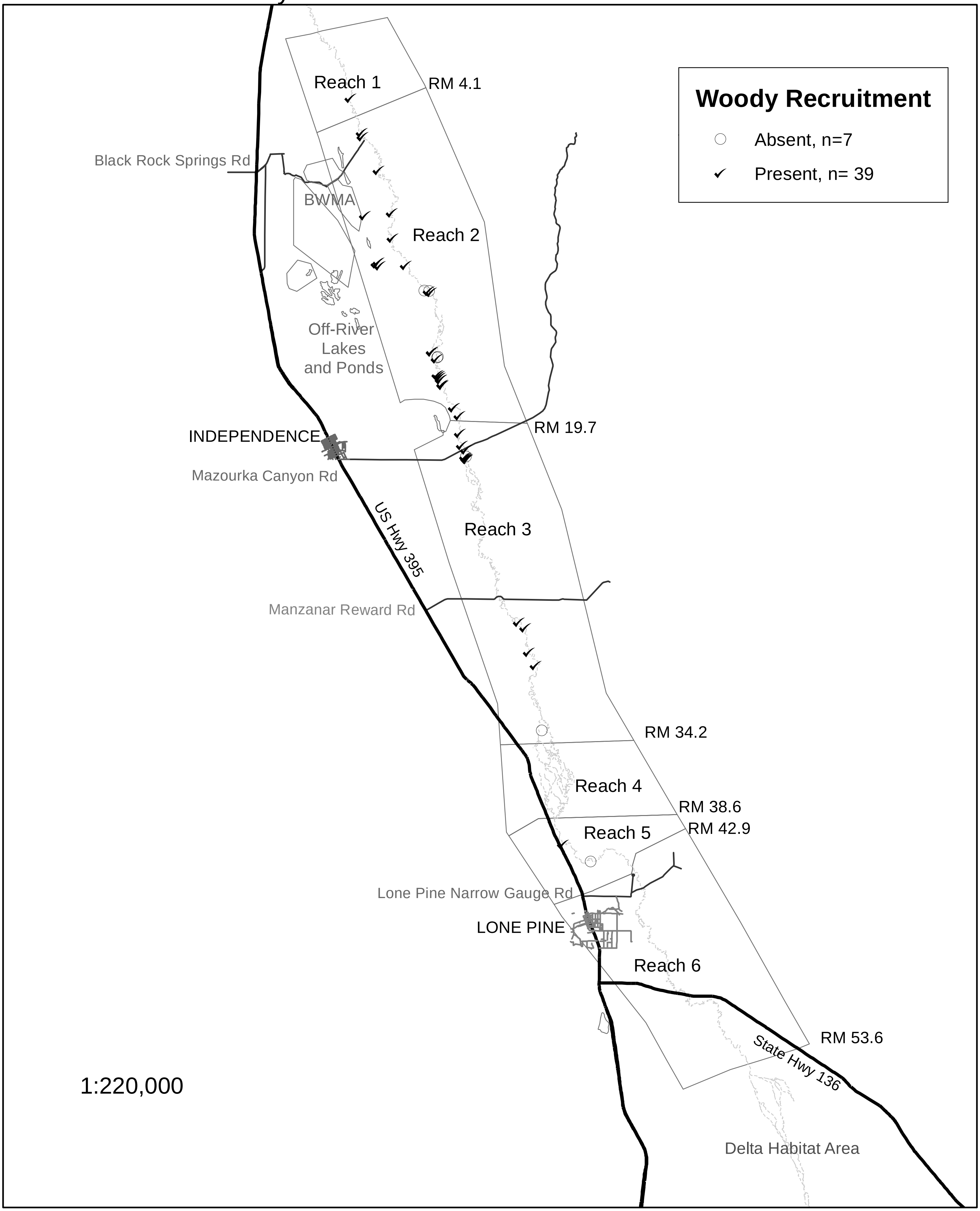
- Seven river obstructions were noted; however none of these caused flooding, or any other alteration to the river's course.

Woody Recruitment - Tree Species



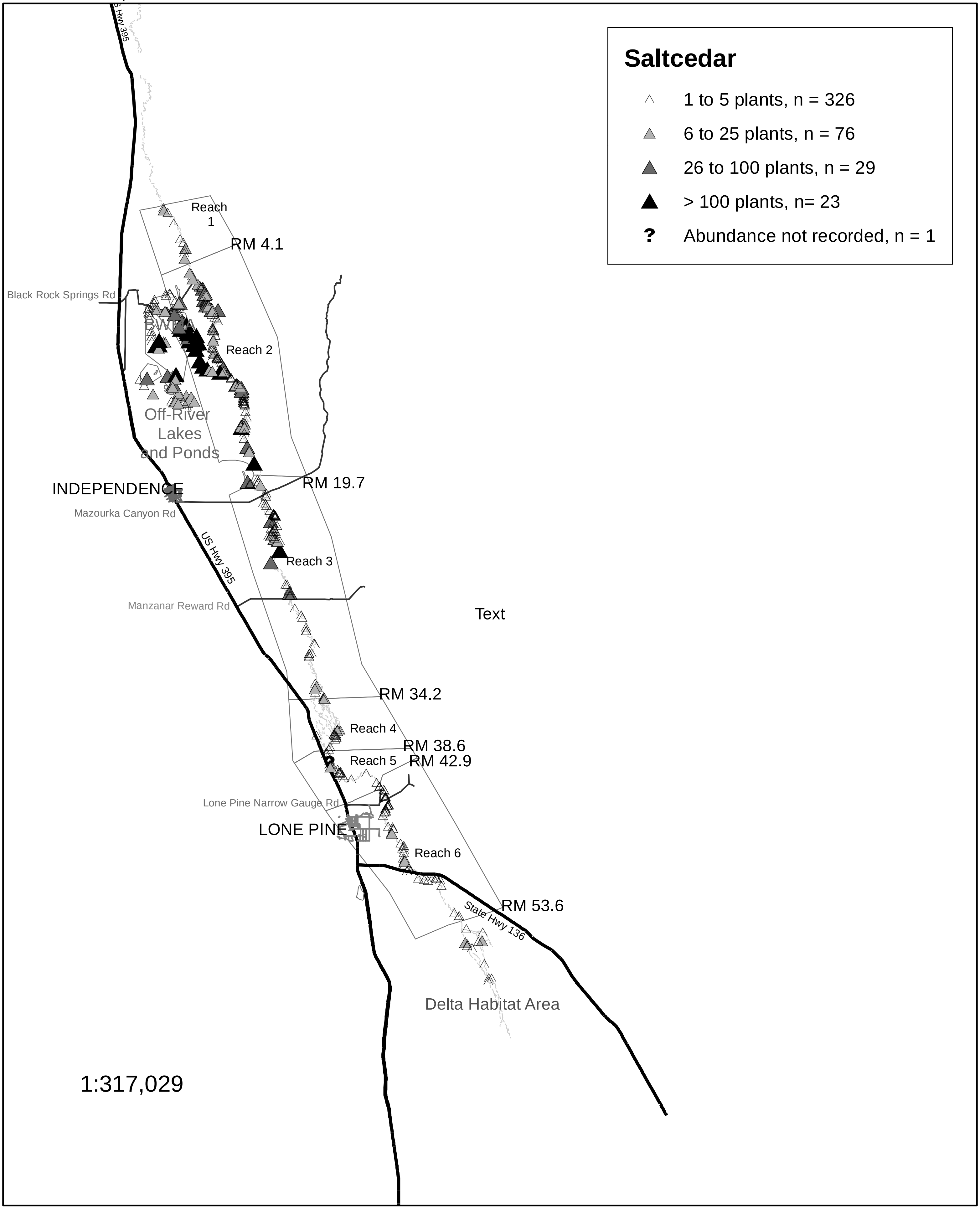
MAP 1

Revisited Sites - Woody Recruitment



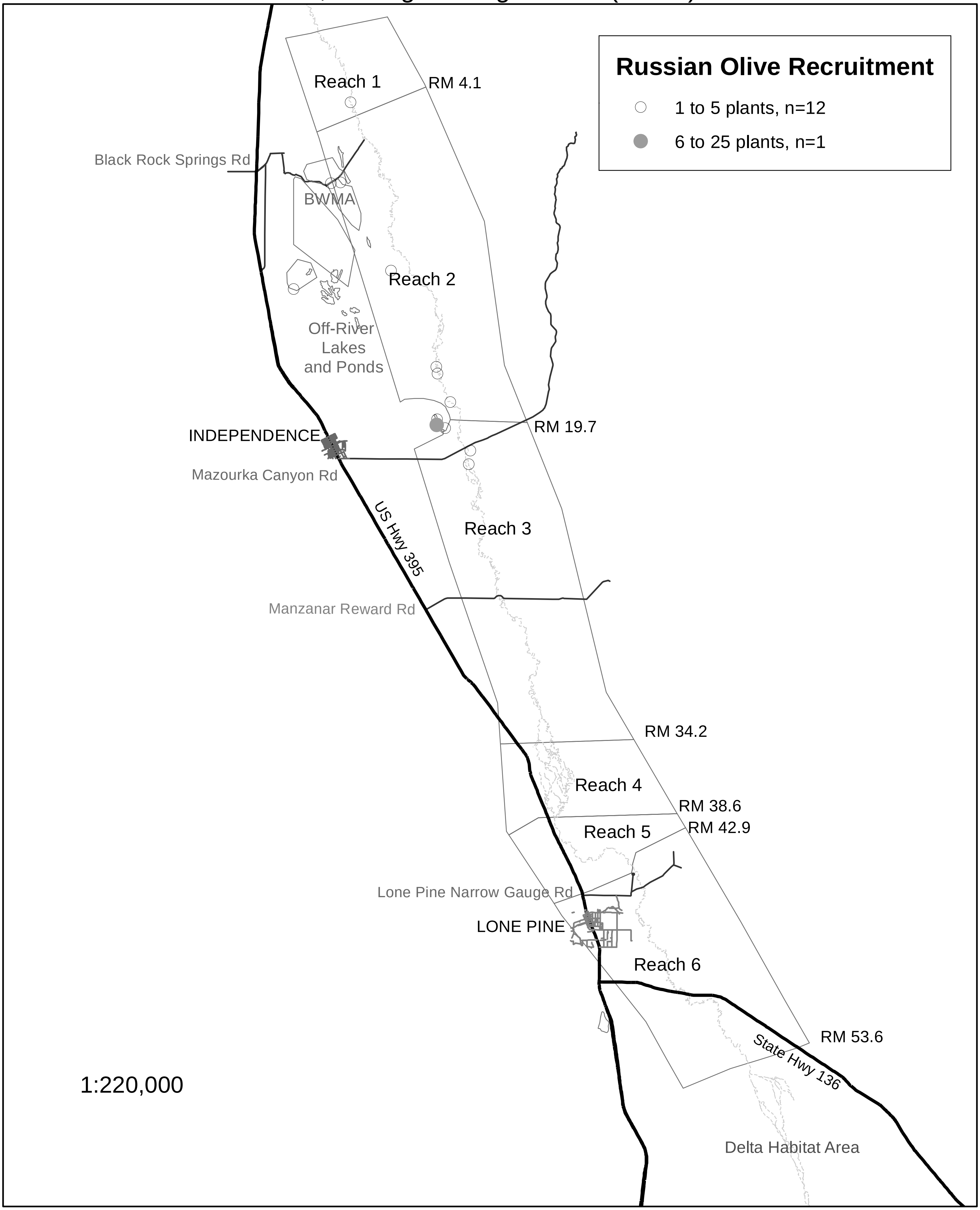
MAP 2

Saltcedar, *Tarmarix ramossisima*



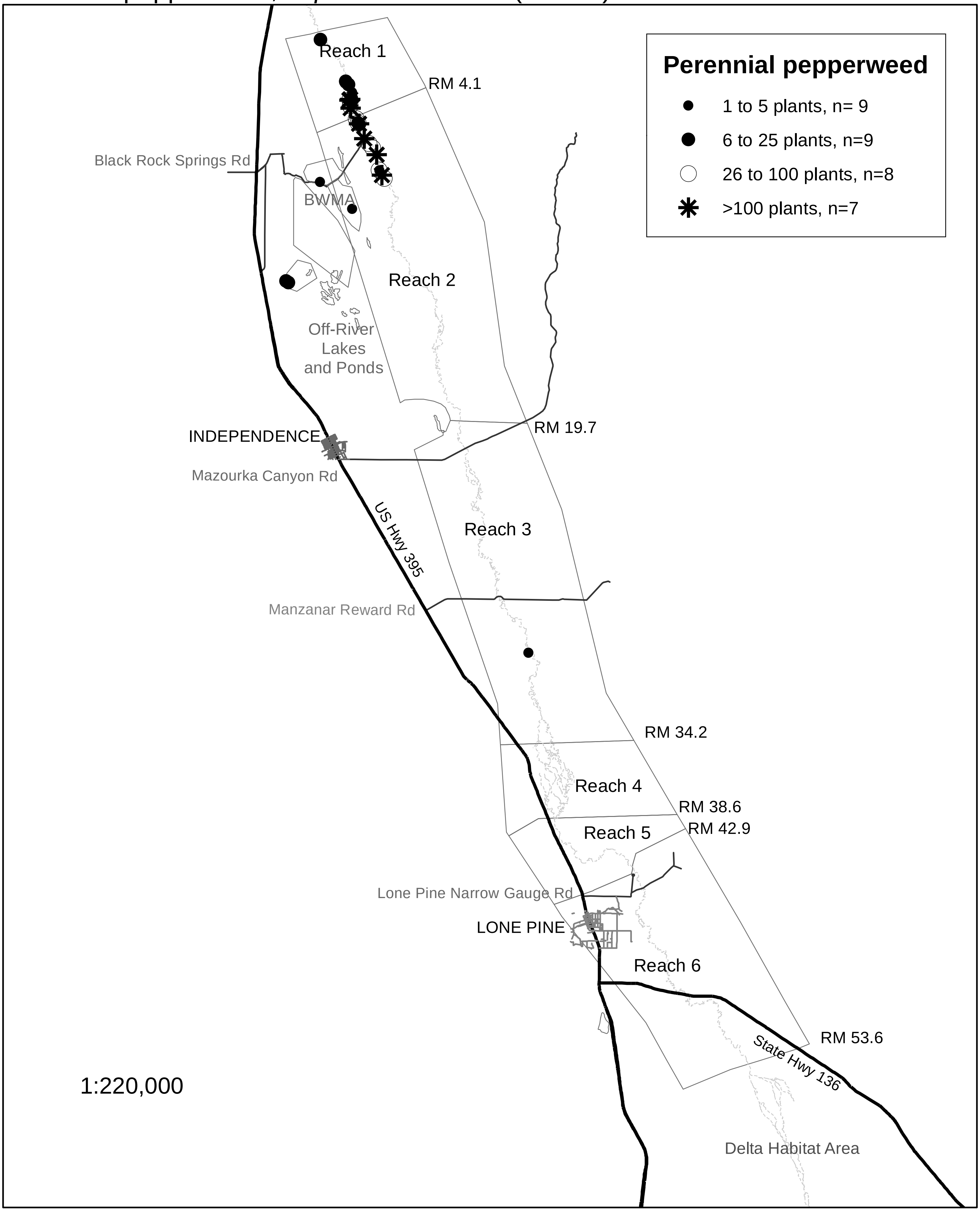
MAP 3

Russian Olive Recruitment, *Elaeagnus angustifolia* (ELAN)



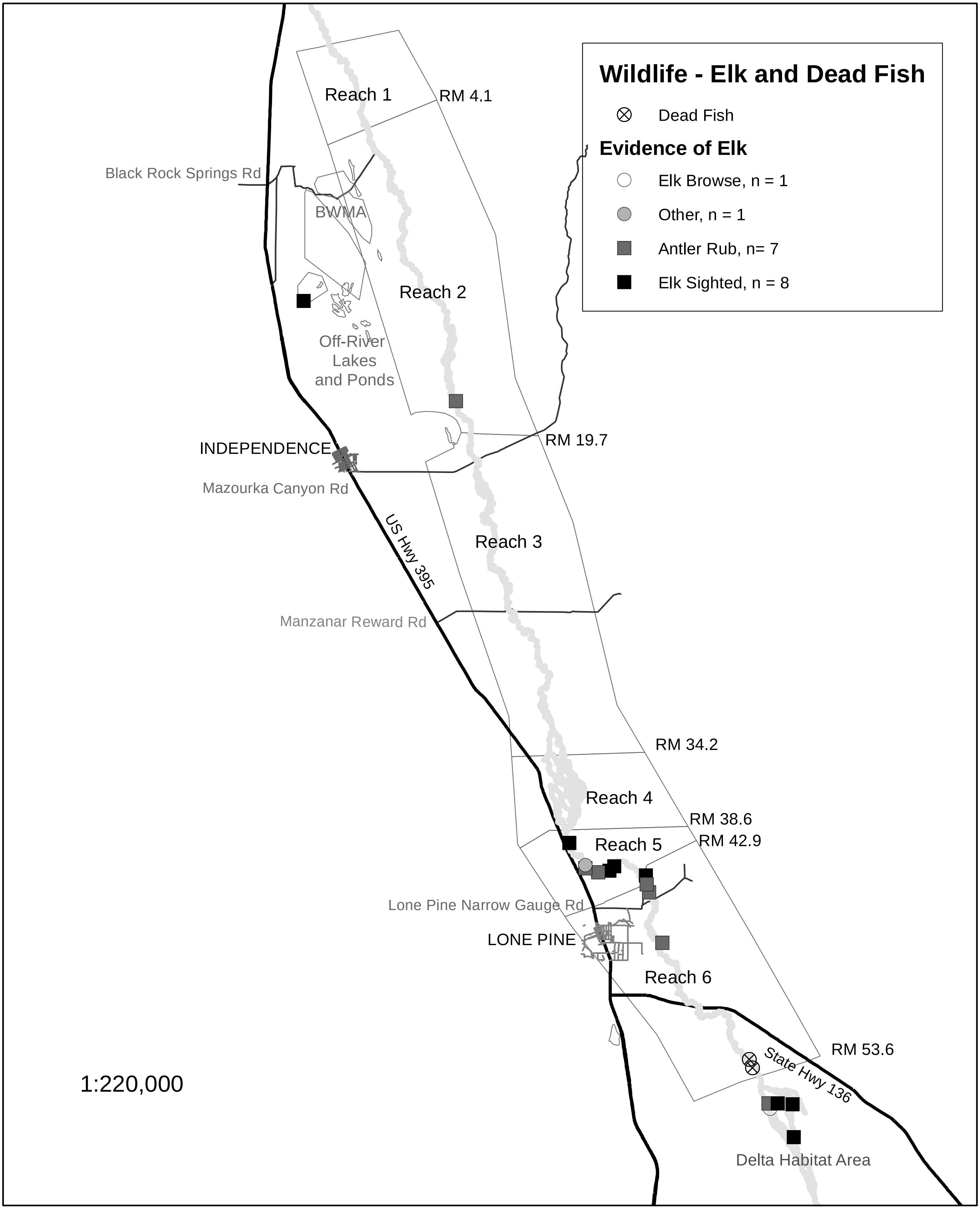
MAP 4

Perennial pepperweed, *Lepidium latifolium* (LELA2)



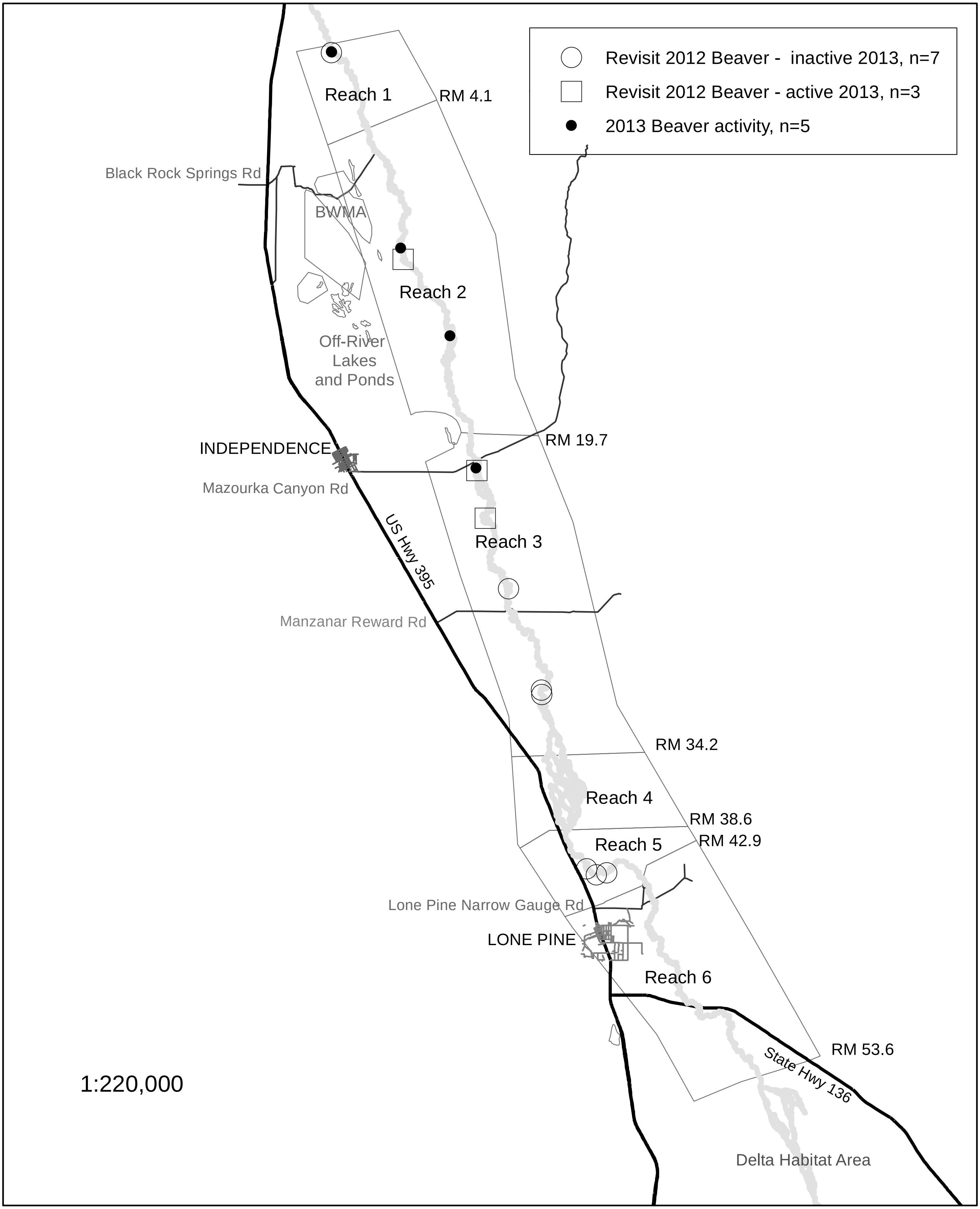
MAP 5

Wildlife Observations - Elk and Dead Fish



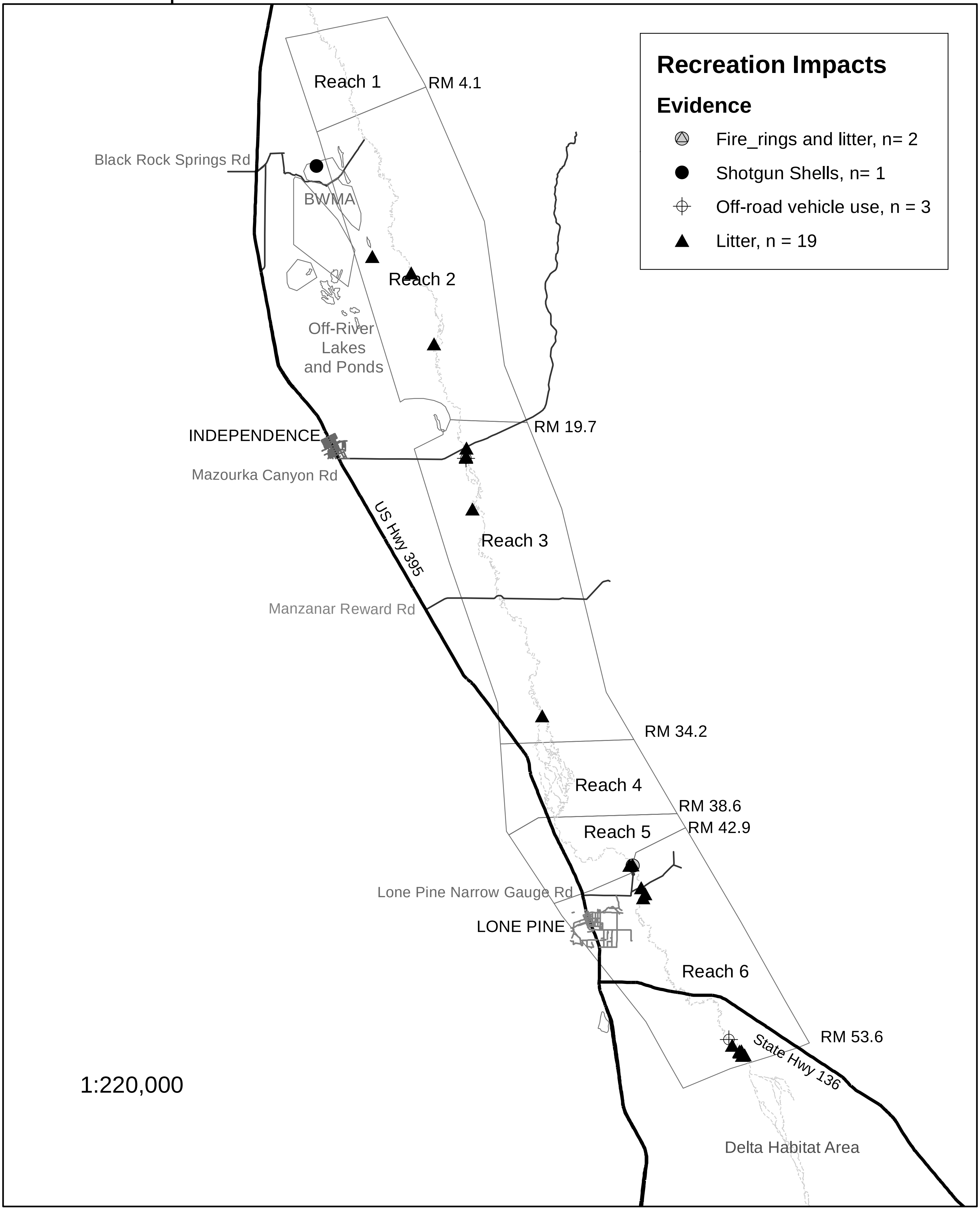
MAP 6

Beaver and Beaver Revisits



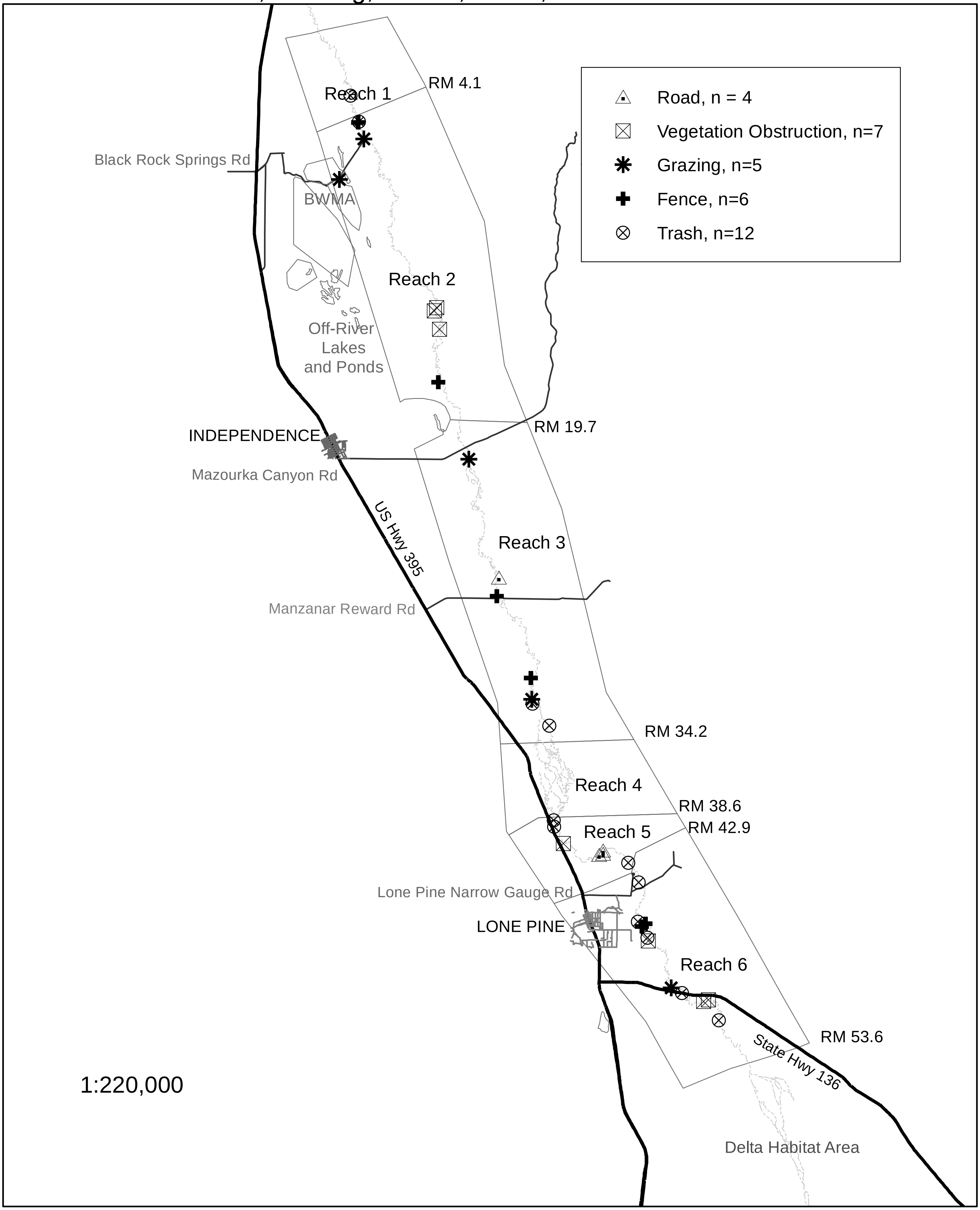
MAP 7

Recreation Impacts



MAP 8

Maintenance: Fences, Grazing, Roads, Trash, River Obstructions



MAP 9

6.0 ALABAMA GATES FLOW RELEASES

6.0 WATER QUALITY MONITORING FLOW RELEASES FROM ALABAMA GATES

**DATA COLLECTED DURING THE SPRING 2013
WITH ADDITIONAL DATA COLLECTED FROM ABOVE AND BELOW ALABAMA GATES
FOLLOWING A FLOW RELEASE FROM THE AQUEDUCT IN LATE JULY 2013**

**Randy Jackson
Senior County Hydrologist**

**Inyo County Water Department
Report 2013-2
October 22, 2013**

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Water Quality Monitoring Data Collected During the Spring 2013 Alabama Gates Flow Releases

6.1. INTRODUCTION

The 2013 Eastern Sierra Runoff Forecast of April 1, 2013 for the Owens River Basin for April through March was 54% of normal. The associated habitat flows from the intake were small and no water quality problems were expected. Water Quality was not monitored in the Lower Owens River above the Alabama Gates. A flow release from Alabama Gates was planned on the schedule in Table 1. LADWP personnel predicted a transit time of approximately 5 days to the Pumpback Station. No flow data for the reach of the river from Alabama Gates to the Pumpback Station were available. Data from the Pumpback Station were available and are shown in Figure 1.

Table 1. Planned Schedule of Releases from Alabama Gates.

Date	Time	Discharge
5/28/2013	10 am	10 cfs
5/28/2013	4 pm	50 cfs
5/28/2013	10 pm	87 cfs
5/29/2013	4 am	60 cfs
5/29/2013	10 am	0 cfs

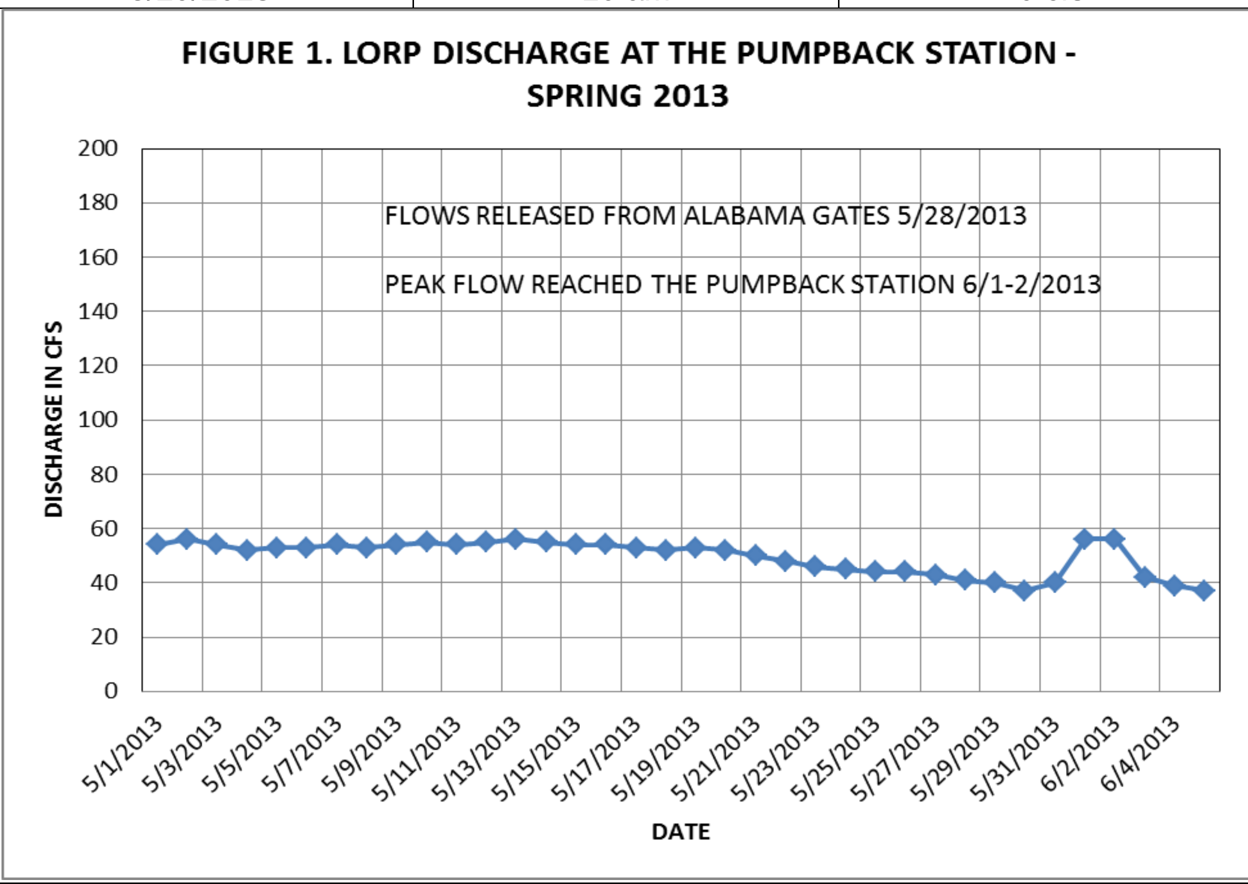


Figure 1 shows that peak flows at the Pumpback Station did not exceed ambient flows a short time before the release from Alabama Gates.

A short release from Alabama Gates took place in late July and Early August and was not part of the 2013 habitat flows. Water Quality Data for this flow are presented in Appendix B.

6.2. METHODS

Monitoring was completed using a YSI (Yellow Springs Instruments) Model 55 Dissolved Oxygen instrument. The instrument was calibrated at each site as per instrument instructions and manual measurements were made at the Thalweg of the Lower Owens River at a depth of approximately 6 inches and recorded on data sheets. Based on the data collected in the past, measurements were made at Lone Pine Ponds, Lone Pine Station Road and Keeler Bridge. River mileages for these locations from the intake are shown in Table 2, below. In addition river mileages for the channel immediately east of Alabama Gates and at the Pumpback station are also shown in Table 2.

Table 2. Mileages from the Owens River Intake of Sample and other Locations.

Location	Mileage from Intake
River Channel Adjacent to Alabama Gates at Contour 1115 m.-No Water Quality Sampling	~40.4
Lone Pine Ponds	48.7
Lone Pine Station Road (aka, Lone Pine Narrow Gage Road)	49.7
Keeler Bridge	55.7
Pumpback –No Water Quality Sampling	~61.2

Prior to the release of flows from the Alabama Gates, the dissolved oxygen predicting regression model for Reinhackle Spring Station was run using the temperature at Alabama Gates on the Los Angeles Aqueduct and estimated peak flows of 87 cfs reaching the river channel and augmenting the ambient base flows. This was done despite the fact that the Reinhackle Spring Station is upstream from Alabama Gates to give an indication of possible problems in the reach below. The prediction showed that adequate dissolved oxygen would be maintained during 2013 Alabama Gates flow releases in the Lower Owens River and no fish stress was expected at the temperatures then present. Given water temperatures approaching the 70’s (F) the model predicted that fish stress might have occurred.

6.3. RESULTS

6.3.1. LONE PINE PONDS

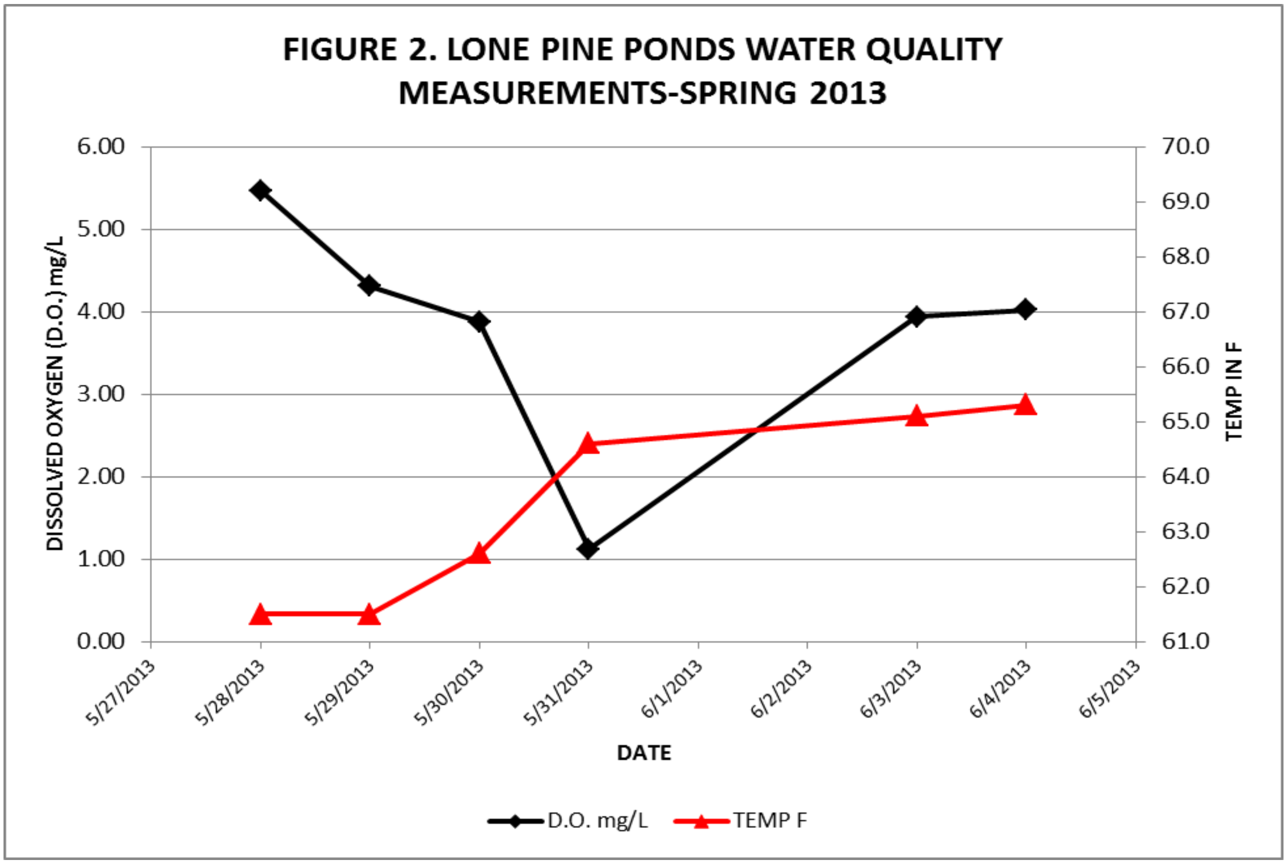
Water quality data were collected manually at Lone Pine Ponds during flow releases. Those data are presented in Table 3 and graphically in Figure 2. Dissolved oxygen declines occurred, however no fish stress was observed during flows at this location.

Dissolved oxygen declined as flows passed the monitoring station and water temperatures increased (A decline of about 3.0 mg/L dissolved oxygen) but remained above 1.0 mg/L (1.12 mg/L). Water temperatures reached a maximum of 65.3 Fahrenheit during the measurement period.

No flow data were available at this location during the flow releases. Tea colored water passed the site on 5-31-2013.

TABLE 3 .LONE PINE PONDS DATA.

DATE	TIME	DISCHARGE (cfs)	D.O. mg/L	TEMPERATURE (F)
5/28/2013	11:37:00 AM	ND	5.47	61.5
5/29/2013	11:28:00 AM	ND	4.31	61.5
5/30/2013	11:29:00 AM	ND	3.88	62.6
5/31/2013	11:06:00 AM	ND	1.12	64.6
6/3/2013	11:46:00 AM	ND	3.94	65.1
6/4/2013	11:30:00 AM	ND	4.02	65.3



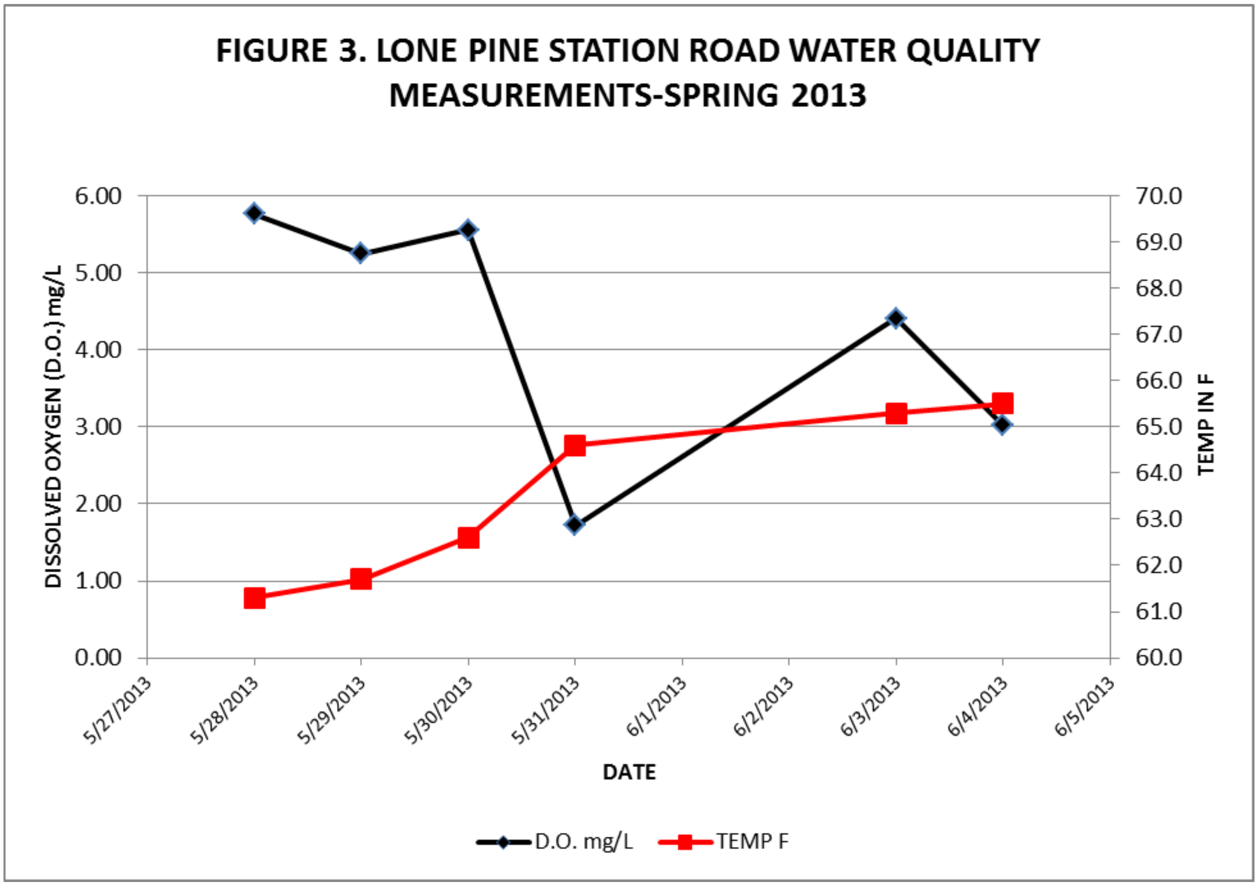
6.3.2. LONE PINE STATION ROAD

Water quality data were collected manually at Lone Pine Station Road during Alabama Gates flow releases. Manual data are presented in Table 4 and graphically in Figure 3. No significant water quality declines occurred and no fish stress was observed during habitat flows at this location.

Dissolved oxygen declined as flows passed the monitoring station and water temperatures increased (A decline of about 3.5 mg/L dissolved oxygen) but remained above 1.5 mg/L (1.72 mg/L). Water temperatures reached a maximum of 65.5 Fahrenheit during the measurement period.

TABLE 4. LONE PINE STATION ROAD DATA.

DATE	TIME	DISCHARGE (cfs)	D.O. mg/L	TEMPERATURE (F)
5/28/2013	11:43:00 AM	ND	5.77	61.3
5/29/2013	11:28:00 AM	ND	5.25	61.7
5/30/2013	11:36:00 AM	ND	5.56	62.6
5/31/2013	11:30:00 AM	ND	1.72	64.6
6/3/2013	11:58:00 AM	ND	4.41	65.3
6/4/2013	11:36:00 AM	ND	3.02	65.5



No flow data were available at this location during the flow releases. Tea colored water passed the site on 5-31-2013.

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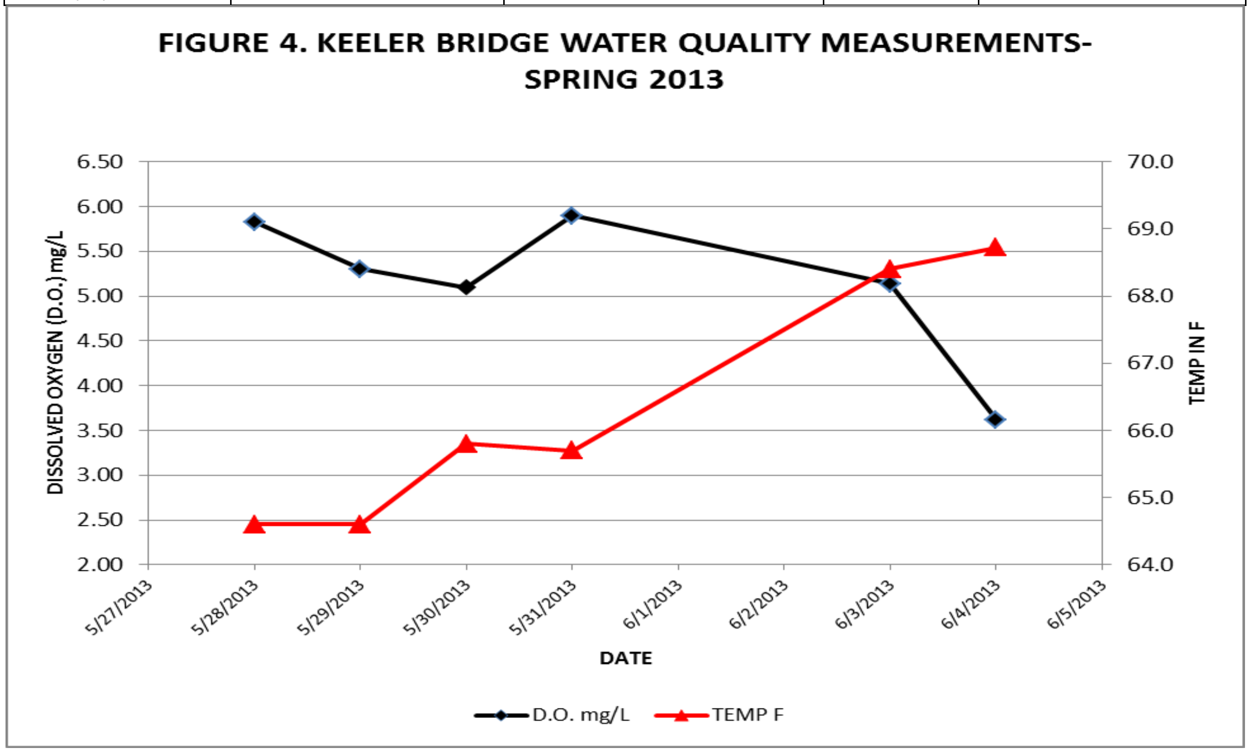
6.3.3. KEELER BRIDGE STATION

Water quality data were collected manually at the Keeler Bridge Station along the Lower Owens River during flow releases. Those manual data are presented in Table 5 and graphically in Figure 4. No significant water quality declines occurred and no fish stress was observed during flows at this location.

Dissolved oxygen declined slightly as water temperatures increased (A decline of about 1.5 mg/L dissolved oxygen) but remained above 3.5 mg/L (3.62 mg/L). Water temperatures reached a maximum of 68.7 Fahrenheit during the measurement period.

TABLE 5. KEELER BRIDGE DATA.

DATE	TIME	DISCHARGE (cfs)	D.O. mg/L	TEMPERATURE (F)
5/28/2013	11:57:00 AM	ND	5.83	64.6
5/29/2013	11:46:00 AM	ND	5.30	64.6
5/30/2013	11:57:00 AM	ND	5.10	65.8
5/31/2013	11:45:00 AM	ND	5.90	65.7
6/3/2013	12:17:00 AM	ND	5.14	68.4
6/4/2013	11:51:00 AM	ND	3.62	68.7



No flow data were available at this location during the flow releases. No period of tea colored water was noticed.

6.4. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Two of the primary monitoring stations (Lone Pine Ponds and Lone Pine Station Road) experienced declines in dissolved oxygen levels as the flows released from Alabama Gates passed these stations in Spring of 2013. No fish stress was observed at any location. This lack of fish stress is attributable to the relatively low water temperatures and low maximum flows that occurred in 2013. Biochemical oxygen demand of the water which drained from the Island Area, following release from Alabama gates is thought to be the reason for the oxygen decline.

Based on water quality data acquired in 2013 , release of habitat flows during colder weather successfully minimizes water quality degradation at the peak flows released in 2013 from the Alabama Gates for the short duration of release.

The 2010 dissolved oxygen multiple linear regression model is a useful tool for predicting D.O. concentrations at the Reinhackle Spring station, a location of the most severe water quality degradation in the data collected previously. This model is even somewhat useful outside of the range of development data and as an indicator at other locations. This model should continue to be used as a predictor in the planning of flow releases.

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REFERENCES

Jackson, R., 2010, Lower Owens River Project EIR Water Quality Monitoring Data Collected During the Summer 2010 Habitat Flow.

6.5. APPENDIX A: WATER QUALITY DATA, Excel FORMAT

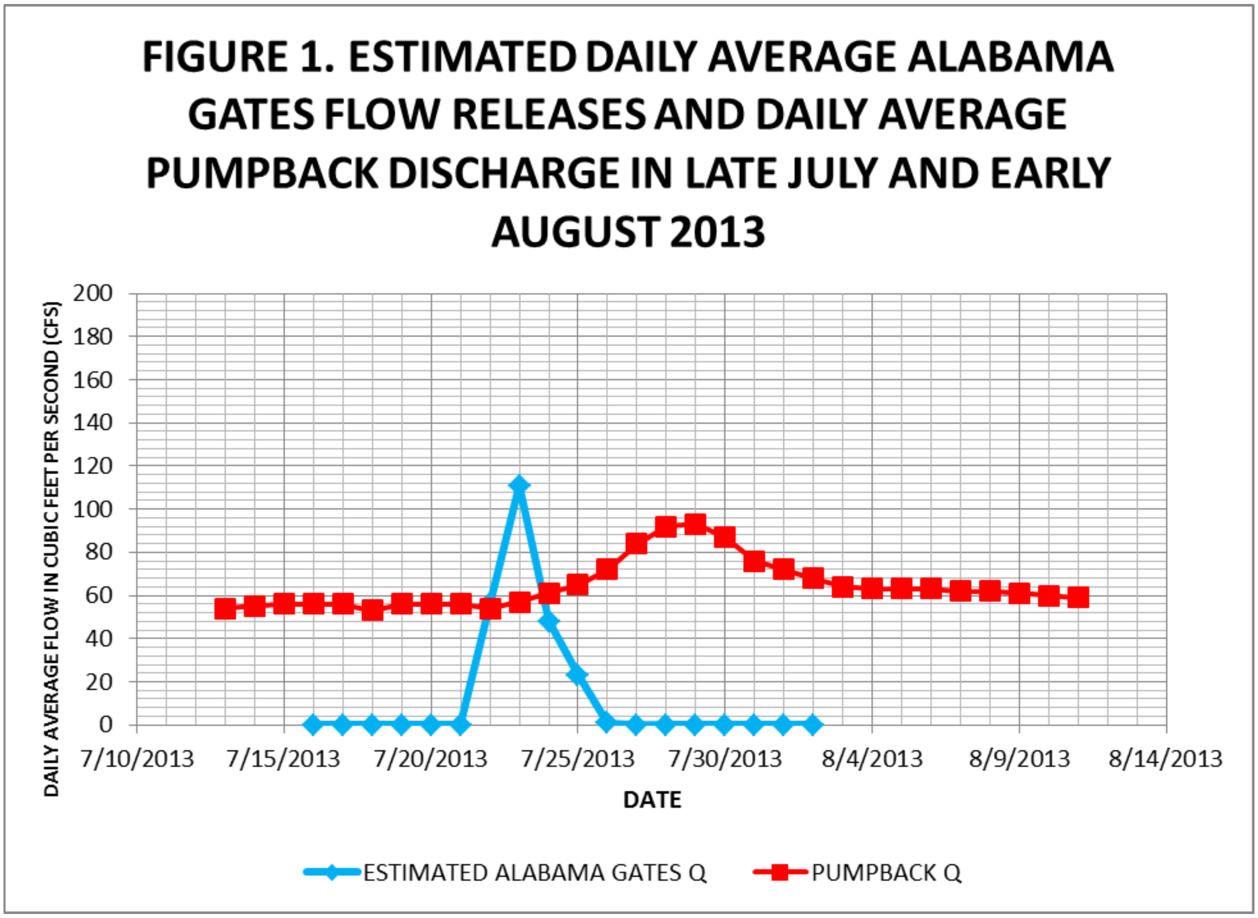
A CD of the Water Quality Data is available from Mr. Randy Jackson at Inyo County Water Department.

6.6. APPENDIX B: WATER QUALITY DATA COLLECTED IN RESPONSE TO ALABAMA GATES FLOW RELEASES IN LATE JULY 2013

Water Quality Monitoring Data Collected In Response to the July 2013 Alabama Gates Flow Releases

6.6.1. INTRODUCTION

A short flow release from Alabama Gates took place in Late July 2013 (See Figure 1). The resulting flows at the Lower Owens River Pump Back Station are also shown in Figure 1.



6.6.2. METHODS

Monitoring was conducted using a YSI (Yellow Springs Instruments) Model 55 Dissolved Oxygen instrument. The instrument was calibrated at each site as per instrument instructions and manual measurements were made at the Thalweg of the Lower Owens River at a depth of approximately 6 inches and recorded on data sheets. Based on the data collected in the past, measurements were made at Reinhackle Springs (above Alabama Gates), Lone Pine Ponds, Lone Pine Station Road, Keeler Bridge and the Pond above the Pumpback Station. River mileages for these locations from the intake are shown in Table 1, below. In addition river mileage for the channel immediately east of Alabama Gates is also shown in Table 1.

Table 1. Mileages from the Owens River Intake of Sample and other Locations.

Location	Mileage from Intake
Reinhackle Springs	38.8
River Channel Adjacent to Alabama Gates at Contour 1115 m.-No Water Quality Sampling	~40.4
Lone Pine Ponds	48.7
Lone Pine Station Road (aka, Lone Pine Narrow Gage Road)	49.7
Keeler Bridge	55.7
Pumpback	~61.2

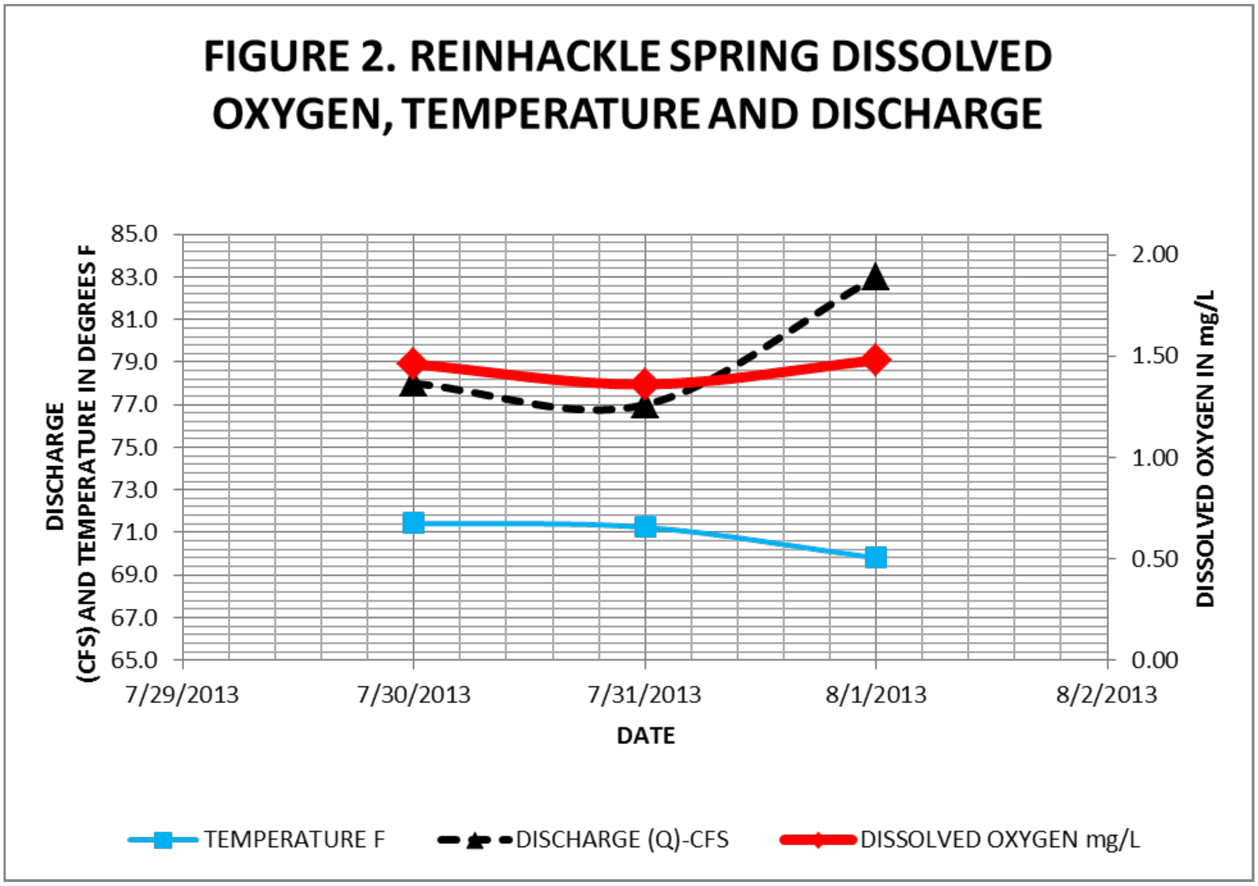
6.6.3. RESULTS

6.6.4. REINHACKLE SPRINGS

This location is upstream of the Alabama Gates and was not affected by flow releases from the Alabama Gates. The data were taken for comparison purposes. Water quality data were collected manually at Reinhackle Springs during the last two days of July and the first day of August 2013. Discharge data was also available for the site and was taken from the LADWP real time data available on their website. Those data are presented in Table 2 and graphically in Figure 2. Dissolved oxygen remained relatively stable over the three days measurements took place while water temperatures declined slightly. Water temperatures reached a maximum of 71.4 Fahrenheit during the measurement period. No fish stress was observed.

TABLE 2. REINHACKLE SPRING

DATE	TIME	DISCHARGE (cfs)	D.O. mg/l	TEMPERATURE (F)
7/30/2013	10:28:00 AM	78.0	1.46	71.4
7/31/2013	8:58:00 AM	77.0	1.36	71.2
8/1/2013	10:28:00 AM	83.0	1.48	69.8



6.6.5. LONE PINE PONDS

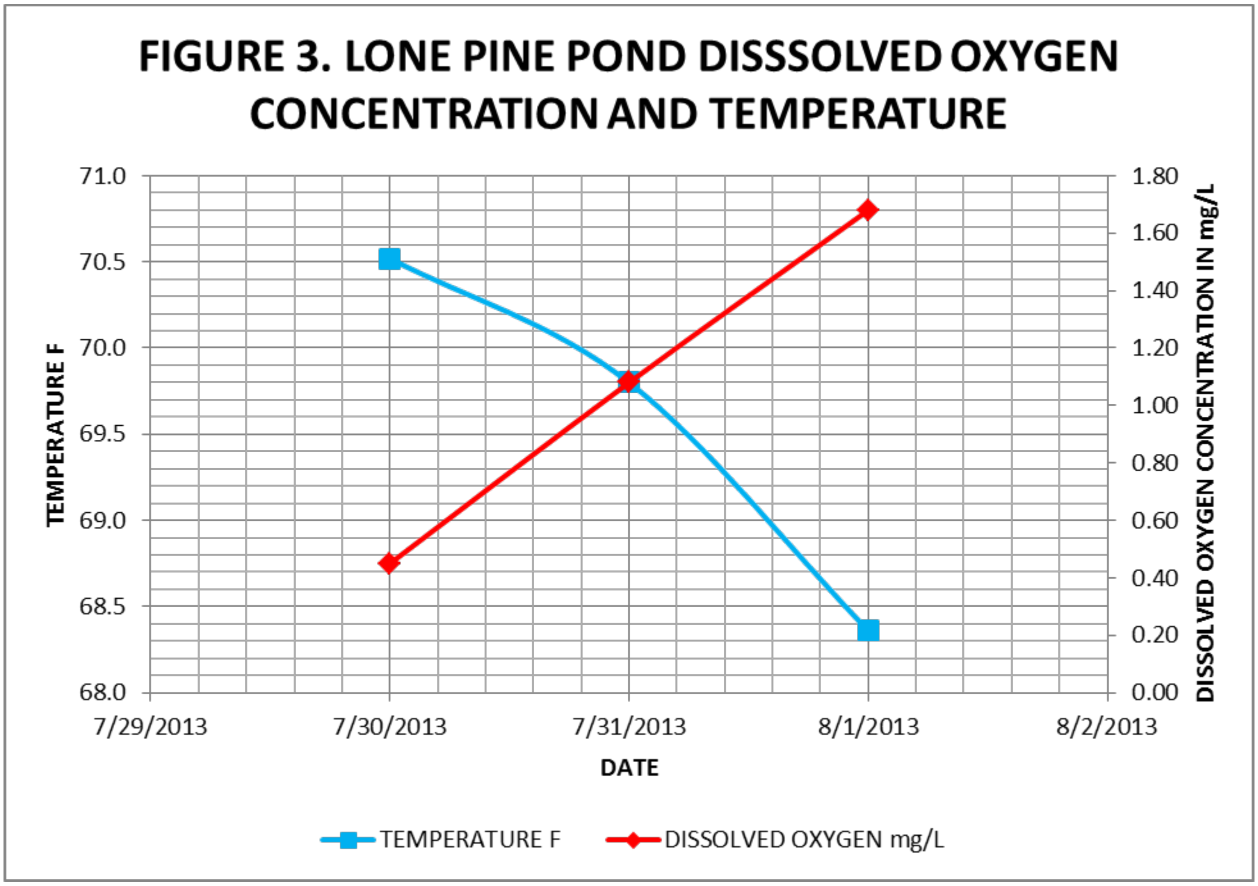
Water quality data were collected manually at Lone Pine Ponds during the last two days of July and the first day of August 2013. Those data are presented in Table 3 and graphically in Figure 3. Dissolved oxygen recovery occurred and water temperatures decreased. Flow measurement data is not available for this station. Water temperatures reached a maximum of 70.5 Fahrenheit during the measurement period. Tea colored water was observed over the three days. The tea color decreased on the last day of measurement. There was no smell of hydrogen sulfide during the measurement period.

No fish stress was observed during the measurement period. Dissolved oxygen concentrations were above those measured at Reinhackle Spring on August 1, 2013.

.

TABLE 3. LONE PINE POND

DATE	TIME	DISCHARGE (cfs)	D.O. mg/l	TEMPERATURE (F)
7/30/2013	10:51:00 AM	n.d.	0.45	70.5
7/31/2013	9:31:00 AM	n.d.	1.08	69.8
8/1/2013	10:53:00 AM	n.d.	1.68	68.4



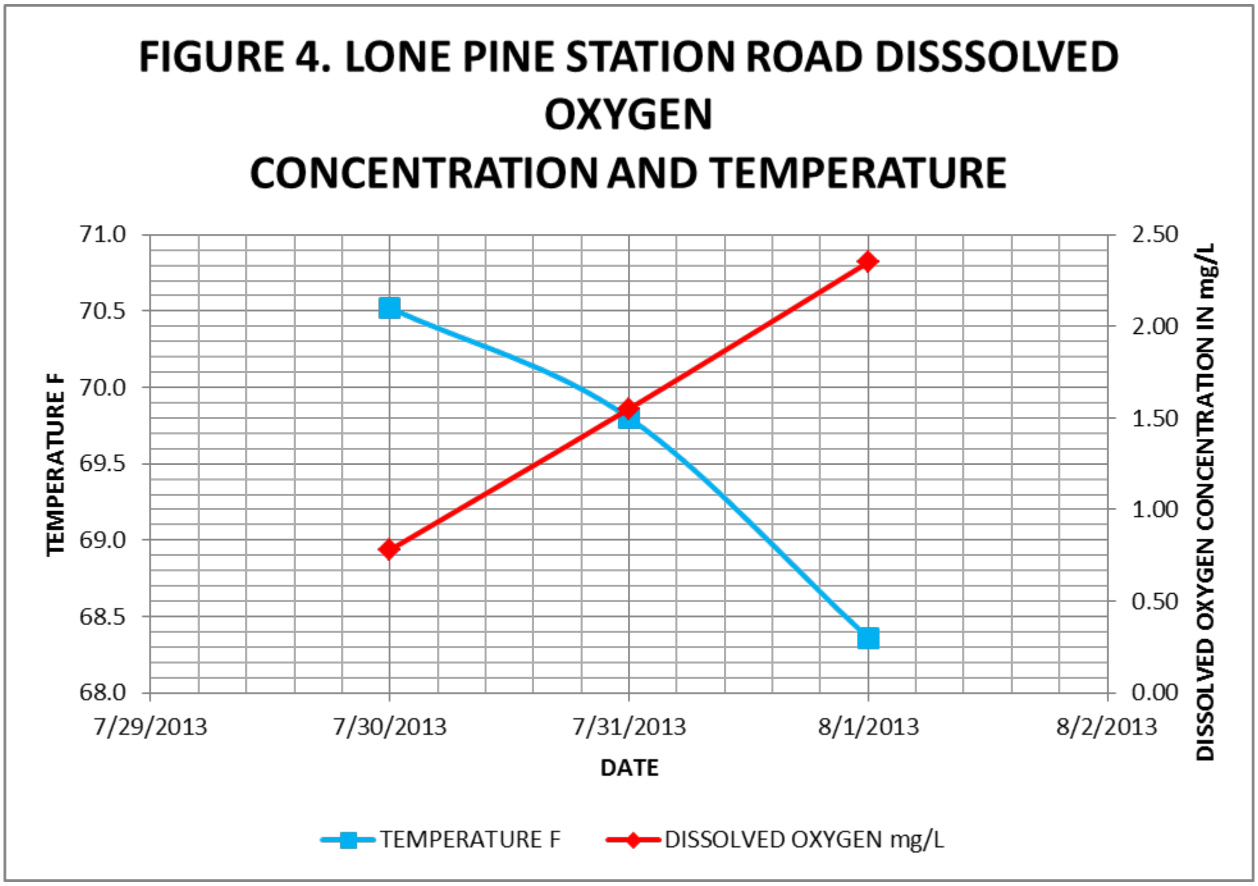
6.6.6. LONE PINE STATION ROAD

Water quality data were collected manually at Lone Pine Station Road during the last two days of July and the first day of August 2013. Those data are presented in Table 4 and graphically in Figure 4. Dissolved oxygen recovery occurred and water temperatures decreased . Flow measurement data is not available for this station. Water temperatures reached a maximum of 70.5 Fahrenheit during the measurement period. Tea colored water was observed over the three days. The tea color decreased on the last day of measurement. There was no smell of hydrogen sulfide during the measurement period.

No fish stress was observed during the measurement period. Dissolved oxygen concentrations were above those measured at Reinhackle Spring on July 31, 2013 and August 1, 2013

TABLE 4. LONE PINE STATION RD

DATE	TIME	DISCHARGE (cfs)	D.O. mg/l	TEMPERATURE (F)
7/30/2013	10:44:00 AM	n.d.	0.78	70.5
7/31/2013	9:24:00 AM	n.d.	1.55	69.8
8/1/2013	10:45:00 AM	n.d.	2.35	68.4



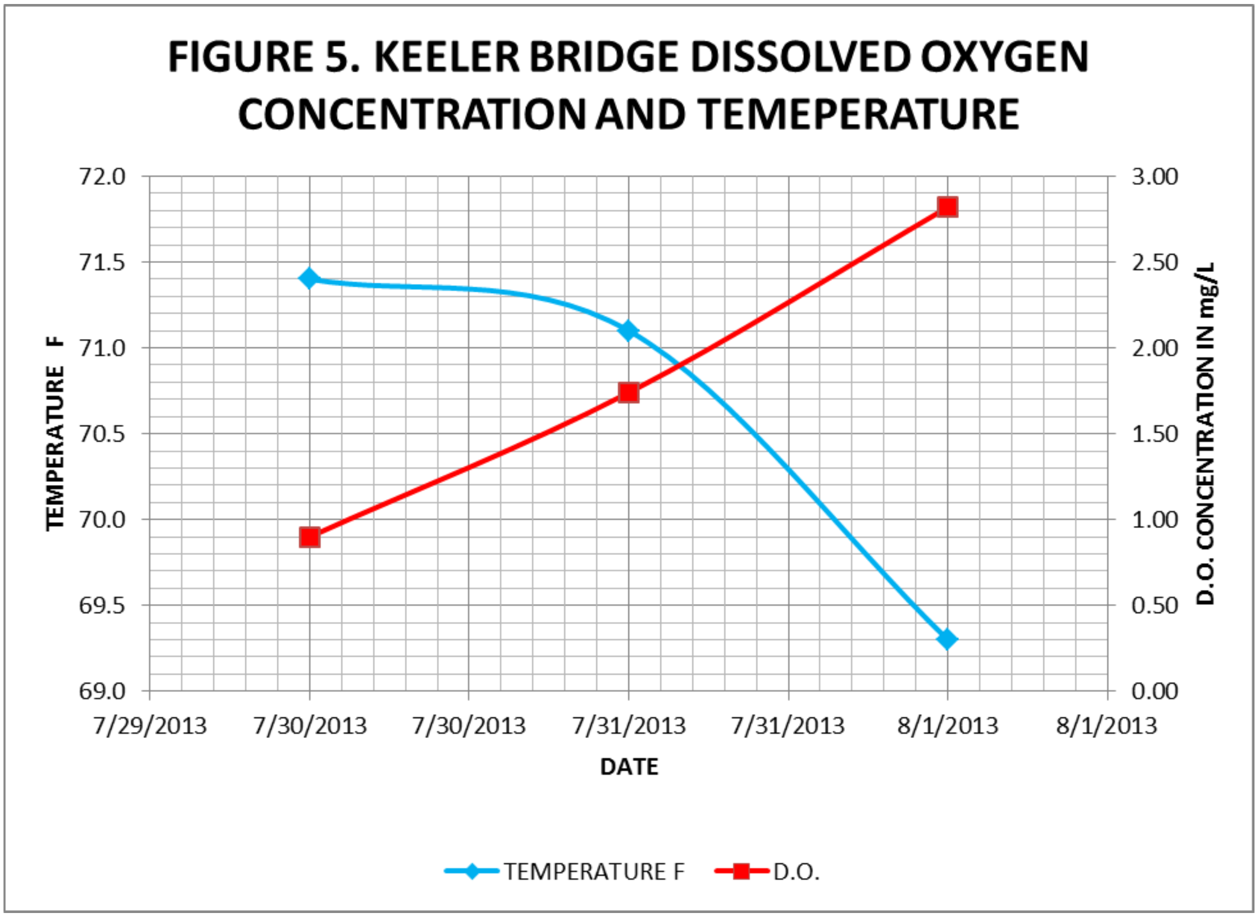
6.6.7. KEELER BRIDGE STATION

Water quality data were collected manually at Keeler Bridge Station during the last two days of July and the first day of August 2013. Those data are presented in Table 5 and graphically in Figure 5. Dissolved oxygen recovery occurred and water temperatures decreased. Flow measurement data is not available for this station. Water temperatures reached a maximum of 71.4 Fahrenheit during the measurement period. Tea colored water was observed over the three days. There was no smell of hydrogen sulfide during the measurement period.

No fish stress was observed during the measurement period. Dissolved oxygen concentrations were above those measured at Reinhackle Spring on July 31, 2013 and August 1, 2013

TABLE 5. KEELER BRIDGE

DATE	TIME	DISCHARGE (cfs)	D.O. mg/l	TEMPERATURE (F)
7/30/2013	11:09:00 AM	n.d.	0.90	71.4
7/31/2013	9:48:00 AM	n.d.	1.74	71.1
8/1/2013	11:10:00 AM	n.d.	2.82	69.3



6.6.8. PUMPBACK STATION

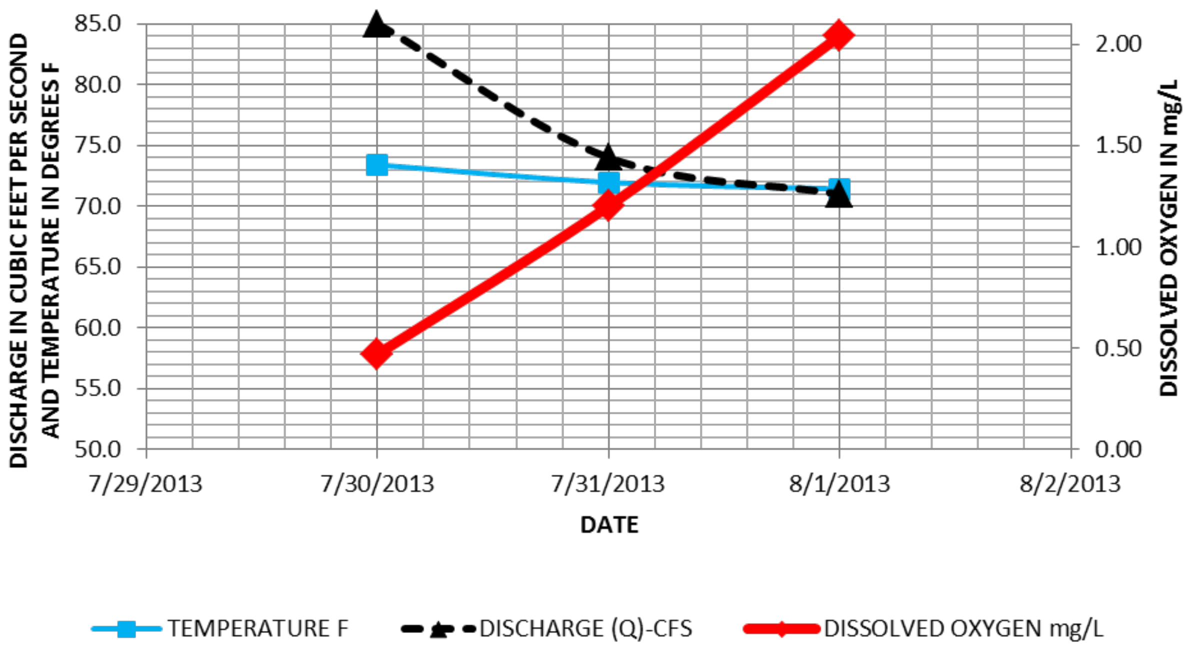
Water quality data were collected manually at the Pumpback Station during the last two days of July and the first day of August 2013. Those data are presented in Table 6 and graphically in Figure 6. Dissolved oxygen recovery occurred and water temperatures decreased. Flow measurement data is available for this station. Water temperatures reached a maximum of 73.4 Fahrenheit during the measurement period. Tea colored water was observed over the three days. There was no smell of hydrogen sulfide during the measurement period.

Fish stress was observed during the first two days of the measurement period. Several hundred dead fish were seen at the site. Dissolved oxygen concentrations were above those measured at Reinhackle Spring on August 1, 2013

TABLE 6. PUMP BACK STATION

DATE	TIME	DISCHARGE (cfs)	D.O. mg/l	TEMPERATURE (F)
7/30/2013	11:27:00 AM	85.0	0.47	73.4
7/31/2013	10:44:00 AM	74.0	1.20	72.0
8/1/2013	11:30:00 AM	71.0	2.04	71.4

FIGURE 6. PUMP BACK STATION DISSOLVED OXYGEN, TEMPERATURE AND DISCHARGE



6.6.9. SUMMARY

Manual water quality monitoring was conducted in response to a flow release from Alabama Gates in late July 2013. Monitoring was conducted for three days at five sites along the Lower Owens River. Among these five sites was a site located at Reinhackle Springs above the Alabama Gates.

The stations monitored below Alabama Gates show a trend of recovering dissolved oxygen concentrations and slightly lowering temperature. Dissolved oxygen concentrations increased above those at Reinhaclkle Spring Station for all stations by August 1, 2013.

The results of a fish kill were observed at the Pumpback Station where several hundred dead fish were observed. Fish stress was observed for two of the three days of monitoring at this location. By August 1, 2013 no fish stress was observed.

.

7.0 LOWER OWENS RIVER PROJECT CREEL SURVEY

Introduction

The 2013 Lower Owens River Project (LORP) creel survey was conducted to continue tracking the development and health of the warm-water recreational fishery in the LORP lakes and river areas. Creel survey data will assist with the adaptive management decision making process for the LORP warm-water fishery. It provides information about the health, abundance, and distribution of game fish throughout the LORP. Fish habitat within the LORP includes the river channel, oxbows, side channels, off-river lakes and ponds, springs, and artesian well ponds. The main purpose of this creel survey is to evaluate the response of game fish populations, and to document compliance with the LORP warm-water fisheries goals (Ecosystem Sciences 2008). A creel survey was completed in 2003, prior to the release of LORP flows and the first post flow creel survey was completed in September of 2010. Future monitoring will be conducted using the same methods that were used in 2003 and are described below.

7.1 Methods

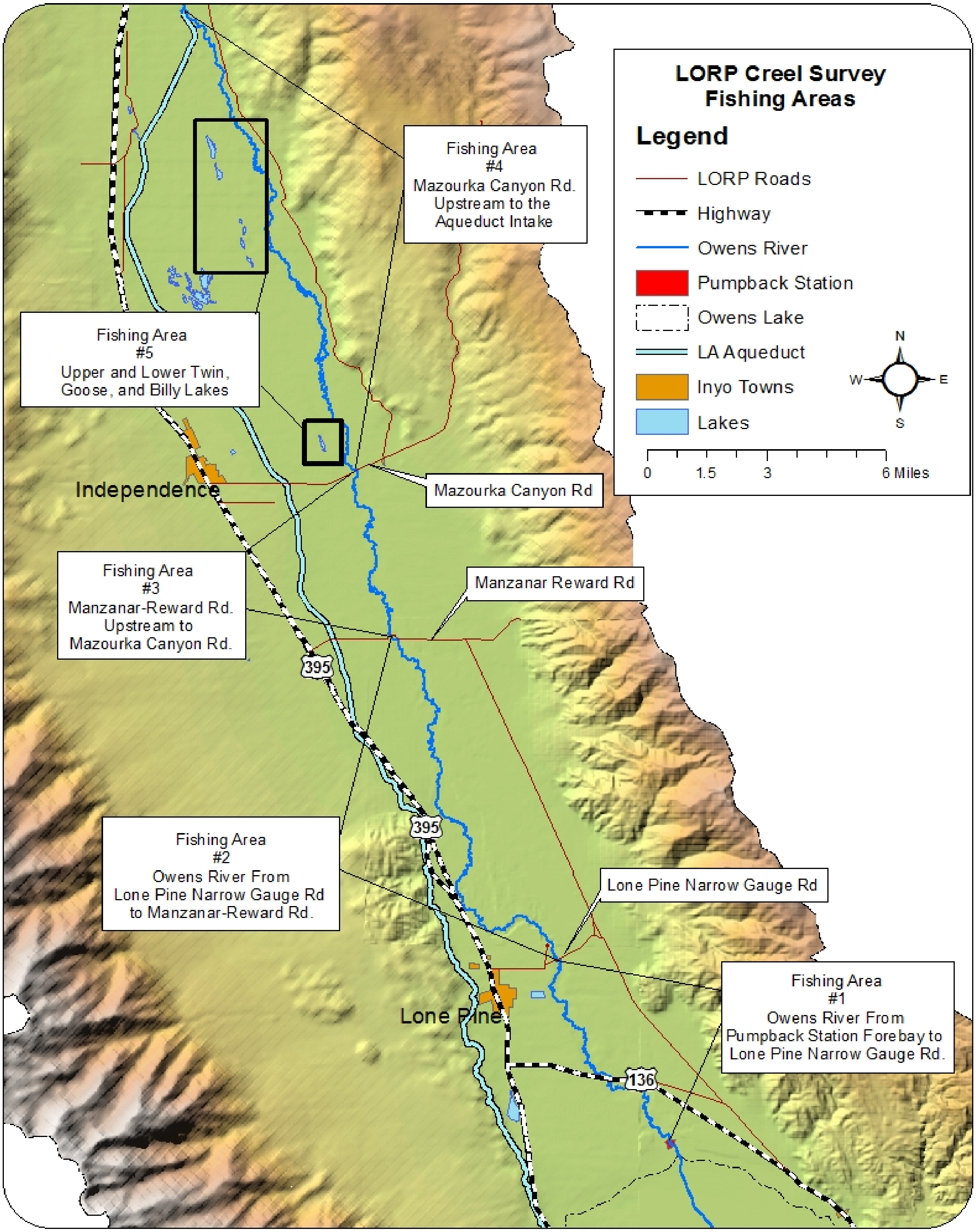
7.1.1 Sites

The LORP area was grouped into five separate fishing areas for the creel survey (Figure 1). Four of the fishing areas are located on the Lower Owens River while the fifth covers designated off-river lakes:

> Area 1 - (Owens River from the Pumpback Station Forebay at Owens Lake upstream to the Lone Pine Narrow Gauge Road)
>
> Area 2 - (Owens River from the Lone Pine Narrow Gauge Road upstream to the Manzanar Reward Road)
>
> Area 3 - (Owens River form Manzanar Reward Road upstream to the Mazourka Canyon Road)
>
> Area 4 - (Owens River from Mazourka Canyon Road upstream to the Los Angeles Aqueduct [LAA] Intake)
>
> Area 5 - (Upper and Lower Twin, Billy and Goose Lakes)

7.1.2 Volunteers

Anglers from the local area were recruited to help conduct the 2013 creel survey. A total of 24 anglers volunteered and were assigned identification numbers 1 to 24. Each identification number was assigned to one of the above fishing areas (Table 1). Identification numbers 1 to 5 were assigned to Area 1, numbers 6 to 10 were assigned to Area 2, numbers 11 to 15 were assigned to Area 3, numbers 16 to 20 were assigned to Area 4, and numbers 21 to 24 were assigned to Area 5 Volunteers in Areas 1 through 4 were allowed to fish anywhere within their assigned area. In Area 5, each identification number was assigned to an individual lake. Angler 21 must fish Upper Twin Lake, angler 22 must fish Lower Twin Lake, angler 23 must fish Goose Lake, and angler 24 must fish Billy Lake.



Fish Creel Survey Figure 1. Creel Survey Fishing Areas

Fish Creel Survey Table 1. Angler Identification Numbers and Assigned Areas

ANGLER ID NUMBERS	ASSIGNED FISHING AREAS
Numbers 1 to 5	Area 1, Pumpback Station Forebay at Owens Lake upstream to the Lone Pine Narrow Gauge Road
Numbers 6 to 10	Area 2, Owens River from the Lone Pine Narrow Gauge Road upstream to the Manzanar Reward Road
Numbers 11 to 15	Area 3, Owens River form Manzanar Reward Road upstream to the Mazourka Canyon Road
Numbers 16 to 20	Area 4, Owens River from Mazourka Canyon Road upstream to the LAA Intake
Number 21	Area 5, Upper Twin Lake
Number 22	Area 5, Lower Twin Lake
Number 23	Area 5, Goose Lake
Number 24	Area 5, Billy Lake

7.1.3 Season Timing and Methods of Creel Survey

The first creel survey (post implementation) was conducted in the fall of 2010. The second creel survey (post implementation) was conducted in the spring of 2011. Adaptive management recommendations in the 2010 LORP Annual Report, recommended that the fall creel survey be dropped and only fish the spring survey when designated by the Monitoring and Adaptive Management Plan (MAMP).

As designated by the MAMP, 2013 was scheduled to be a creel survey year. To complete the survey, volunteers had to fish two periods during the month of May. The fishing period was from May 1 through May 15, 2013, with each volunteer fishing 3.5 hours during this period. The second spring fishing period was from May 16 to May 31, 2013, with each volunteer fishing 3.5 hours during this period. No survey fishing can occur during any period outside of May.

Volunteers were limited to 3.5 hours of fishing per day during the survey. The 3.5 hour period does not have to be fished continuously, but it must be done in the same day. The reason for the 3.5 hour time limit is because this is the average time an angler in the west fishes, on an average fishing day (Dr. William Platts, Ecosystem Sciences, personal communication, August 18, 2010). During the survey, volunteers can fish only within his or her assigned area; however, they may fish anywhere within that assigned area. Volunteers may use any type of fishing gear available, as long as they abide by all applicable State of California fishing rules and regulations.

7.1.4 Creel Records

Anglers were provided the LORP Fishing Creel Survey Guide, gave instructions on how to complete the included LORP Creel Survey Form (Figure 2), briefed on species identification, and assigned fishing locations during a pre-fishing meeting held on the evening of 4/23/2013. Anglers used their LORP Creel Survey Form to record their reach number, date, identification number, number of fish caught, species of fish caught, total length (to the nearest inch), condition (good or poor), and total number of fish observed were recorded. Total length of fish was visually estimated from the tip of the nose to the end of the tail. For condition, if the fish appeared healthy and showed no signs of sickness or damage, and had no lesions, the fish was listed as good condition (GC). If the fish appeared unhealthy or showed signs of damage or had lesions, the fish was listed as poor condition (PC). Total number of fish observed (by species) while fishing was also recorded. At the end of the second fishing period completed data sheets were placed in the self-addressed stamped envelope and returned.

LORP Creel Survey Return to: Jason Morgan 300 Mandich Street Bishop, CA 93514 Office (760) 873-0429 Cell (760) 878-8954			
Reach Number:	**Date:**	**Name:**	**Fisherperson's Number:**
Total Number of Fish Observed			
Largemouth Bass:	**Brown Trout:**	**Bluegill:**	**Smallmouth Bass:**
Common Carp:	**Channel Catfish:**	**Brown Bullhead:**	**Other Species (Name/Number):**

Fish Caught (Fishing Time 3.5 hours)			
Number	**Species**	**Length (Inches)**	**Condition (Good or Poor)**
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			

Fish Creel Survey Figure 2. LORP Creel Survey Form

7.2 Results

Of the 24 anglers, only 18 returned their data sheets in 2013. Missing data was from one angler fishing Area 1, two anglers fishing Area 2, one angler fishing Area 3, one angler fishing Goose Lake and one angler fishing Billy Lake. Compared to previous years, September of 2010, had four (17%) anglers that failed to return datasheets and May of 2011, had one angler fail to return datasheets. By calculating catch per unit effort you can compare between years even if you have missing data in some years.

In the 2011 annual report, the LORP consultants felt that some anglers were misidentifying smallmouth bass (*Micropterus dolomieu)* and calling them largemouth bass (*Micropterus salmoides)*. Based on their own fishing experience they felt that smallmouth bass make up about 5% of their catch. To remedy this problem, they suggested that smallmouth and largemouth bass be combined and referred to as bass. This report will again refer to both small mouth and large mouth just as bass.

Overall, 18 anglers fished 3.5 hours each for a total of 126 hours during the two fishing periods in May 2013. A total of 278 fish were caught, including 181 bass, 61 bluegill (*Lepomis macrochirus)*, 10 brown bullhead (*Ameiurus nebulosus)*, 6 brown trout (*Salmo trutta)*, 8 rainbow trout (*Oncorhynchus mykiss*), 12 common carp (*Cyprinus carpio)*, and 1 channel catfish (*Ictalurus punctatus)* (Table 2).

Overall, catch per unit effort was 2.2 fish per hour. Bass accounted for approximately 65% of the total catch and were caught at 1.4 fish per hour with an average length of 12 inches (maximum 19 inches and minimum 5 inches). Bluegill accounted for approximately 22% of the total catch and were caught at a rate of 0.5 fish per hour with an average size of 5 inches (maximum 8 inches and minimum length 2 inches). Brown bullhead accounted for approximately 4% of the total catch and were caught at a rate of 0.1 fish per hour with an average length of 5 inches. Maximum total length for brown bullhead was 8 inches and minimum length was 3 inches. Brown trout accounted for approximately 2% of the total catch and were caught at a rate of 0.04 and had an average length of 9 inches (maximum 24 inches and minimum 4 inches). Common carp had an average length of 15 inches with a maximum length of 22 inches and minimum length of 12 inches. Common carp accounted for approximately 4% of the total catch and were caught at a rate of 0.1 fish per hour. Rainbow trout accounted for approximately 3% of the total catch and were caught at a rate of 0.1 fish per hour and had an average length of 14 inches (maximum 20 inches and minimum 12 inches). The one channel catfish caught measured 10 inches in length made up 0.4% of the total catch and was caught at a rate of 0.008 fish per hour.

Of the 278 fish caught by the anglers 11 were listed as being in poor condition. All eleven of the fish listed as being in poor condition were bass.

The 18 anglers observed 1,944 fish during the creel survey. The most observed fish was bluegill with 760 fish observed. Common carp was the next most observed fish with 716 individuals seen. Bass was the next most observed fish at 448 fish. The next most observed fish was brown bullhead with 14 individuals, followed by three rainbow trout, then two brown trout and one channel catfish (Table 3).

Fish Creel Survey Table 2. Results of Overall Fish Caught for the LORP Creel Survey, May 2013.

Overall	Bass	Bluegill	Brown Bullhead	Brown Trout	Common Carp	Rainbow Trout	Channel Catfish	Total
Fish Caught	181	61	10	6	12	8	1	278
Percent of Total Catch	65%	22%	4%	2%	4%	3%	T*	100
Average Size (inches)	12	5	5	9	15	14	10	10
Catch/Hour	1.4	0.5	0.1	0.04	0.1	0.1	.008	2.2
Maximum Length (inches)	19	8	8	24	22	20	10	24
Minimum Length (inches)	5	2	3	4	12	12	10	2

* Only one fish caught < 1%

Fish Creel Survey Table 3. Number of Fish Observed During the LORP Creel Survey, May 2013.

	Period 1	Period 2	Total
Bass	222	226	448
Bluegill	353	407	760
Brown Bullhead	10	4	14
Brown Trout	2	0	2
Common Carp	398	318	716
Channel Catfish	0	1	1
Rainbow trout	3	0	3
Total	988	956	1944

During the first period, from May 1-15, 2013 the 18 anglers fished 3.5 hours each for a total of 63 hours. During this period a total of 132 fish were caught; 85 bass, 21 bluegill, six brown bullhead, six brown trout, 11 common carp and one rainbow trout (Table 4). Catch per hour was 1.3 for bass, 0.3 for bluegill, 0.1 for brown bullhead, 0.1 for brown trout, 0.2 for common carp, and 0.05 for rainbow trout for a total of 2.1 fish per hour. The 18 anglers observed 988 fish during the first period of the creel survey with common carp and bluegill and bass making up the majority of the fish observed (Table 3).

Fish Creel Survey Table 4. Results for the First Period LORP Creel Survey May 1-15, 2013

Period 1	Bass	Bluegill	Brown Bullhead	Brown Trout	Common Carp	Rainbow Trout	Total
Fish Caught	85	21	6	6	11	3	132
Average Size (inches)	12	5	5	9	15	14	
Catch/Hour	1.3	0.3	0.1	0.1	0.2	0.05	2.1
Maximum Length (inches)	19	6	8	24	22	16	24
Minimum Length (inches)	7	3	3	4	12	12	3

During the second period, from May 16-31, 2013 the 18 anglers again fished for a total of 63 hours. During this period a total of 146 fish were caught; 96 bass, 40 bluegill, four brown bullhead, five common carp, and one channel catfish (Table 5). Fish were caught at a rate of 2.3 fish per hour during the second period, bass were caught at a rate of 1.5 fish per hour, bluegill at 0.6 fish per hour, brown bullhead at 0.1 fish per hour, common carp 0.1 fish per hour and channel catfish at 0.02 fish per hour. The anglers observed 956 fish during this period; 226 bass, 407 bluegill, four brown bullhead, 318 common carp, and one channel catfish (Table 3).

Fish Creel Survey Table 5. Results for the Second Period LORP Creel Survey May 16-31, 2013

Period 2	Bass	Bluegill	Brown Bullhead	Brown Trout	Common Carp	Channel Catfish	Total
Fish Caught	96	40	4	0	5	1	146
Average Size (inches)	12	5	4	0	16	10	9.6
Catch/Hour	1.5	0.6	0.1	0.0	0.1	0.02	2.3
Maximum Length (inches)	18	8	5	0	20	10	18
Minimum Length (inches)	5	2	3	0	12	10	3

During the first fishing period, Area 3 had the highest catch per unit effort at 3.1 fish per hour, followed by Area 4 at 2.1 fish per hour fish, Area 2 at 2.0 fish per hour, Area 1 at 1.5 fish per hour, and area 5 at 1.4 fish per hour (Table 6). During the second fishing period Area 1 had the highest catch per unit effort at 3.0 fish per hour, fish were caught at a rate of 2.7 fish per hour in Area 3, 2.3 fish per hour in Area 5, and 1.8 fish per hour in Areas 2 & 4 (Table 7).

Fish Creel Survey Table 6. Results by Fishing Area for First Period May 1-15, 2013

Area 1	Bass	Bluegill	Brown Bullhead	Brown Trout	Common Carp	Rainbow Trout	Total
Count	15	6	0	0	0	0	21
Average size	12	5	0	0	0	0	10
Catch/Hour	1.1	0.4	0.0	0.0	0.0	0.0	1.5
Max Length	16	5	0	0	0	0	16
Min Length	8	4	0	0	0	0	4
Area 2	**Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Rainbow Trout**	**Total**
Count	8	12	0	0	1	0	21
Average size	9	5	0	0	12	0	7
Catch/Hour	0.8	1.1	0.0	0.0	0.1	0.0	2.0
Max Length	12	6	0	0	12	0	12
Min Length	7	3	0	0	12	0	3
Area 3	**Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Rainbow Trout**	**Total**
Count	16	3	6	6	10	3	44
Average size	13	5	5	9	15	14	12
Catch/Hour	1.1	0.2	0.4	0.4	0.7	0.2	3.1
Max Length	19	5	8	24	22	16	24
Min Length	10	4	3	4	12	12	3
Area 4	**Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Rainbow Trout**	**Total**
Count	36	0	0	0	0	0	36
Average size	11	0	0	0	0	0	11
Catch/Hour	2.1	0.0	0.0	0.0	0.0	0.0	2.1
Max Length	16	0	0	0	0	0	16
Min Length	8	0	0	0	0	0	8
Area 5	**Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Rainbow Trout**	**Total**
Count	10	0	0	0	0	0	10
Average size	13	0	0	0	0	0	13
Catch/Hour	1.4	0.0	0.0	0.0	0.0	0.0	1.4
Max Length	16	0	0	0	0	0	16
Min Length	8	0	0	0	0	0	8

Fish Creel Survey Table 7. Results by Fishing Area for Second Period May 16-31, 2013

Area 1	Bass	Bluegill	Brown Bullhead	Brown Trout	Common Carp	Channel Catfish	Total
Count	23	19	0	0	0	0	42
Average size	12	5	0	0	0	0	16
Catch/Hour	1.6	1.4	0.0	0.0	0.0	0.0	3.0
Max Length	17	6	0	0	0	0	17
Min Length	8	3	0	0	0	0	3
Area 2	**Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Channel Catfish**	**Total**
Count	6	12	0	0	0	1	19
Average size	7	5	0	0	0	10	23
Catch/Hour	0.6	1.1	0.0	0.0	0.0	0.1	1.8
Max Length	10	8	0	0	0	10	8
Min Length	5	3	0	0	0	10	3
Area 3	**Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Channel Catfish**	**Total**
Count	20	9	4	0	5	0	38
Average size	13	4	4	0	16	0	37
Catch/Hour	1.4	0.6	0.3	0.0	0.4	0.0	2.7
Max Length	18	6	5	0	20	0	20
Min Length	10	2	3	0	12	0	2
Area 4	**Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Channel Catfish**	**Total**
Count	31	0	0	0	0	0	31
Average size	11	0	0	0	0	0	11
Catch/Hour	1.8	0.0	0.0	0.0	0.0	0.0	1.8
Max Length	16	0	0	0	0	0	16
Min Length	7	0	0	0	0	0	7
Area 5	**Bass**	**Bluegill**	**Brown Bullhead**	**Brown Trout**	**Common Carp**	**Channel Catfish**	**Total**
Count	16	0	0	0	0	0	16
Average size	12	0	0	0	0	0	12
Catch/Hour	2.3	0.0	0.0	0.0	0.0	0.0	2.3
Max Length	16	0	0	0	0	0	16
Min Length	8	0	0	0	0	0	8

Tabular results from the 2003 creel survey are included (Table 8) for reference (unpublished data).

Fish Creel Survey Table 8. Creel Survey Data for Lower Owens River Project, May 2003

Area 1. Owens River From Pumpback Pool to the Lone Pine Station Road							
Angler ID#	**Date**	**Fish Caught**	**Number Caught**	**Combined Lengths (inches)**	**Maximum Length (inches)**	**Minimum Length (inches)**	**Condition**
1	5/8/2003	Bass	14	188	16	10	good
1	5/26/03	Bass	14	135	13	6	good
2	5/9/2003	Bass	13	129	13	7	good
2	5/16/2003	Bass	18	176	14	6	good
3	5/13/2003	Bass	3	25	9	7	good
3	5/30/2003	Bass	6	57	14	8	good
4	5/22/2003	Bass	16	78	10	3	good
5	5/13/2003	Bass	7	54	11	5	good
5		Bullhead Catfish	1	9	9		good
5	5/30/2003	Bass	3	27	12	7	good
5		Bluegill	3	19	7	6	good

Hours Fished: 31.5
Catch Rate: 3.1 fish per hour
Average Fish Length: 9.2 inches
Maximum Size: 16 inches, Minimum Size: 3 inches
Max Average Size: 11.6 inches, Minimum Average Size: 5.9 inches

Area 2. Owens River From the Lone Pine Station Road to the Manzanar-Reward Road							
Angler ID#	**Date**	**Fish Caught**	**Number Caught**	**Combined Lengths (inches)**	**Maximum Length (inches)**	**Minimum Length (inches)**	**Condition**
9	5/4/2003	Bass	4	48	14	10	good
9		Bluegill	5	14	3	2	good
9		Bullhead Catfish	3	35	13	10	good
9		Carp	1	15	15		good
9	5/18/2003	Bass	10	84	14	6	good
10	5/12/2003	Bass	6	73	15	10	good
10		Bluegill	2	12	6	6	good
10	5/26/2003	Bass	5	57	12	10	good
10		Bluegill	6	43	8	6	good
6	5/4/2003	Bass	14	151	16	5	good
6	5/19/2003	Bass	14	154	15	6	good
7	5/7/2003	Bass	6	72	14	10	good

Hours Fished: 24.5
Catch Rate: 3.1 fish per hour
Average Fish Length: 9.9 inches
Maximum Size: 16 inches, Minimum Size: 2 inches
Maximum Average Size: 12.1 inches, Minimum Average Size: 6.8 inches

Table 8 (continued) Creel Survey Data for Lower Owens River Project May 2003

Area 3. Owens River From the Manzanar-Reward Road Upstream to Mazourka Canyon Road

Angler ID#	Date	Fish Caught	Number Caught	Combined Lengths (inches)	Maximum Length (inches)	Minimum Length (inches)	Condition
12	5/5/2003	Bass	4	30	9	5	good
12		Bluegill	9	47	6	4	good
12	5/31/2003	Bass	3	29	12	8	good
11	5/31/2003	Bass	7	59	12	5	good/poor
11		Bluegill	7	34	5	4	good
11		Carp	1	15	15	15	good
14	5/15/2003	Bass	3	31	13	8	good
14	5/18/2003	Bass	3	33	12	10	good
14		Bullhead Catfish	1	8	8	8	good
15	5/15/2003	Bass	3	35	15	7	good
15		Bluegill	3	13	5	4	good
15	5/20/2003	Bass	4	30	10	6	good
15		Bluegill	2	9	5	3	good

Hours Fished: 24.5
Catch Rate: 2.0 fish per hour
Average Fish Length: 7.5 inches
Maximum Size: 15 inches, Minimum Size: 3 inches
Maximum Average Size: 9.8 inches, Minimum Average Size: 6.7 inches

Area 4. Owens River From the Mazourka Canyon Road Upstream to the Intake

Angler ID#	Date	Fish Caught	Number Caught	Combined Lengths (inches)	Maximum Length (inches)	Minimum Length (inches)	Condition
No fishable water until flow introduction occurs							

Area 5. Upper and Lower Twin, Billy, Coyote, and Goose Lakes

Angler ID#	Date	Fish Caught	Number Caught	Combined Lengths (inches)	Maximum Length (inches)	Minimum Length (inches)	Condition
21	5/3/2003	Bass	9	128	18	12	good
23	5/15/2003	Bass	1	8	8	8	good
23	5/31/2003	Bass	1	8	8	8	good
23		Bluegill	2	13	7	6	good
22	5/12/2003	Bass	6	68	12	9	good
22	5/20/2003	Bass	18	206	16	6	good
22		Bluegill	1	6	6	6	good
2	5/12/2003	Bass	11	132	14	9	good
2	5/20/2003	Bass	14	156	14	9	good
3	5/15/2003	Bass	1	9	9	9	good
3	5/31/2003	Bass	10	109	13	8	good
24/4	5/11/2003	Bass	10	129	18	10	good
24/4	5/24/2003	Bass	10	119	16	6	good
1	5/3/2003	Bass	12	156	18	10	good
1	5/17/2003	Bass	14	197	18	6	good

Hours Fished: 45.5
Catch Rate: 2.6 fish per hour
Average Fish Length: 12.0 inches
Maximum Size: 18 inches, Minimum Size: 6 inches
Maximum Average Size: 13.0 inches, Minimum Average Size: 8.1 inches

7.3 Discussion

The May 2013 creel survey results continue to demonstrate that the LORP contains a healthy diverse warm-water fish community that is self-sustaining with multiple age classes from young of the year to adults.

Overall, seven different species of fish were caught during the May 2013 creel survey. Five of these species were warm-water species and two were cold-water species. Two additional species were caught during the 2013 creel survey when compared to the 2011 creel survey and three more than the 2003 creel survey. The five species that have been caught in the past include bass, bluegill, brown bullhead, and common carp. This year for the first time an angler caught a channel catfish in Area 2. The two species caught in 2013 and considered to be cold-water species include brown trout and rainbow trout. Brown trout have been sampled during both the 2010 and the 2011 surveys, but not during the 2003 survey. Rainbow trout were caught for the first time in 2013 and were caught in Area 3.

The overall catch per unit effort in May of 2003 was 2.7 fish per hour. In May of 2011 after the LORP was re-watered, the overall catch per unit effort dropped to 1.3 fish per hour. In May of 2013 the catch per unit effort increased to 2.2 fish per hour but is still 0.5 fish per hour less than the 2003 creel survey. There are many factors that could contribute to the reduction in the catch per unit effort when comparing 2003 to 2011 and 2013. Such factors include: water temperature, weather, flows, angler access, experience of the anglers, etc. However, the most likely cause of the reduced catch per unit effort in 2011 and 2013 was the re-watering of approximately 24 miles of river channel. Fish that populated this 24 miles of former dry channel had to come from adjacent reaches and thus lowered the densities (numbers/ha and numbers/mile) of these adjacent reaches.

A literature search was conducted to try and compare the LORP's catch per unit effort to other western warm-water fisheries. The search only provided catch per unit effort numbers using electrofishing and not hook and line sampling, so no comparison could be made.

It appears by examining total fish lengths collected during the September 2010 survey (2010 LORP Annual Report), the May 2011 (2011 LORP Annual Report) and the 2013 surveys results it appears the LORP is still producing multiple age classes from young of the year to adults for most warm-water species caught. With only one channel catfish to examine it is still unclear how many age classes of channel catfish there are. With the last stocking of channel catfish taking place in the 1990's in the Block Rock Ditch there has to be some recruitment of channel catfish for the angler to catch one that is 10 inches in length in 2013.

Of the 278 fish caught, 96% were reported to be in good condition. The other 4% (11 bass) were reported to be in poor condition. Four of the 11 bass came from Area 1 and another four of the 11 bass came from Area 4 in period 1. In the second period three of the 11 bass came from Area 1. Anglers were not instructed to and gave no reason why they thought the fish were in poor condition. Their instructions were to list fish in good condition if the fish appeared healthy and showed no signs of sickness or damage, and had no lesions. If the fish appeared unhealthy or showed signs of damage or had lesions, the fish was listed as poor condition. Based on 96% of the fish caught were reported to being in good condition, it appears that managed river flows and available habitat are capable of maintaining the warm-water fishery in good condition. In future reports, it would be beneficial to know why the fish was in poor condition. Was the poor condition due to malnutrition, disease, or some other cause.

The next creel survey is designated by the MAMP for May 2015 and should be conducted in the same manner as the past creel surveys.

7.4 Creel Survey Summary

The purpose of the creel survey is to track the development and health of the warm-water fishery in the Lower Owens River Project (LORP). Methods developed during the 2003 creel survey were utilized in the September 2010, May 2011, and the May 2013 and will be used in future monitoring. Eighteen volunteer anglers fished five separate fishing areas for a total of 126 hours and caught 278 fish with an overall catch per unit effort of 2.2 fish per hour. Fish caught ranged from young of the year to adults for all warm-water species and were in good condition. The 2013 creel survey results continue to demonstrate that the LOPR contains a healthy, self-sustaining warm-water fishery.

7.5 References

Ecosystem Sciences. 2008. *Lower Owens River Project Monitoring and Adaptive Management and Reporting Plan.* Prepared for Los Angeles Department of Water and Power and Inyo County Water Department. April 28, 2008.

Platts, William. 2010. Personal Communication.

8.0 2013 INYO/MONO COUNTIES AGRICULTURAL COMMISSIONER'S OFFICE LORP WEED REPORT

Introduction

Inyo and Mono Counties Agricultural Commissioner's Office (AgComm) efforts on LADWP lands focus on the protection of the LORP area during habitat restoration from noxious weed invasion. This is accomplished primarily by efforts to eradicate known weed populations within the LORP area, and also by monitoring the LORP area for pioneer populations. The detection component is critical to the protection of the LORP, as this region is a recovering habitat with many disturbed areas. Disturbed conditions make this area more conducive to weed establishment, as does increasing recreation use.

While protecting native habitat during the critical first stage of the lower Owens River re-watering is the paramount goal of this project, there are many other positive consequences resulting from this work. A healthy native plant habitat will support wildlife (including some threatened and endangered species), help to reduce stream bank erosion and dust, maintain healthy fire regimes, preserve the viability of open-space agriculture, and conserve recreational opportunities.

Summary of LORP Weed Management Activities in 2013

LORP invasive plant management during 2013 included both treatment of known sites throughout the growing season, as well as ongoing survey activities to identify new infestations. Field staff numbers were the same as 2012, supported by both joint contributions from Inyo County and LADWP as well as grant funding through the Sierra Nevada Conservancy. All known *Lepidium latifolium* sites within the LORP area were treated three times. Invasive plant populations totaled .30 net acres, up very slightly over 2011. Individual sites totaled 39 in 2013, up 1 new site discovered by field staff during surveys. Of the 39 known sites, 29 sites had no plants present in 2013. After five continuous years of no growth, sites may be considered eradicated.

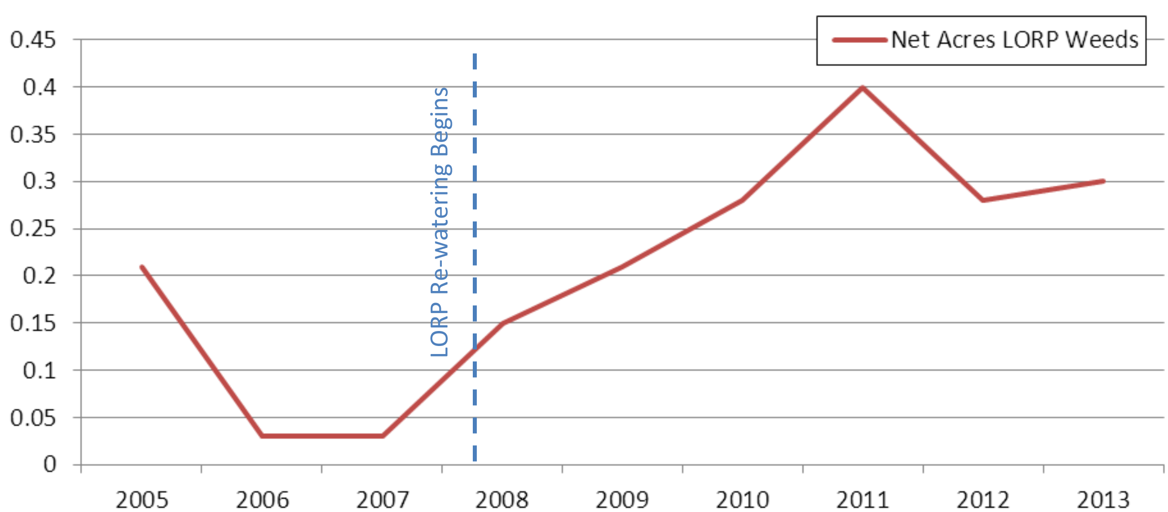
Table 1 – Count of LORP Invasive Weed Sites

Year	Total Number of Sites	New Sites Discovered	Sites with No Growth
2002	2	0	0
2003	2	0	1
2004	3	1	1
2005	4	1	1
2006	4	0	1
2007	4	0	1
2008	12	8	1
2009	17	5	4
2010	32	15	5
2011	35	3	19
2012	38	3	19
2013	**39**	**1**	**29**

Survey efforts continued in 2013, with 42,330 acres surveyed within the LORP area. This includes areas of known infestations, as well as several surveys into other areas to ensure no new populations are allowed to establish undetected.

Treatment methods followed successful strategies used in 2012, including low-volume, directed spot treatments using selective herbicides. These applications were made on foot using backpack sprayers to mitigate damage to the recovering native plant communities within the LORP. The AgComm will continue to employ these methods as long as these results continue and staffing levels permit.

Chart 1 – Net Acreage of Weed Populations on LORP



Management Difficulties

The most significant management difficulty continues to be maintaining adequate resources for effective management. Although previously discovered populations continue to decline as a result of control efforts, new populations continue to appear. Detecting small invasive plant populations in the vast LORP project area early in the colonization cycle while treatment activities are most effective, has become a difficult task to maintain. Resources provided through a grant agreement from the Sierra Nevada Conservancy have helped greatly in facilitating proper management activities during the 2013 growing season, and this contract will continue for two more seasons. Management issues should improve in 2014 as the effects of a full year of this assistance begin to emerge.

9.0 SALTCEDAR CONTROL PROGRAM

Saltcedar (*Tamarix ramosissima*) is the most abundant noxious species in the LORP. The goal of Saltcedar Control Program is to eliminate existing saltcedar stands, to prevent the spread of saltcedar throughout the Lower Owens River and associated wetland environments, and to sustain the ecological restoration that is now occurring in the LORP.

PROGRAM BACKGROUND

Saltcedar is an invasive non-native shrub or tree that can grow to 25 feet and live up to 100 years. Given favorable conditions a tree can grow 10 to 12 feet in one season. Saltcedar can compete with native vegetation and degrade wildlife habitat. Its presence in the southern Owens Valley has the potential to interfere with the LORP goals of establishing a healthy, functioning Lower Owens River riverine-riparian ecosystem.

References to the importance of managing saltcedar can be found in documents that guide the saltcedar program and govern the LORP:

- The LORP Monitoring, Adaptive Management, and Reporting Plan (MAMP), notes that saltcedar may increase in some areas of the river because of seed distribution with stream flows. The MAMP states that the potential risk of infecting new areas with saltcedar is considered a significant threat in all management areas

- The 1997 Memorandum of Understanding (MOU), between Inyo County, City of Los Angeles, Sierra Club, Owens Valley Committee, CA Dept. of Fish and Game and California State Lands Commission, expresses that saltcedar reinfestation in the LORP area would compromise the goal of controlling deleterious species whose “presence within the Planning Area interferes with the achievement of the goals of the LORP” (1997 MOU B. 4)

- Parties to the Long Term Water Agreement (LTWA) recognized that even with annual control efforts saltcedar might never be fully eradicated, but that ongoing and aggressive efforts to remove saltcedar will be required. (Sec. XIV. A)

PROJECT MANAGEMENT AND STAFF

The Saltcedar Control Program is administered by the Inyo County Water Department, and managed by a Saltcedar Project Manager. Work crews are hired seasonally and consist of eight employees and one shared county employee. In addition, the California Department of Corrections and Rehabilitation (CDCR) can provide work crews to assist in efforts to cut, pile and burn dry saltcedar slash. In 2012-2013, the field season began in mid-October and concluded in mid-April.

METHODS

Saltcedar Control Program personnel use chainsaws, brushcutters, herbicides, and controlled burning to treat and control saltcedar, and remove saltcedar slash in the Owens Valley.

WORK ACCOMPLISHED (Figure 1)

During the 2012-2013 field season, crews cleared 203 acres of saltcedar within the boundaries of the Wildlife Conservation Board (WCB) grant work site.

In 2012, work began under the scope of a new WCB grant. Efforts focused on eradicating saltcedar in the water-spreading basins that lie just to the west of the Lower Owens River and river-riparian area. These spreading basins are a concern because they harbor mature saltcedar thickets that serve as vast reservoirs of windborne seed.

Surveying the river-riparian corridor to locate and remove saltcedar is an ongoing activity. At various times during the cutting season, crews worked in this area to treat resprouts, pull seedlings, and remove mature plants. Guided by information obtained in the 2011 Rapid Assessment Survey, crews covered about 89 miles of riverbank and floodplain.

With the assistance of the California Department of Forestry and Fire Protection and the Los Angeles Department of Water and Power, about 660 piles of dry slash, which had accumulated over the years, were burned in the 2012-13 field season.

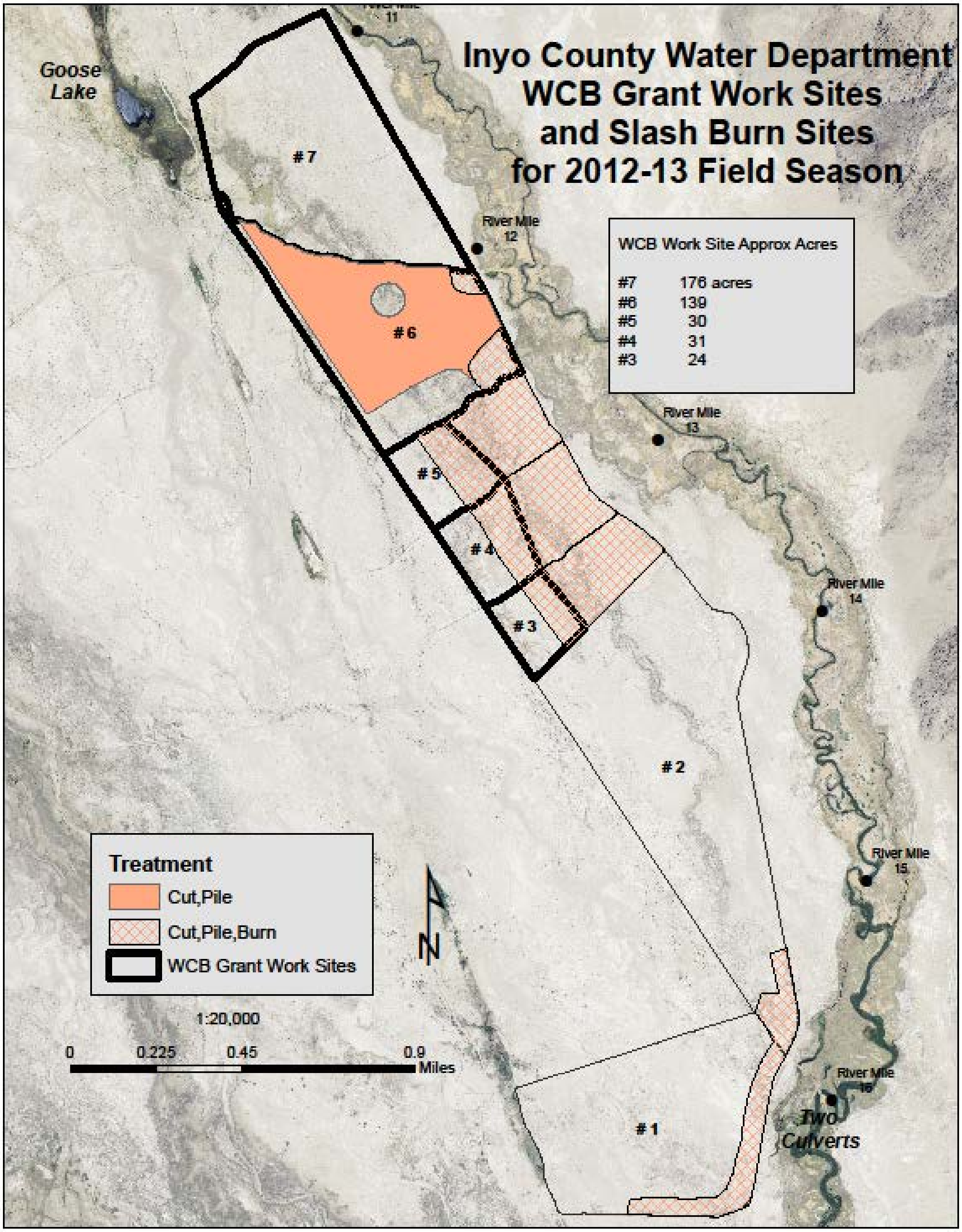
FUNDING

An ongoing responsibility of the Saltcedar Program, with assistance from the LADWP, is to secure grant funding to maintain an active Saltcedar Control Program.

The County's three-year Wildlife Conservation Board (WCB) saltcedar eradication grant expired in April 2011. This generous funding had enabled a level of effort that would not have been possible with Inyo County and LADWP contributions alone.

In December 2011, the Water Department was awarded a new three-year, $350,000 grant from the WCB. LADWP will match this new grant dollar for dollar. The $350,000 matching funds from LADWP will complete their obligation of providing $1,500,000 in matching funds, which is required under the 2004 Stipulation and Order.

Figure 1. Saltcedar Cut and Slash Disposal Areas 2012-2013



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10.0 PUBLIC COMMENTS

10.1 LORP Annual Report Public Meeting

The LORP 2013 Draft Annual Report public meeting was held on January 13, 2014, at the LADWP Bishop office. The following pages list those in attendance.

2013 Annual LORP Report Meeting

January 13, 2014

Name	Affiliation	E-Mail/Phone
[illegible signature]	ICWD	878-0005
Jason Murray	LADWP	
CRAIG PATTEN	INYO COUNTY WATER COMMISSION	760 258-1120
Gary Peck	LADWP	
Bob Murphy	Inyo Reg.	
BRUCE KINNEY	CDFW	
Mark Hill	MOU consultants	
Bill Platts	MOU Consultant	
Dale Schmidt	LADWP	
NATE READE	INYO/MONO AG. COMM.	nreade@inyocounty.us
DAVE LIVINGSTON	DWP	
Dick Noles	AAPL	
Jim Stroh	Inyo Water Commission	stroh354@aol.com
Mark Midgett	Leeson Thibault Field	
KARL CHANG		
Luis Elias	Civil Engineer	873-5762
Jerry Gabriel		jerrydgabriel@yahoo.com

Sally Manning smanning@ telis.org or s.manning@bigpinepaiute.org

Nancy Masters nancymas@qnet.com

Mary Roper marya@qnet.com

Mark Lacey mjlacey@wildblue.net

Clarence Martin LADWP

Julie Anne Hopkins julieanne@cruzio.com

Katie Quinlan CNPS

2013 Annual LORP Report Meeting

January 13, 2014

Name	Affiliation	E-Mail/Phone
Debbie House	LADWP	873-2284
Scott Kemp	Kemp Ranch	878-2321
Matt Kingsley	Inyo County	
MARK BAGLEY	SIERRA CLUB	m.bagley@verizon.net
Rick Delmas		REDELMAS@hotmail.com
Rick Pucci	Inyo	
DANNA STROUD	Sierra Nevada Conservancy	dstroud@sierranevada.ca.gov
Jon Patzer	Bishop Amateur Radio Club	jonpatzer@hotmail.com
Charles James	The Sheet	freelance.Charles.James@gmail.com
Sherm Jensen	DWP	Sherman.Jensen@LADWP.com
Eric Tillemans	DWP	873-0256
Jacklyn Velasquez	Big Pine Paiute Tribe	760-938-2003
April Zrelak	Lone Pine Paiute-Shoshone Res.	760-876-4690
Linda Arcularius	Inyo County Supervisor	760-387-2692
Bob Harrington	Inyo Co	
TERRY Russi	Inyo Co.	birdsong.123@gmail.com
Jeff Griffiths	Inyo Co Sup	jgriffiths@inyo.co.us
MARK DREW	CALTROUT	mdrew@caltrout.org

10.2 Public Meeting

The audio recording of the LORP 2013 Draft Annual Report public meeting is included on enclosed disk.

10.3 2013 Draft LORP Report Comments

The comment period for the 2013 Draft LORP Report was from December 5, 2013 through January 28, 2014. The following pages are the comments received.

January 10, 2014

AAPL

LORP CONCERNS

1. The draft LORP PLAN should address:
    a) hardened road surface encircling the project
    b) access for many campsites on west side of Hwy.395 to the project on the east side of 395.
        1) work with Cal Trans to sign the Hwy. with ATV signage
        2) develop access at staging points west side of 395
        3) recognize most campers are bringing OHVs for travel when recreating to the LORP from campsite
        4) encourage 15 mph speed limits
        5) encourage LORP use to compliment our tourist based economy

Dick Noles
AAPL/HMFIC

WINTER PHONE: (760) 872-8331

Serving Inyo & Sierra National Forests

SUMMER PHONE (760) 935-4493

ROCK CREEK PACK STATION
P. O. BOX 248
BISHOP, CALIFORNIA 93515

January 21, 2014

Mr. James G. Yannotta
Manager of Aqueduct
Los Angeles Department of Water & Power
300 Mandich Street
Bishop, CA 93514-3449

Dear Mr. Yannotta:

Subject: Request to graze Thibaut Lease Riparian Exclosure

We are asking for the LADWP to open the large riparian exclosure to grazing. When the Thibaut Lease (RLI-430) Grazing Management Plan was prepared, the plan stated that at the end of the 10 yrs, LADWP would evaluate whether the vegetation goals have been met and decide future management for the area.

In the 2013 Draft-LORP Annual Report on page 4-98 you state that the Riparian Exclosure has been excluded from grazing for 11 yrs.

John Summers and I recently visited the Thibaut Riparian exclosure. Our observations are consistent with the findings of the Draft LORP report. We believe that opening up grazing access to the River will be beneficial to the entire Thibaut Lease.

Allowing stock access to the Owens River will allow the horses and mules to water and spend more time in the eastern portion of the Lease. A goal of the City and us is to reduce grazing pressure on the irrigated portion of the lease.

The area has been closed for over ten years. We would hope that you would reopen the area to grazing this winter. And, with ten years of grazing data it would be good Adaptive Management to see what happens when we reintroduce horses and mules to the area.

We would request that we be allowed to remove some of the cattle guards or put gaits in that would make it safer for the equines.

Sincerely,

Craig London and John Summers

Cc: Dave Martin, Ph.D.

RECEIVED
JAN 27 2014
AQUEDUCT MANAGER
BISHOP ADMINISTRATIVE OFFICE

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January 26, 2014

To: Mark Bagley
Owens Valley Committee Consultant and
Sierra Club 1997 MOU Representative

From: Duncan Patten, Ph.D.
Research Professor, Hydroecology, Montana State University

Subject: Comments on 2013 LORP Annual Plan and Adaptive Management Recommendations

Mark, I am attaching to this memo my comments on the 2013 LORP Annual Plan and Adaptive Management Recommendations. These comments include the text and a set of hydrographs which are referred to in the text.

I look forward to discussing this with you if needed, and hope the comments are appropriate for your needs.

Duncan T. Patten

Comments on the 2013 Lower Owens River Project (LORP) Annual Report

Duncan T. Patten

To address the success and/or progress of the LORP, one first must look at the overall goals of the project, then assess what might be needed to accomplish these goals and using this analysis evaluate the progress as reported by the 2013 monitoring studies in the 2013 LORP Annual Report. The following commentary follows this process.

What are the projects goals?

"*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.*"

To achieve a "healthy, functioning Lower Owens River riverine-riparian ecosystem" ..."for the benefit of biodiversity and the Threatened and Endangered Species", the primary management tools are associated with ability to control the hydrological dynamics of the system. The LORP is very much an ***environmental flows project*** with associated land management (e.g., "other physical features of the LORP"). The establishment of environmental flows should be informed by an analysis and understanding of natural flows (not impacted by human influences when possible) and flow:ecology relationships that support native aquatic and riparian species life histories. Environmental flows should take into account the following hydrologic attributes: *magnitude, frequency, timing, duration, and rate of change.* These attributes are more applicable to high flow events than base flow but are important when managing hydrology of a system (see next paragraph).

Environmental flows have several components that are directly related to success or failure of LORP. Simply put, these include several hydrologic conditions. (1) Properly timed and shaped high flow events which both enhance recruitment of riparian woody plants but also, if large enough, are channel maintenance flows, scouring plant invasion and moving sediment buildup. (2) Maintenance of base flows which maintain the alluvial aquifer and support aquatic organisms.

In LORP vernacular, #1 above, the high flow events, are referred to as Seasonal Habitat Flows (SHF) and "flushing flows", and #2 above are maintenance flows (releases) below which release from the intake should not fall.

The reason for the above discussion on environmental flows is to create a foundation on which to evaluate the progress of LORP as reported in the LORP 2013 Annual Report.

Recruitment of Woody Riparian Species

A major goal of LORP is to create riparian habitat for the T and E species or indicator species (mostly birds) that will use the habitat once it has established. Monitoring has emphasized *Salix goodingii* (tree willow) and *Populus fremontii* (cottonwood), with measurements including *Salix exigua* (or other shrub willows). Monitoring data (Rapid Assessment) show that few if any cottonwoods establish under the present hydrological regime used by LORP (see Section 5.0). Some tree willows have established and shrub willows seem to be established or maintained. Overall, recruitment of a healthy riparian habitat dominated by diverse woody riparian species has failed, even if one considers that there has been insufficient time for the recruited plants to mature and create an adequate habitat for T and E or indicator species. If appropriate conditions were created that would produce recruitment of the woody riparian species, monitoring along the floodplain should show a continual "gain" in number and age of these species. This is not the case. Why is this not happening?

Recruitment of woody riparian plants will occur if (1) there is a seed source, (2) there are sufficient bare soil surfaces at the "right" elevation on river margin for seed deposition and germination, (3) the bare soil surfaces are wetted by high flows at the right time of year (i.e., during seed dispersal period), (4) high flows that wet the surface decline at a rate (i.e., rate of change) allowing seedling root growth and development to "track" the declining alluvial water tables, and (5) base flows maintain an alluvial aquifer sufficiently shallow to allow young woody recruitment to establish and be maintained.

What has happened with each of these conditions?

(1) There is a seed source for all of the native woody riparian species and, unfortunately, for the non-natives as well.

(2) Apparently, there is sufficient bare soil available at the right time of year for recruitment.

(3) Wetting the bare soils at the right time of year in 2013 is questionable. In 2013 flows were slowly ramped up from late May (scheduled SHF) to late June (45 to 90 cfs) (see Figure 1a in attached set of hydrographs).

(4) The high flows in 2013 were held near 85cfs and did not begin to decline until mid August where it declined to about 65cfs over about ten days.

(5) It is uncertain whether base flows maintained a shallow alluvial aquifer in areas of woody riparian plant recruitment as the monitoring data in the LORP Annual Report do not include shallow groundwater data in areas of riparian recruitment.

How does one address these outcomes? The most obvious irregularity of the data relative to appropriate hydrology for woody plant recruitment in 2013 is in the SHF and follow-on higher flows which ramped up in May (scheduled SHF) but then was followed by high flow releases that didn't decline until mid August when the down ramp or change went from about 85 cfs to 65 cfs and then about 50 cfs. The planned schedule for the SHF was to begin on May 21. When it was started it was scheduled at about 50 cfs reaching a maximum average daily flow on May 22 of 56 cfs. In late May and into June the releases then ramped up to the highs for the year near 85 cfs which ecologically would "undo" any successful woody plant recruitment occurring in late May, a time when riparian seed dispersal is probably minimal. The high flows of about 85 cfs would not scour any recruitment that might have occurred during prior years with SHF flows much higher, however, the timing of earlier years' SHFs may not have been appropriately scheduled to mimic natural hydrographs for the system (see following discussion).

In the discussion of Environmental Flows earlier, it is recommended that one " should be informed by an analysis and understanding of natural flows". Recent hydrology of the Owens River is not the correct place to look, but rather hydrographs from years prior to major changes in the upper Owens River reaches (1920 to 1940) might be instructive. Even these dates post-date the completion of the LA Aqueduct but they predate the diversion of water from the Mono Basin to the Owens River and construction of Crowley Lake. Figure 1 shows several hydrographs at locations along the upper Owens River in 1920, 1930 and 1940. All of these historic hydrographs show a typical snow melt hydrograph with the beginning of increased flows in mid May with the peak lasting through June and then declining during July. In addition to the peak maximum, it is the rate of the declining limb of the hydrograph that is so critical to woody riparian plant recruitment and this concept has been developed into a model termed the "recruitment box" (Mahoney and Rood 1998). It is also important to consider the evolution of riparian woody plant recruitment in the Owens River system as well as throughout the West. Successful recruitment is dependent on the timing of seed dispersal with the declining limb of the snow melt hydrograph. Seed dispersal may start in May but successful recruitment in the past would have occurred in late June and early July. Establishment and maintenance of the woody riparian species in the Owens River system evolved with the patterns of snow melt coming off the Sierras represented by the several hydrographs in Figure 1.

Using the hydrograph examples from the past as the "model" on which to base the SHF, and then evaluating the SHF from 2013 or perhaps other years for the Lower Owens, is it any wonder that there is little recruitment of woody riparian plants. The magnitude of the peak is not as important as the timing, duration and rate of the declining limb of the spring peak because appropriate peak flows in the past regularly created conditions for recruitment of woody riparian species. Peak flows that supported riparian woody plant recruitment probably occurred only every five to ten years, an indication of the annual variability of natural flows. Recognizing this annual variability is important to planning future release patterns for the Lower Owens River. These occasional high peak flows should be of such a magnitude to wet the river margins high enough to recruit seedlings that will be above high flows that may follow within a few years of those that established the initial seedling cohort. Within a few years riparian woody plants are strong enough to resist most high flow events.

There is no similarity between historic and LORP hydrographs. Lessons should be learned and this should be corrected in the future (see recommendations). There is a lesson that can be learned from historic data at Rush Creek in the Mono Basin. There in 1995 and 1998 peak flows spilled from Grant Reservoir a month after the unimpaired peak event in mid to late June when cottonwood recruitment likely was occurring during the controlled impaired flows. Established willows survived these peaks and thus the woody riparian vegetation was dominated by willow and other shrub species with few if any cottonwoods.

Tule (*Scirpus* and *Typha*) Control.

It is obvious that whatever hydrology is designed or practiced for the Lower Owens River, it is not being successful in controlling expansion of tule density in the river. Maintenance of low flows with little if any scouring high flows will allow expansion of in-river vegetation. Channel maintenance flows as discussed above relative to environmental flows are a critical component of managing restoration of a riverine system.

Recommendations:

The following recommendations are made recognizing that there must be a balance between water availability, water requirements for maintenance of the LORP system, methods of water release and management within the system and overall goals of the LORP program. The recommendations are made primarily to enhance the potential of riparian habitat development (habitat for indicator species) and maintenance of a healthy instream ecosystem. Consequently they relate mostly to hydrology and water management.

1. Design Seasonal Habitat Flows (SHF) to mimic natural snow melt hydrographs for the Owens River with peaks in early to mid June and decline from the peak into July. This may require more water than presently allocated, or limit these flows only during wet years (see discussion in comments on Adaptive Management recommendations below).

2. Create SHFs occasionally (every 5 years or so) with maximum flows that would mimic at least an average or normal snow melt hydrograph (e.g., peak flows of about 300 to 400 cfs). These high flows should reach those locations along the Lower Owens where there is a high potential for recruitment of woody riparian plants which may require supplementing the initial releases down stream.

3. In addition to the SHF recommended in #1 and #2, regularly release high flows in the 200 cfs magnitude range to act as additional channel maintenance flows that would aid in tule control.

4. Historically there was a natural flow pulse in March (see hydrograph in Figure 1f). This should continue to be mimicked but not with planned flow pulses greater than the SHF which should be in June and July (see recommendation #1).

5. Determine appropriate base flows that would maintain a shallow alluvial aquifer in areas where woody riparian plants have recruited, or may recruit. Monitor these locations for depth to water table in areas of potential woody plant recruitment.

6. Determine the annual volume of water needed to produce the inputs and outcomes recommended above realizing that periods of SHFs, high flows and/or pulses may not totally mimic natural conditions although attempts should be made to come close. Also, within these calculations there must be consideration of appropriate base flows to maintain a shallow alluvial aquifer that is critical to maintenance for establishment and maintenance of a healthy riparian plant community (see recommendation #5) as well as a healthy instream ecosystem.

7. All deliberations on determining future flows in the Lower Owens River should consider potential future watershed water outputs under expected climate change scenarios.

8. Continue to monitor browsing in riparian areas to understand browsing impacts and to prevent loss of new and established woody riparian plants (Section 4.8). Plots that had no cottonwood or willow were eliminated from the survey. This action will result in no discovery of browsing on future establishment of these species in these areas. This should be reconsidered.

Comments on the LORP Adaptive Management Recommendations

Most of the following comments relate to the Riverine-Riparian Area component of the Adaptive Management Recommendations (AMR). Those dealing with hydrology may have some relationship to water being released to the Delta Habitat but that is somewhat secondary to attempts at establishing a healthy riverine-riparian system throughout most of the length of the Lower Owens River.

The AMR basically recommend reconsidering many of the approved hydrological processes under the FEIR and MOU. The reason for these recommendations relate to the fact that the present accepted and/or approved hydrology is not working. Comments are offered relative to the AMR recommendations below:

AMR #1. Do not hold the base flow at 40cfs, but rather establish a new average annual flow of 55cfs.

Comment: the use of an annual average flow, or annual volume of water (not necessarily based on 55 cfs, see comments below) seems reasonable as using an average annual flow will allow, along with peak flow considerations, consideration of base flows that, when determined, will maintain a shallow alluvial aquifer to maintain riparian woody plants.

AMR #2. The water for all flow regimes will come out of a volume of water based on 55 cfs annual flow average.

Comment: This is equivalent to nearly 40,000 acre feet (af) per year. 300 cfs for three weeks is about 12,500 af. If a peak flow lasted that long without ramp up or down, a potential SHF, the remaining 27,500 af could support a base flow of nearly 40 cfs for the remainder of the year. This is a very rough calculation but demonstrates the potential flexibility of using a volume of water for release planning rather than specific flows for specific purposes.

In general I support the recommendation of using annual volume but caution that if 40,000 af is the total allocated annual volume and there is a SHF of 300 cfs for several weeks, the base flows will have to be lower than 40 cfs. Figure 2.2.2 in the Adaptive Management recommendations shows a peak lower than 300 cfs as well as a spring flushing flow. To accommodate these flows, the base flow for much of the year is below 40 cfs. This figure represents releases at the Intake and one must ask, if there is a base flow lower than 40 cfs at the Intake, what will be the base flows throughout the system to the pump station? Augmentation of flows below the intake will have to be considered to maintain an adequate base flow for the length of the river. This augmentation mimics natural inflows from tributaries. It is essential that if total volume becomes the annual metric for water releases at the Intake, then serious consideration must be given to having annual volumes determined based on potential watershed releases so that, for example, very wet years might have total volumes of 60,000 af or more, and dry years volumes below 40,000 af. This annual variability coincides with natural annual variability found in unimpeded watershed output.

AMR #3. A habitat peak flow (SHF) of 300 cfs be planned for 2014.

Comment: In both my comment above and my recommendation #2 in review of LORP Annual Plan, I use or recommend a SHF of 300+/- as a planning flow. Although it is unlikely the MOU consultants anticipated such a dry year when making this recommendation, when undertaken, the duration and shape of this peak will have to be part of the planning but mimicking natural peak flow hydrographs should seriously be considered as the ARM does in Figure 2.2.2. They should also reach potential recruitment locations along the Lower Owens River which may require supplementing water at appropriate locations.

AMR #4. Release late winter or early spring flushing flows in 2014.

Comment: this type of flow is found in the historic hydrographs (see hydrograph Figure 1f) and plays a role in water quality and channel maintenance. It also will help water the alluvial aquifer prior to the summer peak flows that should result in establishment of woody riparian plants if properly planned. This flushing flow along with the summer SHF, both unlikely during a dry year like 2014, will use a lot of the 40,000 af allotted under AMR #1 above. One must recognize that these peaks may create base flows lower than 40 cfs but low flows during parts of the year are natural for this system. A base flow lower than 40 cfs at the Intake also may be a problem (see comments under AMR #2 above). Unfortunately, base flows in the past prior to major alteration of the system were probably closer to 150 cfs. This level exceeds any potential planning and mimicking all past hydrological patterns is no longer an option with water presently being removed from the system.

AMR #5. Determine appropriate flows for Tule control.

Comment: There are many options here from high flows, either scouring or flooding tules, to only moderately high flows that may inundate tule habitat. Understanding what hydrology has created the tule problem is critical to understanding what hydrology is needed to help solve it aside from using large equipment to dredge it out (probably not an option).

AMR #6. Delta Habitat recommendations include putting pulse water to be released to the Delta into the system at the intake.

Comment: it seems logical to manage the water through the system rather than at the end of it at the pump station. I'm not sure I fully understand the Delta Habitat needs thus do not have any definitive comments on this.

Adaptive management recommendations related to other parts of the Lower Owens River system and watershed are important to consider but most are not related to creating a healthy riverine-riparian system except perhaps those that related to controlling browsing or other uses of the immediate floodplain of the river. Other locations off the mainstem of the river also have management needs and perhaps adaptive management change consideration but I am not familiar enough with those areas and will make no comment here on those areas.

References

Mahoney, J.M. and S.B. Rood. 1998. Streamflow requirements for cottonwood seedling recruitment—An integrative model. Wetlands 18:634-645.

FIGURES ACCOMPANYING COMMENTS ON LORP

Figure 1. Hydrographs of LORP flows during summer 2013 below river intake, and historic flows at locations along the Owens River near or upstream of Bishop, CA.

Figure 1a. Hydrograph of Owen River flows below river intake summer 2013 (Y axis in figure is cfs).

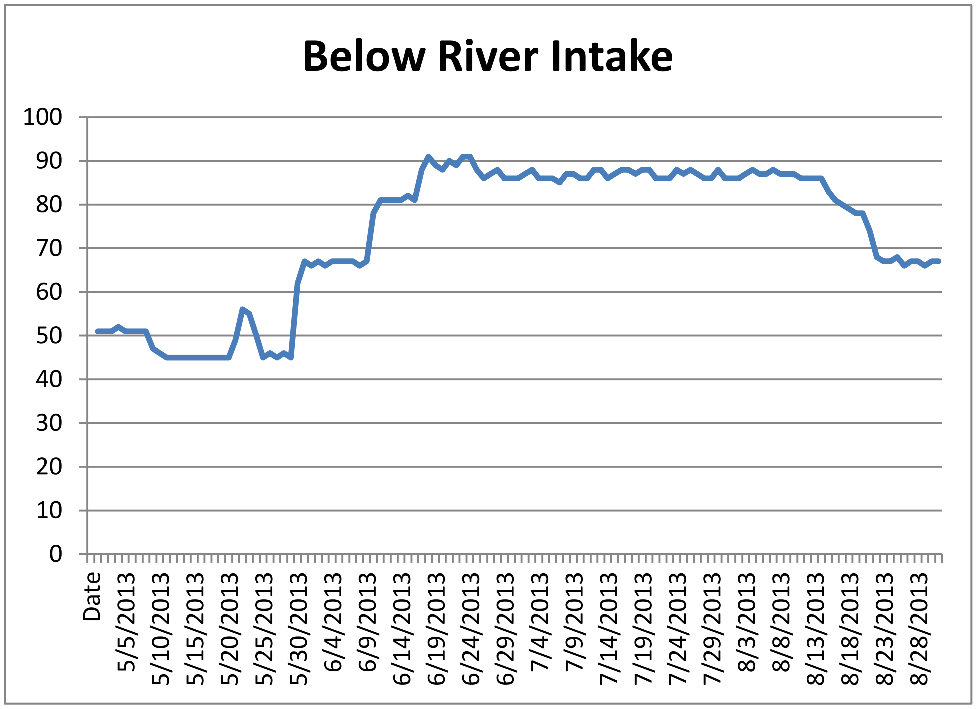


Figure 1b. Hydrograph of Owen River flows in summer 1920 near Round Valley upstream of Bishop, CA.

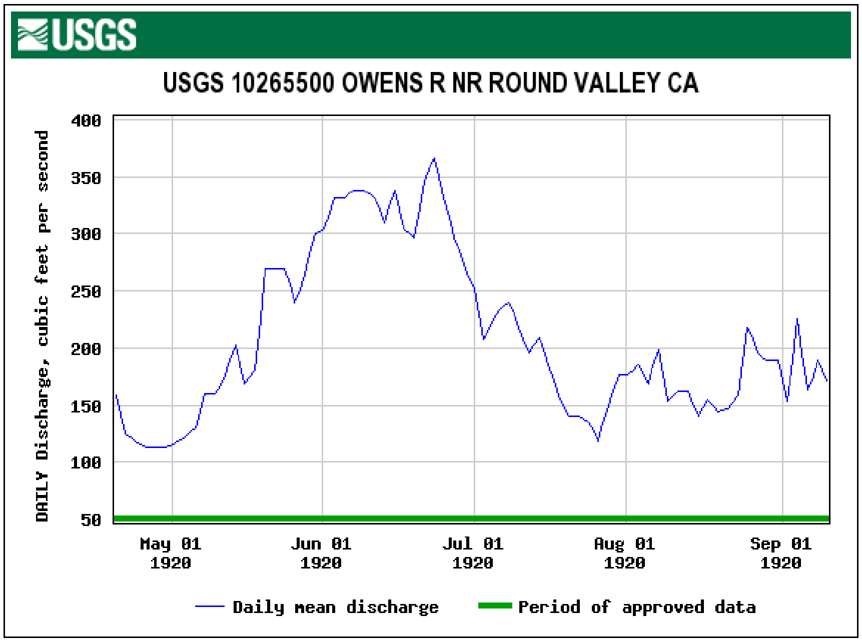


Figure 1c. Hydrograph of Owen River flows in summer 1930 near Bishop, CA.

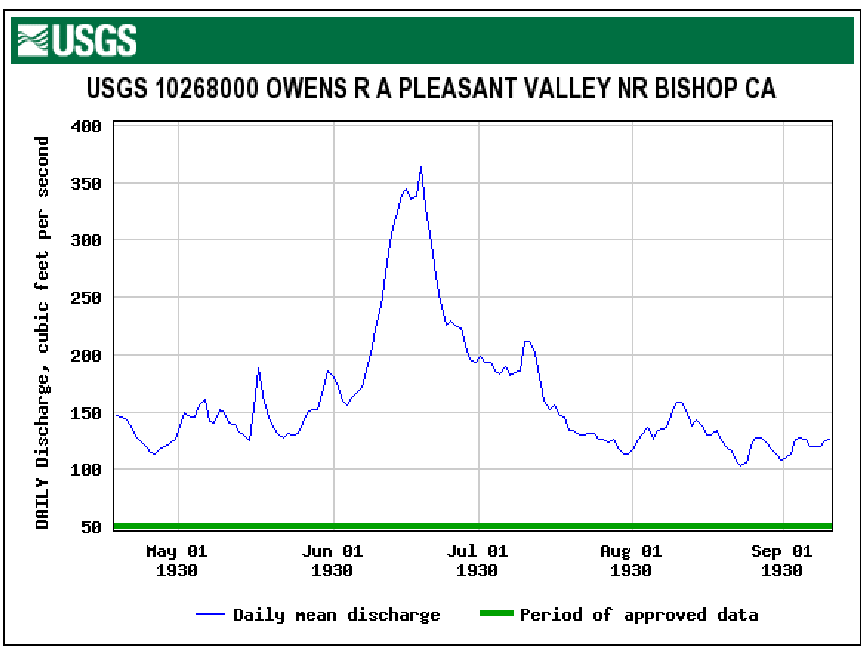


Figure 1d. Hydrograph of Owen River flows in summer 1940 near Round Valley upstream of Bishop, CA.

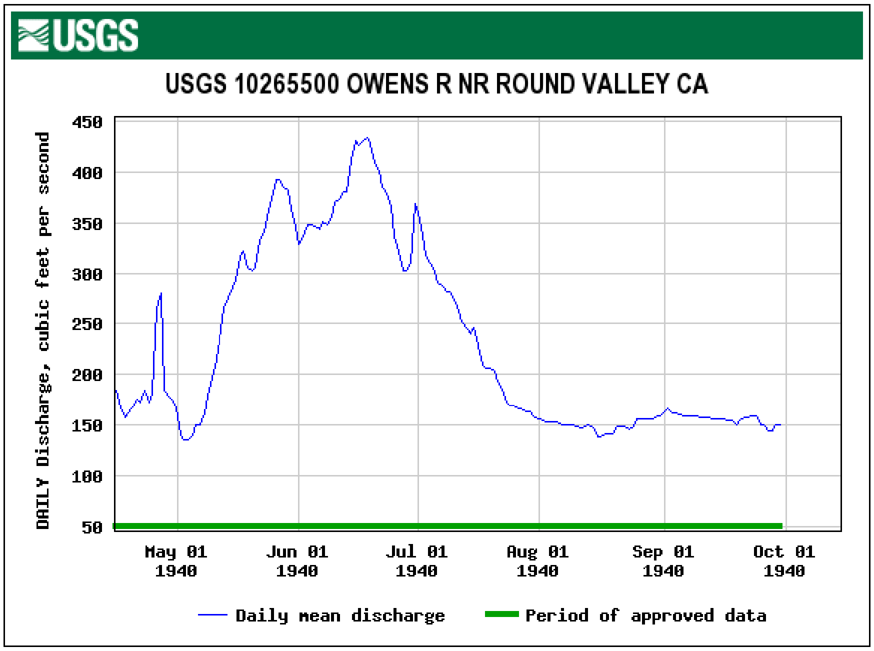


Figure 1e. Hydrograph of Owen River flows in summer 1940 near Bishop, CA.

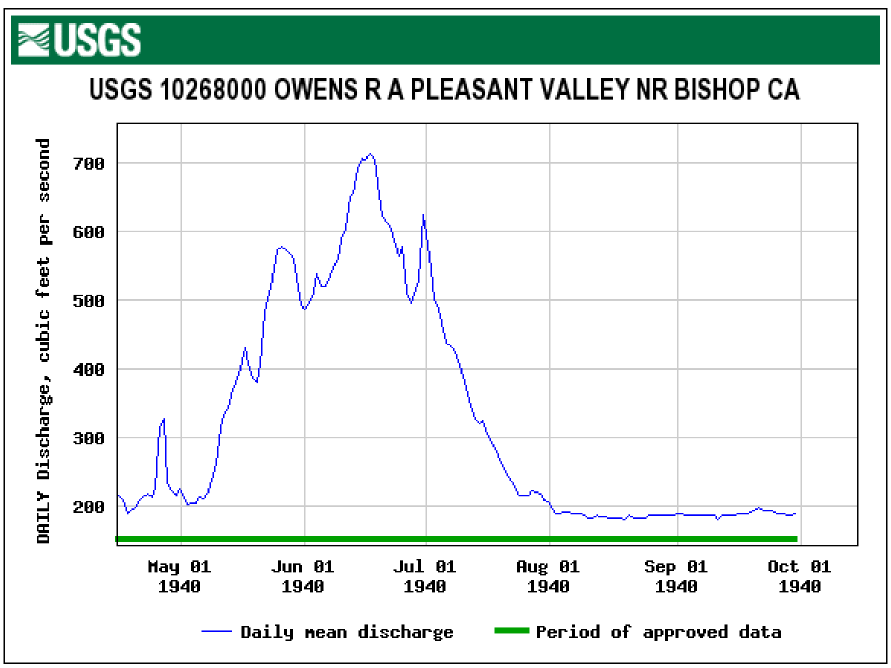
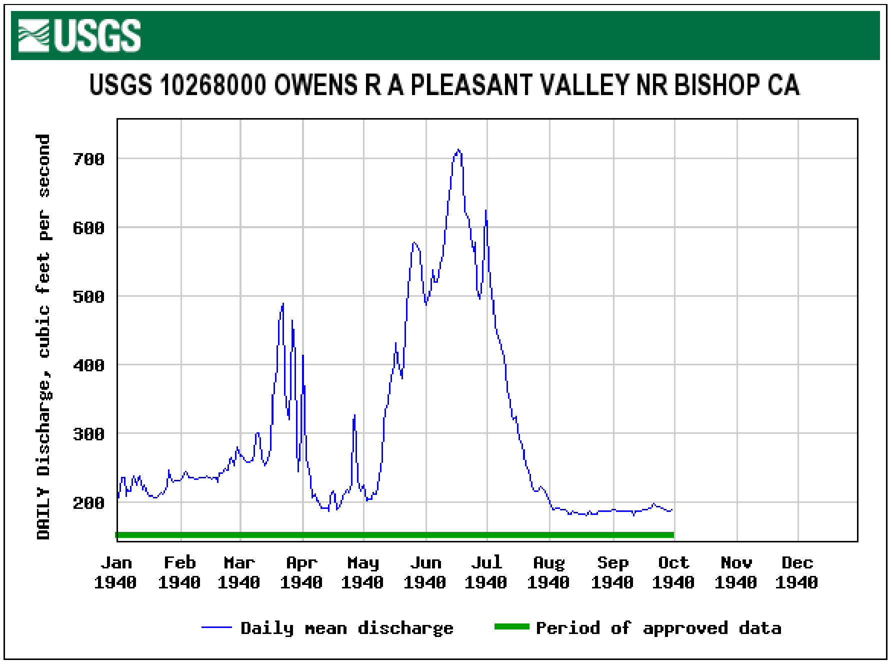


Figure 1f. Hydrograph of Owen River flows in 1940 near Bishop, CA.



RESUME

DUNCAN T. PATTEN

The information in this abbreviated resume was selected from a full resume for relevance to the Eastern Sierra.

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Professor Emeritus, School of Life Sciences, Arizona State University, Tempe, AZ
Certified Senior Ecologist, Ecological Society of America

DEGREES

A.B., Biology-Chemistry, Amherst College, 1956
M.S., Botany, University of Massachusetts, Amherst, 1959
Ph.D., Botany-Ecology, Duke University, 1962

ACADEMIC EXPERIENCE

Instructor (part-time) 1957-59, University of Massachusetts
Assistant Professor 1962-65, Virginia Polytechnic Institute
Assistant Professor 1965-67, Arizona State University
Associate Professor 1967-73, Arizona State University
Professor 1973-1995, Arizona State University
Professor Emeritus 1995 -- present, Arizona State University
Research Professor (adjunct) 1995-1999, Montana State University
Research Professor 1999 -- present, Montana State University

RELEVANT ADMINISTRATIVE EXPERIENCE

Co-director, Rocky Mountain Environmental Research Grant, 1973-74.
Chairman, Department of Botany and Microbiology, Arizona State University, January 1977-July 1981.

Director, Center for Environmental Studies, Arizona State University, 1980-1995.
President, Arizona Riparian Council, 1985-89.
President, Society of Wetland Scientists, 1996-97
Director, Montana Water Center, Montana State University, 2012-present

RELEVANT OTHER PROFESSIONAL EXPERIENCE

Bureau of Reclamation - Department of the Interior:

Senior Scientist, Department of the Interior, Bureau of Reclamation, Glen Canyon Environmental Studies 1989-1996.

National Research Council/National Academy of Sciences:
Committees, Boards, and Commissions (selected from 12 committees/boards, etc)

Chair, Mono Basin Ecosystem Study, Board on Environmental Studies and Toxicology, 1985-87.

Member, Glen Canyon Environmental Studies Committee, Water Science and Technology Board, 1986-89, ex officio 1989-1996.

Member, Committee on Western Water Management Change, Water Science and Technology Board, 1989-91.

National Science Foundation (relevant committees):

Panel Member -- National Science Foundation: Environmental Biology 1975-76 and Ecological Sciences, 1976-78.

Environmental Protection Agency (relevant committees):

Member: Scientific Advisory Committee Panel to Review 2007 Report on the Environment, 2007.

Member: Chartered Science Advisory Board, 2008-present

Awards and Honors

Phi Sigma 1963
Sigma Xi 1959 (Associate), 1962 (Full)
Arizona State University Chapter: Treasurer, 1966-68
President-Elect, 1968-69
President, 1969-70
American Association for the Advancement of Science, Fellow 1979
Arizona/Nevada Academy of Sciences, Fellow 1976.
Ecological Society of America, Distinguished Service Award. 1994, Fellow 2013.
Bureau of Reclamation, Citizens Award. 1996.

Relevant Research Grants and Contracts

Riparian vegetation response model. Southern California Edison, 1986. $15,454

Inventory and evaluation of riparian vegetation along lower Rush Creek, Mono County, California. Los Angeles Department of Water and Power, 1987. $9,008

Riparian vegetational changes along Bishop Creek: an historical photo interpretation. Desert Research Institute/Southern California Edison, 1988. $7,150

Dynamics of riparian species along Rush Creek. Los Angeles Department of Water and Power, 1988. (With J. Stromberg.) $30,015

Instream flow requirements for riparian vegetation at Bishop Creek, Inyo County, California. Southern California Edison, 1989-92. (With J. Stromberg.) $64,310

Effective management of water resources: a function of geomorphology and instream flow requirements. U.S. Geological Survey, 1990-92. (With J. Stromberg.) $36,740

Instream flow needs of riparian trees. Los Angeles Department of Water and Power (Jones and Stokes, Prime). (With J. Stromberg). 1990. $9,020
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1986 Patten, D. T., C. Fox, and R. Risser. Effects of stream diversion and instream flow requirements in the riparian ecosystems of the Sierra Nevada. Abstract, First Annual Arizona Riparian Council Meeting, Flagstaff, AZ. Page 11.

1989 Stromberg, J. C., and D. T. Patten. Long-term effects of stream diversion on riparian tree growth. Bulletin of the Ecological Society of America 70(2)Supple.:275.

1997 Patten, D.T. Riparian ecosystems of semi-arid North America. Society of Wetland Scientists 18th Annual Meeting Abstracts pg 97. June 1-6, 1997, Bozeman, MT. (Invited).

1998 Patten, D.T., L. Rouse, and J.C. Stromberg. Vegetation dynamics of Great Basin springs: potential effects of groundwater withdrawal. p.98-99 *in* abstracts of the Society of Wetland Scientists annual meeting, Anchorage, AK. June 7-12, 1998.

1998 Shafroth, P.B., J.C. Stromberg, and D.T. Patten. Woody riparian vegetation along the dammed Bill Williams River and the undammed Santa Maria River, Arizona. p. 67 *in* abstracts of the Society of Wetland Scientists annual meeting, Anchorage, AK. June 7-12, 1998.

1999 Patten, D.T. and J.C. Stromberg. Riparian restoration decisions: lessons from two dewatered eastern Sierra streams. Society of Wetland Scientists. June 6-12, 1999. Norfolk, VA.

1999 Patten, D.T., L. Rouse, and J.C. Stromberg. Great Basin springs: vegetation response to potential groundwater withdrawal. Ecological Society of America. Annual Meeting, Spokane, WA. August 8-12, 1999.

1999 Patten, D.T. Riparian challenges in the United States. Riparian Restoration Conference, Red Deer, Alberta, Canada. October 20-21, 1999. (Invited)

2000 Patten, D.T. Importance of riparian zones and their ecological services. Southwest River Management Restoration Conference. Arizona Floodplain Management Association. Phoenix, AZ. April 3-5, 2000. (Invited).

2000 Patten, D.T. and J.C. Stromberg. Ecological consequences of groundwater withdrawal and aquifer protection in the arid-West. Geological Society of America Abstracts with Program Vol 32 (7): A140. GSA. Annual Meeting Reno, NV. Nov. 13-16, 2000. (Invited).

2000 Patten, D.T. and J.C. Stromberg. Riparian tree growth-streamflow models may reflect climate-induced hydrologic changes. Eos, Transactions, American Geophysical Union (Supplement) 81 (no. 48):517. AGU Fall Meeting, December 15-19, 2000, San Francisco, CA. (Invited).

RELEVANT PUBLICATIONS IN PEER REVIEWED JOURNALS

1990 Stromberg, J. C., and D. T. Patten. Riparian vegetation instream flow requirements: a case study from a diverted stream in the eastern Sierra Nevada, California. Environmental Management 14:185-194.

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1991 Stromberg, J. C., and D. T. Patten. Instream flow requirements for cottonwoods at Bishop Creek, Inyo County, California. Rivers 2(1):1-11.

1992 Stromberg, J.C. and D.T. Patten. Mortality and age of black cottonwood stands along diverted and undiverted streams in the eastern Sierra Nevada, California. Madrono 39:205-223.

1992 Stromberg, J.C. and D.T. Patten. Response of *Salix lasiolepis* to augmented stream flows in the upper Owens River. Madrono 39:224-235.

1993 Wiens, J.A., D.T. Patten, D.B. Botkin. Assessing ecological impact assessment: lessons from Mono Lake, California. Ecological Applications 3:595-609.

1996 Stromberg, J.C., and D.T. Patten. Instream flow and cottonwood growth in the Eastern Sierra Nevada of California, USA. Regulated Rivers: Research and Management 12:1-12.

1998 Patten, D.T. Riparian ecosystems of semi-arid North America: diversity and human impacts. Wetlands 18:498-512.

2001 Patten, D.T., and L.E. Stevens. Restoration of the Colorado River ecosystem using planned flooding. Ecological Applications 11:633-634.

2001 Patten, D.T., D.A. Harpman, M.I. Voita, and T.J. Randle. A managed flood on the Colorado River: background, objectives, design, and implementation. Ecological Applications 11:635-643.

2006 Patten, D.T. Restoration of Wetland and Riparian Systems: The Role of Science, Adaptive Management, History, and Values. Journal of Contemporary Water Research and Education 134:9-18.

2008 Patten, D.T., L. Rouse, and J.C. Stromberg. Isolated spring wetlands in the Great Basin and Mojave Deserts, U.S.A.: Potential response of vegetation to groundwater withdrawal. Environmental Management 41(3): 398-413.

2008 G. Mathias Kondolf, G., P. Angermeir, K. Cummins, T. Dunne, M. Healey, W. Kimmerer, P. Moyle, D. Murphy, D. Patten, S. Railsback, D. Reed, R. Spies, and R. Twiss. Prioritizing River Restoration: Projecting Cumulative Benefits of Multiple Projects. Environmental Management 42:933-945.

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1989 Stromberg, J. C., and D. T. Patten. Early recovery of an eastern Sierran riparian system following forty years of stream diversion. Pp. 399-404 *in* Proceedings of the California Riparian Systems Conference, U.S. Forest Service, General Technical Report PSW-110, Berkeley, CA.

1989 Stromberg, J. C., and D. T. Patten. Instream flow requirements for riparian vegetation. Pages 123-130 *in* G. R. Baumli, ed., Legal, institutional, financial, and environmental aspects of water issues. American Society of Civil Engineers, New York, NY.

1991 Patten, D.T. and J.C. Stromberg. Instream flows for aquatic/riparian ecosystem integrity. Pp. 28-41 *in* Proceedings of the 1991 Annual Meeting of the University Council on Water Resources. UCOWR, Southern Illinois University, Carbondale, IL.

1995 Patten, Duncan T. An overview of restoration ecology: an ecological foundation. In Proceedings of a National Symposium: Using Ecological Restoration to Meet Clean Water Act Goals, March 14-16, 1995, Chicago, Ill. U.S. Environmental Protection Agency.

1997 Patten, D.T., J.C. Stromberg, M.L. Scott and M.K. Chew. Sustainability of western riparian ecosystems. p. 17-31 *In* W.L. Minckley (ed.) Aquatic Ecosystem Symposium. Denver, CO: Western Water Policy Review Advisory Commission. Springfield, VA: National Technical Information Service.

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1988 Patten, D. T., and J. Stromberg-Wilkins. Inventory, mapping, and evaluation of the riparian vegetation along Rush Creek, Mono County, California. Report to Los Angeles Department of Water and Power. 50 pages.

1989 Patten D. T., and J. C. Stromberg. Riparian vegetational changes along Bishop Creek based on analysis of historical aerial photographs. Final report prepared for Southern California Edison, Rosemead, CA.

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1989 Stromberg, J. C., and D. T. Patten. Short-term changes in riparian vegetation at Rush Creek, Mono County, California. Final report prepared for Los Angeles Department of Water and Power, Los Angeles, CA.

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1990 Stromberg, J. C., and D. T. Patten. Instream flow requirements for riparian vegetation at Bishop Creek, Inyo County, California. Final report prepared for Southern California Edison Co., Rosemead, CA.

1991 Stromberg, J. C., and D. T. Patten. Cottonwood age structure and mortality at Bishop and Pine Creeks. Report prepared for Southern California Edison Co., Rosemead, CA.

1991 Stromberg, J. C., and D. T. Patten. Cottonwood growth response at Bishop and Pine Creeks. Report prepared for Southern California Edison Co., Rosemead, CA.

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State of California – Natural Resources Agency
DEPARTMENT OF FISH AND WILDLIFE
Bishop Field Office
407 West Line Street
Bishop, CA 93514
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January 28, 2014

Mr. James Yannotta
Aqueduct Manager
Los Angeles Department of Water and Power
300 Mandich Street
Bishop, CA 93514

Dr. Robert Harrington
Director
Inyo County Water Department
P. O. Box 337
Independence, CA 93526-0337

Dear Mr. Yannotta and Dr. Harrington:

LOWER OWENS RIVER PROJECT 2013 DRAFT ANNUAL REPORT COMMENTS

The California Department of Fish and Wildlife (CDFW) is concerned that continuing the current flow regime on the Lower Owens River will NOT result in achievement of the Lower Owens River Project (LORP) goals, as stated in the Adaptive Management section of the 2013 draft LORP Annual Report. CDFW would like to see a comprehensive analysis of how flow impacts the Lower Owens River, that includes considering changes in the timing, magnitude and duration of base and pulse flows. CDFW is supportive of using higher magnitude flushing and seasonal habitat flows, releasing delta habitat flows from the intake, and potentially altering the timing and ramp down from seasonal habitat flows to better support recruitment of riparian trees.

CDFW is open to considering a change in the legal documents that set the base and peak flows of the Lower Owens River. At this time CDFW continues to support increasing the pumpback station capacity if this is essential to providing the flexibility to implement different flow recommendations. CDFW was pleased with MOU parties' efforts this May to implement a one-time lifting of pumpback station restrictions in order to allow an augmentation flow from the Alabama Gates to promote restoration from the Lone Pine fire. This is a positive step that will hopefully set the stage for continued cooperation and adaptive management actions. CDFW encourages the MOU parties to continue to work on permanent changes to the pumpback station regulations. However, regardless of pumpback station negotiations, the flow guides in the LORP EIR should not limit water flow to the Lower Owen River, and should change if LORP goals are not being met. CDFW is also open to consider setting a specific amount of water for the LORP, such as the 55cfs average proposed by Ecosystem Sciences. However, at this time, it is unclear how 55cfs will achieve the ecological goals of the LORP. If legal regulations are preventing success of the LORP, than MOU parties should work together to change the regulations.

CDFW is very supportive of the recommendation to have a Lower Owens River Summit meeting that includes a comprehensive assessment on the status of the LORP in achieving its goals and objectives. This assessment should include a summary of what has been learned about the relationship between flow and stage height and water quality conditions from past flow management as well as from unplanned flow events that have occurred. Additional topics for consideration at the river summit should include the impact of restoration efforts after the Lone Pine fire, tule management using flow regimes or mechanical methods, salt cedar control, increased prescribed burning, and training the channel from the Alabama Gates. The meeting would likely benefit from bringing in additional experts, and possibly a facilitator. This discussion should also include the effectiveness of current monitoring and consider future monitoring needs to evaluate the effectiveness of any flow regime changes. CDFW does understand that there may be conflict between project goals and the flow regimes that would support each of these goals and realizes that tradeoffs will need to be made.

CDFW commends the effort, and appreciates the information from Mr. Francis Pedeneau regarding the bass fishery conditions on the Lower Owens River that was incorporated in the Adaptive Management section. CDFW agrees with the recommendation to add a creel census this year. The creel census should be coordinated with ICWD and CDFW.

CDFW was disappointed at the lack of communication from LADWP regarding water released in July 2013 from the Alabama Gates. More than 800 dead fish were found on the shores of the Lower Owens River as a result of this release. CDFW was only contacted about this flow release after a third party observed dead fish, more than four days after the water was released. In the future, CDFW would like to see more immediate and open communication regarding events that impact the Lower Owens River so that every effort can be made to maximize the amount that can be learned from these events and discussion of these events should be included in future annual reports.

CDFW appreciates the changed timing of the public meeting and the extended review period. The large number in attendance at the LORP meeting this year indicates just how much the public values the Lower Owens River. Future changes to the timetable should continue to be considered.

CDFW found Figure 22 (p4-64) very informative in showing how the flow regime for the Lower Owens River has changed over time. From this figure it is easily apparent that the seasonal habitat flows from 2012 and 2013 were much smaller than the base flows that were released later in the season in order to maintain the 40cfs baseflow. It was also helpful that Ecosystem Sciences provided a similar graph (Fig 2.2.2) to conceptually demonstrate how flows might be changed with an average 55cfs allotment. It would be helpful if similar graphs were created for the other measuring stations on the river. This would help clarify how different flow regimes move through the Lower Owens River system.

Thank you for the opportunity to comment on the 2013 Lower Owens River Project Annual Report.

Sincerely,

Lacey Greene

Lacey Greene
Environmental Scientist

Ecosystem Sciences | 202 N 9th Street, Suite 400 Boise, ID 83702 | Telephone 208.383.0226 | Facsimile 208.368.0184 | ecosystemsciences.com

MEMORANDUM

TO: Dave Martin, LADWP

FROM: Bill Platts and Mark Hill, MOU Consultants

DATE: January 29, 2014

SUBJECT: MOU CONSULTANTS COMMEMENTS ON ROCK CREEK PACK STATION JANUARY 21, 2014. REQUEST TO GRAZE THE THIBAUT GRAZING LEASE RIPARIAN PASTURE IN 2014.

The Thibaut Grazing Lease Plan (2006) calls for all livestock to be excluded from grazing the large riparian exclosure to ensure that future riverine-riparian values are protected. The MOU (1997) specifically states that "management activities should promote diverse natural communities that are self-sustaining, comply with state and federal law concerning protected species, be consistent with water quality laws and objectives, control deleterious species, and be consistent with the LORP goals."

To confirm with the above, the Thibaut Grazing Lease Plan states that, "healthy riparian vegetation will be established along the re-watered Owens River and these areas will not be grazed for at LEAST 10 years." A 10 year or longer period was called for because vegetation conditions in the Lower Owens Basin react very slowly to change and part of the evaluation would be to determine if a 10 year period was long enough to determine needed changes or non-changes. The lease grazing plan calls for a non-grazed period in the riparian exclosure for a MINIMUM of 10 years. At the end of this 10 year designated period LADWP will evaluate whether the vegetation goals have been met and decide future management for the area.

The BMP for the Thibaut Grazing Lease was designed to meet all the above requirements and improve watershed health and prevent or reduce nonpoint source water pollution. Over time the BMP was to be fine-tuned as needed through the adaptive management process until MOU goals are met.

The grazing lease plan calls for an evaluation at the end or the designated 10 year non-grazed period for the riparian exclosure. Then LADWP would evaluate whether the vegetation goals have been met and then decide future management for the area. It is very definite that this evaluation process results must go through the Adaptive Management Process.

The 10 year period to be evaluated is a little confusing. The intent of the riparian exclosure was to conduct a 10 year non-grazing treatment test that would evaluate the Lower Owens River response to applied management. The applied river management started with the first seasonal habitat flow released in 2008. Thus, the ten year period would end in 2018 and an evaluation findings report would then go through the adaptive management process to determine if the riparian exclosure should or should not be grazed in 2019.

We are not sure when the grazing plan was finally implemented but assume it was implemented in 2006; after a pre-trial period to become accustomed to the new grazing requirements. Thus, the 10 year test period would be over in 2016 and the evaluation and adaptive management process would determine if the lease should or should not be grazed in 2017. Table 3 in the grazing lease plan also causes some confusion in determining the designated 10 year evaluation period in outlining that the Thibaut Riparian Exclosure will be in non-use until 2014. This infers that the lease would be evaluated at the end of 2014 grazing season and sent through the adaptive management process to determine if the lease should remain un-grazed in 2015 or opened up for grazing in 2015. The lease direction does allow management direction to be modified over time as long as it goes through the adaptive management process based on review of all monitoring information.

The MOU Consultants do not know at what stage we are in for the grazing evaluation process and we can only remember observing conditions one time during the past implementation years on this lease. Therefore, we cannot input into the evaluation process or be in position to process it through the adaptive management requirements at this time.

Our position is that the designated period needed to properly evaluate the riparian exclosure calls for 10 years of river treatment for comparison to 10 years of grazing and 10 years of no grazing treatments for valid evaluation purposes. Thus, the riparian exclosure should be evaluated in 2018 to determine if it should remain un-grazed or grazing allowed in 2019.

Thanks for the opportunity to comment.

*** These comments were received on January 30, 2014.

VIA EMAIL

Date: ***January 30, 2013 {sic}

From: Mark Bagley
Sierra Club 1997 Owens Valley MOU Representative
and Owens Valley Committee Consultant
<m.bagley@verizon.net>

–and–

Peter Vorster
Consulting Hydrologist with Owens Valley Committee and Sierra Club
<vorster@bay.org>

To: Bob Harrington,
Inyo County Water Department Director
<bharrington@inyowater.org>

–and–

Jim Yannotta
Manager of the Los Angeles Aqueduct, LADWP
<James.Yannotta@water.ladwp.com>

Subject: DRAFT LOWER OWENS RIVER PROJECT 2013 ANNUAL REPORT COMMENTS

This memo is being submitted on behalf of the Owens Valley Committee (OVC) and Sierra Club, parties to the 1997 Owens Valley MOU. It represents these organizations comments on the "Draft 2013 Lower Owens River Project Annual Report" released by Inyo County and LADWP in December 2013. That report was released in two parts. The first part was released on December 5th and consisted of the chapters on the 2013 monitoring work, weed control, etc (285 pages). The second part was the MOU Consultants 2013 LORP Adaptive Management Recommendations (72 pages), released on December 18th.

OVC and Sierra Club were assisted in this review by Mark Bagley (Sierra Club MOU Representative and former Executive Director of OVC), Peter Vorster (consulting hydrologist), and Dr. Duncan Patten (consulting ecologist). This memo has been authored by Mr. Bagley and Mr. Vorster. We are providing Dr. Patten's comments as a separate memo under his authorship. Brief biographies of the authors are provided in Attachment 1.

LORP Goals

The Lower Owens River Project (LORP) is, in addition to being a requirement of the Inyo-LA Long Term Water Agreement, a mitigation project in the Los Angeles Department of Water and Power (LADWP) 1991 EIR on water gathering activities to fill the Second Los Angeles Aqueduct. In that EIR it is presented as compensatory mitigation for numerous, diffuse and unquantified adverse environmental impacts due to groundwater pumping and surface water management practices of LADWP that occurred in Owens Valley from 1970, with the commencement of operation of the Second LA Aqueduct, to 1990. It is mitigation, so it requires all the attention and resources possible to help make it equal to or better than all the unquantified valley resources that were lost as set forth in the EIR and to meet the goals set forth and agreed to by the City of Los Angeles and LADWP in the 1997 MOU.

It is important to note that the LORP is not a "restoration" to previous conditions pre-1913. That would be impossible given the export of so much water from the system to Los Angeles. Rather, as the result of the 1997 MOU, the river was designed to be managed to achieve goals set forth in the MOU (see below) using certain agreed upon flows. What was agreed on was not a certain volume of water for the project, but flow rates: a 40 cfs minimum base flow in the river, year-round and throughout the river, and a spring seasonal habitat flow (SHF) with a peak flow of 200 cfs in average or above average runoff years and lower peaks in less than average runoff years. The timing, duration and ramping of the SHF was left to the recommendation of the MOU Consultants in their LORP Ecosystem Management Plan and to later adaptive management as needed to meet the goals of the project.

The overall goal of the LORP is provided in Section II. B. of the 1997 MOU (only the first paragraph is reiterated in the Annual Report, p. 1-3):

> "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 Goal of the LORP includes:
>
> 1. Establishment and maintenance of diverse riverine, riparian and wetland habitats in a healthy ecological condition. The LORP Action Plan identifies a list of "habitat indicator species" (Table 1, Attachment A) for each of the areas associated with the four physical features of the LORP. Within each of these areas, the goal is to create and maintain through flow and land management, to the extent feasible, diverse natural habitats consistent with the needs of the "habitat indicator species." These habitats will be as self-sustaining as possible.
> 2. Compliance with state and federal laws (including regulations adopted pursuant to such laws) that protect Threatened and Endangered Species.
> 3. Management consistent with applicable water quality laws, standards and objectives.
> 4. Control of deleterious species whose presence within the Planning Area interferes with the achievement of the goals of the LORP. These control measures will be implemented jointly with other responsible agency programs.
> 5. Management of livestock grazing and recreational use consistent with the other goals of the LORP."

Additionally, in Section II.C the MOU provides more specific goals for each of the four project areas:

> 1. "The goal for the Lower Owens River Riverine-Riparian System is to create and sustain healthy and diverse riparian and aquatic habitats, and a healthy warm water

recreational fishery with healthy habitat for native fish species. Diverse natural habitats will be created and maintained through flow and land management, to the extent feasible, consistent with the needs of the 'habitat indicator species' for the riverine-riparian system. These habitats will be as self-sustaining as possible. Management of flows in the riparian-riverine system will be consistent with the flow regime set forth below."

2. Delta Habitat Area. "The goal is to enhance and maintain approximately 325 acres of existing habitat consisting of riparian areas and ponds suitable for shorebirds, waterfowl and other animals and to establish and maintain new habitat consisting of riparian areas and ponds suitable for shorebirds, waterfowl and other animals within the Owens River Delta Habitat Area. Diverse natural habitats will be created and maintained through flow and land management, to the extent feasible, consistent with the needs of the 'habitat indicator species' for the Owens River Delta Habitat Area. These habitats will be as self-sustaining as possible."
3. Off-River Lakes and Ponds. "The goal is to maintain and/or establish these off-river lakes and ponds to sustain diverse habitat for fisheries, waterfowl, shorebirds and other animals as described in the EIR. Diverse natural habitats will be created and maintained through flow and land management, to the extent feasible, consistent with t h e needs of the 'habitat indicator species' for the Off-River Lakes and Ponds. These habitats will be as self-sustaining as possible."
4. Blackrock Waterfowl Habitat Area. "The goal is to maintain this waterfowl habitat area to provide the opportunity for the establishment of resident and migratory waterfowl populations as described in the EIR and to provide habitat for other native species. Diverse natural habitats will be created and maintained through flow and land management, to the extent feasible, consistent with the needs of the 'habitat indicator species' for the Blackrock Waterfowl Habitat Area. These habitats will be as self-sustaining as possible."

Comments on Progress Towards Achieving LORP Goals

The Annual Report represents a lengthy compilation and analysis of a tremendous amount of monitoring data but progress towards LORP goals and objectives over the life of the project cannot be easily discerned from the report. DWP and Inyo County as the LORP implementing agencies should use the Annual Report to inform the public and decision-makers whether LORP is achieving its goals and objectives and not merely as a check-the-box exercise in monitoring and flow compliance.

A clear assessment and analysis of progress towards project goals and objectives and whether the goals and objectives are sustainable should be included in the Annual Report and not relegated to the Adaptive Management Recommendations chapter. Taking the monitoring data and analyzing it to determine progress, or lack thereof, towards achieving project goals and objectives is a separate task from making adaptive management recommendations and one which is largely missing in the Annual Report. The management recommendations need to be based on the analysis of project outcomes determined from the monitoring data, i.e. the analysis of progress towards achieving project goals. In making adaptive management recommendations one needs to have some understanding why adequate progress is not being achieved, then suggesting actions to address that.

In assessing progress towards project goals, staff and consultants need to be clear about what those goals are. We have listed the goals above from the MOU. As an example of where this is not clear, there has been a persistent problem in understanding the goals for the Delta Habitat Area. In Chapter 3, Delta Habitat Area Assessment, the goal is stated as (page 3-1):

> "The management goal for the DHA is to **maintain or enhance** habitat conditions consistent with the needs of habitat indicator species (Ecosystem Sciences 2008). A minimum of 755 acres of vegetated wetland habitats will be maintained in the DHA under the Lower Owens River Project (LORP), which is the baseline acreage present prior to project implementation (LADWP 2004)." (emphasis added)

The problem with this is that it does not come from the goal in the MOU which states, in part:

> "The goal is to **enhance and maintain** approximately 325 acres of existing habitat consisting of riparian areas and ponds suitable for shorebirds, waterfowl and other animals **and to establish and maintain new habitat** . . ." (emphasis added)

Due to an inaccurate figure in the MOU of 325 acres of habitat that existed in 1996-97 when the MOU was negotiated and the delay in implementing the project, it was determined in the LORP EIR (LADWP 2004) that a new pre-project baseline would be determined; that is the 755 acres of vegetated wetland habitats cited above from page 3-1. What is missing from the goal statement from the Annual Report is the part in the MOU where the project should "establish and maintain new habitat" beyond the pre-project conditions.

This can make a difference when assessing whether the project is meeting its goals. However, from the data presented in Chapter 3, there has been an overall increase in total vegetated wetland habitats from the 2005 baseline of 755 acres, so the basic goal to establish new habitat is being met at this time. As noted in the report there has been a dramatic increase in alkali marsh and a dramatic decrease in alkali meadow in the Delta Habitat Area. The Chapter 3 Discussion (Section 3.12) contains a good explanation of the concerns that this raises.

Comments on the LORP Annual Report Review Process

As previously noted multiple times by MOU parties and others, including the MOU Consultants, the process for the LORP Annual Report review and the opportunity to provide meaningful input on the draft report including the adaptive management recommendations is flawed and needs to be addressed by the MOU parties. The Annual Report release date (which is typically in mid-December, just before the holidays), annual public meeting, and total review time of 30-40 days do not allow for adequate public review of the 350-plus page Annual Report and constructive dialogue with the public, MOU parties and consultants on the monitoring program, adaptive management recommendations, and report presentation. Every year the MOU parties go through a perfunctory process that inhibits providing meaningful input and helping to make the necessary adaptations to achieve LORP objectives in a cost-efficient manner. DWP's budgeting process and the Stipulation and Order should be not be used as an excuse for the current irrational timetable particularly if there are opportunities to make the program more cost-effective and increase the possibility of meeting the LORP goals.

The Annual meeting, scheduled for two hours, was allowed to go approximately 2 hours and 45 minutes because over 40 people showed up with many questions and comments. But it still was not sufficient for all the questions to be answered and the necessary dialogue with the public, MOU parties and consultants, particularly since the MOU consultants had not been asked to give a formal presentation on their extensive adaptive management recommendations. It also did not give enough prior time for review of the Annual Report, given that it is a very long and complex document and that many people take time off during the holidays in December. There is very limited time and opportunity at the Annual meeting or after we submit our comments to get feedback on some of our specific comments and recommendations.

Comments on Proposed Adaptive Management Changes to River Flows

Dr. Duncan Patten, a noted expert on ecological processes of riparian, wetland, and riverine ecosystems in the Western U.S., has assisted us in our review of the LORP riverine-riparian issues and the MOU Consultants' proposed adaptive management recommendations. We are providing Dr. Patten's comments as a separate memo under his authorship. OVC and Sierra Club fully endorse his analysis of the situation and his recommendations.

We are providing a brief listing here of our most important comments on the proposed changes to the LORP river flows. We believe that the pattern of river flows is the most critical issue that needs to be addressed in order get the project on a trajectory towards successfully meeting its goals. Hopefully, flow modifications can be made that will address the crucial issues of poor water quality, low recruitment and establishment of riparian trees, and over abundance of tules and cattails. For our more detailed flow comments see Dr. Patten's comment memo and our comments, below, on Chapter 11, Adaptive Management Recommendations, under our comments on specific sections.

1. It is clear from the analysis is Chapters 4 and 11 and Dr. Patten's memo that the current LORP flow regime will not result in the achievement of project goals and objectives.
2. Addressing LORP water quality should initially be the highest priority. The July 2013 LORP fish kill highlights the point that something needs to be done sooner rather than later to deal with LORP water quality. The water quality issue is affecting the ability to release high SHFs in June when temperatures are higher and the chance of a fish kill is greater than it is in May. Tree willow and cottonwood seed fly often occurs sometime in June, but if water quality is not addressed the ability to time the SHF in June and July as suggested by Dr. Patten and the MOU Consultants (see Figure 2.2.2) will be compromised due to the threat of a major fish kill.
3. After water quality improvements, priority should be given to adjusting SHFs to promote riparian tree recruitment and establishment, and to control tule and cattail growth. SHFs should be designed to mimic natural snow melt hydrographs for the Owens River, with peaks in the late spring to early summer period and decline from the peak into July. A periodic high pulse in later winter or early spring is also a feature of Owens River natural hydrographs.

The hydrograph presented in Chapter 11, Figure 2.2.2, and the hydrographs presented in Dr. Patten's memo provide a good starting point for discussions.

4. The MOU Consultants recommendation that flow releases be set equal to a 55 cfs average annual flow needs to be evaluated very carefully to determine if that is the best starting point for a new agreement on flows between the MOU Parties. The Annual Report does not provide adequate ecological justification for selecting this figure.
5. There needs to be a determination of appropriate base flows that would maintain a shallow alluvial aquifer in areas where woody riparian plants have recruited, or may recruit. Areas of actual or potential woody plant recruitment should be monitored for depth to water table.
6. There needs to be a determination of appropriate minimum winter base flows that would maintain the fishery in a healthy condition while acting to control tule and cattail growth.
7. Year to year variations in flows should be considered, not just seasonal variation. SHFs should occasionally (every 5 years or so) have a peak of about 300 to 400 cfs. In other years there should regularly be a SHF release with a peak in the 200 cfs range to act as channel maintenance flows that would aid in tule control and water quality. In extremely dry years SHFs and other pulse flows could be curtailed.
8. We strongly agree with the MOU Consultants recommendation to hold a River Summit meeting that would take a comprehensive look at the status of the LORP in achieving its goals, with the objective to achieve a common understanding and provide an informed basis for revising the MOU and Stipulation & Order.

OVC and Sierra Club are willing to work with the other MOU Parties and the MOU Consultants to find reasonable solutions. Given the analysis and adaptive management recommendations by the MOU Consultants and by Dr. Patten, it would seem there are opportunities for solutions.

Comments On Specific Draft Annual Report Sections

<u>Chapter 1- Executive Summary</u>

1. We recommend preparation of an executive summary or separate progress report that the interested public and decision-makers can more easily comprehend. The current executive summary is mostly a descriptive summary of what the different sections of the report covers and does not provide a summary overview of the program and progress towards the program goals and objectives. The summary should include quantitative and qualitative indicators presented in a comprehensible manner (with clearly defined metrics) to determine whether the monitoring results, to date, indicate whether the LORP is trending toward attainment and maintenance of the MOU goals. Specific MOU goals should be cited and progress towards attainment of those goals discussed.
2. In the first sentence it is stated that this is the seventh year of monitoring the LORP. However, later in the chapter it is stated that "2013 was the sixth year of monitoring the LORP" (p. 1-4). The latter is correct as the first LORP Annual Report was for 2008.
3. Also on page 1-4 in the second and third paragraph, incorrect chapter numbers are given for several of the chapters.

Chapter 2- Hydrologic Monitoring

1. Hydroclimatic Information
    a. As stated multiple times in previous comments, the Owens Valley runoff forecast and the actual monthly and annual runoff should be provided. Precipitation and air temperature data should also be provided (monthly and daily as appropriate). The hydroclimatic information is needed to explain the SHF magnitude and volume (determined by the runoff) and timing (seed release and avoidance of water quality problems).
    b. Data for unusual hydroclimatic events (such as the late July flash floods) that affect river flow should also be provided.
    c. Recommend that the hydroclimatic information for the current and the previous years be presented so that the runoff, precipitation, and temperature can be assessed over time and used in the gains and losses discussion and other analyses of trends over time.

2. Graphs, Narrative, Data Presentation
    a. In this chapter or the more comprehensible executive summary suggested above, hydrographs of the daily flow over the water year and short narrative to accompany the graphs would be useful (could use the graphs in the Chapter 2 appendix or even better are the graphs on p. 4-64 which show the flow over the last several years of the LORP at the intake; similar graphs should be done for all the stations).
    b. Should explain that in a dry year like 2013 the seasonal habitat flows (SHF) were lower than the flows later in the summer and also explain the need for releases from Alabama Gates in June just after the SHF presumably to insure flow compliance at the Pumpback stations.
    c. Recommend that a short synopsis of unusual flow events that affected river management and water quality conditions be included in this chapter. The Adaptive Management chapter should not be the only part of this Annual Report where that event is described. We note that appendix B in Chapter 6, Alabama Gates releases, provided a one-sentence description of the late July event.
    d. Peak Flow data - When there are significant flow changes within the day, the peak flow for the day should be provided along with the mean daily flow, e.g. releases from Alabama Gates. We would particularly like to see detailed flow data for the Alabama Gates releases in late July, such as hourly rates and peak flow for each day.
    e. Stage height data should be graphed and analyzed for the seasonal habitat flows. Change in stage height within the seasonal habitat flow period and over the life of the project is as meaningful as the discharge measurements.

3. Section 2.1 River Flows
    This section only provides the base flow requirements set forth in the July 2007 Stipulation & Order. It should be pointed out that those requirements were established so that there was

a clear procedure in place to ensure that the base flow requirement in the 1997 MOU was followed. The requirement in the MOU for LORP base flow is found in Section II.C.1.b.1:

> b. The flow regime within the riverine-riparian system will be as follows:
>
> 1. A base flow of approximately 40 cfs from at or near the Intake to the pumpback system to be maintained year round.

4. Section 2.2 Flows to the Delta and 2.2.1 Adaptive Management Results
   a. This section describes an alternative way of meeting the flows to the Delta in the March-April period by releasing it from the Intake, but it describes a flow regime at odds with what the MOU Consultants recommended by not releasing the appropriate amount at the Pumpback Station. Was the flow regime implementation discussed with the County and MOU Consultants beforehand? Did Inyo County agree to the implemented flow regime by DWP?
   b. Recommend that prior to implementing this pulse flow again, that the County and DWP respond to the MOU Consultants' analysis and critique of the flows to the Delta and come to a common understanding of how the adaptive management flow regime should be implemented.

5. Section 2.5 Gains and Losses
   a. This discussion would benefit by providing the annual and monthly gains and losses information from all the previous LORP years as was partially done in other annual reports (e.g. 2011 Annual Report provides all prior year annual losses).
   b. It appears that there is a misstatement on the top of p. 2-12 where it states "The decrease in losses is an unknown because up until this year the losses in the river had formed a correlation between runoff and river losses where the lower runoff years resulted in lower losses." The previous year's data suggest that lower losses occurred in the higher runoff years, not lower runoff years.

6. Section 2.6 Seasonal Habitat Flows
   a. An explanation for the specific SHF magnitude and volume (determined by the runoff) and timing (seed release and avoidance of water quality problems) should be provided (Chapter 6 –Alabama Gate releases provides some of that information).
   b. Regarding timing of the SHF, we could not find anywhere in the Annual Report how the determination was made to set the schedule for the SHF presented in Table 6. That should be provided. It is stated in the Land Management chapter that the SHF is "synchronized with seed fly of desirable tree willow species in an effort to facilitate widespread germination events . . ." (p. 4-62). We request that the protocol for determining when seed fly was expected to occur, and the observations made using that protocol in 2013, be provided in the Annual Report. We have made this request in the past and it has been ignored. The "LORP Monitoring, Adaptive Management and Reporting Plan" does not provide such a protocol. What happens now is that LADWP staff makes that determination based on factors unknown to the rest of the world.

c. As noted by the MOU Consultants, the SHF was so minimal it had no value and arguably should not be called an SHF since the Intake flows were higher a week later and arguably should have been that high anyway at the time of their release as evidenced by the Pumpback Station flow levels 13 days later.

d. It is also not clear from the narrative and graphs how the 13-day travel time for the SHF was calculated.

e. Stage height data should be graphed and analyzed for the seasonal habitat flows. Change in stage height within the seasonal habitat flow period and over the life of the project is as meaningful as the discharge measurements.

7. Section 2.7 LORP Hydraulics and Tule Distribution
This was a useful addition to this years report. It would also be helpful to present any data from mapping or aerial photography on the changes in tule distribution and acreage over the last decade given the concern about the affect the tules have had on achieving LORP objectives and the desire to control their extent.

8. Overall Summary of Hydrology and River Management
This chapter should also summarize lessons learned in river management and flow compliance over the life of the LORP in the different river reaches, different seasons and water year types. It was surprising, for example, to see that in the middle of June of 2013 the Pumpback Station came close to violating the Stip and Order requirement of at least 3 days of 40+ cfs over a 15 day period.

9. Section 2.9 Appendix 1
The river flow plots and table are helpful. Recommend that similar plots of absolute or relative stage height be shown. Also if Keeler Bridge station is still being monitored, would include its discharge and stage data in the appendix. Even thought that station is not one of the required compliance gaging stations, as noted in previous reports, Keeler Bridge gaging station provides “ideal conditions for water measurements” and provides more meaningful stage height measurements than the pumpback station. The pumpback station is the sum of 3 gages and so the stage height measurements are not as meaningful and there is more opportunity for error.

<u>Chapter 3- Delta Habitat Area (DHA) Assessment</u>

1. This chapter is very well done in its presentation of the 2013 monitoring data, comparing that data to earlier data, and in its discussion of the results. We appreciate the work done to correct and complete the landscape vegetation mapping that was begun in 2012.

2. Section 3.12 Discussion

   a. The data and discussion make it clear that periodic flooding of meadow habitats greatly increases the value of that habitat and usage by habitat indicator species. It is also stated in the discussion that "Intermittently flooded playa habitats are of high value to many indicator species . . ." The delta pulse flows were suggested by OVC and Sierra Club and adopted in the LORP plan for the purpose of providing that periodic flooding. We concur with the suggestion in the discussion that "The timing and magnitude of the pulse flows should be re-evaluated to determine if these are still optimum for the goals of maintaining and enhancing habitat for indicator species in DHA." The MOU Consultants a few years ago recommended making some changes to the timing and magnitude of the pulse flows. That recommendation was not accepted and they have not included it in their 2013 adaptive management recommendations. We support the re-evaluation of these flows and suggest that the MOU Consultants consider including that in their recommendations. This evaluation is for the benefit of those pulse flows in the DHA, which is a separate consideration than what the Consultants have recommended this year for where the pulse flows should be released.

b. It is pointed out that there is no recent documentation of conditions in the DHA during pulse flow events and that the only information on the extent of flooding over time has been the field observations taken during wetland avian censuses. This kind of documentation would be very useful in considering the proper magnitude of the pulse flows. Monitoring the extent of flooding for each pulse flow should be done to document the effects that the 2014 pulse flows have.

c. We concur with the statement: "Documentation of conditions of the DHA at various times of the year through aerial photos or other means would aid in the evaluation of indicator species habitat and avian census data." This should be done and should be used to document conditions during pulse flow events and at times in between those events.

3. Section 3.1- There seems to be a word missing near the end of the paragraph where it says ". . . as sheet flow over sparsely ____ playa in the brine pool transition area . . ."

<u>Chapter 4- Land Management</u>

1. There is a vast amount of data here reflecting a tremendous amount of good work. This is very informative. We appreciate the new location maps for the streamside monitoring transects (Figures 9-12, btw Figure 10 is missing its number). There are some formatting problems that need correcting with sections not being numbered correctly and the page numbers in the Table of Contents not being correct.
2. The discussion of the streamside monitoring is very good and provides a detailed understanding of how the recent flow patterns have negatively impacted establishment of trees and shrubs. Figures 21 and 22 are very revealing and will contribute greatly to the discussion of modifications to current flow management. We suggest similar hydrographs be prepared for each of the flow measuring stations to shed light on how the flows move through the river and affect the different reaches.
3. In 2013 LADWP and ICWD prepared a "LORP Adaptive Management Response to the Lone Pine Fire." The plan called for a modest amount of tree willow pole planting and seeding. The plan called for monitoring to be done in LADWP's ongoing range monitoring program. We did not find a discussion of the monitoring for this plan. There is information from some of the streamside monitoring transects about plant growth following the fire, but there is nothing presented on the tree willow pole planting and seeding efforts and no discussion of the results. There should be a report on the fire plan in the annual report. The only mention is in the Adaptive Management Recommendations where it is stated that the willow pole

plantings and seeding appear to have been unsuccessful (Chapter 11, p. 59). We agree with the MOU Consultants recommendation "that the City and County review the results of their restoration efforts on the Lone Pine burn to determine why seeding and pole planting had little success. Given the condition throughout the river corridor, there may be a need for such restoration actions in the future and what does or does not work should be evaluated" (Chapter 11, p. 60).

<u>Chapter 5- Rapid Assessment Survey</u>

1. This is a very important component to LORP monitoring and should continue.
2. Woody Recruitment- Table 1 indicates that what is cataloged is the current year's cohort of willow and cottonwood seedlings. We concur with the MOU Consultants recommendation that woody recruitment be examined more closely and with greater specificity (Chapter 11, Section 11.2.10).
3. Woody Establishment- Woody species recruitment is only part of the equation. Seedlings need to survive and become established after the first years' growth. We suggest that you consider adding an observation type to the RAS that would record young tree saplings and not just the current year's seedlings. These would probably be 1-3 year old plants, you could categorize them by height, i.e. < 1m, 1-2m, 2-3m.
4. Russian Olive- This is a highly invasive species in riparian systems; in some places in the southwest a bigger problem than saltcedar. So far that has not been the case in the Eastern Sierra, but there is still potential for serious problems with Russian olive invasions. Table 1 indicates that seedlings and juveniles (height <2m) are recorded by the RAS. However on p. 5-9 it is stated that what is recorded is "all recruitment (plants <1m)." It does not appear that survivorship of the recruits is followed in time. Again, establishment is part of the equation, not just recruitment. We suggest that the RAS track new recruitment sites of Russian olive for an additional 2-3 years to determine if successful establishment has occurred. An alternative would be to just pull up new recruits when they are found, then you don't need to track them and they will not become established and become a problem.

<u>Chapter 6- Alabama Gates Flow Releases</u>

5. Staff from the Lone Pine Tribe environmental office collected water quality measurements in the Owens River below the Alabama Gates starting on July 26 and they shared that data with ICWD staff. The measurements taken by ICWD and presented in this chapter were collected July 30-August 1. The analysis in this chapter should also use data collected by others and available to ICWD to give a more complete picture of the water quality situation related to the late July releases from the Alabama Gates.
6. Our understanding is that with a large release of water from the Alabama Gates much of it flows to the river essentially as sheet flow over the pasture lands between the river and the Alabama Gates release site. As it does that what happens to the quality of the water by the time it reaches the river? Presumably the sheet flow would warm the water, allow it to interact with the soil and organics on the surface. What would be the benefit to water

quality, if any, of training the channel as recommended by the MOU Consultants in Chapter 11, Section 11.2.7?

Chapter 7- LORP Creel Survey

1. We understand that LADWP organized the 2013 creel survey and that there was no coordination with ICWD or the MOU Consultants. This should not have happened and should not happen in the future.
2. Due to the late July fish kill below the Alabama Gates, we concur with the MOU Consultants recommendation that a creel survey be conducted in 2014 using the protocols that have been used in the past (Chapter 11, Section 11.2.6). This will provide some data that can be used to evaluate the condition of the fishery in area affected by the late July fish kill and get an idea of the effect of that event.

Chapter 8- Weed Report

1. Good progress has been made with limited resources. We believe it is essential to keep this program going into the future. *Lepidium latifolium* in particular poses a very serious threat to the system if it is not controlled. Control of *Lepidium latifolium* must remain a management priority.
2. Table 1- We suggest that a column be added to the table showing the number of sites with weed growth (total number of sites - sites with no growth).
3. Chart 1- The beginning of the LORP re-watering is incorrect. Base flows were established in 2007.

Chapter 9- Saltcedar Control Program

We very strongly support the work done by County staff in the saltcedar control program. We are concerned that their grant funding ends later this year and strongly urge the County and LADWP to seek additional grants and funding to support this program.

Chapter 11- Adaptive Management Recommendations

We agree with many of the adaptive management recommendations and the urgency that is needed to expeditiously address the threats to the river (e.g. poor water quality and fish kills) and the non-attainment of the LORP goals (e.g. riparian habitat development). The MOU Consultants recommendations that base flow and peak SHF requirements of the MOU should be rescinded in favor of an alternative flow regime are appropriate as they are based on the needs of the river and directed to reaching the project goals and objectives. Our thoughts on these recommendations are presented below.

However, the recommendation to rescind all legal and mandated restrictions on the amount of water the Pumpback Station can pump out of the Lower Owens River is a policy decision that the MOU Parties need to make that is not based on the needs of the river and of reaching project goals. Therefore, it is not an appropriate recommendation for the MOU Consultants to make. It is something that the Parties spent considerable time discussing a couple of years ago and OVC and Sierra Club are open to renewing those discussions.

The following are a few overall comments on Chapter 11 followed by comments on some of the specific sections and recommendations.

1. We appreciate that the adaptive management recommendations are specific and detailed. Where appropriate an explanation of the hypothesis being tested and the monitoring and feedback loop that will be implemented should be clearly delineated.
2. As noted above we do not think the Annual Meeting provides sufficient opportunity to have a detailed technical discussion of the adaptive management recommendations and recommend that meeting(s) of the MOU parties be convened to go over the recommendations both prior to the finalization of monitoring work plans and after the runoff forecasts are issued and the SHFs can be quantified.
3. As discussed in the last four annual meetings, we would also like to see a timely and detailed response from the implementing agencies of which recommendations were adopted, adopted with modifications, or not adopted along with an explanation for why they were modified or not adopted. The cursory responses to the MOU Consultant recommendations provided last year offer little explanation and they were for the decisions made the previous year on the 2011 Annual Report recommendations – not timely. Therefore, we would like to have the explanations for the recommendations from last year's 2012 LORP Annual Report included in this years Annual Report. We request that this spring you provide an explanation for this year's recommendations shortly after you have made a decision on them. It is not timely to wait until the end of the year to include it in the 2014 annual report.

<u>Section 11.0- Executive Summary</u>
We appreciate the executive summary and would like to have seen a condensed version of the progress on the goals and objectives that was in the next section (Section 11.1) included in this summary. This is the kind of summary that is needed for the entire Annual Report and we recommend that the County and DWP plan to incorporate this into the Final 2013 LORP Annual Report and in future annual reports.

<u>Section 11.1- Adaptive Management of the LORP</u>
We appreciate the review of the goals and objectives and the summary of progress towards attaining them in Table 1.2, however we have several questions on the table and summary.

1. Fishery - given the fish kill in 2013 and the threat of future fish kills, whether it is appropriate to show it in the “attained” category. It is footnoted in the Table but the threat of future fish kills is not included in that footnote.
2. Delta Habitat Area - we recommend that this is separated into compliance and effectiveness as was done with the SHF and Base flow. As noted on pp. 36-37 of this report the Delta Habitat Area flow release in the spring of 2013 was not implemented as was recommended by the MOU Consultants so the compliance attainment is questionable and should be noted in this table.

3. We recommend that progress towards achieving an objective should also be summarized with agreed-upon metrics and indicators, where appropriate. Are the specific metrics for assessing progress on the LORP goals and objectives clearly defined and agreed-upon? This brings up the question we raised earlier about the need to have a separate analysis of the progress towards attaining LORP goals and objectives. This Table presents the Consultants views on attainment of the goals, but the report does not provide the analysis for all of the objectives that led to the rating in this table.

<u>Sections 11.2.1, 11.2.2, 11.2.4- Base Flow and Seasonal Habitat Modifications, Amending the MOU, FEIR, and Stip and Order</u>
We understand and agree that changes to the base flow and SHF requirements may be needed to improve river conditions. There needs to be a clearer ecological justification for the recommendation of adopting the 55 cfs average annual flow, which is the 2007-2013 average flow, as the basis for a new flow regime. The 2007-2013 average release includes the base flow and SHFs over a series of dry and wet years (with Owens Valley runoff in that period skewed to the drier side). More explanation of how the recommended flow regime will attain the MOU goals and objectives is needed and the possible trade-offs that may need to be made between potentially competing objectives.

Figure 2.2.2 on p. 23 provides a helpful "conceptual" example hydrograph and although it raises a lot of questions, it is a useful starting point for dialogue. However, there are several aspects of the example hydrograph that suggest that 55 cfs average annual flow may not provide enough water to meet the objectives. Also, the Figure 2.2.2 caption states the hydrograph in red represents an average annual flow of 55 cfs, but the label in the figure is 58 cfs. This is a difference of over 2,000 acre-feet per year. Please correct.

For example, flows from the intake shown for August and September may be too low to provide adequate flows for the fishery in the lower reaches. If so, flows will need to be increased in this time period or augmented from downstream sources such as the Alabama Gates. If that is the case reductions elsewhere in the hydrograph would need to be made to keep the total flow at the 55 cfs annual average target. If we are to agree to a new paradigm, that of having a fixed volume of water allocated to the project, there need to be some additional analyses on the needs of the project to meet project goals.

The recommendation of the 55 cfs long-term average flow implies, but is not explicitly stated, that the flow in a wet versus a dry year could be significantly different. Further elaboration of the recommendation and how much inter-annual variation might occur should be provided. Conceptual hydrographs for a wet, dry and average year could be helpful.

These sections provide good explanations of why the past six years interpretation and implementation of the various legal mandates have not worked well for the river and not advanced many of the MOU goals and objectives, but some of the problem may be in the interpretation and implementation and not in the legal mandates themselves which were crafted over many years of negotiation with the assistance of the MOU Consultants.

We agree that a different flow regime is needed and that some on-the-ground actions will need to be taken (e.g. training Alabama Gate releases, tule clearing), but in some cases more detail is needed to design the best flow regime and actions within the constraints of the different MOU Parties' interpretation of the guiding legal agreements. We are concerned that the MOU Consultants are making policy/legal interpretations about some of the possible volumetric constraints of the legal mandates.

The information in Table 2.2.8 on p. 21 comparing the SHF intake release and the Pumpback station flow in the different years is helpful, but showing the resulting six-year average is misleading if the purpose is to show the attenuation of the releases over time. The average does not need to be included in the table.

Section 11.2.3 Flow Management Changes to Minimize Future Fish Kills

1. Comments on the July Fish Kill. From July 22-25, 2013 LADWP released substantial flows from the Alabama Gates to the Lower Owens River because of aqueduct maintenance. These flow releases were much higher than LADWP had originally planned due to major thunderstorms and flash flooding that put a lot of water into the aqueduct. Clearly it was a poor decision by LADWP to schedule the aqueduct work in July when thunderstorms and flash flooding are always a risk. In fact thunderstorms and flash floods were forecast for the area the week before the work was to begin and it was another poor decision to not postpone the work due to that threat.

   LADWP did not inform Inyo County, the MOU Consultants or the MOU Parties of their planned July maintenance and plan to dry up the aqueduct below the Alabama Gates in order to conduct that maintenance. Inyo County Water Department staff (ICWD) learned about the releases after a fish kill in the Lower Owens River was reported to them (not by LADWP) four days after the first releases from the Alabama Gates. The pulse of water released from the Alabama Gates predictably resulted in extremely low dissolved oxygen levels and the death of hundreds if not thousands of fish in the Lower Owens River.

   The July fish kill is barely mentioned in the Annual Report jointly produced by LADWP and Inyo County. There is a brief appendix on dissolved oxygen and temperature monitoring performed by Inyo County Water Department for several days, but only after the fish kill was reported and more than a week after the flows were released from the Alabama Gates. No one was monitoring water quality for the first three or four days of the releases.

   In Chapter 11, Adaptive Management Recommendations, the MOU Consultants do discuss the fish kill incident. It is important to disclose and analyze the fish kill, not only to document it, but also to learn from the situation so it doesn't happen again. The fish kill alerted the public that little to no communication occurs between LADWP and Inyo County when LADWP embarks on projects such as non routine maintenance or alterations that affect where they put water, even when it is for a jointly managed project such as the LORP.

   OVC and Sierra Club believe that disclosure according to the California Environmental Quality Act (CEQA) should have been done for this repair project and planned release from the Alabama Gates; there should have been advance planning done with ICWD staff; and MOU parties, the public, and agencies should have been informed, including the Lahontan Regional Water Quality Control Board and California Department of Fish and Wildlife. LADWP and ICWD should have had personnel monitoring the diversion of the LA Aqueduct water, and a contingency plan should have been in place in case something went wrong. By detailing and analyzing the event in the annual report, the parties and public at large would have the opportunity to propose management changes to avert potentially disastrous future events.

The MOU Consultants state: "As a consequence of the fish kill below Alabama Gates in 2013, the present and future health of the fishery in the lower river is in question." (Chapter 10, Table 1.2) This incident, monitoring data, and statements by the MOU Consultants indicate a riverine environment with water quality often on the brink of degeneration to a state incapable of supporting animal life. The MOU Consultants have for several years now been recommending that changes be made in the LORP riverine flow regime to improve water quality, to prevent the kinds of events that happened in July and to allow the SHF to occur as needed in June without the danger of causing critical declines in water quality that would result in a major fish kill.

OVC and Sierra Club acknowledge this condition and we have supported the Consultants recommendations in the past to deal with this, but those adaptive management recommendations have not been approved by LADWP and Inyo County. This fish kill brings home the point that something needs to be done sooner rather than later to deal with LORP water quality.

2. We agree with the Consultants recommendations in this section.

<u>Section 11.2.5 Delta Habitat Flows Modifications</u>

1. We concur with the Consultants recommendations that Delta pulse flows in the cooler months be released from the intake instead of the Pumpback Station. This would use little more or no additional water and should provide some benefit to improving water quality. Water quality monitoring should be conducted when these flows are released to monitor their efficacy.
2. We urge the MOU Consultants to recommend and the County and City to accept the suggested changes recommended in the Chapter 3, Section 3.12 Discussion:
    a. "The timing and magnitude of the pulse flows should be re-evaluated to determine if these are still optimum for the goals of maintaining and enhancing habitat for indicator species in DHA." This evaluation is for the benefit of those pulse flows to the DHA, which is a separate consideration than what the Consultants have recommended this year for where the pulse flows should be released.
    b. Monitoring the extent of flooding for each pulse flow should be done to document the effects that the 2014 pulse flows have. It is pointed out in Section 3.12 that there is no recent documentation of conditions in the DHA during pulse flow events and that the

only information on the extent of flooding over time has been the field observations taken during wetland avian censuses. This kind of documentation would be very useful in considering the proper magnitude of the pulse flows.

c. "Documentation of conditions of the DHA at various times of the year through aerial photos or other means would aid in the evaluation of indicator species habitat and avian census data." This should be done and should be used to help document conditions during pulse flow events and at times in between those events.

Section 11.2.6 Creel Census

We agree with the Consultants recommendations in this section.

Section 11.2.7 Alabama Gates Spillway

We agree that the attenuation of flows through the Island areas needs to be addressed and that there may be one or more physical solutions which will allow higher magnitude flows in the river reaches below the Islands, which is essential for improving the riverine-riparian corridor and riparian tree recruitment in those downstream river reaches. The February 2008 release from Alabama Gates demonstrated that higher releases can be provided to the downstream river reaches.

1. We agree that "training" the flow from the Alabama Gates to the river is one possible solution to increase the flow to the lower river and help control the spread of tules on the flats. This is a recommendation that we have supported in the past and urge LADWP and the County to evaluate its utility and feasibility. It appears that "training" the flow would have the added benefit of reducing the outbreak of mosquito populations when releases are made in the warmer months. The sheet flow from the late July 2013 releases caused standing water and increased mosquito breeding habitat posing the risk of infection of West Nile Virus and Viral Encephalitis to the human populations in Lone Pine and Independence. After the July releases there was the need for Inyo County to fog Lone Pine twice and Independence once to diminish the public health threat thus exposing the populations of these two towns to the pesticide.
2. We also recommend that an evaluation of the Islands area channels including the plugged East side channel is warranted. This evaluation would include assessing the historic and current capacity of the existing multiple channels through the Islands and recommending sustainable fixes to increasing their current capacity so that higher flows from upstream of the Islands will not be so greatly attenuated by their spreading over a wide area by what are very modest flows compared to historic natural flows. Restoring historic channels in the Islands could still maintain its value as a wooded wetland but should reduce the acreage of tules which increase water consumption and decrease feed for livestock.

Section 11.2.8 Tule and Cattail Management

We agree with the Consultants recommendations in this section. This should be a priority.

Section 11.2.9 Blackrock Waterfowl Management Area

We agree with the Consultants recommendations in this section.

Section 11.2.10 Rapid Assessment Survey

1. We concur with the MOU Consultants recommendation that woody recruitment be examined more closely and with greater specificity. We suggest that you consider adding an observation type to the RAS that would record young tree saplings and not just the current year's seedlings. These would probably be 1-3 year old plants, you could categorize them by height, i.e. < 1m, 1-2m, 2-3m.
2. We recommend that the RAS track new recruitment sites of Russian olive for an additional 2-3 years to determine if successful establishment has occurred. An alternative would be to just pull up new recruits when they are found, then you don't need to track them and they will not become established and become a problem.

Section 11.2.11 Monitoring
We agree with the recommendation to do the vegetation monitoring and the evaluation of the indicator species. The information is needed to track progress on LORP goals and objectives. Hopefully one of the results of the vegetation monitoring will be a quantitative assessment of the change in tule distribution and acreage over time. That information is helpful in assessing cost-effective actions to control tules and the increased water loss that they engender. We also recommend that there be a periodic review of the monitoring to see if it is cost-effective and efficiently designed to tracking the overall LORP goals and objectives and the more specific goals and objectives of the Seasonal Habitat Flows.

Section 11.2.12 River Summit
We agree with the suggestion of a "River Summit" workshop (including field visits) that would cover current river conditions, progress on the LORP, ways of making the monitoring more targeted and cost-effective, and the adaptive management proposals. It should include all the MOU parties and strive to achieve a common understanding and provide an informed basis for revising the MOU and Stip and Order. Part of the "River Summit" should be geared to interested members of the public and decision-makers.

Section 11.2.13 Communication
We agree that there is great need to improve the communication among the MOU parties and with the interested public. It is clear the current process does not foster meaningful and informed dialogue and build the necessary trust that will be essential to make any changes in the MOU and Stip and Order. There were several instances this year where it was also clear that communication between LADWP and ICWD staffs was lacking, i.e. the creel census and the July water releases from the Alabama Gates. This should be addressed by management.

Section 11.2.14 Range Monitoring
We agree with the Consultants recommendations in this section.

Chapter 12- Glossary
Inspection of the glossary of terms shows it is mostly a listing of the acronyms used in the report and not a true glossary. There are also several incomplete entries.

Comments on the Proposed Southern Owens Valley Solar Ranch Project

In August 2013, LADWP released a draft Environmental Impact Report disclosing the proposed construction of an industrial-scale photovoltaic solar facility on 1,200 acres of LADWP land located within the LORP area boundary. This project, the Southern Owens Valley Solar Ranch (SOVSR), lies a mere 0.5 – 1.5 miles east of the Lower Owens River. The solar project has the potential for significant effects on the Lower Owens River and its adjacent lands. Among the concerns raised in the OVC comment letter on the project Draft EIR are potential impacts from vegetation clearing and resulting dust emissions and stormwater runoff into the Lower Owens River, use of herbicides to keep the solar project area free of vegetation and of dust palliatives and the potential affects off site from the use of these chemicals in such close proximity to the river, and effects from pumping new wells to supply the project.

The Owens Valley Committee's comments on LADWP's Draft SOVSR Project EIR were submitted in November and are available on the OVC website: <http://ovcweb.org/docs/Owens%20Valley%20Committee%20LADWP%20Solar%20Project%20DEIR%20Comments%20final.pdf >.

LADWP's proposed solar project is in direct conflict with the LORP plan and with LADWP's Owens Valley Land Management Plan (OVLMP). Converting 1,200 acres of open space and ephemeral grazing land to industrial development does not contribute to the LORP goals of providing for continued sustainable uses (including recreation, livestock grazing, agriculture, and other activities), promotion of biodiversity and healthy ecosystems, and protection and enhancement of sensitive species and their habitats within the LORP management area.

LADWP must take seriously the mitigation and other sustainable land management goals. The MOU parties should meet and discuss the proposed solar project, because it is inconsistent with both LORP management and LADWP's land management plan for lands outside the LORP area.

We thank you for the opportunity to comment on the LORP Annual Report. With such a large report and a relatively short time for us to digest its contents and make comments, we have not been able to address everything. However, we do think our comments and those of Dr. Patten cover the most important issues. We hope that you take these comments into consideration as you move forward with this process.

Sincerely,

Mark Bagley and Peter Vorster
for OVC and Sierra Club

cc: Larry Freilich, ICWD
Brian Tillemans, LADWP
Dave Martin, LADWP
MOU Party Representatives:
Carla Scheidlinger
Colin Connor, State Lands Commission
Lacey Greene, California Department of Fish and Wildlife
Sally Manning, Owens Valley Committee
MOU Consultants:
Bill Platts
Mark Hill

ATTACHMENT 1

About the Authors

OVC and Sierra Club were assisted in this review by its consultants Mark Bagley, Peter Vorster, and Dr. Duncan Patten. This memo has been authored by Mark Bagley and Peter Vorster. We are providing Dr. Patten's comments as a separate memo under his authorship.

Mark Bagley. Mr. Bagley has been self-employed as a Consulting Botanist for thirty years, working on natural resource surveys and environmental assessment, impact and mitigation reports and specializing in vegetation and rare plant studies in the Mojave Desert and Eastern Sierra of California. He has extensive experience working on rare plant studies at China Lake Naval Weapons Center, Fort Irwin Army National Training Center, and Edwards Air Force Base. Mr. Bagley has worked on many energy and utility projects, including the Coso Geothermal Area, LUZ solar power plants at Kramer Junction and Harper Lake, Bright Source Ivanpah Valley solar project, fiber optic cable installation projects from Inyokern to Bridgeport and from Adelanto to Las Vegas, and several long electric power transmission lines and natural gas pipelines. He holds B.A. and M.A. degrees in Botany from the University of California, Santa Barbara. He has been active with local environmental groups since 1985 and has been involved with OVC and Sierra Club efforts on Owens Valley water issues since the late 1980's. Mr. Bagley represented Sierra Club in the negotiations that led to the 1997 MOU and has been the Club's MOU Representative since its inception. From 2005 to 2012 he also served as the OVC Policy Director and in 2012-2013 was Executive Director of OVC. Mr. Bagley is now a consultant with OVC and is the Sierra Club Range of Light Group Owens River Watershed Conservation Chair.

Peter Vorster. Mr. Vorster has over 38 years of experience as a hydrologist and hydrogeographer, primarily working in the Mono-Owens watersheds and San Francisco Bay-Delta Watershed. He is a Consulting Hydrologist based in Oakland, California and a Senior Scientist with The Bay Institute, San Francisco, California, a public interest research and advocacy group focused on the protection and restoration of the San Francisco Bay-Delta estuary and its inflowing rivers. Currently, Mr. Vorster leads the technical effort on the San Joaquin River restoration program for The Bay Institute and is involved in both water supply and restoration efforts. He holds an A.B. degree in Geography and Geology from the University of California, Berkeley, an M.A. in Geography from California State University at Hayward, and has completed Ph.D. coursework in Environmental Planning at the University of California, Berkeley. His 1985 master's thesis, "A Water Balance Forecast Model for Mono Lake, California" was judged by a court-appointed Special Master to be the most complete and accurate representation of the water balance of the Mono Basin. From 1979 to 1982, Mr. Vorster assisted Philip Williams in his role as special hydrological consultant to Inyo County in the County's CEQA litigation over LADWP's water gathering to fill the Second LA Aqueduct. Since 2005 he has served as a consultant to OVC and Sierra Club on hydrology and water management in Owens Valley. He has assisted with the review of each of the LORP Annual Reports. Mr. Vorster has been a consultant to the Mono Lake Committee since 1979.

Duncan Patten. Dr. Patten is Director of the Montana Water Center and Research Professor with the Department of Land Resources and Environmental Sciences at Montana State University, Bozeman. He is also Professor Emeritus in the School of Life Sciences and past director of the Center for Environmental Studies at Arizona State University, Tempe. Dr. Patten holds an A.B. degree from Amherst College, an M.S. from the University of Massachusetts at Amherst, and a Ph.D. in Botany-Ecology from Duke University. His research interests include arid and mountain ecosystems, especially the understanding of ecological processes of riparian, wetland, and riverine ecosystems. Research in this arena included hydroecological studies of riparian systems along Eastern Sierra streams including Rush Creek, Bishop Creek and the Upper Owens River. He was Senior Scientist of the Bureau of Reclamations Glen Canyon Environmental Studies, overseeing the research program evaluating effects of operations of Glen Canyon Dam on the Colorado River riverine ecosystem. He is a Fellow of the American Association for the Advancement of Science and the Ecological Society of America. He has been a member of the National Academy of Sciences/National Research Council (NAS/NRC) Board on Environmental Studies and Toxicology; the NAS/NRC Commission on Geoscience, Environment and Resources, and eleven NAS/NRC committees, chairing two; one being the Mono Basin Ecosystem Study. A short resume for Dr. Patten is included with his memo.

Dr. Patten has served as a consultant to OVC and Sierra Club on the monitoring and adaptive management of the LORP since 2006. He reviewed and provided comments on drafts of the MOU Consultants' LORP Monitoring, Adaptive Management and Reporting Plan, and has provided review and comments on the previous 2010 and 2011 LORP Annual Reports.

10.4 2012 Draft LORP Report Comments

The following letter was received after the end of the comment period for the 2012 Draft LORP Report.

Date: January 31, 2013

From: Mark Bagley
Owens Valley Committee Executive Director
and Sierra Club 1997 Owens Valley MOU Representative
<m.bagley@verizon.net>
–and–
Peter Vorster
Consulting Hydrologist with OVC and Sierra Club
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To: Bob Harrington,
Inyo County Water Department Director
<bharrington@inyowater.org>
–and–
Jim Yannotta
LADWP Los Angeles Aqueduct Manager
<James.Yannotta@WATER.LADWP.com>

Subject: LOWER OWENS RIVER PROJECT 2012 DRAFT ANNUAL REPORT COMMENTS

This memo is being submitted on behalf of the Owens Valley Committee (OVC) and Sierra Club, parties to the 1997 Owens Valley MOU. It represents our comments on the "2012 Lower Owens River Project Draft Annual Report" released by Inyo County and LADWP in mid-December 2012. We were assisted in this effort by Peter Vorster, our consulting hydrologist. His comments are incorporated into this memo.

Comments on Progress Towards Achieving LORP Goals

As we have stated in the previous years oral and written comments, the annual report represents the compilation and analysis of a tremendous amount of data, but progress towards LORP goals and objectives over the life of the project cannot be easily discerned from the report. A clear assessment and analysis of progress towards these goals and objectives and whether the goals and objectives are sustainable is lacking.

Page 1-3 of the Annual Report provides the overall goal of the LORP, as stated in 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."

This goal is stated in MOU Section II. B. Goal of the LORP. However, following the passage quoted in the Annual Report is the following which provides some more specificity:

> "The Goal of the LORP includes:
>
> 1. Establishment and maintenance of diverse riverine, riparian and wetland habitats in a healthy ecological condition. The LORP Action Plan identifies a list of "habitat indicator species" (Table 1, Attachment A) for each of the areas associated with the four physical features of the LORP. Within each of these areas, the goal is to create and maintain through flow and land management, to the extent feasible, diverse natural habitats consistent with the needs of the "habitat indicator species." These habitats will be as selfsustaining as possible.
> 2. Compliance with state and federal laws (including regulations adopted pursuant to such laws) that protect Threatened and Endangered Species.
> 3. Management consistent with applicable water quality laws, standards and objectives.
> 4. Control of deleterious species whose presence within the Planning Area interferes with the achievement of the goals of the LORP. These control measures will be implemented jointly with other responsible agency programs.
> 5. Management of livestock grazing and recreational use consistent with the other goals of the LORP."

Outside of Chapter 10, there are only two places we have found where these more specific goals are mentioned. In stating the purpose of the seasonal habitat flow in Chapter 3 the goal (number 1, above) to "create and maintain, to the extent feasible, diverse natural habitats consistent with the needs of the 'habitat indicator species.' " is mentioned. (Annual Report, p. 3-1) However, in Chapter 3 there is no further mention of any of the indicator species. A word search of the Annual Report for "indicator species" turned up only this one use of the term in the text of the report outside of Chapter 10.

In Chapter 7, goal number 4, above, is referred to in the statement that saltcedar "has the potential to interfere with the LORP goals of establishing a healthy, functioning Lower Owens River riverine- riparian ecosystem." This kind of reference to specific LORP should be included in most every chapter and the data collected related back to the goal.

In Chapter 10 there is mention of habitat indicator species, but no discussion of any data, past or present, that supports statements such as "Habitat for all indicator species continues to develop. Biodiversity in wetlands and riverine habitats has increased." And, "LORP indicator species numbers have increased" (Annual Report, Ch. 10, p. 3 and p. 25, X.2.12) If such statements are made they should be supported by data that can be referenced in the current report or in previous annual reports.

We are concerned that the data presented does not show very much recruitment of riparian tree species. The new work being done as part of the land management monitoring to collect data on woody species recruitment provides better data on this important part of the habitat development. But, more than half of the riverine-riparian habitat indicator bird species need riparian forest habitat and this data and the RAS data do not seem to indicate that much of this habitat type is developing yet. Yet, in Chapter 10, the statements cited above seem to indicate that all is well with the habitat indicator species. Where is the data that indicates that the indicator species Yellow-billed cuckoo has increased in numbers or that its habitat "continues to develop?" Or where is the data to support developing habitat or increase in numbers of the indicator species Owens pupfish and Owens tui chub?

Overall Comments on Presentation and Analysis

1. We recommend preparation of an executive summary or separate progress report that the interested public and decision-makers can more easily comprehend. The current executive summary is mostly a descriptive summary of what the different sections of the report covers and does not provide a summary overview of the program and progress towards the program goals and objectives. The summary should include quantitative and qualitative indicators presented in a comprehensible manner (with clearly defined metrics) to determine whether the monitoring results, to date, indicate whether the LORP is trending toward attainment and maintenance of the MOU goals. Specific MOU goals should be cited and progress towards attainment of those goals discussed.
2. We note that a glossary of terms was included in the report but inspection of it shows it is mostly a listing of the acronyms used in the report and not a true glossary.
3. Stage height data should be graphed and analyzed for the seasonal habitat flows. Change in stage height within the seasonal habitat flow period and over the life of the project is as meaningful as the discharge measurements.

Comments On Specific Sections

Chapter 2- Hydrologic Monitoring

1. Either in this chapter or the next chapter on the seasonal habitat flow, the Owens Valley runoff forecast and actual runoff should be presented, including the daily and monthly runoff pattern especially during the seasonal habitat flow period. Air temperature data should also be presented.
2. In this chapter or the more comprehensible executive summary suggested above, a short narrative analysis of the flow variability through the different seasons to accompany all the data would be useful. It would, for example, explain in a dry year like 2012 the seasonal habitat flows were lower than the flows later in the summer and also explain the need for the periodic releases from Alabama Gates. The graphs and tables are very helpful but a short narrative story of what they are telling would be helpful to the interested public and decision-makers.

Chapter 3- Seasonal Habitat Flow Report

1. As discussed at the annual meeting, it would be helpful to provide more explanation for the specific seasonal habitat flow (SHF) magnitude and volume (determined by the runoff) and timing (seed release and avoidance of water quality problems).

2. Should explain what the inundation acreage numbers mean in terms of progress towards the LORP goals and objectives. Are the surfaces inundated areas of recruitment for woody riparian vegetation or areas of tule colonization?
3. The overall findings and conclusions should also be tied back into progress towards LORP goals and objectives. Even though the program is still in its early stages, was the acreage inundated above base flow conditions recruiting and sustaining the hypothesized number and type of woody species? Does the data indicate that progress is being made towards LORP goals and objectives? Can progress towards attaining and sustaining the goal be measured quantitatively? Was the magnitude and duration sufficient to recruit and sustain woody vegetation, particularly in the lower reaches? Do the authors of this chapter agree with the MOU consultants observation that there is still a considerable amount of area below the Islands compared to above the Islands that could be inundated?
4. Appendix 1- The river flow plots are very helpful. We recommend that similar plots of absolute or relative stage height be shown. Also if Keeler Bridge station is still being monitored, would include that flow and stage data. As noted in previous reports, Keeler Bridge gauging station provides "ideal conditions for water measurements" and provides more meaningful stage height measurements than the pumpback station. The pumpback station is the sum of 3 gages and so the stage height measurements are not as meaningful and there is more opportunity for error. We believe that the Keeler Bridge station should be used.

Chapter 4- Land Management

1. In addition to the belt transect count and browsing data, we would like to see frequency of occurrence data.
2. We would like to see a map that shows the location of all the belt transect locations relative to each other. This is in addition to the detailed locations on the photos for each transect that is in the report. If this is in an earlier report, please include it here to make it easier to follow what's going on.

Chapter 5- 2012 Rapid Assessment Survey

1. No page numbers in this chapter.
2. No maps.
3. On January 24 Mark Bagley discussed our concerns about the RAS with Larry Freilich of the Inyo County Water Department. We will not take the time to repeat those comments here.

Chapter 6- 2012 Inyo/Mono Counties AG Commissioner's Office LORP Weed Report

1. No page numbers in this chapter.
2. The report indicates new noxious weed invasion continues, but we are pleased to see that the efforts of the AG Commissioner's office and staff has been pretty successful in keeping it at bay. Given that new noxious weed sites continue to be discovered each year since the implementation of seasonal habitat flows and that successful treatment often takes multiple years (see Table 1), it is vital that this important program continue or it can easily get out of hand.

3. We are very concerned with the statements at the end of Chapter 6 that "The most significant management difficulty continues to be maintaining adequate resources for effective management." And, "Detecting small invasive plant populations in the vast LORP project area early in the colonization cycle while treatment activities are most effective, has become a difficult task to maintain."
4. We are also concerned about the discrepancy pointed out by the MOU Consultants in Chapter 10 (p. 23) between the number of new weed sites reported in Chapter 6 (3) and the number reported in the RAS report, Chapter 5 (26). This may be due to how the sites are defined, but this discrepancy should be explained and it should be determined whether or not all of the new weed sites reported in the RAS were treated and included in Table 1 of Chapter 6.
5. We agree with the comments and recommendations made by the MOU Consultants in Chapter 10 (section X.2.9) regarding perennial pepperweed, the main noxious weed dealt with by the AG Commissioner's staff. We concur that sufficient funding and resources must be allocated to weed control as it is a threat to the developing ecosystem. This is absolutely necessary to meet one of the goals of the LORP which is, "Control of deleterious species whose presence within the Planning Area interferes with the achievement of the goals of the LORP." (MOU, Sec. II.B)

Chapter 7- Saltcedar Report

1. No page numbers in this chapter.
2. We strongly support the work done by the County Saltcedar Control Program crews. It looks like good progress was made in 2012.

Chapter 8- LORP Flow Modeling

1. Chapter 8 consists of the draft report prepared by NHC in May 2012 on the Lower Owens River Project Hydraulic Model. It is our understanding that a final was issued in late June of 2012. Why was the final not included in the LORP report? What changes were made between the draft and final?
2. The OVC and Sierra Club did not participate in any of the modeling meetings that were conducted with the MOU consultants, DWP and Inyo County so our observations and comments are based on the written report. At last year's annual report meeting we requested participation in model gaming sessions but were never invited to any meetings with the consultants.
3. The report is well-written and explains the challenges of developing, calibrating and using the model. The summary and conclusions would have been even more useful had there been a more detailed discussion of how the model could and should be used to address the study objectives spelled out in Section 1.2 of the report, as well the questions and uses of the model that the MOU consultant outlined in Section X.2.4 of their recommendations on river flow modeling.
4. The report notes that the 2011 inundation mapping was used as a qualitative check on the model but the 2008 mapping was not used because of the significant differences at the same

flows between 2008 and 2011. We think that those differences are relevant and helpful to use as a check on the model or in its application on future management regimes.

5. The inundation mapping as well the field observations and measurements during the seasonal habitat flows is essential to the future use of the model. We recommend that if the model is to be used to evaluate river management alternatives, that the modelers be tasked to observe the flow at key sites during the seasonal habitat flows and other times of the year as needed.

Chapter 10- Adaptive Management Recommendations

We agree with many of the adaptive management recommendations and the following provides comments and additional recommendations for some of them. We think the adaptive management recommendations should be as specific and detailed as possible with an explanation, where appropriate, of the hypothesis being tested and the monitoring and feedback loop that will be implemented.

As discussed in the last two annual meetings, we would also like to see a response from the implementing agencies of which recommendations were adopted, adopted with modifications, or not adopted along with an explanation for why they were modified or not adopted. We think this transparency in the decision making process is very important.

1. X.2.1 Base Flow Augmentation. We agree with the proposal to augment base flow in the winter to improve water quality conditions, particularly dissolved oxygen concentrations, during the SHF later in the year. We also recommend that the base flow augmentation occur next winter from Alabama Gates for water quality improvement prior to next years SHF. We recommend that the model and other analytical tools be used to evaluate whether the recommended base flow augmentation will be sufficient to improve water quality conditions.
2. X.2.2 Seasonal Habitat Management. We agree with the observations about the SHF in this section and the next section (X.2.3) including that the "applied 2012 SHF was so low it was ineffective." We agree with the adaptive management recommendation at the end of this section to meet to discuss future rive management in order to meet the MOU goals, but that the meeting(s) needs to include all the MOU parties including California Department of Fish and Wildlife, State Lands Commission (if they want to participate), the Sierra Club, and the Owens Valley Committee. This needs to happen is there is a desire to change the agreements on the Pumpback station capacity.
3. X.2.3 Seasonal Habitat Flow for Water Quality and Habitat Improvement. We agree with the problem statement that "the SHF, by itself, under present implementation procedures will not maintain the river in a healthy condition" and thus not achieve the MOU goals. We also agree that augmentation from Alabama Gates to achieve higher stage and greater inundation below the Islands is a worthy adaptive management option to test. We do not agree that the seasonal habitat flows are limited by the total volume of water in the tables and flow guides for the different levels of seasonal runoff. If the habitat and wildlife goals of the project are not being met, then magnitude (up to a peak of 200 cfs), duration, and timing can and should be adjusted which might result in greater volumes of water being released from the intake or downstream augmentation points. We agree that the amount that can be recaptured is constrained by existing Pumpback station capacity and that the MOU parties should address

these capacity constraints and a possible capacity increase in order to provide more flexibility in the flow regime. However, we have been asking for some suggestions or recommendations for what additional capacity is needed. Also, it is our position that a larger Pumpback station is not absolutely necessary–if the LORP goals are not being met and higher SHF is needed, it must be done whether or not there is a larger capacity Pumpback station. The MOU consultants should proactively recommend alternative flow regimes and infrastructure modifications that will address the shortcomings of the existing flow regime and infrastructure constraints in meeting the LORP goals.

4. X.2.4: River Flow Modeling. Even with the model shortcomings and constraints we think that the model should be used to evaluate a wide range of base and seasonal habitat flow scenarios to assist with flow actions that can be empirically tested to help determine if they will help achieve and sustain the LORP goals and objectives. The model will also help inform the discussions on increasing the Pumpback station capacity. We would like the MOU parties to have opportunity to participate in in the development and evaluation of flow scenarios that will be modeled.

5. X.2.5: Tule Status and Needs. We agree with the adaptive management recommendation at the end of this section to have meeting(s) to consider actions to manage tules, including modification of the existing flow regime, but that the they need to include all the MOU parties including California Department of Fish and Wildlife, Sierra Club, and the Owens Valley Committee.

6. 10.2.6: Delta Habitat Area Flow. We agree with the MOU consultants recommendation in this section to "1. implement the base and pulse flow changes requested in 2011 adaptive management recommendations, 2. Release DHA flows from the Intake rather than the Pumpback station." We do not think that a change in the capacity of the Pumpback station is necessary to implement those changes.

7. 10.2.7 Thibaut Ponds. The MOU consultants should provide more specific recommendations on how the Pond management needs to be changed. At the annual meeting, they recommended resurrecting a previous DWP management plan that would include drying out the ponds in the summer but there needs to be more specificity on the process and substance of what should be done in the coming year.

8. X.2.11 Monitoring Protocols. We agree with the recommendations on monitoring protocols. We also recommend that there is periodic review of the monitoring to see if it is efficiently geared to tracking the overall LORP goals and the more specific goals and objectives of the Seasonal Habitat Flows. We do think that monitoring could be done more efficiently.

   Are the specific metrics for assessing progress on the LORP goals and objectives clearly defined?

9. X.2.12 Workshop for Discussing Present and Future River Conditions. We also agree with the suggestion of a "River Summit" workshop (including field visits) that would cover current river conditions, progress on the LORP, ways of making the monitoring more targeted and cost-effective, and adaptive management proposals particularly ones geared to recruiting big wood in the lower sections of the Owens River (below the Islands) and managing tules. It should include all the MOU parties including California Department of Fish and Wildlife, State Land Commission (if the want to participate), the Sierra Club, and

the Owens Valley Committee. Part of the "River Summit" should be geared to interested members of the public and decision-makers.

10. X.2.13 MOU (1997) Needed Changes via Stipulation and Order. We also agree that the MOU parties should get together and explore ways to modify the MOU and Stipulation and Order that may be hindering river management prior to the April deadline for recommending and setting of the 2013 and future seasonal habitat flows

    We recommend the MOU parties review the overall process and, if necessary, make changes to insure that all parties have the opportunity to provide meaningful input and engagement with the implementing agencies. For example, the current report release date, annual meeting, and review time do not allow for meaningful and timely review of the Annual Report and time for constructive dialogue with MOU parties and consultants on adaptive management recommendations, monitoring program, report presentation and other comments. DWP's budgeting process should be not be used as an excuse for the current irrational timetable particularly if there are opportunities to make the program more cost-effective and increase the possibility of meeting the LORP goals.

We thank you for the opportunity to comment on the LORP Annual Report. We acknowledge that these comments would be more useful to you if we had submitted them about two weeks ago, but with the short turn around time, the holidays, and flu season we were not able to do that. Many of our comments were made at the January 3ed public meeting and in previous years. We hope that you take them into consideration as you move forward with this process.

Sincerely,

Mark Bagley and Peter Vorster
for OVC and Sierra Club

cc: Larry Freilich, ICWD
Brian Tillemans and Dave Martin, LADWP
MOU Party Representatives

11.0 ADAPTIVE MANAGEMENT RECOMMENDATIONS

2013

Lower Owens River Project
Adaptive Management Recommendations

Prepared for the Lower Owens River Project, Annual Report 2013

Prepared by the MOU Consultants:
Dr. William Platts, Mr. Mark Hill; Ecosystem Sciences

11.0

ADAPTIVE MANAGEMENT RECOMMENDATIONS

Executive Summary

Several undesirable trends and conditions are affecting the Lower Owens River Project. The past and current flow management regime for the river is causing ecological stagnation and limiting the ability of the river to achieve original goals, expectations, improve overall health and develop a balanced ecological system. While the Lower Owens River is stagnating it is also exhibiting some alarming early signs of stress. While some goals can be pointed to as early successes since project inception these could easily be reversed by downward trends in the system.

While there are significant issues with the river there are also many solutions that can be examined, agreed upon and put into effect to slow the declines, reverse many of the concerning trends and bring needed energy to the river system.

The flow regime for the Lower Owens River, as currently configured, is problematic yet it is the key to whether the LORP will succeed or fail. The current flow regime is managed to attain policy and compliance obligations first and foremost. If these prescribed river flows happen to benefit the riverine ecology it is secondary to the need to meet fixed legal obligations. As such the current river baseflow is confounding and recent seasonal habit flows are so small as to be completely ineffective. The Lower Owens River is degrading because it is fixed in place by legal stipulations dictating flow regimes that do not conform to any ecological or natural process. Compliance restrictions are inhibiting the LORP's potential and are affecting it negatively.

The Adaptive Management Recommendations, and the discussion and reasoning for each, are included in this report so that solutions can be forged (Table 1.1). The MOU Consultants believe that there are several feasible solutions that can positively affect the LORP. These solutions are neither draconian nor outlandish. Each recommendation is based in reality, on scientific principals and expert judgment, and can be attained through mutual cooperation and diligence by all responsible parties.

Over the last six years the MOU Consultants have made many recommendations for adaptive management. Too many of these recommendations have not been implemented or acted upon. The most difficult and important prescriptions are not followed nor is satisfactory justification given as to why they are not followed. Unfortunately, it is easy to speculate that the adaptive management process is broken, and perhaps has never actually worked as intended. Adaptive Management is not among the successes for the LORP.

Given the current condition of the LORP it is imperative that the recommendations that are made here are reviewed, discussed and critically evaluated by all MOU Parties. If the LORP continues to be managed as it has been for the last six years we can expect continued stagnation and potentially damaging consequences to the ecology that has developed in the riverine-riparian system up to this point. The MOU Consultants do not intend this as a shrill or dire warning of imminent ecological collapse; rather the recommendations are made with the intention that enough time and capacity still is available to navigate the system towards a better and lasting trajectory. This will require thinking and solutions that have not been in the LORP toolbox over the past many years. It requires critical examinations of the project limitations and development of new resource management tactics.

Table 1.1 Summary of 2013 Adaptive Management Recommendations
These are brief summaries of adaptive management recommendations. The full context and reasoning for each is described in the document in detail.

Management Area	Recommendations and/or Actions to be Taken
Riverine-Riparian Area	• Base flow stipulations and requirements of 40 cfs should be rescinded. • Peak flow restrictions required in the FEIR and the MOU should be rescinded. • A new Stipulation and Order be developed requiring flow releases be equal to an annual average flow of 55 cfs from the Intake Control Station into the Lower Owens River. • Develop a new river flow management strategy to be equal to an annual average of 55 cfs of continuous water being available, with all water needed for future SHFs and pulses coming out of the annual average flow allotment. • A Habitat Flow peak of 300 cfs or more to be released during 2014. • River flow management changes should be made to improve flow timing, flow duration, and flow magnitude. • Rescind all legal and mandated restrictions on the amount of water the Pumpback Station can pump out of the Lower Owens River. • County, City and MOU Consultants meet in winter of 2014 to draft example base, pulse, and SHF scenarios using water from the 55 cfs annual average to be available for Technical Committee consideration. • Release late winter and/or early spring flushing flow in 2014 and evaluate the results to determine benefits achieved. • Conduct creel census in May of 2014. • Tule control analysis be performed for all river reaches similar to that presented in the Tule and Cattail Management section of this AMR. The goal is to identify flows which provide a range of depths that create the greatest control on tules.
Blackrock Waterfowl Management Area	• Assess the ratio of open water to emergent vegetation within the Drew Unit. Managers should construct a plan to prepare the next unit for flooding. • When the run-off year is known, make an informed decision about the flooding the newly prepared unit (Winterton or Waggoner) and the utility of retaining water inflows into the Drew unit based on the characterization of Drew.
Off-River Lakes and Ponds	• None
Delta Habitat Area	• Three of the DHA pulse flows should be released at the Intake Control Station instead of the Pumpback Station. The three DHA flow periods recommended are Period 1 (March-April), Period 3 (September and add October), and Period 4 (November-December). • All future pulse flows to use full amount of water called for and use actual LORP base flow in determining future flow allocations. • County, City and MOU Consultants to meet in winter of 2014 to develop three DHA habitat pulse flow guides for release at the Intake. • The City to release the full amount of DHA habitat flow and all required water designated for release into the DHA for each flow period from the Intake Control Station for all future releases. • The City to *not* release DHA habitat flow from the Intake Control Station that resembles the 2013 March-April release, as it was completely ineffective. • The City and County to use shorter pulse flow duration periods in all future pulse flow releases so higher peaks can be attained. • Rescind all legal and mandated restrictions on the amount of water the Pumpback Station can pump out of the Lower Owens River.

Rapid Assessment Survey	• Develop a monitoring effort for woody recruitment to be examined more closely and with greater specificity than the RAS currently allows for. • The primary focus of the salt cedar control program should be in the riverine/ riparian corridor above all other areas. • Control of invasive pepperweed should remain a management priority.
Land/Grazing Management	• Develop and implement a robust controlled burn plan. • Review and report on the results of the restoration efforts on the Lone Pine burn to determine efficacy and any additional steps that may need to be taken.
Salt Cedar and Weed Control	• Sufficient funding and resources continue to be allocated to deal with salt cedar control and invasive species. • LORP managers continue to maintain a robust pepperweed control effort even if the County Ag. Commission is unable to do so.
Management	• Any management activity by the City that would or could influence any environmental condition in the LORP be coordinated with all MOU Parties and the MOU Consultants. • Task Orders be developed that allows the MOU Consultants to respond and work on unanticipated events as needed. • The County and the City to evaluate all past and current Adaptive Management Recommendations that apply to maintaining the warm water fishery in a healthy condition. • Train the Alabama Gates release flow channel so that flow enters directly into Lower Owens River below the Islands. • Construct a sediment debris basin below LAA spillway to prevent sediment accumulation in the trained channel. • Perform monitoring for: 1) Landscape Vegetation Mapping; 2) Site Scale Vegetation Sampling and Evaluation; and 3) Evaluation of Indicator Species this monitoring year. • Conduct a River summit in April 2014 where MOU Parties and non-MOU parties meet and come to a understanding on expectations based on direction given in the MOU (1997) and the FEIR (2004), supporting documents, and MOU Consultants recommendations. • The MOU Consultants to be allowed to participate in the County/City work plan and the follow-up Technical Guidance Committee meeting. • The MOU Consultants allowed to have open dialog with all other MOU parties.

11.1 Adaptive Management of the LORP

Responsibilities

The roles and responsibilities of the County, City and MOU Consultants for collecting, analyzing and reporting monitoring data and developing adaptive management recommendations are described in the 2008 LORP Monitoring, Adaptive Management and Reporting Plan (MAMP). The County and the City submit annually to the MOU Parties and the public an Annual Report that displays LORP data and management activities. The MOU Consultants reviewed LADWP's and ICWD's 2013 Annual Monitoring Draft Report and developed adaptive management recommendations needed to ensure LORP goals are met in the four Lower Owens River management areas: the Riverine-Riparian Area, Blackrock Waterfowl Management Area, Delta Habitat Area, and Off-River Lakes and Ponds. These recommendations are related to and build upon the adaptive management recommendations made by the MOU Consultants from 2008 to 2012.

LORP monitoring began in 2008, and after six years of project implementation it must be asked if the goals and objectives being met. Can we determine from the monitoring data to what extent the project is trending toward or away from the LORP goals? In order to address these key questions it is important to understand the goals and objectives established for the LORP.

The MOU describes goals for the LORP once the mandated changes in land and water management have been applied over a sufficient period of time. The five goals described below were recognized as broad and lacking in specifics. Therefore, in consultation with all MOU parties, 13 objectives were identified to attain the LORP goals. These objectives and the monitoring, analysis and adaptive management actions for each are described in detail in the LORP Monitoring and Adaptive Management Plan (MAMP 2008).

Goals

The overall MOU (1997) goal for the LORP is: "*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 elements 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.*"

1. *Establishment and maintenance of diverse riverine, riparian and wetland habitats in a healthy ecological condition. The LORP Action Plan identifies a list of "habitat indicator species" (see Table 1, Attachment A in the Plan) for each of the areas associated with the four physical features of the LORP. Within each of these areas, the goal is to create and maintain through flow and land management, to the extent feasible, diverse natural habitats consistent with the needs of the "habitat indicator species." These habitats will be as self-sustaining as possible.*

2. *Compliance with state and federal laws (including regulations adopted pursuant to such laws) that protect Threatened and Endangered Species.*

3. *Management consistent with applicable water quality laws, standards and objectives.*

4. *Control of deleterious species whose presence within the Planning Area interferes with the achievement of the goals of the LORP. These control measures will be implemented jointly with other responsible agency programs.*

5. *Management of livestock grazing and recreational use consistent with the other goals of the LORP.*

Objectives

The 13 objectives to attain the goals of the LORP and measures to implement adaptive management recommendations are described in Section 3.0 of the MAMP and summarized here.

Base Flow Objective
Maintain an average base flow of 40 cfs throughout the Lower Owens River from the LAA Intake to the Pumpback Station. If the 15-day average falls below 40 cfs, appropriate augmentation releases at the intake or spill gates will be necessary to meet base flow criteria.

Seasonal Habitat Flow Objective
A seasonal habitat flow of 200 cfs will be released at the Intake during average to above average runoff years. Seasonal habitat flows in below average water years will be determined by the standing committee in consultation with CDFG.

The seasonal habitat flow in the Lower Owens River is intended to meet habitat expectations (described in section 3.9 of the MAMP), promote establishment of riparian vegetation and enhance riparian habitat conditions. If seasonal habitat flows are not achieving habitat expectations management can modify the timing of seasonal habitat flows, modify the magnitude and/or duration of seasonal flows, release higher quality water from spillgates modify the ramping pattern of seasonal habitat flows, modify tule removal activities, and/or modify utilization rates and timing within riparian and upland pastures.

Fishery Objective
Create and sustain a healthy warm water fishery in the Lower Owens River.

Actions that can be taken to meet the objective include release of higher quality water from spillgates during the seasonal habitat flows, tule removal, beaver and beaver dam control, improving grazing utilization rates and timing within riparian and upland pastures, recreational and human use management, and modify water releases to maintain off-channel lakes/ponds.

Indicator Species Objective
Implementation of the LORP must benefit the majority of indicator species and guilds by increasing the quantity and quality of their habitat (Riverine-Riparian, Black Rock Waterfowl Management Area, and the Delta Habitat Area).

Actions that can be taken to meet the objective include modifying the magnitude and/or duration of seasonal habitat flows, modifying schedules for maintenance and mechanical intervention activities, plant native vegetation species, modify fencing or addition of new fencing for riparian and upland pastures, modify utilization rates and timing within riparian and upland pastures, install grazing exclosures, modify livestock management following wildfire, modify recreational and human use management, use controlled burning.

Riverine-Riparian Habitat Objective
Implementation of the LORP (base flow and seasonal habitat flow compliance) is expected to result in the recruitment of riparian vegetation (habitat), primarily willow and cottonwood.

Recruitment of riparian vegetation can be managed by modifying the timing of seasonal habitat flows, modifying the magnitude and/or duration of seasonal habitat flows, planting native vegetation species and removal of non-native and tule vegetation, modify beaver populations and beaver dams, modify fencing, or addition of new fencing, for riparian and upland pastures, modify utilization rates and timing within riparian and upland pastures, install grazing exclosures, modify recreational and human use management.

Water Quality Objective
Water Quality standards, as outlined in the Lahontan RWQCB Order, are being met within the Lower Owens River. (Lahonton RWQCB exemption to discharge prohibitions expires July 14th 2015).

Compliance with water quality standards is expected to be achieved by modifying water releases during base flows, modifying the timing of seasonal habitat flows, modifying the magnitude/duration of seasonal habitat flows, releasing higher quality water from spillgates, modifying beaver and beaver dam control activities, modifying utilization rates and timing within riparian and upland pastures, and/or modifying recreational and human use management.

Tule/Cattail Control Objective
It has always been recognized that controlling tules will be challenging. It is also recognized that tules do provide valuable habitat especially for fish and waterfowl. The objective therefore is to strike a balance such that tules do not impede project goals.

Tule control methods include the timing of seasonal habitat flows, modify the magnitude/duration of seasonal habitat flows, implementing tule removal activities, modifying beaver and beaver dam control activities, modifying the river channel, use of controlled burning, and/or modifying flow releases to off-channel lakes and ponds.

Delta Habitat Area Objective
An annual average flow of 6 to 9 cfs is being released below the LORP Pumpback Station (this flow does not include that flow passing the Pumpback Station during the seasonal habitat flow releases) and wetland habitat is being maintained or enhanced.

Habitat in the Delta can be maintained by modifying schedules for maintenance and mechanical intervention, activities, modifying fencing, or addition of new fencing, for riparian and upland pastures, modifying utilization rates and timing within riparian and upland pastures, modifying recreational and human use management, modifying Delta base flow water releases, modifying timing, magnitude and/or duration of Delta pulse flow, and/or berm excavation to direct flow or contain flow.

Invasive Species Objective
Control, to the extent possible, exotic and invasive (class A and B noxious weeds) plants, that interfere with the achievement of LORP goals.

Adaptive management actions include modifying the timing of seasonal habitat flows, planting native vegetation species, conducting exotic plant control activities, using controlled burning, modifying utilization rates and timing in riparian and upland pastures, modifying fences, or add new fences for riparian and upland pastures, and/or modifying livestock management following wildfires.

Blackrock Waterfowl Management Area Objective
Approximately 500 acres of habitat area is to be flooded in the BWMA during average and above average runoff years, and during below average runoff years, flooded area in Blackrock is commensurate with forecasted LADWP runoff models and achieves the area-acres determined by the Standing Committee and in consultation with CDFG.

BWMA is adaptively managed by modifying timing and/or duration of wet/dry cycles using Drew, Waggoner, and Winterton wetland cells, berming and/or excavating to direct flow or contain flow, modifying water releases to maintain Off-River Lakes and Ponds, and removing critical flow obstructions.

Range Condition Objective
The LORP emphasizes multi-uses, which includes ranching. Grazing strategies established for each ranching lease is intended to lead to the establishment of healthy riparian pastures and exhibit an upward trend in range conditions.

Adaptive management actions to meet range objectives could include conducting exotic plant control activities, use of controlled burning, installing grazing exclosures to improve monitoring, modifying the magnitude and/or duration of seasonal habitat flows, modifying fencing, or adding of new fencing for riparian and upland pastures, changing livestock management following wildfires, modifying utilization rates and timing within riparian and upland pastures, and modifying recreational and human use management.

Lakes and Ponds Compliance Objective
The objective for off-channel lakes and ponds such as Goose and Billy lakes is to maintain existing water surface elevation. In addition, Thibaut Pond will be maintained for 28-acres.

The adaptive management tools will focus on altering inflows from adjacent canals to maintain water levels. Another action specific for Thibaut Pond is a wet/dry cycle somewhat like BWMA. In the past LADWP has affectively maintained 28 acres of suitable habitat for waterfowl by drying Thibaut in the summer and flooding it in the Fall and Winter. This method provides open water habitat as well as tule control.

Recreation Objective
The LORP recreation objective is to provide for continued and sustainable recreational uses, consistent with LORP goals.

Adaptive management includes planting native vegetation species and modifying recreational and human use management as impacts or over use of areas occurs.

Monitoring

Environmental conditions in the LORP can change in response to water and land management activities. The collection, evaluation, and reporting of environmental data is central to the monitoring program and will determine the effectiveness of adaptive management actions in meeting project goals and objectives. The driving tool of adaptive management is environmental monitoring results. Monitoring data is used to measure progress toward a desired management objective over time. Data and analysis provides the necessary information to allow managers to adapt actions and methods to on-the-ground circumstances and unforeseen events. Successful adaptive management is dependent upon a monitoring program that provides a reliable measure if change occurs in ecosystem components.

Adaptive Management

The MOU defines adaptive management as a method for managing the LORP that provides for modifying project management to ensure the project's successful implementation and/or the attainment of the project goals, should ongoing data collection and analysis reveal that such modifications are necessary. The MOU requires that data and information be collected and evaluated so that recommendations and decisions can be made, and changes implemented (adaptive management procedures) to ensure that LORP goals are achieved or, conversely, determine if any LORP goals are not achievable.

Findings

As postulated previously, after six year since project implementation are goals and objectives being met? Table 1.2 is a summary of objectives that have been attained, or are trending in a positive direction toward attainment or have not been attained. This summary has been determined by review and analysis of the monitoring data made available to the MOU Consultants spanning these first six years.

It is important to address the reasons some objectives are attained and others are not, while some may be trending toward attainment at this stage of the LORP implementation and monitoring cycle. The fundamental reason why many objectives have not been met is a failure to consider and/or implement adaptive management recommendations.

TABLE 1.2. Summary of Progress of LORP Objectives

Objective	Attained	Trending*	Not Attained
Base flow - Compliance	■**		
Base flow - Effectiveness			■
Seasonal Habitat Flow - Compliance	■		
Seasonal Habitat Flow - Effectiveness			■
Fishery	■***		
Indicator Species			■
Riverine-Riparian Habitat			■
Water Quality			■
Tule/Cattail Control			■
Delta Habitat Area	■		
Invasive Species		■	
BWMA		■	
Range Conditions		■	
Lakes and Ponds	■		
Recreation		■	

* Indicates there is sufficient monitoring data to determine that these objectives are trending toward attainment.

**Since flow introduction in 2006, both base flows and seasonal habitat flows have been attained to meet compliance objectives as stipulated; however these flows have not been adequate to attain MOU objectives as described in the adaptive management section related to river flows, habitat and ecological health.

***As a consequence of the fish kill below Alabama Gates in 2013, the present and future health of the fishery in the lower river is in question.

Adaptive Management Status and History

The MOU Consultants are responsible for issuing Adaptive Management recommendations, prescriptions and actions to ensure the LORP is succeeding. Each year since 2008 when monitoring was initiated, the MOU Consultants have reviewed the annual reports, discussed project objectives and results with managers, and analyzed conditions and trends in order to form adaptive management actions that need to be taken. These adaptive management recommendations are submitted after careful review to move the project forward in a positive direction and minimize or avoid problems.

Adaptive management recommendations and prescriptions should be evaluated and acted upon. The actionable items from each year's annual report, up to and including this 2013 report, need to be considered and a plan of action implemented. 2013 recommendations should be considered and weighed with the previous years recommendations to make the adaptive management process function as intended.

Adaptive management recommendations have generally required more effort, money or water to apply. Some adaptive management recommendations have been accepted and implemented over the years by LADWP and ICWD. However, the most critical adaptive management recommendations, especially those requiring additional funds or water, have not been implemented. Table 1.3 summarizes past adaptive management recommendations that have not been implemented since 2007.

Dr. Duncan Patten is the Sierra Club's and Owens Valley Committee's ecological consultant who reviewed and provided comments on the 2012 annual report and adaptive management recommendations. His comments are contained in a letter to Mr. Mark Bagley, who submitted them to LADWP and ICWD's Technical Committee and the Standing Committee. Dr. Patten is professor emeritus from Arizona State University, is currently the Director or the Montana Water Center and holds an adjunct position at Montana State University where he teaches watershed ecology and management. Dr. Patten's comments represent an independent analysis and his comments corroborate the conclusions of the MOU Consultants as follows (his full analysis is in Appendices):

"It is important that the consultants pointed out the application of adaptive management is not among LORP success. They point out that difficult prescriptions are not followed nor are explanations given as to why they are not followed. This highly selective approach taken relative to application of adaptive management should be challenged…They recommend, and I support, that there should be action on adaptive management recommendations or justification of 'no action'". Dr. Patten goes on in his analysis to support all of the other MOU Consultant's recommendations.

It is clearly time to re-examine LORP goals and objectives and determine how and if they can be obtained. The MOU Consultants have repeatedly called for a river summit to do precisely that; reset the LORP on a course with realistic goals and objectives that recognize current conditions and design in the flexibility to implement adaptive management; particularly river flow management changes. A river summit that examines the status of river flows, riverine-riparian habitat, fisheries, wetlands, uplands, and indicator species relative to original goals and objectives is long overdue.

Table 1.3. Summary of Critical Adaptive Management Recommendations Not Followed and Actions Not Taken from 2007 to 2012

Management Area	Year	Recommendation and/or Action to be Taken
Riverine-Riparian Area	2007	• Allow flexibility to deviate from the 40 cfs codified base flow and 200 cfs maximum flow; alter flow duration, timing and magnitude as needed to meet MOU goals, and allow for winter pulse flows to improve water quality (see letter to MOU Parties in Appendices).
	2008	• Consider river flow adjustments that can alleviate tule encroachment and abundance, and improve water quality conditions. A thorough analysis of flow changes and predicted results is needed.
	2009	• Re-map landforms, including channel landform, to improve accuracy of monitoring seasonal habitat flow events. Re-mapping of landforms can be performed in conjunction with the flow modeling recommendation using current aerial photos and survey data.
	2010	• LADWP, ICWD and the MOU Consultants participate in a mapping conference to identify a repeatable methodology for the landscape mapping and determine how to account for error when comparing multiple years of data. • Normalize the flooding extent and inundation data for the seasonal habitat flow before extrapolating to the reach and river-wide. Perform the vegetation inundation analysis.
	2011	• Seasonal Habitat Flow: in addition to normal requirements add needed changes in flow timing, flow duration, and flow magnitude that will maintain and improve LORP resources. • Seasonal Habitat Flow Augmentation: during the SHF, flows can be augmented at selected downriver site(s) as needed to obtain more wetted acreage along the river corridor to benefit the recruitment and maintenance of woody and other riparian vegetation. • Base Flow Augmentation: improve water quality by releasing the required Delta Habitat Area habitat flows from the Intake instead of the Pumpback Station. • Water Quality: monitor selected water quality parameters (mainly dissolved oxygen and temperatures) during the release of the 2012 seasonal habitat flow.

	2012	• Seasonal Habitat Flow Augmentation: flow augmentation be considered when the Owens Basin Runoff is predicted to be over 100% of normal. • Base Flow: improve water quality by releasing some of the Delta Habitat Area habitat flows from the Intake instead of the Pumpback Station. • Tule status and needs: actions to manage tules and cattails, including modification of the current flow regime for increased recreational access should be considered. • Pumpback Station: the MOU Parties should resolve, immediately, an effective means for the Pumback Station to increase capacity. The lack of a solution to the Pumpback Station capacity increase is limiting the LORP flow modifications.
Blackrock Waterfowl Management Area	2008 2011	• Wetted perimeter and inflow monitoring in the BWMA wetland cells to produce a reliable alternative to walking the perimeter several times a year. The purpose of relating inflow to area is to create a predicative model for future decision making as to when to switch cells. • New species be added to the HSI list, but that all occurrences of the new HSI species be updated in previous years data. • Adding new species to the indicator species list should be done through the adaptive management process soliciting input from the scientific team. • Thibaut Pond Management: LADWP complete an analysis of reasonable alternatives to determine if there is a most feasible method to regain and maintain 28 acres of surface water in the Thibaut Ponds over the life of the project. Complete a *detailed* report by May of 2012 and submit to the Scientific Team for their review and comment.
Delta Habitat Area	2008 2011 2012	• The number of pulse flows, quantity of water and duration of flow needed to meet and maintain project goals requires evaluation. • Pulse flow modification: the present number of annual flows now being released into the DHA should be increased to 10 habitat flows annually, including the SHF bypass flow to enhance diversity and habitat for indicator species. • Same as 2011 and 2012 riverine-riparian recommendations
Rapid Assessment Survey	2010 2011 2012	• LADWP, ICWD and MOU Consultants meet to re-examine the present RAS methodology, analysis and reporting procedures and to bring the survey design back to the original intention and purview of the RAS. • Woody Recruitment: RAS is not a comprehensive survey to monitor woody recruitment. If managers desire more systematic information on woody recruitment, then another method should be employed. • Re-examine the present RAS methodology, analysis and reporting procedures and to bring the survey design back to the original intention and purview of the RAS. • The RAS woody species data be used to inform a targeted riparian woody species analysis that pools the data from all of the available sources within the LORP
Land/Grazing Management	2011	• Belt transect Monitoring: characterize the vegetation communities along the entire transect, not just the water's edge. Expand the belt width to 10 meters to encompass a greater percentage of the possible woody species habitat. Transects should also extend across the wetted channel in order to monitor the survival of established woody species within the existing channel. Doubling of the number of sites. All existing and newly established belt transects be performed in 2012.

Salt Cedar and Weed Control	2011	• Priority Areas: the top priority of the annual saltcedar control work program is to clear the river corridor annually of all saltcedar plants.
Other	2008	• The LORP data warehouse should be reviewed and redesigned to meet contemporary standards, define QA/QC and data management protocols, be based on a spatial/GIS platform, be online and easily accessible.
	2009	• All MOU parties should gather at a convenient time to review LORP progress and discuss flow management and other recommendations to meet project goals. Essentially a river summit that resets LORP goals and objectives as necessary and reexamines flows and flow management.
	2010	• Monitoring Protocols: Revisit all previous monitoring data and field tabulations, scanning and electronic filing as described in the MAMP protocols. All future changes or modifications to any protocols be submitted through the adaptive management process for consideration.
	2011	• Implement QA/QC protocols required in the MAMP to ensure field data is collected and data entry performed correctly. • The MAMP specifies data management and storage protocols for many monitoring actions. In addition to a data warehouse, field forms are supposed to be scanned and stored for future reference in the event there are questions regarding data compilation and tabulation as well as data entry to the LORP warehouse. • Annual Report: annual report schedules with the current imposed deadlines be revisited with a goal of finding at least two months of flexibility in the data analysis, report preparation, review and adaptive management recommendation phase. • MOU and Stipulation and Order: management and legal staff begin the process of developing a new Stipulation and Order to minimize the time lag between determining what river flow change is agreed upon and the legal processes now restricting the capacity of the Pumpback system. • Adaptive Management: Actionable adaptive management procedures and recommendations must be treated and acted upon, or thorough justification given for non-action. The actionable items from each year's annual report, up to and including this report, must be considered and followed upon with a plan of action that is transparent, responsible and conclusive.
	2012	• All MOU parties should gather at a convenient time to review LORP progress and discuss flow management and other recommendations to meet project goals. Essentially a river summit that resets LORP goals and objectives as necessary and reexamines flows and flow management.

11.2 RECOMMENDATIONS

Introduction

The MOU (1997) defines adaptive management as a method for managing the LORP that provides for modifying project management to ensure the projects successful implementation. The process ensures the attainment of project goals by making management changes, should on-going data collection and analysis reveal that such modifications are necessary. The County and the City conduct the LORP monitoring and prepare a draft Annual Report summarizing results. The Annual Report displays monitoring measures and results, LORP achievements and deficiencies, and provides conclusions. From the analysis of the draft report and in combination with their own findings the MOU Consultants develop Adaptive Management Recommendations (AMRs). These recommendations are presented to the County and the City. The Adaptive Management Report becomes a section of the Annual Report.

The Technical Group, the Standing Committee, and the governing boards of the County and the City make the ultimate decision on implementing adaptive management actions. This is done after reviewing the AMRs submitted by the MOU Consultants and other relevant monitoring data and analysis. The MOU Consultants also monitor the implementation of past AMRs and track those recommendations not accepted, but may be worthy of further consideration at a later date. Implemented recommendations are reviewed to determine success.

The MOU Consultants reviewed the County-City 2013 Draft Annual Report and from it developed their AMRs. The recommendations that follow are organized by LORP management areas or issues. The 2013 Adaptive Management Recommendations provide guidance as to what changes or additions in LORP management are needed to meet LORP goals as outlined in the MOU (1997) and the EIR (2004) and other guiding documents.

11.2.1 Base Flow Modifications

Background

Lower Owens River base flows required under the LORP were initiated in December 2006. A base flow of at least 40 cfs was mandated throughout all reaches of the river. Therefore, the river over the past 7 years has functioned under steady-state conditions 11.5 months out of the year and even longer on drought years. This has resulted in the river being managed much like a canal. Each year, large amounts of organic debris and other materials enter the river. This organic load and the resulting muck must be continually processed and eliminated annually from the river. If this annual process is not completed and eliminated, the river will continue on its path toward eutrophication. Base and pulse flows applied over the past 7 years, if continued, cannot keep this from happening. Present base flow restrictions must be eliminated and new requirements developed in order to solve current water quality problems.

MOU Consultants, in a 2007 letter to all MOU Parties, appealed that they not set river base flows via Stipulations and Orders (see appendices, MOU Consultants 2007 memorandum). The main reason was that sufficient knowledge, experience, and evaluation was not available at that time to set base flows that would be difficult to change. At the time, the river response under existing conditions was unknown making it difficult to predict future conditions. For these reasons, the Consultants were against setting base flows that could not be modified. Once set, the Consultants knew it would be hard to make needed changes in the future. In the 2007 letter, the Consultants went so far as to state that such criteria (base flows being set) are not even realistic standards for managing a river ecosystem. The Consultants predicted it would be necessary within 5 years (which would be in 2012) to make some critical river flow management changes.

Based on preliminary monitoring results and observations that started to become available at that time, the Consultants emphasized that using a set overall 40 cfs base flow mandate would lead to canal-type flow management of the river. Under current conditions, decision makers, managers and scientists must abide by

Court directives that limit the ability of future changes to flows to meet LORP goals. Again, it was pointed out that to set such base flow Stipulation and Orders, which were obviously premature, would simply complicate future river management, if not negate intelligent and informed decision making.

MOU Consultants in their 2008 Adaptive Management Recommendations continued to emphasize the immediate need to adjust river flows to improve tule, cattail, riparian, and water quality conditions. The recommendations pushed for a detailed plan, to be available to all MOU Parties, that displayed flow alternatives and scenarios that would improve and maintain river health. MOU Consultants, again in their 2011 Adaptive Management Recommendations, outlined base flow changes needed to help improve Lower Owens River water quality conditions. It must be acknowledged, however, that the Lower Owens River, as a result of implementing the LORP flow requirements, produced some valuable resources. Under better flow management, however, the river will be able to maintain and hold on to these valuable resources and improve other resources that are now being detrimentally affected.

Legal Constraints

The MOU (1997) requires a base flow over all reaches of the Lower Owens River at all times of at least 40 cfs. This mandate applies to the river from the Intake Control Station downriver to the Pump Back Station. This 40 cfs flow must be maintained year around in all reaches. On July 12, 2003, a Stipulation and Order was issued requiring the City to meet even more specific base flow requirements for the river. These additional base flow release mandates are:

1. A minimum of 40 cfs will be released from the Intake Control Station at all times.
2. No in-river measuring station can have a 15-day running average of less than 35 cfs.
3. The mean daily flow at each in-river measuring station must equal or exceed 40 cfs on 3 individual days out of every 15 days.
4. The 15-day running average of any in-river flow measuring station can be no less than 40 cfs.

The MOU Parties fortunately reserved the right to amend the MOU (1997). They can amend, delete, or add to the MOU (1997) at any given time by unanimous written agreement of all Parties. Using amendments, deletions, changes, and additions provide the solution to implement flows that will build and maintain a healthy river and resulting warm water fishery. Amending the MOU (1997) and revising Stipulations and Orders that set base flow conditions should be done immediately. Legal and obligatory mandates are outdated and should not stand in the way of good river management.

Justification

The MOU (1997) Action Plan calls for river flow adjustments when needed. The LORP Ecosystem Management Plan also calls for the modification of the magnitude of flows if needed. The intent of the LORP plan was not intended to develop binding restrictions that restrict future needed changes in flow management. Plan intent was to allow the adaptive management process to find the way to improve flow management. Current river conditions inform us that it’s time to go beyond the present flow management regime because it is not working. As Dr. Pattan advises in his Annual Report review comments, it’s time to start “thinking out of the box.” (see appendices).

In 2010, the Lower Owens River experienced its first observed large scale detrimental water quality event. These conditions were so severe that it stressed the warm water fishery and other aquatic animals to a critical point. Over the past few years, the river experienced very low dissolved oxygen conditions during late spring, summer, and early fall; this should have been viewed with concern and due attention. Three years later (2013), when a small augmentation flow was released during the summer into the Lower Owens River, aquatic conditions become so harsh that large fish kills resulted. These underlying conditions that caused this fish kill are indicators of worsening conditions and potential catastrophic fish kills. This experience alone justifies immediate changes in flow management and a high priority need. Allocated water, already available under MOU (1997) and EIR (1997) guidelines and Court Orders, can be used to help prevent fish kills. Changes made to the MOU (1997) and the FEIR (2004) and Stipulation and Order guidelines can help prevent these fish kills in the future, and ameliorate water quality conditions.

MOU Consultants Recommendation

Recommendation
The MOU Consultants recommend that all requirements in the MOU (1997) and respective Stipulation and Orders that dictate how the 40 cfs flow is applied over all reaches of the Lower Owens River be rescinded. The MOU Parties can accomplish this by written agreement signed by all Parties and obtaining relief from the Courts as needed.

Recommendation
A new Stipulation and Order be submitted to the Court for approval requiring the City to release annually an average flow of 55 cfs from the Intake Control Station into the Lower Owens River. The 55 cfs flow level is selected based on flows released from the Lower Owens River from March 21, 2007 through November 18, 2013. This 6 year period averaged 54.8 cfs.

Recommendation
The MOU Consultants, the County and the City develop a new Lower Owens River flow management strategy based on an average of 55 cfs of continuous water being available. This flow strategy will be presented to all MOU Parties for refinement and agreement. The plan would guide the management of future base, pulse, and seasonal habitat flows. The continuation of adaptive management will ensure that the plan maintains the river in a healthy condition and meets all applicable LORP and MOU (1997) goals.

11.2.2 Seasonal Habitat Flow Modifications

Background

Twenty years have elapsed since the flow management plan was developed that recommended the flows now being applied to the Lower Owens River to meet MOU (1997) and LORP goals. The original modeled river flows implemented were supposed to establish and maintain riverine-riparian habitats that would sustain healthy populations of wildlife and warm water fish, including both large and smallmouth bass. Smallmouth bass populations are presently doing very poorly in the Lower Owens River.

In 1993, Controlled Flow Studies were performed to evaluate the actual conditions of released flows at 20, 40, and 80 cfs. The study planners described up-front that the model flow predictions resulting from this study could not be reliably tested. Therefore, the Consultants recommended that all final flows applied must be monitored through time to determine if their implementation resulted in meeting MOU (1997) goals. The final model was based on information from real flows and simulated and predicted results of 15, 30, 50, 80, 100, and 200 cfs flows. The model did not simulate flows above 200 cfs because of flow limitations mandated in the MOU (1997). We now know through monitoring and evaluation that model derived flows, now used for the Lower Owens Flow regime, have not produced all the anticipated results.

So far 6 seasonal habitat flows (SHFs) have been released into the Lower Owens River (Table 2.2.1). These peaks ranged from a low of a 58 cfs to a high of 220 cfs. The MOU Consultants recommended a minimum peak flow of 200 cfs for both the 2012 and 2013 SHFs. The SHF peaks in 2012 (92 cfs) and 2013 (58 cfs) were much smaller than the peak flows recommended by the MOU Consultants. The SHFs applied on both years (2012 and 2013) were even lower than base flows applied later in the year. In the summer of 2013, the Department of Water and Power released a base flow of 90 cfs at the intake to get 40 cfs at the Pumpback station. As a result, the Lower Owens River has faced back-to-back years with the SHF peak actually much smaller than the following required base flow. Just the reverse flow pattern of how natural rivers operate.

The average SHF peak release of 149 cfs (from 2008 to 2013) resulted in an average peak flow reaching the Pumpback Station of only 91 cfs. This even includes two years of flow augmentation (2008 and 2013) from the Alabama Gates (Table 2.2.3). The purpose of the SHF is to create a natural disturbance regime that produces good water quality conditions and diverse riparian habitat resulting in productive ecological systems. To date, this purpose has not been completely fulfilled.

Table 2.2.1. Past seasonal habitat peak flows released at the Intake Control Station by year and travel time to the Pumpback Station

Year	Peak Flow Release (cfs)	Travel Time to Pumpback station (days)
2008	220	9
2009	110	13
2010	209	17
2011	205	15
2012	92	13
2013	58	13
Average	**149**	**13.3**

As the 2013 Annual Report points out, during 2012, there was a 40-day period beginning on June 28 where mean base flow release was 97 cfs; well above the 89 cfs SHF peak for that year. In 2013, mean base flow for the four month period (June 1 through September 30) was 21 cfs higher than the peak SHF released earlier in the year (Table 2.2.2). The high sustained summer base flows in 2012 and 2013 could have drowned out any tree willow germinating seeds which may have been present after seed fly. The last two years well demonstrate how far out of sync base flow management is with the SHF management and vice-versa (Table 2.2.3). This type of river management can only lead to lower value LORP resources and goals not being met.

Table 2.2.2. Average daily flow released at the Intake Control Station and passing the Mazourka, Reinhackle Control Stations. Flows released at the Alabama Gates are also displayed (2013 Annual Report).

Date	Intake	Mazourka	Reinhackle	Above Pumpback	Alabama Gates
20-May	45	51	53	52	0
21	49	51	52	50	0
22	56	51	51	48	0
23	55	50	51	46	0
24	50	52	48	45	0
25	45	56	44	44	0
26	46	58	42	44	0
27	45	57	42	43	0
28	46	54	45	41	22
29	45	52	46	40	30
30	62	51	55	37	0
31	67	50	55	40	0
1-Jun	66	50	52	50	0
2	67	54	51	50	0
3	66	59	50	42	0
4	67	61	50	39	0
5	67	62	50	37	0
6	67	62	52	35	0
7	67	63	54	33	0
8	66	63	56	33	0
9	67	62	56	33	0
10	78	62	56	29	9
11	81	63	57	36	15
12	81	63	57	32	15
13	81	65	58	34	15
14	81	69	57	39	15

15	81	73	56	46	15
16	82	75	56	45	15
17	88	76	59	44	15
18	91	76	63	46	6
19	89	77	65	46	0
20	88	79	65	46	0
21	90	82	68	45	0
22	89	83	69	44	0
23	91	84	69	43	0

As stated before, successful seed germination that may have occurred in response to the 2012 and 2013 SHFs would have later been submerged by the greatly increased summer base flows. Base flows higher than seasonal habitat flows eliminates the effectiveness of the SHF. Sustained high summer base flows experienced over the past two years (2012 and 2013) have also facilitated the expansion of cattails and tules out onto the floodplains and over point bars (2013 Annual Report). These landforms do or could support willow (2013 Annual Report). The 2013 Annual Report also goes on to predict that "If flow management continues as it has during the last several years then most range belt monitoring sites (to determine willow response) will either be permanently flooded out or out-competed by tules and cattails." The aggradation/ eutrophication of the Lower Owens River and its expansion further out onto the floodplains will further the abundance of tules and negate the proportion of riparian tree establishment.

Table 2.2.3. 2013 Peak flow (cfs) travel time as the peak passes the respective Control Station

Station	Date	Peak Flow (cfs)	Travel Time from Intake (days)
Intake	23-May	58	0
Mazourka	26-May	60	3.7
Reinhackle	30-May	57	7.6
Pumpback	5-Jun	43	13.4

<u>Justification</u>

Changes to present river flow practices will need to occur through the adaptive management process if the river is to improve. The river will not attain favorable water quality conditions or healthy riparian habitat diversity mandated in the MOU (1997) without flow management changes. Changes are needed in flow timing, flow volume, flow duration, and flow augmentation.

Releasing only one SHF annually to flush the river system and improve water quality was never expected to be a feasible solution. The river channel and water column are so heavily modified by tules, the river, in turn, cannot generate the stream power necessary to scour and export large amounts of constantly accumulated biomass and muck. The Ecosystem Management Plan (2002) states that if monitoring data shows riparian plants are not being recruited within the first 5 years of flow releases, in areas subject to out-of-channel flows, then SHFs can be modified. The sixth SHF has now been applied and neither water quality nor riparian habitat diversity conditions have met expectations.

MOU Parties are well aware of the need to improve river conditions. One example is the creation of the 2012 Lower Owens River Addendum to the EIR (2004). This Addendum calls for river flow augmentation (up to 200 cfs) below the Intake Control Station to increase flow magnitude and duration if needed. The Addendum allows an additional 928 afy of water to pass into the Delta Habitat Area (DHA) over those flows listed in the Ecosystem Management Plan.

The California Department of Fish and Game (CDFG) also commented on the need to implement adequate SHFs. CDFG pointed out, via a letter in 2013, that the lack of riparian forest development requires evaluating present flow formulas and consideration of implementing alternative flow management scenarios. CDFG also expressed concerns about the possibility of future fish kills due to declining water quality conditions. CDFG requested additional monitoring to detect if fish stress occurs during any SHF release.

A major goal of the MOU (1997) is to create and sustain healthy and diverse riparian and aquatic habitats. The MOU (1997) also calls for flows sufficient in frequency, duration, and amount that numerous beneficial environmental changes will take place. The MOU (1997) calls for higher SHFs to improve water quality, woody tree recruitment, and riparian health. This implies in part that flows applied should be of sufficient magnitude and duration that they will move and export organic solids and muck from the channel. Most of the organic muck must be transported out of the system while flooding bordering landforms during key seed fall periods.

In both of their 2010 and 2012 Adaptive Management Recommendations, the MOU Consultants submitted river flow changes to improve river conditions. These included releasing a 200 cfs peak SHF every year even on those years with below normal runoff forecast. They also called for flow augmentation to increase downriver flows all the way to the Pumpback Station. Shorter SHF duration periods were recommended to allow more water to create higher flow levels river wide. These recommendations are still valid, but have not been taken up and implemented.

The type of SHF applied over the past six years, because of low peak flows, short flow duration periods, and very low flow levels in downriver reaches, should not be used in the future to manage the Lower Owens River. Although some MOU (1997) goals and objectives are being met, some important goals are not. The fundamental processes that need to be met more effectively include; improving water quality, meeting future water quality regulations, decreasing muck and other organics from the channel, and developing proper abundance and distribution of tules and cattails. Present tule and cattail distribution and encroachment compromises needed open water habitat, decreases stream power, deposits large annual loads of high biochemical oxygen demand (BOD) materials on and in the channel, and inhibits needed habitat diversity and recreational opportunities.

The river is demonstrating each year that it needs immediate management changes to stay healthy and sustain the gains already made in meeting some fisheries, wildlife and habitat goals. SHFs were supposed to be the primary management tool to promote riparian tree establishment and water quality improvement. The past six SHFs have failed to do this. Some data and information is available showing that SHFs are not helping the river meet LORP goals, while there is little data or information demonstrating that SHFs are helping the river meet LORP goals.

Dr. Duncan Patten (2012), in his 2012 Annual Report review, called for changes in SHF timing, flow duration, and flow magnitude. He called for changes needed to ensure appropriate gains are made in channel improvement, development of healthy riparian habitats, and maintaining riparian conditions already gained. Increasing the potential for future woody riparian vegetation recruitment by using flows more conducive to their establishment will ensure a more stable long-term recovery of the Lower Owens River (Patten 2012).

Concerns

A major concern of the MOU Consultants is that the 2012 and 2013 SHF flows and their peaks were so low that they were completely ineffective. They were so low they were much less than the required base flows that followed. Current flow management is forcing the river to function and react in a manner opposite to how rivers normally react and function. The Sierra Club (SC) and the Owens Valley Committee (OVC), in their 2012 Annual Report reviews, expressed strongly that attaining the LORP goal of a healthy, functioning ecosystem is best achieved if future SHFs are designed and applied through Adaptive Management experimentation. Both MOU Parties are very concerned that the recruitment and survival of riparian vegetation is being inhibited by past flow practices.

Unless river stage height (via higher flows) is increased to get higher landform inundation, riparian habitat will continue to be inhibited. To preclude this inhibition, ramping rates (up and down flow levels) must be properly designed and implemented. Both MOU Parties favored applying spill gate releases (augmentation), to increase downriver flows, which in turn, will increase inundation of streambanks, floodplains and low terraces. These MOU Parties were especially concerned about river conditions that are developing in river reaches below the Islands area.

The SC and OVC requested that peak flows (preferably 200 cfs) be released over sufficient number of days to mimic natural spring (runoff) flows. For example, they believed that the 2009 SHF release was too low in magnitude and too short in duration to be effective. Limited by only a 105 cfs release peak flow and a 7 day flow volume reduction they felt the SHF was too little and too short to be effective. They had difficulty understanding why appropriately timed flow augmentation from spill gates was not applied. Given the lack of adequate peak flows released from the Intake Control Station, they questioned why it would not be appropriate to increase downriver flows. Dr. Pattan (in this same review) stated, that "To the extent the MOU (1997) contemplates adaptive management, then one should be willing to 'think-out-of-the- box' and determine changes that might enhance the riverine system."

CDFG (2012) also expressed concerns. In an Annual Report review letter to the County and the City they pointed out with justification that after 5-years of LORP implementation, scheduled SHFs have not promoted woody plant establishment. This is particularly true for the taller stature species including Gooding's Willow, Red Willow, and Fremont's Cottonwood. CDFG recommended that the efficacy of applied past seasonal flows for establishing woody vegetation be evaluated. This has not been done.

<u>River Response to Past SHFs</u>

Low river channel gradient (0.07% average), under the low flow volumes experienced to date, does not provide the stream power necessary to eliminate accumulated and stored organic muck and debris. The 2010 and 2011 SHFs, even though they had 200 cfs peak flows, did not accomplish needed channel scouring and movement of organic material out of the system. A 200 cfs peak flow released at the Intake Control Station quickly reduces in volume as the flow moves downriver. By the time this 200 cfs released peak flow reaches the Pumpback Station, peak flow has been reduced to about 78 cfs. Thus, a large stream power loss occurs and affects the ability of the river to cleanse itself, especially in downriver reaches. The largest downstream flow reduction occurs in the river reach between Reinhackle Station and the Pumpback Station.

<u>2013 Seasonal Habitat Flow Release</u>

The 2013 SHF covered four days and only increased flows over the four day base flow period in the Intake-Blackrock river reach by about 10 cfs (Table 2.2.4). Required base flows released just two weeks later were actually 35 cfs higher than the peak SHF. The river has been forced to function two years back-to-back with base flows much higher than the spring pulse flow and is exhibiting concerning issues. The MOU (1997) Action Plan called for the development of Lower Owens River flows that mirror natural flow conditions. Nothing is more unnatural than a river with summer flows much higher than spring pulse flows. The current flow regime is unbalanced, ineffective and is causing stagnation of the river ecosystem.

The 2013 SHF peak flow of 58 cfs that was released at the Intake Control Station resulted in only an 8 cfs increase in the peak flow passing the Mazourka measuring station over the applied base flow. An 8 cfs flow increase is an insufficient and ineffective flow increase. This same peak flow from the Intake Control Station only increased existing base flow by about 10 cfs as it passed Reinhackle Station. Again, this 10 cfs increase is a very ineffective flow increase. The same peak flow arrived 13 days later at the Pumpback Station and was only 15 cfs higher than base flow. This scenario is inadequate and ineffective and needs to be amended for the health of the river.

Table 2.2.4. City prescribed 2013 seasonal habitat daily peak flows (cfs) released at the Intake Control Station. The actual real time average daily flow released is in parenthesis ( ) and the peak flow reached on that day is in brackets [ ]

Date	Intake Control Station	Alabama Gates Release
21-May	42 to 50 (49)	0
22	50 to 53 (56)	0
23	53 to 50 (55) [58]	0
24	50 to 42 (50)	0
25		0
26		0
27		0
28		0 to 87 (22) [87]
29		87 to 0 (30) [55]
30		0

This flow may have been slightly influenced by the two day augmented flow released from the Alabama Gates (Tables 2.2.4 and 2.2.5). After the 58 cfs peak flow at the Intake Control Station was reduced back to 50 cfs, the City got into immediate trouble with resulting low flows reaching the Pumpback Station being under the 40 cfs flow requirement. Within a couple weeks, the Intake Flow Release was over 90 cfs almost twice as high as the SHF. This type of flow management is perplexing and ineffective. It has no apparent basis in sound river ecology.

The Alabama Gates are used to eliminate sediment accumulated in the LAA. This Gate dumps flushed sediment onto the floodplain near the Islands area. On June 10, 2013, one week after the SHF reached the Pumpback Station, the City released 9 days of flow from the Alabama Gates (a median daily flow of 15 cfs) to increase river flow back up to required flow. The flows arriving at the Pumpback Station had been flowing below 40 cfs for 11 days. This flow augmentation was released long after the 2013 peak SHF reached the Pumpback Station. Therefore, this 9-day flow augmentation was of no value in helping the 2013 SHF be effective. The Alabama Gate flow augmentation was released five days after the Intake Control Station peak flow release. Therefore, the Alabama Gate augmentation waters may have entered and flowed downriver prior to the peak flow arriving from the Intake Control Station. This flow may have increased flows slightly at the Pumpback Station prior to the Intake Control Station peak flow arrival.

It can only be speculated that current river flow management is only done to satisfy legal stipulations regardless of ecological conditions and needs of the river.

Table 2.2.5. The average daily flow (cfs), including the Seasonal Habitat Flow Period released at the Intake Control Station. Alabama Gate augmentation flow is also included (2013 Annual Report)

Date	Intake Control Station	Alabama Gates
20-May	45	0
21	49	0
22	56	0
23	55	0
24	50	0
25	45	0
26	46	0
27	45	0
28	46	22
29	45	30
30	62	0
31	67	0
1-Jun	66	0
2	67	0
3	66	0

River Augmentation Needs

The MOU Consultants have in the past and are again recommending that all future SHFs be augmented, as necessary, in downriver reaches. Some flow augmentation can be implemented under present legal and policy mandates. This can be accomplished by shortening the SHF duration period, changing sites of water releases, and using additional water now available under the 2010 Stipulation and Order. Eliminating the required 40 cfs flow mandates also releases water that can be used for augmentation as needed (see Recommendation #5). The MAMP (2008) states that, "In the event project goals are not being met in lower river reaches, augmentation of flows or increased duration of flow will be modified accordingly."

The Alabama Gate release site is presently the best place to add additional flow to the river. A large decrease in flow occurs between the Reinhackle Control Station and the Pumpback Station. Alabama Gate releases can correct this situation. Achieving the highest flushing flow levels possible in all river reaches, even if it means shortening SHF duration, is a must to achieve and maintain river health. The largest drop in river depth over base flow depth caused by the SHF occurs in the river reach between the Intake Control Station and Mazourka Control Station river reach (Table 2.2.6). Flow augmentation from the Alabama Gates (because it is downstream) will not eliminate this reduction problem. Flow release sites (spill gates) within this river reach should be identified and evaluated for augmentation releases. Flow augmentation at key river sites will increase river depth, increase stream power, increase pulse and base flows, cause more landform inundation, recharge many shallow groundwater aquifers, move muck and sediments, and enhance riparian recruitment and survival.

Table 2.2.6. River Depth (feet) Increase over previous base flow depth as a 200 cfs SHF peak flow from the Intake Control Station passes by

River Reach	Depth Increase over Base Flow
Intake	4.4
Mazourka	1.8
Reinhackle	1.5
Keeler	1.2

Additional Winter Flushing Flows

The annual one time SHF as presently applied, because of its short duration, low average peak flow and very low flows in lower river reaches in all years, cannot be used as the sole source for improving water quality and riparian habitat condition (Table 2.2.7). The SHF, by itself, under present management implementation procedures will not maintain the river in a healthy condition. The majority of the large annual incoming biomass load entering the water column and depositing on the channel bottom should be eliminated annually, mainly through solution and water column transport, if the river is to maintain its health. Under present flow management this organic break-down (to muck) and removal process is a very slow and ineffective. A winter pulse flow with up to a 300 cfs peak released during February and probably March would go a long way in countering these detrimental developing conditions as an example. The February 2008 high SHF with flows of 227 reaching the Pumpback Station produced good river conditions in 2009 (Table 2.2.8).

Table 2.2.7. Examples of Different Released SHF Peaks by Site as These Peaks Move Downriver.

Location	Resulting Peak Flows (cfs)			
Intake	209 Peak Flow	110 Peak Flow	92 Peak Flow	58 Peak Flow
Blackrock		98		
Goose		96		
Culverts		98		
Mazourka	125	82	90	60
Manzanar		84		
Reinhackle	116	89	84	57
Keller	116	71		
Pumpback	76	47	61	43 (Augmented)

Table 2.2.8. Intake Peak Flow Releases (cfs) and the Resulting Peak Flow (cfs) Arriving Above Pumpback Station

Year	Intake Release Peak Flow	Pumpback Arrival Peak Flow
2008	220	227 (augmented at Alabama Gates)
2009	110	69
2010	209	76
2011	205	78
2012	92	54
2013	58	43 (augmented at Alabama Gates)
Average	149	91

What Needs To Be Done

MOU Consultants have recommended SHFs ranging from a low of 110 cfs to a high of 200 cfs peak flow. Dr. Duncan Patten, however, recommended in his 2012 review of the LORP Annual Report that implementing peak SHFS above 200 cfs should be considered. The MOU Consultants agree that it's time to evaluate the effectiveness of 300 cfs or more peak SHFs to find flow levels that work. Future SHFs also need to be synchronized much better with tree seed fall optimum time periods. Successful seed germination events need to be increased by developing and extending favorable soil moisture conditions within potential seed beds. Tree recruitment needs to be moved higher up the banks and adjacent floodplains using increased numbers and magnitudes of pulse flows.

Although there is no legal agreement that mandates it, a concern of the City has been to maintain a "water neutral" policy in regards to the LORP. Due to the capacity of the pumpback station, a 300 cfs flow released from the Intake would likely result in flows reaching the pumpback station that exceed the pumpback capacity, resulting in additional flows to the DHA. A possible management strategy to minimize this loss is to reduce or eliminate bypass flows to the DHA for a period of time prior to the SHF releases. The pump back bypass flows will refill the DHA. The resulting variable hydroperiod may benefit DHA habitat diversity. The DHA has sufficient groundwater and can sustain a drying period, which will likely bring additional benefits.

Little is known about what hydrograph would best increase riparian tree recruitment and survival along the Lower Owens River. Even less is known as to what flows will be required to improve water quality conditions. This is particularly true and will be difficult to determine because stage heights that control tule encroachment are variable (Sierra Club 2012), although we have some empirical evidence of tule control depths of 3-4 feet for the lower reaches of the LORP (Tule and Cattail Management Recommendations 2013). However, research has shown the tules and cattails favor highly regulated, canal-like flows over the more natural flow regime being recommended (Sojda and Soderber 1993, King et al 2004).

The natural hydrograph of the Lower Owens River is unknown. Diversions and flow modification predate reliable flow data. However, other systems can provide guidance when recreating the most critical components of the natural flow regime. The Kern River hydrograph shows a stark contrast in comparison to the LORP flows since implementation (Figure 2.2.1). The LORP peak flows are much lower and base flows much higher. The ratio of maximum flows to minimum flows illustrates how the LORP is managed more like a canal, than a natural river system (Table 2.2.9).

Table 2.2.9. Ratio of mean maximum to minimum flows in the LORP and Kern Rivers 2007-2013 and the proposed ratio of maximum and minimum flows for the LORP according to 2013 Adaptive Management Recommendations.

	LORP	Kern	LORP Proposed Discussion Flow
Mean Maximum	91.4	596.0	285+
Mean Minimum	42.7	8.8	20
max/min ratio	2.1	67.7	14

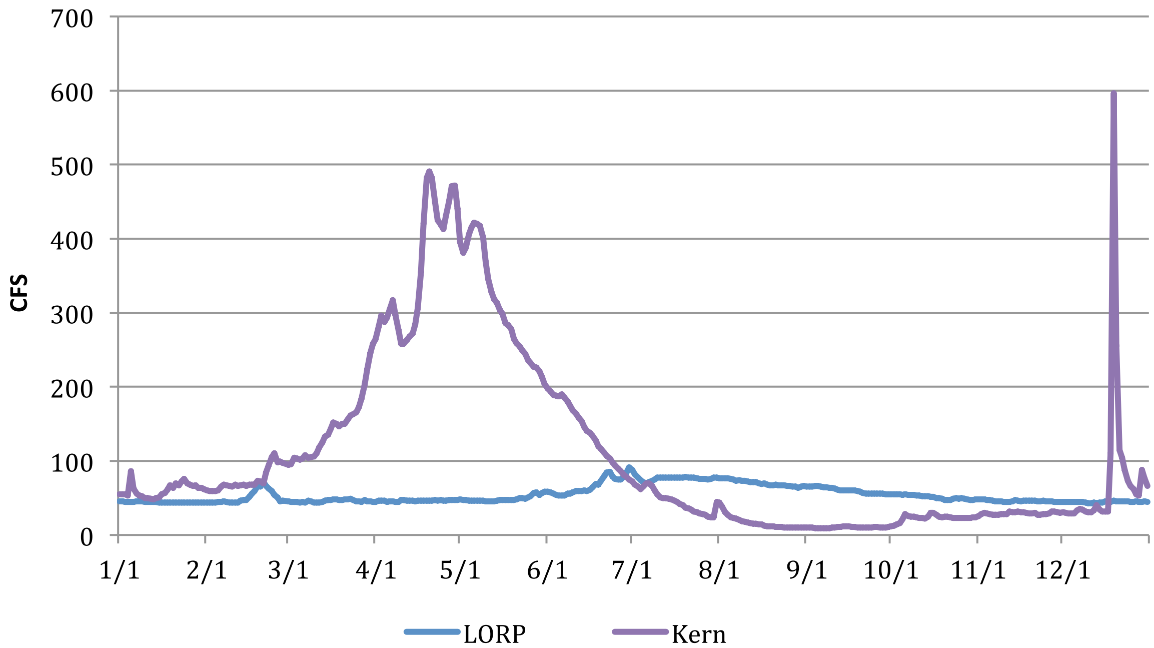


Figure 2.2.1. Hydrograph of mean daily flows for the Kern River and the Lower Owens River from 2007-2013.

Future river flow management needs to accomplish many things. The four most important are to improve water quality, establish more tree willow, increase bordering riparian habitat diversity and quality, and control tule and cattail abundance, distribution and encroachment. SHF magnitude and duration patterns, now being released into the Lower Owens River, were designed and approved over a decade and half ago. The models used to predict which flows to apply were selected with reservations, but, they were expected under adaptive management to bring successful results. The past six years of LORP flow implementation has proven other-wise and no adaptive management has been implemented. Present river flow implementation methods need to be re-designed. To do this requires moving forward with experimenting, evaluating, upgrading and implementing through adaptive management more efficient base and pulse flows.

The first and only Lower Owens River flushing flow (over a 200 cfs flow peak) was released in February 2008; the downriver moving peak flow was augmented so the peak flow reaching the Pumpback Station would also be over 200 cfs (Table 2.2.8). Although this winter pulse was somewhat successful in helping to cleanse the Lower Owens River, this procedure was never used again. Winter flushing flows need serious consideration for future application.

Adaptive management decisions on adjusting river flows to improve tule and cattail distribution and improve water quality should be based on careful analysis of studied flow scenarios. The MOU Consultants have been recommending a thorough analysis of all past flow releases and then to use the results and experience to design and implement better river flows for the future.

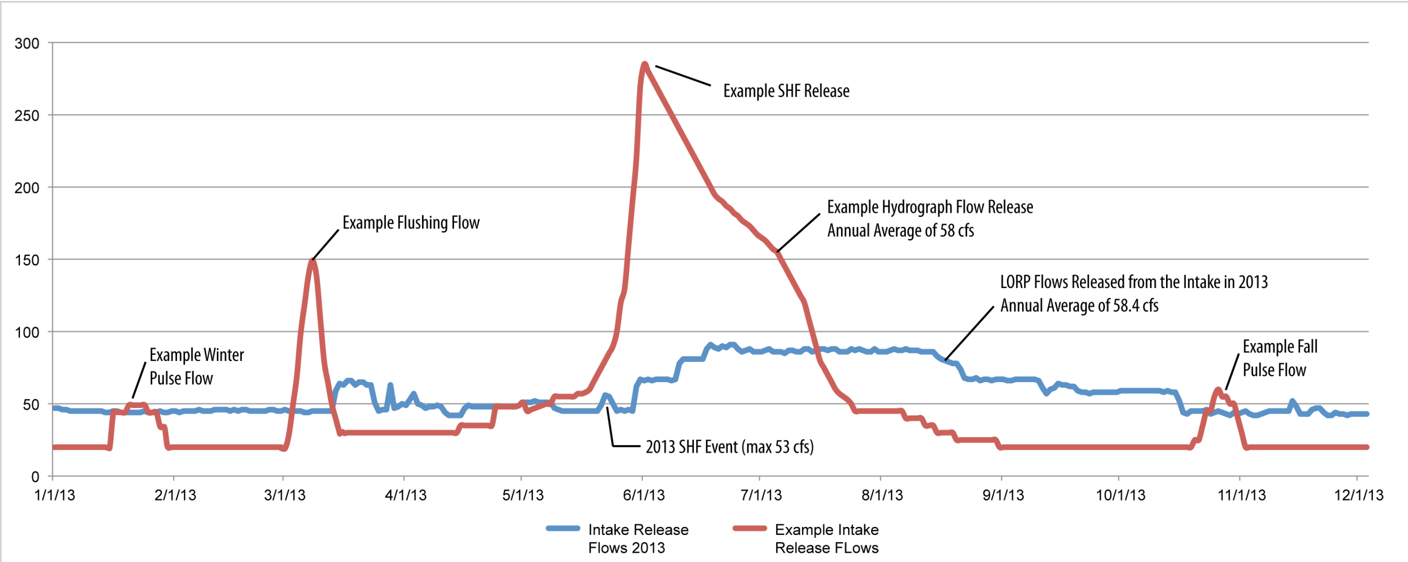


Figure 2.2.2. Existing river flows versus an example flow for the LORP. The existing flows released from the Intake in 2013 for the period of record shown here were an annual average flow of 58.4 cfs. The example hydrograph shows a redistributed flow regime with multiple potential ecological benefits with an annual average flow of 55 cfs. **It is important to note that this is only shown for illustration purposes and does not represent any future actual final flow recommendation**.

MOU Consultants Recommendation

Recommendation
The MOU Consultants recommend that a SHF peak of 300 cfs or more be released during 2014. Water to accomplish this would come from the 55 cfs average annual base flow allotment (this is the average annual flow released from the Intake into the Lower Owens from 2008 to 2013) (Figure 2.2.2). Part of the needed water could come from implementing the 2010 Addendum to the EIR (2004).The Addendum allows an additional flow by-pass into the DHA of up to 928 afy over past required flow by-passes.

Recommendation
The MOU Consultants recommend that flow management changes be made to improve flow timing, flow duration, and flow magnitude. To provide the base for these changes an analysis and evaluation report of all past flows should be prepared that will describe and document reactions to past flow management. This evaluation and findings report should help determine the changes needed to improve LORP resources to be effective. This draft report would be available to the County and City prior to the MOU Consultants recommending the 2014 SHF.

Recommendation
The MOU Consultants recommend that during the winter of 2014, the MOU Parties eliminate and void all presently legal and mandated restrictions on the amount of water the Pumpback Station can pump out of the Lower Owens River.

Recommendation
The MOU Consultants recommend that the County, City, and the MOU Consultants meet prior to the MOU Consultants time-frame for recommending the 2014 SHF and discuss what can be done to increase the effectiveness of future SHFs.

Recommendation
The MOU Consultants recommend that the MOU Parties, during the winter of 2014, revise the Stipulation and Orders that govern present base flow requirements in the Lower Owens River. This revision would be replaced with a Stipulation and Order requiring the City to release from the Intake Control Station, a 55 cfs average annual flow (this is the average annual flow released from the Intake into the Lower Owens from 2008 to 2013). The reason for selecting the 55 cfs average flow is because flows released from the Intake Control Station from March 21, 2007 through November 18, 2013, a period of about 7 years, averaged 54.8 cfs. The average annual flow could then be formed so that flow alternatives will be able to improve riverine-riparian conditions. Water would be available to release more efficient SHF's. The flow regime can be designed to more effectively manage the river seasonally.

Recommendation
A late winter or early spring seasonal flushing flow, similar to the flushing flow released in February 2008, should be released during 2014. This will increase the annual SHF's applied each year from 1 to 2. This flushing flow would be evaluated to determine benefits received. It would provide experience and information to make future winter pulses more effective and help eliminate environmental problems in the Lower Owens River.

11.2.3 Flow Management Changes to Minimize Future Fish Kills

Background

Over the past 4 years, MOU Consultants have discussed and identified the potential for future fish kills in the Lower Owens River if changes were not made in LORP river management. Flow recommendations were made to modify and improve degraded river conditions (see past Adaptive Management recommendations). In 2008 and 2009, at the beginning of LORP seasonal habitat flows (SHFs), high river flows (up to 212 cfs) larger than base flows, did not create observed adverse environmental conditions. During early years of LORP flow implementation, dissolved oxygen (DO) and other water quality parameters generated during Seasonal Habitat Flows (SHFs) caused little observed fish stress.

Because the river is managed much like a canal, large quantities of organic material (including muck) have accumulated annually. Short-term detrimental water quality conditions were discussed during the 2010 SHF (212 cfs peak). The same stressful condition continued, but, to a lesser extent during the much lower 2011 SHF peak. Future high flows, released in the summer, without changes in flow management will cause fish stress and make it more difficult to maintain favorable water quality conditions. As predicted, water quality conditions became so hazardous during the summer of 2013 that localized fish kills were observed and recorded in the Lower Owens River.

Upon being alerted in July 2013 that a large fish kill had just occurred in the LORP (Figure 2.3.1), the MOU Consultants requested permission to evaluate on-site the fish kill magnitude and determine cause and effect. This request was not authorized by the City and County and the MOU Consultants could not observe conditions. Therefore, the only available alternative the MOU Consultants had was to evaluate the fish kill from any data or information available from those who would pass it on. Almost all reliable information and data of value was received from the County, and in part from local fisherman.

As the available data and observations used in this report demonstrate, information documenting fish kill causes and effects was lacking. Adequate fish kill observations, fish kill recording, and fish kill analysis were spotty and lacking. No known fish autopsy analysis was conducted. No health or mortality determination characteristics were described. Little analysis was presented to determine the cause, magnitude, or significance of the mortality.

Management Actions

The City planned, during the winter of 2012-13, to repair and upgrade sections of the Los Angeles Aqueduct (LAA). The concrete repairs to the LAA were programmed to be completed in April of 2013. The City apparently determined there was no immediate hurry to repair the LAA as repairs were postponed until July 2013. The repair work required the release of water from the LAA via Alabama Gates into the Lower Owens River. The City did not notify the MOU Consultants that this repair work would take place during the hot periods of summer. In July of 2013, the City started repairing 250 yards of the LAA about 0.5 miles downstream from the Alabama Gates (Sierra Wave 2013). Later information showed other sections of the LAA were also being repaired or in the process of being repaired.

Large flood and mudslide events were reported by the City soon after repair work was initiated, but these events did not affect Lower Owens River flow. During the flood events, the river continued stable flow from the Intake Control Station downriver to the Reinhackle Station. During and after the storms, the river from Reinhackle Station to the Pumpback Station also showed no flood effects. Thus, the changes in river conditions resulted from water released at the Alabama Gates by the City for maintenance purposes in the LAA.

The Alabama Gate flow release resulted in higher river flows in lower river reaches. Only a 4 to 5 cfs flow increase occurred during the initial period of the fish kill in the river reach below the Lone Pine Bridge. Later, as flow releases from the LAA increased, 185 cfs flow below the Alabama Gate release site only resulted in a 93 cfs peak flow reaching the Pumpback Station. The LAA below the Alabama Gates was dried up for 6 days for repair work. Water released from Tinemaha Reservoir into the LAA was emptied into the Lower Owens River via the Alabama Gates. Less stress to the river may have been possible if the flows had been portioned over multiple release gates and/or done at a different time of year. Also, a controlled flow release from Tinnemaha Reservoir that allowed the Intake structure to function and put a small flow down the LAA may have helped (Table 1).

Figure 2.3.1. Lower Owens Fish Kill occurred in July and August of 2013. Photo: ICWD.

Timeline of Events

September 12, 2012
Mr. Francis Pedeneau (a local fisherman) fished one Lower Owens River pool located in the river reach adjacent to the town of Lone Pine for one weekend and caught 97 bass (Pedeneau 2013).

June 4, 2013
The County monitored water quality conditions at hydro station sites south of the Alabama Gates and found river DO levels were low but above 3 mg/L. During this same period, the MOU Consultants observed poor river conditions, especially low DO levels, from Two Culverts downstream to the Pumpback Station.

June 10, 2013
Mr. Pedeneau fished a short time in the river reach adjacent to the town of Lone Pine and caught 3 large bass.

July 7, 2013
Mr. Pedeneau again fished the river reach adjacent to the town of Lone Pine and caught 7 large bass.

July 22-24, 2013
The City shut the flow off in the LAA below the Alabama Gates on July 22, 2013 (Table 2.3.1 and Figure 2.3.1). Flows coming down the LAA were diverted into the Lower Owens River via the Alabama Gates. During the week of July 22, 2013, the Sierra and White-Inyo mountains were hit by extreme thunderstorms. The storm started on Sunday (July 21, 2013) and increased in intensity the next day (Monday July 22). Mud slides were reported on July 22, 2013. Numerous creeks along both mountain ranges experience very high mud and debris flows. There are numerous massive fans occurring along the base of both mountain ranges that demonstrate that this type and magnitude of flooding and resulting mud slides are common geologic events and should be expected and planned for.

Flash flooding caused unmeasured water surges into the LAA. To minimize impacts to the LAA some water was released from the LAA, via the Alabama Gates, into the Lower Owens River from July 22 through July 26. The City cited the flash floods for significantly impacting Lower Owens River water quality, most likely resulting in the fish kills (LADWP {Joseph Ramido} 2013a); this turned out not to be the case. Flow in the LAA was shut off at the Alabama Gates during this period for planned repair work and a significant amount of water was being discharged under US 395 (through the Alabama Gate Complex) and into the Lower Owens River (LADWP 2013b).

Information available does not allow a determination of why flows were bypassed from the LAA into the Lower Owens River when flows were not reduced at Tinnemaha Reservoir control gates or from the Intake Control Station. Intake Control Station flow (86 to 88 cfs), Mazourka Control Station flow (78-88 cfs), and Reinhackle Station flow (74-83 cfs) were very steady during this period. The peak flow released at the Alabama Gates took 6 days to reach the Pumpback Station. The first fish kill, however, was reported on the fourth day of the Alabama Gate day release flows. Given this information and timing, it appears that flows released from the LAA for maintenance was the cause of detrimental water quality conditions that caused the fish kill.

July 25, 2013
The County observed no dead fish or evidence of invertebrate stress at the Keeler Bridge between 9:00 am to 2:00 pm on July 25. The river at this site, however, was the color of “root beer” with abundant tannins and lignin’s causing low transparency of less than 19 inches (Inyo County 2013). River temperature was in the high 70’s (F) to low 80’s (F). Lethal water quality conditions and resulting fish kills had probably already developed by this time.

July 26, 2013
The City received a report that a fish kill occurred in the LORP. About 400 to 500 dead fish were observed at the southern end of the LORP (LADWP 2013). The number of dead fish observed during a fish kill usually represents only the tip of the iceberg when related to the magnitude of the total fish kill.

The Lone Pine Tribe Environmental Office reported that during this period, the water passing under Lone Pine Narrow Gate Bridge was dirty and turbid with a foul odor (Hays 2013). About a dozen dead fish were observed in the Lone Pine Bridge area. This water observed at the Lone Pine Bridge, was reported to not have reached the Keeler Bridge reach by this time. Because the fish kill had already occurred, it must have reached Keeler and passed through. The extreme odor produced by the river could be detected from as far away as Highway 395.

The fish kill now encompassed the Lower Owens River from the Lone Pine Narrow Gage Bridge downstream to the Pumpback Station, a distance of 10 river miles. The major fish kill observed was from the Keeler Bridge downstream to the Pumpback Station, a distance of 5 river miles. Smaller more isolated fish kills may have occurred upstream, possibly to the Alabama Gates, a distance of 21 river miles. The County, however, reported that upstream from the Pumpback Station they did not find rafts of bloated fish. They found no dead fish trapped in between the tules or on the river bottom where the County was clearing tules.

July 29, 2013
366 dead fish (mostly bass) were observed on the west side of the Pumpback Station forebay pond (Inyo County 2013). Additional dead fish were observed in tules and cattails and in surrounding open water (Inyo County 2013). The City reported that only one dead carp was observed on this day between Lone Pine Bridge and the Keeler Bridge (LADWP 2013c).

August 2013
In September 2012, Mr. Pedeneau fished a large pool in the Lower Owens River adjacent to the town of Lone Pine, catching 97 bass in one weekend. In August of 2013, he again fished the same pool using the same equipment and fishing effort and only caught one bass. On September 13, 2013 he fished the same area again using the same effort and fishing equipment and only caught one bass. This supports the conclusion that a very large fish kill occurred, or a large number of fish moved out of the reach.

August 1, 2013
Mr. Pedeneau photographed 2 dozen dead fish near the Lone Pine Bridge river reach. Three additional dead fish were found in tall grass by his dog 0.5 miles above the Pumpback Station.

August 13, 2013
Mr. Pedeneau fished 2 hours and only caught one bass in the river reach adjacent to the town of Lone Pine.

September 13, 2013
Mr. Pedeneau again fished 2 hours and only caught one bass in the river reach adjacent to the town of Lone Pine.

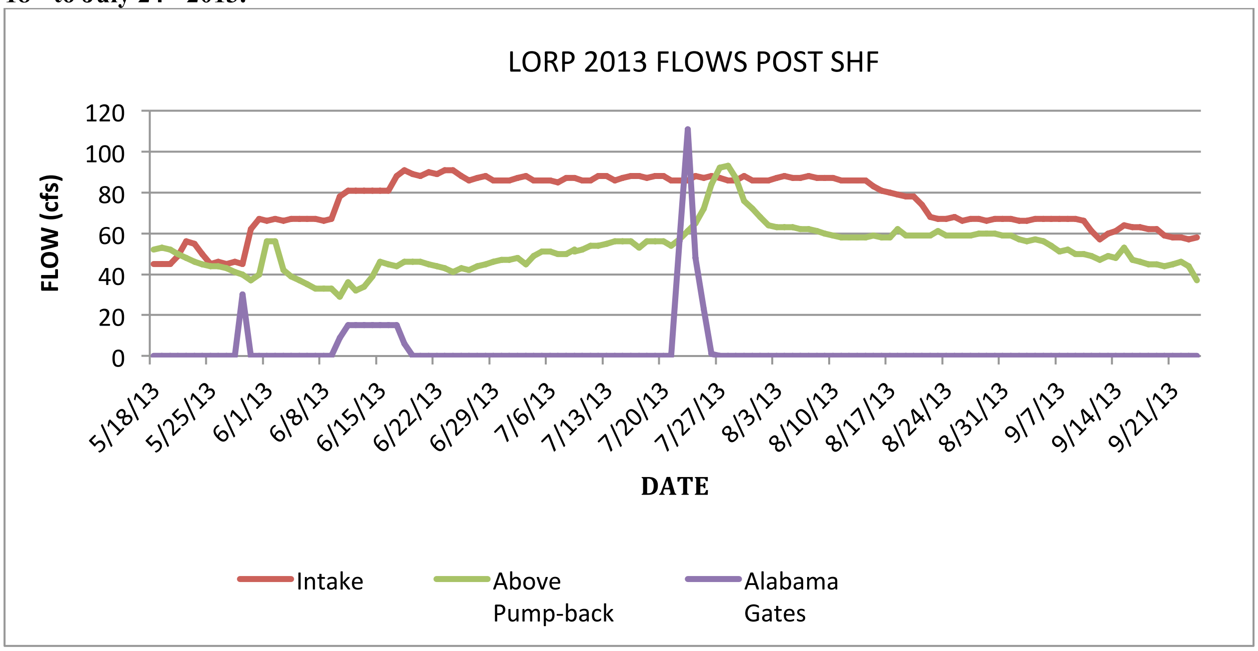
October 15 to 20, 2013
Fishermen from Independence reported excellent bass fishing at the confluence of Georges Creek and in the river reach upstream from the Alabama Gates.

Table 2.3.1. Lower Owens River Flows (cfs) at selected stations and the Alabama Gates from July 20, 2013 through August 3, 2013

Date	Intake	Mazourka	Reinhackle	Alabama Gates	Above Pumpback	Tinemaha Res
7/20	88	87	80	0	56	150
7/21+	86	87	77	0	56	150
7/22!	86	84	77	56	54	130
7/23	86	84	83	111	57	127
7/24	88	83	76	48	61	129
7/25	87	86	75	23	65	129
7/26*	88	87	75	1	72	131
7/27	87	88	75	0	84	130
7/28	86	87	75	0	92	130
7/29	86	88	76	0	93	134
7/30	88	86	77	0	87	151
7/31	86	82	75	0	76	173
8/1	86	79	77	0	72	174
8/2	86	79	76	0	68	196
8/3	87	78	74	0	64	248

+ Storm started; ! Mud slides reported; * First fish kill reported

Figure 2.3.1. Lower Owens River Flows (cfs) at selected stations and the Alabama Gates from May 18th to July 24th 2013.



Other Information

It is significant that the first reported fish kill on July 26 occurred at a time when the river flow at the Pumpback Station site only increased 15 cfs as a result of the Alabama Gate flow release (Table 2.3.1 and 2.3.2). The actual fish kill occurred earlier than the observed kill was reported. Therefore, the fish kill could have actually occurred when the flow increase at the kill site was only 8 cfs higher than the normal base flow being delivered.

The fish kill was observed about 4 days after the first flows were released from the Alabama Gates. The peak flow released did not arrive at the Pumpback Station until the 7th day. The fish kill occurred about the time the very first lenses of the Alabama Gate release water were reaching the Pumpback Station.

Justification

A major goal of the MOU (1997) is to manage and release river flows that will create and maintain a healthy warm water fishery. Six SHFs have now been released to improve river conditions into the Lower Owens River. These flow releases have not maintained river conditions necessary to maintain a healthy warm water fishery in all reaches at all times. As July 2013 conditions demonstrate, the river is not capable of buffering short-term higher than base flow event without damaging results when summer river temperatures are high.

The MOU (1997) requires consultation with the Parties, ranch lessees, and the public on matters that would affect the LORP. Each Party in the MOU (1997) agreed to maintain frequent, informed communications with the other Parties with regard to the work to be accomplished hereunder to minimize disagreements. The MOU (1997) also directs the City and the County to provide direction and assistance to the MOU Consultants in the implementation of the LORP. Communication among parties was inadequate during these events and for the planned flow releases from the LAA for repairs. Had communication been open, the fish kill probably would not have happened. Conducting this type of LAA repair during hot summer conditions may not have been necessary (LADWP 2013-B). The July fish kill does demonstrate that management changes are needed to prevent much larger fish kills in the future.

Table 2.3.2. Time series showing environmental observations, fish kill information, and storm event periods.

Event	Date	Alabama Avg Daily Release Flow
LAA flow stopped at Alabama Gates	7-18-13	0
	7-19-13	0
	7-20-13	0
Storm started and first flow diverted through Alabama Gates	7-21-13	0
Mud slides reported	7-22-13	56
	7-23-13	111
	7-24-13	48
First major flow increase appears at PB fish kill site	7-25-13	23
Nasty dark smelly water passing Lone Pine Br. Large fish kill first reported	7-26-13	1
Higher flows passing PB Station	7-27-13	0
	7-28-13	0
88 + dead fish plus many more at PB	7-29-13	0
Highest peak flow (+37 cfs over base) reaches Pumpback	7-30-13	0
	7-31-13	0

MOU Consultants Recommendation

Recommendation
The MOU Consultants recommend that in the future the City coordinate with all MOU Parties and the MOU Consultants on any management activity that would or could influence any environmental condition in the LORP.

Recommendation
The MOU Consultants recommend that the City and the County develop Task Orders that allow Consultants to meet their responsibilities under their MOU (1997) mandates for the remainder of LORP implementation. This would specify the ability for the MOU Consultants to respond and work on unanticipated events as needed.

Recommendation
The MOU Consultants recommend the City evaluate all past and current AMRs that apply to maintaining the warm water fishery in a healthy condition.

11.2.4 Amending the MOU, FEIR and Stipulation Orders for more Effective Flow Management of the River

Background

The Monitoring and Adaptive Management Plan (2008) states flows can be modified if MOU Parties agree even though flows have been codified in the Court Stipulation and Order. The MOU (1997) Action Plan calls for river flow augmentation when it can be justified. The LORP Ecosystem Management Plan (2002) also calls for the modification of the magnitude, duration, augmentation and timing of flows if needed. The LORP intent for flow management was not to restrict future improvements needed in flow management, but rather to allow the adaptive management process to improve river flow management.

Present legal and obligatory mandates place very tight and hard to meet restrictions on when, where, and how much flow is to be released into the Lower Owens River. The City has met the compliance standard on all these restrictions. If abiding by these flow restrictions was in fact developing a high quality Lower Owens River, then abiding by them would be well worth the time and money spent. However, this is not the case. Restrictions and mandates on river flow are not doing the job of creating a high quality river ecosystem. The current flow mandates are instead causing stagnation of the ecosystem.

Flow restrictions have forced the river to function much like a canal. As a result, the river has taken on many characteristics of a canal. The river is now overwhelmed by tules while resulting water quality conditions continue to worsen. The MOU Consultants have continuously recommended changes to the mandates that restrict the City while they try to implement the LORP.

Now is the time to go beyond past recommendations. It is clear that some river flow management changes need to be made to meet all of the MOU (1997) goals and intent. A good example hampering good river flow management for many years is the maximum 50 cfs allowable pump-out by the Pump Back Station. The MOU Consultants spoke out in the very beginning of the LORP that they did not want this restriction. For the past 6 years, both verbally and in recommendations, the Consultants constantly tried to get this handicap eliminated. Other restrictions place additional handicaps keeping needed flow changes from being approved and implemented. The major restrictions are covered in this Adaptive Management Section.

As outlined in the MOU (1997), river flows should be managed for the following purposes:

- Apply river flows to increase open water areas.
- Apply river flows to control tule encroachment.
- Apply river flows to improve summer and winter river temperatures.
- Apply river flows to improve dissolved oxygen (DO) concentrations and other water quality conditions.
- Apply river flows to increase woody recruitment.

Under the current flow conditions and management regime, the river is having difficulty developing conditions that will meet these purposes.

Concerns

The California Department of Fish and Game (CDFG) expressed their concern that after 5 years of LORP implementation, scheduled seasonal habitat flows (SHFs) have not promoted adequate woody plant establishment, particularly the taller stature species (CDFG 2012).CDFG, therefore, recommended that the efficiency of the scheduled seasonal flows in establishing woody vegetation be evaluated. This efficiency has not been determined or evaluated.

The Sierra Club (2010) and the Owens Valley Committee (2010) expressed environmental concerns in their 2010 letter to the County and City. They expressed concern that recruitment and survival of riparian vegetation in the lower reach of the LORP may be inhibited. They believe that unless adequate stage height (flow) is increased, proper landform inundation will not be provided, and the shortened ramping rates being applied will inhibit plant recruitment. They urged management to develop stage-discharge relationships so the down-ramping flows needed to develop an appropriate decline of the alluvial water table for cottonwoods and willows are estimated. This has not been done.

SHFs applied over the past 6 years have proven to be ineffective in reducing water quality problems. The last two SHF peaks (2012 &2013) were less than the respective summer base flow for both years. Major dissolved oxygen (DO) reductions and other gas and chemical increases occurred in the river in 2012. This flow reduction occurred even when the SHF peak increased base flow levels by 46 cfs at the Intake Control Station. In 2013, drastic reductions in DO occurred in river reaches when a non-planned peak flow increased base flow by only 19 cfs. The results of poor flow management are especially pronounced in down-river reach environmental conditions in all years. Environmental problems are increasing because SHFs are too low and too short of duration. Also, the SHF peak flow effectiveness is not helped by the current application of year-round base flows.

SHFs released in 2012 and 2013 were ineffective. Even the 200+ cfs peak flows released in the Lower Owens River in 2010 and 2011 were not very effective in addressing major water quality stressors. A 200 cfs SHF peak flow released from the Intake Control Station quickly reduces in volume as the flow moves downstream. This flow reduction results in only a 78 cfs pulse flow through lower-river reaches. The large flow decrease reduces stream power needed to move and eliminate accumulated detrimental organic muck and sediments from the river channel. The result is the river now exhibits abnormally high biochemical oxygen demand (BOD) (and to a lesser extant the chemical oxygen demand (COD)) during warmer periods of the year, especially if river flow fluctuates.

<u>Past Recommendations</u>

To buffer negative affects to the river from low water-year flow restrictions (i.e., 2012 and 2013), the MOU Consultants recommended in their 2009, 2010, 2011, and 2012 Adaptive Management Recommendations, alternate ways to achieve a 200 cfs peak flow during all annual SHF releases. In their 2010 Adaptive Management Recommendations they recommended a series of flow alternatives. This would allow various management scenarios to be reviewed, discussed, and considered for future flow needs. The consideration of these flow alternatives has not been discussed.

The MOU Consultants, in their 2011 Adaptive Management Recommendations, recommended that river flow augmentation be considered, especially on years Owens Basin runoff is forecasted to be over 100% of normal. This recommendation was supported by lengthy discussions on Lower Owens River water quality conditions and actions needed to maintain a healthy warm water fishery. Changes in base flows to improve water quality conditions were also displayed. Changes include releasing Delta Habitat Area (DHA) flows from the Intake Control Station instead of the Pump Back Station. This change has yet to be effectively implemented.

<u>Problems</u>

The MOU Consultants, in their 2011 Adaptive Management Recommendations warnedthat if actions are not taken to decrease biological oxygen demand (BOD) during future higher river flow periods, fish kills could occur. Especially during future high flow releases occurring during summer conditions. Also stressed was that if water quality problems are not addressed now, it will be more difficult to meet future water quality regulations. The 2013 fish kill in the lower reaches of the Lower Owens River should not have been a surprise.

Lower Owens River DO can run from 11 ppm in winter to as low as 0.1 ppm in summer. Presently, DO decreases rapidly as stream power and river temperatures increase. Toxic gasses also probably increase.

During the 2010 SHF, DO levels decreased drastically in river reaches while peak flows were passing. River DO was recorded as low as 0.14 mg/L; a limit that usually causes fish kills. SHFs and winter-spring pulse flows are needed to decrease BOD effects following high flows if the river is to function properly and improve health.

Restrictions

Base and SHFs now being released into the Lower Owens River were designed, approved, and implemented many years ago. The MOU (1997) allows for no SHF when the Owens Basin water year runoff is forecasted to be 50% or less of normal. The MOU (1997) also allows lower SHFs when basin runoff is between 51% and 99% of normal. This restriction stands in the way of making management changes needed to maintain healthy river environmental conditions. Flow restrictions specified in the MOU (1997), the EIR (2004), and a series of Court Stipulations and Orders are inflexible and obstruct flow changes needed for good river management. The 40 cfs uniform year around base flow requirement, the 50 cfs maximum pump-out restriction and the absence SHF in certain low runoff years, are prime examples of inflexible restrictions that stand in the way of effective river management.

The MOU Consultants have recommended several modifications in base and SHFs over the past 6 years. Accepting and implementation these recommendations has been hampered by restrictions described below.

River Base Flow
On July 12, 2003, a Court Stipulation and Order was issued requiring the City to meet specific flow requirements for the LORP. The base flow requirements are:

1. A minimum of 40 cfs will be released from the Intake Control Station at all times.
2. No in-river measuring station can have a 15-day running average of less than 35 cfs.
3. The mean daily flow at each in-river measuring station must equal or exceed 40 cfs on 3 individual days out of every 15 days.
4. The 15-day running average of any in-river flow measuring station can be no less than 40 cfs.

Base flows were initiated in December 2006. 40 cfs was mandated throughout all reaches of the river. Therefore, the river functions under steady state conditions 11.5 months out of each year and even longer on drought years. Each year massive quantities of in-coming and internally produced organic sediments accumulate in the river channel. These decomposing organic sediments coming in contact with free oxygen during warmer periods of the year can create deadly water quality conditions for fish and other aquatic species. Base flow restrictions must be modified or these water quality problems cannot be addressed effectively.

Seasonal Habitat Flow
The MOU (1997) calls for SHFs of sufficient frequency, duration, and amount that they will minimize muck, fulfill seed germination needs, recharge groundwater, control tules and enhance the river channel. The MOU (1997), then specifies that the SHF peak will be reduced from 200 cfs to as low as 40 cfs in general proportion to the forecasted runoff in the watershed for years when basin run-off is forecasted to be less than average. These two mandates conflict with each other and confound quality river management (Table 2.4.1).

Table 2.4.1. Seasonal Habitat Flow Peaks (cfs) Released From the Intake Control Station

Year	Flow
2008	220 (augmented at Alabama Gates)
2009	110
2010	209
2011	205
2012	92
2013	58 (augmented at Alabama Gates)

Pump Back Station
Court Stipulations and Orders restrict the maximum amount of water (up to 50 cfs) the Pump Back Station can pump out of the Lower Owens River. This restriction decreases the opportunity to release higher flows needed to develop healthy river conditions. This restriction needs to be lifted before Adaptive Management Recommendations on flow can be most effective.

<u>MOU Consultants Recommendation</u>

Recommendation - Base Flows
The MOU Consultants recommend that all Court Stipulations and Orders and mandates appearing in the MOU (1997) and EIR (2004) that require a constant 40 cfs flow in all reaches of the Lower Owens River be eliminated. The flow requirements would be replaced with a new Court Stipulation and Order. The Order would require the City to release an annual average flow equaling 55 cfs over the year from the Intake Control Station into the Lower Owens River. The reason for the 55 cfs flow selection is because from March 21, 2007, through November 18, 2013, the average annual flow released from the Intake Control Station was 54.8 cfs. Because 55 cfs is the average flow requirement the base flow could then be increased or decreased (temporally and spatially) to better-fit environmental needs. The number and magnitude of pulse and SHFs could be increased. Base flows could be better formed to match seasonal requirements. High base flows now released during summer conditions that are eliminating willow seedlings could be reduced to match more appropriate flow conditions.

Recommendation - Seasonal Habitat Flows
The MOU Consultants recommend that 40 to 200 cfs SHF peak flow restrictions required in the EIR (2004) and the MOU (1997), based on forecasted annual runoff conditions, be eliminated. All present SHF restrictions on flow would be eliminated. Instead, a new Stipulation and Order would require the City to release an annual average flow equaling 55 cfs over the year from the Intake Control Station and follow an annual hydrograph. All water needed to release future SHFs and pulses would come out of the 55 cfs average annual flow allotment. Higher SHF's and additional pulse flows could then be planned and implemented.

Recommendation - Delta Habitat Area Flows
The MOU Consultants again recommend that three of the DHA pulse flows be released at the Intake Control Station instead of the Pump Back Station. For more information on the justification, procedures and processes to accomplish this, see the 2011, 2012 and 2013 Adaptive Management Recommendations. Future pulse flows need to be released much differently than how the single 2013 DHA habitat flow was released at the Intake Control Station.

Recommendation - Pump Back Station
The MOU Consultants again recommend that all Lower Owens River pump-out limitations that appear in the MOU (1997), EIR (2004), or in any Court Stipulation or Order be eliminated. No limitations would be placed on the amount of water that can be pumped out of the Owens River at the Pump Back Station. An exception would be that water designated to pass by into the DHA, as required by the Court, could not be affected by any pump-out actions.

Recommendation - Future Base and Seasonal Habitat Flows
The MOU Consultants recommend that the County, City, and the MOU Consultants meet during the winter of 2014 and draft example base, pulse, and SHF scenarios using water from the 55 cfs average annual flow release from the Intake Control Station. These flow plans would then be available for Technical Committee consideration.

11.2.5 Delta Habitat Flows Modifications

Background

Delta Habitat Area (DHA) habitat flows, presently being released from the Pumpback Station, can improve river water quality, aquatic habitat, and channel substrate conditions if they are released at the Intake Control Station. Doing so will allow seasonal habitat flows (SHFs) to be released later in the year. Delaying SHF releases later in the year, compared to past release dates, will allow peak flow releases to better match riparian tree seed fall periods. The City experienced difficulty delaying SHF releases late enough in the growing season to meet sufficient seed fall conditions. In past years there has been concern with releasing SHFs during high river temperatures, thus causing some SHFs to be released too early.

The MOU (1997) requires a minimum year-around average base flow of 40 cfs in the Lower Owens River from the Intake Control Station to the Pumpback Station. Therefore, 11.5 months of the year or more (and even longer on drought years) the river functions under steady-state flow conditions much like a canal. During this steady long low flow period the water column and channel bottom are storing large quantities of organic biomass and muck. The build-up and accumulation of stored muck cannot be overcome by the present available stream power to erode, dissolve and transport it out of the system.

Fortunately, to date, biological oxygen demand (BOD) levels have not significantly impacted fish and other aquatic life when the Lower Owens River is at normal base flow. BOD levels, however, are causing low dissolved oxygen (DO) and other stressful conditions from late spring through early fall during base flow conditions. River BOD, resulting DO concentrations, and other toxic conditions will worsen over time if corrective actions are not implemented. The largest decrease in DO presently occurs in the Mazourka Bridge to Pumpback Station river reach.

When flows exceed critical channel bottom shear pressure, biomass and muck erodes, lifts, transports, and goes into solution in the downstream moving water column. Muck and debris, once in the flowing system during high-river temperature periods, greatly decreases free oxygen (Table 2.5.1). These reduction processes, in companion with other gases and chemicals, caused near fish kill conditions in 2010 over large river reaches. A large, localized, river reach fish kill occurred in July of 2013 in lower river reaches with only a small increase in flow. This recent fish kill is a warning of critical conditions that could portend larger fish kills in the future. In most rivers, DO concentrations below 1.0 mg/L, synergized by high river temperatures, would result in massive fish kills (Table 2.5.1). Why this has not yet happened in the Lower Owens River is unknown; certainly the conditions exist for it to occur.

Table 2.5.1. Examples of low DO and high river temperatures game fish and other aquatic life encountered during the 2010 and 2013 pulse flows.

River Site	DO mg/L		River Temperature (F)	
	2010	2013	2010	2013
Mazourka	< 1.0		75	
Manzanar	0.5		76	
Georges Ret	0.1		76	
Reinhackle	1.4	1.5	75	
Lone Pine Reach		0.5		71
Keeler	1.6	0.9	74	71
Pumpback		0.5		73

MOU Consultants, in their 2011 Adaptive Management Recommendations, advised that if management actions are not taken to decrease BOD influences, fish kills could occur during future SHFs. They also stressed that if the problem is not managed immediately, it will be more difficult to meet future water quality regulations. Two years (2013) after submitting these recommendations and pushing for their implementation, fish kills did occur when a small pulse flow was released during high summer temperatures into the lower river. The MOU Consultants again recommend augmenting base flows to improve water quality and stream channel substrate conditions. River conditions can be improved by releasing three DHA habitat flows from the Intake Control Station instead of the Pumpback Station. The County and the City did not accept or put these recommendations into action in 2012. The City did, however, release one low spring-time (March-April) DHA habitat flow in 2013 at the Intake Control Station.

<u>Problem</u>

A short-term (24 hrs.) 200 cfs peak flow released at the Intake Control Station increases river depth 4.4 feet over base flow depth in the Intake-Blackrock river reach (Table 2.5.2) (NHC, 2012). As this 24-hour 200 cfs block of water moves downriver, flows widen and lengthen and velocity decreases because portions of the flow travel faster than other portions (surface flow is faster than bottom flow because of less friction). The released pulse flow lessens in magnitude in the downstream direction as it flows to the Pumpback Station. Rises in water surface elevation increases channel friction. Flow retardants and blockages caused by in-channel vegetation and debris reduce average velocity. Also, part of the flow enters adjacent shallow aquifers to return to the river at a later time. As a result of flow decrease in the down-river direction, river depth also decreases. Decreasing river depth lowers stream power which lessens the rivers ability to move and eliminate organic biomass, channel sediments, and muck from the system.

Table 2.5.2. Example of how the 2010 peak pulse flow decreased river depth over base flow depth in the downriver direction

River Reach Location	Water Depth Increase over Base Flow Depth (Feet)
Intake Control Station	4.4
Mazourka Control Station	1.8
Reinhackle Control Station	1.5
Keeler Control Station	1.2

<u>Present DHA Habitat Flows</u>

Four annual seasonal DHA habitat flow releases ensure that adequate water and nutrients are available to support DHA habitats. Presently four seasonal habitat flows are required to be released annually as described in the LORP-EIR, Section 2.4 (Table 2.5.3).

Table 2.5.3. Current habitat flows released annually into the DHA, by date, time, and volume.

Period	Date	Flow	Purpose
1	March-April	25 cfs for 10 days	Replenish water lenses
2	June-July	20 cfs for 10 days	Meet high ET rates
3	September	25 cfs for 10 days	Enhance migrant habitat
4	Nov-Dec	30 cfs for 5 days	Benefit habitat and recharge groundwater lenses

Past DHA pulse flows, in conjunction with continuous year-around base flow, resulted in the City meeting all MOU (1997) goals for the DHA. Presently, winter-spring habitat flows (Periods 1 and 4) released into the DHA appear to be much larger and released more often than is needed to maintain good winter DHA conditions. This possible over-supply of water allows a better opportunity to change the flow release site. Establishing winter pulse flows from the Intake will serve both purposes of meeting DHA flows as well as a winter river pulse (see the Base flow section for additional information for reducing flows to the DHA prior to SHF release.).

<u>Justification for Changing the Flow Release Site</u>

The Monitoring and Adaptive Management Plan (MAMP 2008) calls for river flow augmentation if LORP goals are not being met; the requirement to maintain good river water quality conditions (a MOU 1997 goal) was one of the major reasons given. The MOU (1997) Action Plan calls for river flow augmentation when it can be justified. This Action Plan calls for a natural disturbance flow regime consisting of multiple stream flows that emulate natural water year events. The MAMP (2008) recommends increasing river flow augmentation by applying higher flows at the Intake Control Station, releasing additional water from spill gates, and modifying flow duration and ramping rates. These planning and guiding documents describe the potential for future modifications to river flow management to maintain and improve river health. Presently, the river's health is stagnant and deteriorating.

Solutions

High BOD and chemical oxygen demand (COD) easily and efficiently strip free oxygen from the water column. This, in turn, causes fish stress, fish kills, and decimation of other aquatic species. This reduction process also increases toxic gas levels and lethal toxic conditions can result. Muck, debris and sediments stored on the channel bottom and aquatic vegetation have high BOD potential. These materials, however, can be moved downriver and out of the system with sufficient high flows. However, moving these materials and solutes out of the system, during low river temperature conditions, could be accomplished without removing excessive amounts of DO and increasing other stressful gasses. Water quality can be improved over-time by releasing higher annual SHFs and adding the three additional seasonal pulse flows recommended from the Intake. The rehabilitation procedure needs to be implemented during cold water river conditions. During high river temperatures, BOD can increase quickly and dangerously as stream power increases.

During late fall, winter, and early spring, Lower Owens River downriver flow is in a near neutral "water loss" situation. At times, the river is in a "water gain" situation during certain winter periods. Therefore, DHA habitat flow releases during these cold-water periods would have no or minimum water loss.

A DHA pulse flow released from the Intake Control Station takes 10 to 13 days to reach the Pumpback Station. Daily flows released at the Intake Control Station (because of the large flow lag time and other flow retarding influences) lose flow volume as water moves downstream. Over time, however, as the lag water catches up, the gain-loss situation tends to equalize. Therefore, little river loss occurs during cold winter conditions. The present reduction in downriver flows allows much higher peak flows to be released from the Intake Control Station. DHA flows released from the Intake Control Station will provide dual benefits. They will improve river health and still maintain DHA habitats in a healthy condition.

2013 March-April DHA Habitat Flow Applied by the City

Intake Control Station Releases
A portion of the 2013 Period 1 (March-April) DHA habitat flow was released by the City at the Intake Control Station instead of the Pumpback Station. The City initiated the pulse flow release on March 14, 2013 increasing the required base flow to an average of 63.7 cfs for 10 days (Table 2.5.4). The required base flow released from the Intake Control Station during the two week period prior to the March DHA flow release averaged 45 cfs (Tables 2.5.5 and 2.5.6). The required base flow released during the two week period after the DHA flow release ceased averaged 51 cfs. Therefore, the average base flow required by Stipulation and Order to be released from the Intake Control Station during the actual release of the additional DHA habitat flow would have been about 48 cfs. The City, however, used only a 40 cfs level in their base flow to DHA flow calculations. Therefore, the City took credit for 8 cfs of release flow they were required to release. The City did not actually release the full required amount of pulse flow over base flow. After 10 days, the 63.7 cfs average pulse flow applied was reduced back to the required base flow of about 51 cfs.

The City reported that on March 14, 2013, the LORP Intake Control Station flow was increased from 40 cfs (actual required base flow was about 48 cfs) to 61 cfs. The City claimed this 21 cfs increase matched the Period 1 required pulse flow of 25 cfs. The City justified part of this by subtracting the 4 cfs DHA base flow to get the 21 cfs flow release at the Intake Control Station. It is not valid to decrease the pulse flow by 4 cfs at the Intake Control Station if this amount is counted again during the 25 cfs DHA pulse flow release. Flow at the Pumpback Station increased to a high of 60 cfs when the peak flow from the Intake Control Station arrived. Therefore, lower river reaches only increased 11 cfs over the required base flow as a result of the Intake Control Station pulse release. For the purpose of improving river health, this small 11 cfs increase is completely insignificant. Especially, when you consider that the normal required base flow that followed reached over 90 cfs in 2013 and over 100 cfs in 2012.

The average flow increase below the Intake Control Station was only 15.7 cfs. Again, this is insignificant as far as trying to improve river health. This 15.7 cfs flow increase becomes even more insignificant when you consider that the MOU (1997) required base flow in 2013 reached levels of over 110 cfs. The 2013 DHA habitat flow released at the Intake Control Station was not what the MOU Consultants intended in their Adaptive Management Recommendations.

Pumpback Station Release
The City (2013 Annual Report, Hydraulic Chapter) DHA Period 1 flow release from the Pumpback Station covered 7 consecutive days rather than the required 10 days (Table 2.5.4).

Table 2.5.4. A comparison of the City claimed flows and actual released flows (cfs).

Date	City Claimed Increased Flow	Actual Increased Flow Released
3/27/2013	5	8
3/28/2013	8	10
3/29/2013	10	11
3/30/2013	11	11
3/31/2013	11	11
4/01/2013	5	12
4/02/2013	5	13

This Annual Report data differs from the flows listed in the available daily flow tables. The City claims, based on the above data, that river water flow losses allowed the City to reduce the DHA habitat pulse flow significantly. The DHA pulse flow volume released at the Intake Control Station, however, upon reaching the Pumpback Station was not reduced significantly by any river loss. The Intake Control Station release flow lagged, spread out, and arrived over a longer period of days. The longer lag time is demonstrated in Table 2.5.5.

Table 2.5.5. Daily average flows (cfs) released from the Intake Control Station and the resulting flow arriving at the Pumpback Station (2013 Annual Report).

Intake Pulse Flow Release (cfs)	Respective Pulse Flow Arriving at Pumpback Station (cfs)
59	53
64	56
63	58
66	59
66	59
63	59
66	60
65	59
63	58
63	56
51	54
45	53
46	51
46	52
Average – 59	**Average - 56.2**

Summary
The difference in the daily pulse flows released at the Intake Control Station and the daily pulse flows arriving at the Pumpback Station was actually only 2.8 cfs. The flow difference would even be less than 2.8 cfs over-time as later lag water was yet to arrive at the Pumpback Station. The loss of released pulse flow water was insignificant and the City should not have penalized the DHA habitat flow release. During April 2013, the average flow reaching the Pumpback Station was actually higher than the respective flow released earlier from the Intake Control Station.

The City reports in their 2013 Annual Report that from December 2012 to March 2013, an average flow of 47 cfs was released into the Lower Owens River from the Intake Control Station. An additional 4 cfs entered the river via return ditches for a total accumulated release of 51 cfs. The average flow reaching the Pumpback Station during this period was 55 cfs, a gain of 4 cfs during this period. It is questionable if the City should be claiming the augmented 4 cfs in their flow loss analysis as this water is mandated by the LORP guiding documents.

The City also displays in their Annual Report that from December through March (having very low ET levels) the river increased flow in a downstream direction from return water stored in shallow aquifers. These groundwater aquifers are higher in elevation than the adjacent river levels. The City released an average of 63.7 cfs over 10 days for a total of 1,263 af of water. The MOU (1997) required portion of these mandated 1,263 af was 952 af of water. Therefore, the City only released 311 af of additional water that would come out of the DHA habitat flow account. The City should have released the full 496 af DHA habitat flow, which would include the missing amount of water not released (185 af).

Table 2.5.6. Increased Intake Control Station flow (cfs) from adding the DHA habitat Flow water.

Date	Intake Flow Release	Average Base Flow	Added Flow	Acre Feet Difference
14-Mar	59	48	11	21.8
15	64	48	16	31.7
16	63	48	15	29.7
17	66	48	18	35.7
18	66	48	18	35.7
19	63	48	15	29.7
20	65	48	17	33.7
21	65	48	17	33.7
22	63	48	15	29.7
23	63	48	15	29.7
Ave. Flow	**63.7 cfs**		**15.7 cfs**	
Water Used	**1,263 af**	**952 af**		**311 af**

Table 2.5.7. Water released to the DHA from the Pumpback Station during the 2013 March-April Habitat Flow period (from the 2013 Annual Report)

Date	Delta Flow	Acre Feet	MOU Flow Required	Acre Feet
27-Mar	5	9.9	25	49.6
28	8	15.9	25	49.6
29	10	19.8	25	49.6
30	11	21.8	25	49.6
31	11	21.8	25	49.6
1-Apr	11	21.8	25	49.6
2	12	23.8	25	49.6
3	11	21.8	25	49.6
4	10	19.8	25	49.6
5	8	15.8	25	49.6
Total		**192**		**496**

The City released a portion of the DHA habitat flow (March-April Period 1) available from the Intake Control Station for 10 consecutive days (Tables 2.5.6 and 2.5.7). The 10 day pulse flow released into the DHA started on March 28 and averaged only 9.2 cfs. The peak flow was only 12 cfs; far short of the 25 cfs daily flow required in the Ecosystem Management Plan. In 2013, the average base flow released into the DHA was 8.9 cfs. Therefore, the DHA Period 1 pulse flow was only 0.3 cfs higher than the average base flow. The flows should have been 15.8 cfs higher than the average base flow.

The pulse flow released into the DHA only used 192 af of water while the LORP required a release of 496 af of water. Both the Intake Control Station pulse flow and the pulse flow reaching the Pumpback station were also far short of what is required or needed by the river. The flows released by the City shorted the DHA during Period 1 habitat flow fell short by 302 af of water. This water could have been used to increase the Intake Control Station pulse flow to help make it more effective.

Flow Processes the MOU Consultants Recommended

The MOU Consultants, in their 2010 Adaptive Management Recommendations, called for proper planning and analysis of flow needs prior to considering any change of flow release site as follows:

> *"Prior to the DHA Period 1 habitat flow scheduled for March-April, the City, County, and MOU Consultants meet and consider the benefits and feasibility that a new point-of-release of the DHA selected habitat flows could provide."*

The City and the County did not accept this recommendation and it appears the City planned and implemented the 2013 DHA March-April release flow alone.

Pumpback Station Flow Restrictions

The Pumpback Station is limited by Court Order to pumping up to, but no more than, 50 cfs of the incoming river flow (Table 2.5.8 and 2.5.9). This limitation must be voided by the MOU Parties if DHA habitat flows released at the Intake Control Station are going to be large enough to sufficiently benefit the Lower Owens River. Even under this present 50 cfs handicap, however, a much better planned, implemented, and more effective 2013 pulse flow could have be released from the Intake Control Station.

What Could Have Been Done

An 86 cfs peak flow could be released at the Intake Control Station before any additional unallocated flow would bypass to the DHA. A yearly average of 7 cfs (8.9 cfs in 2013) is by-passed into the DHA to meet MOU (1997) and EIR (2004) requirements. Therefore, it would take a flow over 93 cfs before any additional unallocated flow is by-passed. A 10 day flow of 25 cfs is required to by-pass into the DHA during the March-April Period 1 habitat flow. This again increases the pulse flow that could have been released at the Intake Control Station. This allows a pulse flow of 111 cfs before any by-pass flow exceeds required mandates. A 111 cfs peak flow would provide much higher benefits than the 63.7 cfs 2013 average flow applied by the City. A 111 cfs peak flow, however, is still not high enough to gain the benefits the river needs to improve health.

Summary

MOU Parties, by eliminating all binding pump-out restrictions, have the opportunity to improve Lower Owens River environmental conditions. Also, the County and City should consider eliminating the daily flow levels required for flow Periods 1, 3 and 4. This would allow higher daily flows to be released from the Intake Control Station over a shorter time period. The Period 1 habitat flow calls for 25 cfs flow release for 10 days using 496 a/f of water. If the 25 cfs minimum required flow limit was waved during the period the Intake Control Station peak arrives at the Pumpback Station, a very high peak flow could be released from the Intake Control Station. The additional water over the 25 cfs flow level would be compensated from water saved by using a shorter duration period. A very large Period 1 peak pulse flow could be released from the Intake Control Station while still staying within water allocation levels.

Table 2.5.8. Lower Owens River flows at the Intake Control Station, above Pumpback Station, and flows released into the Delta Habitat Area

Date 2013	Intake Control Station	Above Pumpback Station	Delta Release
28-Feb	45	53	5
1-Mar	46	53	5
2	45	53	4
3	45	54	6
4	45	54	6
5	45	54	6
6	44	53	5
7	44	53	5
8	45	53	5
9	45	53	5
10	45	52	4
11	45	52	4
12	45	50	4
13	45	49	4
14	59	49	4
15	64	50	4
16	63	51	4
17	66	48	4
18	66	47	4
19	63	47	4
20	65	47	4
21	65	46	4
22	63	46	4
23	63	47	4
24	51	47	4
25	45	49	4
26	46	48	4
27	46	53	5
28	63	56	8
29	47	58	10
30	50	59	11
31	49	59	11
1-Apr	52	59	11
2	53	60	12
3	57	59	11
4	50	58	10
5	49	56	8
6	47	54	6
7	48	53	5
8	48	51	5
9	49	52	4
10	48	52	4
11	44	52	4
12	42	51	4
13	42	50	4
14	42	51	4
15	42	50	4
16	47	51	4
17	49	48	4
18	48	48	4
19	48	47	4
20	48	47	4
21	48	47	4
22	48	47	4

Table 2.5.9. Flows at the Intake, Mazourka, Reinhackle, and Above Pumpback Control Stations and flows released Into the Delta Habitat Area

Date 2013	Intake	Mazourka	Reinhackle	Pumpback	Delta Release
12-Mar	45	52	48	50	4
13	45	53	49	49	4
14	59	53	49	49	4
15	64	54	49	50	4
16	63	53	50	51	4
17	66	59	50	48	4
18	66	66	51	47	4
19	63	68	50	47	4
20	65	70	52	47	4
21	65	72	56	46	4
22	63	73	61	46	4
23	63	73	62	47	4
24	51	73	64	47	4
25	45	72	66	49	4
26	46	72	66	48	4
27	63	67	66	53	5
28	47	61	66	56	8
29	48	60	66	58	10
30	50	59	66	59	11
31	50	63	61	59	11
1-Apr	52	66	59	59	12
2	53	63	59	60	11
3	57	63	57	59	5
4	50	62	60	58	10
5	49	63	62	56	8
6	47	63	62	54	6
7	48	62	61	53	5
8	48	60	60	51	5
9	49	59	59	52	4
10	48	60	60	52	4
11	44	61	60	52	4
12	42	61	58	51	4
13	42	61	57	50	4
14	42	59	55	51	4
15	42	55	57	50	4
16	47	52	57	51	4
17	49	52	56	48	4
18	48	52	54	48	4
19	48	54	53	47	4
20	48	56	52	47	4
21	48	54	50	47	4
22	48	57	50	47	4

MOU Consultants Recommendations

Recommendation
The MOU Consultants again recommend improving Lower Owens River water quality and other environmental river conditions by releasing three of the DHA habitat flows from the Intake Control Station rather than the Pumpback Station. The three DHA flow periods recommended are Period 1 (March-April), Period 3 (September and add October), and Period 4 (November-December).

Recommendation
MOU Consultants recommend that in all future pulse flow releases that the City use the full amount of water called for and use the true LORP required base flow in determining all future flow allocations.

Recommendation
The MOU Consultants recommend that during the winter of 2014, the County, the City, and the MOU Consultants meet and develop three DHA habitat pulse flow guides for release at the Intake Control Station. These guides would then be used by the County and the City for input into their future management decisions.

Recommendation
The MOU Consultants recommend that in all future DHA habitat flow releases from the Intake Control Station, the City release the full amount of DHA habitat flow at this Station. Also, all the required water designated for release into the DHA for each flow Period should be released.

Recommendation
The MOU Consultants recommend that in the future the City not release DHA habitat flow from the Intake Control Station that resembles their 2013 March-April flow release. This insufficient pulse flow was completely ineffective.

Recommendation
The MOU Consultants recommend that the County and City use shorter pulse flow duration periods in all future pulse flow releases, as needed. The water saved could then be used to increase daily flow levels in all future DHA habitat flow releases. Much higher peak and daily flows could then the released at the Intake Control Station.

Recommendation
The MOU Consultants again recommend that the MOU Parties eliminate all restrictions now appearing in the MOU (1997), EIR (2004) or any Court Stipulation and Order that limits the amount of water the Pumpback Station can pump-out of the Lower Owens River.

11.2.6 Creel Census

Background

The first pre-LORP implementation Lower Owens River fishing creel censuses was conducted in 2003. Additional creel censuses were conducted post-implementation in 2010 and 2013. These censuses evaluated fish population abundance, development, species composition, fish health, and body condition of the larger size age classes of warm water game fish. These censuses do not evaluate young-of-the-year recruitment or the condition of their health and survival. The fish catch per unit effort was lower in 2013 (2.2 fish/hr.) than it was in 2003 (2.7 fish/hr.) prior to the implementation of the LORP.

Fisheries Goals and Objectives

The MOU (1997) and the Monitoring and Adaptive Management Plan (2008) requires the creation and sustainability of a healthy warm water fishery in the Lower Owens River. Also, the MOU (1997) requires that a healthy, functioning, Lower Owens River riverine-riparian ecosystem be developed through flow and land management to produce the diverse natural habitats to support this warm water fishery.

Problem

The City planned, during the winter of 2012-13, to repair and upgrade sections of the Los Angeles Aqueduct (LAA). The concrete repairs to the LAA were programmed to be completed in April of 2013. The City determined there was no immediate hurry to repair the LAA as repairs were postponed until July 2013. The repair work required the release of water from the LAA via Alabama Gates into the Lower Owens River. The City did not notify the MOU Consultants that this repair work would take place during the hot periods of summer. In July of 2013, the City started repairing 250 yards of the LAA about 0.5 miles downstream from the Alabama Gates (Sierra Wave 2013). Later information showed other sections of the LAA were also being repaired or in the process of being repaired.

The Alabama Gate flow release increased flows in lower river reaches and resulted in a large fish kill during July of 2013. Only a 4 to 5 cfs flow increase occurred during the initial period of the fish kill in the river reach below the Lone Pine Bridge. Later, as flow releases from the LAA increased, an augmented 185 cfs flow below the Alabama Gate release site only resulted in a 93 cfs peak flow reaching the Pumpback Station. The LAA below the Alabama Gates was dried up for 6 days for repair work. Water released from Tinemaha Reservoir into the LAA was emptied into the Lower Owens River via the Alabama Gates. Less stress to the river may have been possible if the augmented flows had been portioned over multiple release gates and/or done at a different time of year.

The observed fish kill was concentrated mainly in the river reach between the Lone Pine Narrow Gage Bridge and Pump Back Station. On July 26, 2013, 366 dead fish (mostly bass) were observed on the west side of the Pumpback Station forebay pond (Inyo County 2013). Additional dead fish were observed in surrounding tules and cattails and open water (Inyo County 2013 and Pedeneau 2013). CDFG estimated that about 800 dead fish were observed in this reach (CDFG 2013). About 500 dead fish were observed in this reach by the City (LADWP 2013).

The actual fish kill was much larger than observed because water column and above water surface cover are so dense along this reach of the river that finding dead fish is very difficult. The Lone Pine Tribe Environmental Office reported that during this period, the water passing under Lone Pine Narrow Gate Bridge was dirty and turbid with a foul odor (Hays 2013). The extreme odor produced by the river could be detected from as far away as Highway 395.

The large July 2013 fish kill took place after the May 2013 fish creel census was completed. Because the census was completed in May and the fish kill occurred the following July, the 2013 fishing creel census cannot be used to determine the present status of the warm water fishery. A creel census conducted in 2014 could determine the status and provide some interpretation of the 2013 fish kill effects. Also, the recent 2013 fishing creel census results show that bass (11) in poor condition are appearing in the census. The cause needs to be determined.

<u>Fish Kill Information</u>

Because MOU Consultants were not authorized to observe and directly evaluate the fish kill that occurred in July of 2013, the Consultants had to rely on other accounts as outlined below.

On August 1, 2013, Mr. Pedeneau saw and photographed 2 dozen dead fish (bass, blue gill, carp, and catfish) 7 to 15 inches in length in the Lone Pine Station river reach (Pedeneau 2013). Several fish on shore had been eaten. Most of the dead fish in this area were moved downstream by the current. On this same day, while observing the river reach 0.5 miles above the Pump Back Station, he observed 3 dead bass (4 to 9 inches) and 1 blue gill (7 inches) on the floodplain above the watered channel. These fish were hidden in the tall grass and located by his dog. These dead fish may have been dropped or moved into this area by the increased flow levels. The river through this reach expelled a very strong odor. On August 1, 2013, Mr. Pedeneau also observed many hundreds of large dead bass along the east shore of the Pump Back Station Pond. Dead carp were also observed. The known fish kill observed by Mr. Pedeneau covers the river reach from the Lone Pine Bridge to the Pump Back Station.

<u>Fishing History Before and After the Fish Kill</u>

On June 10, 2013, Mr. Pedeneau fished the Big Beaver Pond east of the town of Lone Pine and caught 3 large bass (Pedeneau 2013). He again fished the reach for a short time in the morning of July 7, 2013, and caught 7 bass. Two days in August (1st and 13th), Mr. Pedeneau fished this same beaver pond for 2 hours and only caught one bass (10.5 inches). He again fished the pond on September 13, 2013 and again only caught one bass (13 inches). Mr. Pedeneau reported fishing was very poor in this area after the fish kill.

A year before the fish kill, Mr. Pedeneau on September 13, 2012, fished a small river reach between the Lone Pine Bridge and the Pumpback Station catching 97 bass in one weekend (Pedeneau 2013). In August of 2013, after the fish kill, he again fished the same river reach using the same gear and effort and only caught one bass. On September 13, 2013 Mr. Pedeneau again fished the same river reach with the same equipment and effort and again only caught one bass. This before-and-after catch-rate difference supports the conclusion that a very large fish kill occurred, or a large number of fish moved out of the reach.

Mr. Pedeneau reported that fishermen from Independence, fishing during the last two weeks of October 2013, were having very good fishing success in the river reach upstream of the Alabama Gate flow confluence. They also had high fishing success in river reaches adjacent to the confluence of Georges Creek. These two river reaches are up-river from the Alabama Gate flow release site and the information strongly infers that no fish kill occurred up-river above the Alabama Gate flow release site. The sudden release of higher flows into the Lower Owens River via the Alabama Gates caused the fish kill in the lower portion of the river.

Justification

Warm water fish have remarkable ability to recover when stresses that reduce their populations are quickly buffered or eliminated. High fecundity potential allows them to quickly replace population losses once the environmental stress causing the fish kill is eliminated. We do not know at this time if or when similar or even more severe environmental conditions that led to the fish kill will return. We do not know if the 2013 fish kill was insignificant or significant as far as the total population rebound capability over-time is concerned. The July 2013 fish kill may prove to be insignificant when compared to total population size. But, it is not wise to wait until 2015 to find this out. The next LORP creel census is not scheduled until May of 2015. A 2014 fishing creel census would help to put the 2013 fish kill in better perspective in a much shorter time frame and allow Adaptive Management actions to be applied much faster if needed.

MOU Consultants Recommendation

The MOU Consultants recommend that the City conduct a Lower Owens River creel census in May of 2014 using the same methods, procedures, application levels, and number of fishermen called for in the Monitoring and Adaptive Management Plan (2008).

11.2.7 Alabama Gates Spillway

Background

The Alabama Gate Release Control Structure delivers water from the Los Angeles Aqueduct (LAA) to the Lower Owens River when needed. The structure is also used to flush accumulated sediment build-up in the LAA. The flushed sediment passes through a spillway into a heavily plugged outflow channel. This channel, because it is plugged with sediment, spreads the released flow over what is now becoming an artificial fan covering a small portion of the Island complex (Figure 2.7.1). Channel deposition caused by the flushed sediment has plugged most of the Alabama Gates release channel, and thus this flow does not follow a direct pathway to the Lower Owens River. Flows now flood over the banks, spread out, and find their own path to the Lower Owens River. Because flows leave the channel and spread, they could also be dumping sediments into the Lower Owens River.

The spreading flow adds surface water to the Island area. This not only affects vegetation composition but, also raises the shallow ground water aquifers closer to the surface. Plant composition can then change from dryer species types to riparian and wetland vegetation types. The conversion, at the present time, is producing mainly cattails and tules. The lessee, of the grazing lease, constantly points out that the conversion is reducing forage for livestock. The City, to mitigate for this forage loss, (which if true, the loss would be mainly caused by the widening flow influence area caused by the Lower Owens River itself) recently control-burned a few hundred acres of the lease to eliminate brushy vegetation and increase grass forage for the lessee's livestock. This mitigation practice was very successful, but, only provides a short-term solution. Training the Release channel could potentially reduce the accumulated future forage loss issue mentioned above.

The proposed new channel is an historic canal built to convey agriculture water or divert runoff and has a capacity of several hundred cfs. Some work is needed with a backhoe to remove a couple of blocks and downstream plugs as shown in in the Figure 2.7.1. The channel would then adequately move water released from Alabama Gates to confluence with the river below the Island.

Flow released from the Alabama Gates, under present conditions, takes 4 days to reach the Pump Back Station. Spreading the flow overland and discharging into the middle of the Island area increases travel time to the Pump Back Station. In June of 2013 the City released a two day flow from the Alabama Gates averaging 30 cfs with a peak of 87 cfs. In July 2013 the City released a second flow for about 9 days reaching a 111 cfs peak flow; demonstrating the Alabama Control Gates capability of releasing high flows. This makes the gate complex a very valuable augmentation site to assist future flow management in the LORP.

The Island reach causes the largest flow delay (per/river mile) in the Lower Owens River. It takes 2 to 3 days of travel time for all flows entering the Island area to cross through this reach. The flow delay is caused by the very low channel gradient and dense in-channel vegetation. Flow is also delayed because the channel is heavily modified by beaver dams. Alabama Gate flow presently releases directly into the middle of the Island area. Therefore, one could expect the flow to proceed much more slowly downriver than if this flow was released directly into the Lower Owens River below the Island area. An Alabama Gate flow release should arrive quicker at the Pump Back Station if the release water flowed down a channel that confluence directly with the Lower Owens River (Figure 2.7.1). A direct flow release of this type will also create a higher river pulse flow downriver depending upon combined Intake and Alabama Gate releases.

The decrease in flow through the Island area and in the river reach between the Alabama Gate release site and the Pump Back Station is dramatic. This large flow decrease makes it very difficult for the City to manage in-river flow as they attempt to keep a required daily average 40 cfs flow reaching the Pump Back Station at all times. Flow management is especially demanding and confusing during the summer and again during cold winter periods.

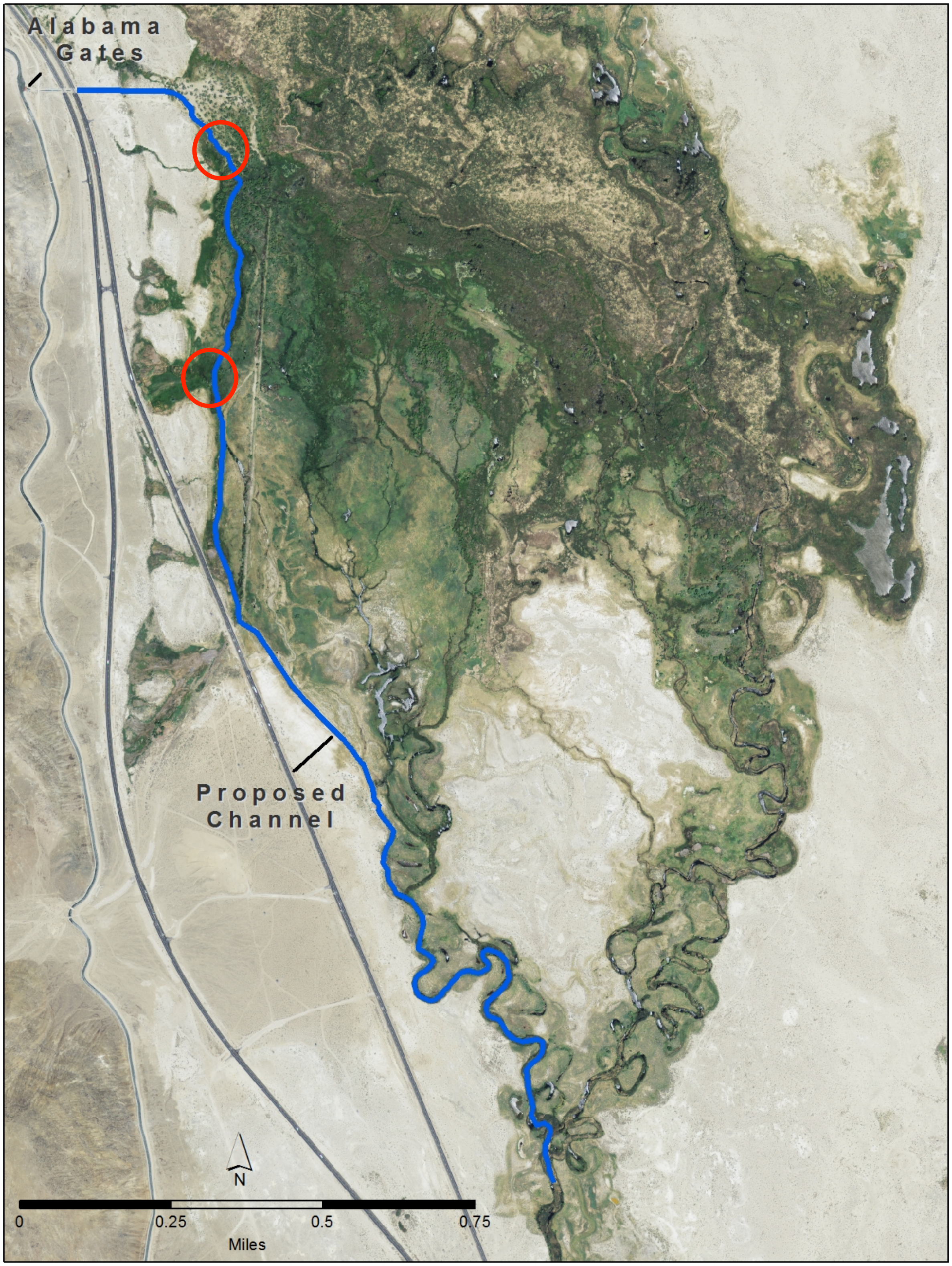
Changing flow management in the Lower Owens River is a must if there is to be an improvement in environmental conditions; especially the water quality component. The Alabama Gates will play a significant role in the future by providing the flow augmentation needed to maintain a healthy river and, in turn, support a healthy warm water fishery. Therefore, training the new release channel could not only have advantages to the lessee's forage production, but could increase river health. Eliminating surface flow spreading that occurs during Alabama Gates releases and redefining the channel to confluence directly with the Lower Owens River can help enhance Delta pulses and SHFs, and improve water quality conditions.

<u>MOU Consultants Adaptive Management Recommendations</u>

Recommendation
The MOU Consultants recommend training the Alabama Gate release flow channel so that flow enters directly into the Lower Owens River below the Islands as shown in Figure 2.7.1.

Recommendation
Because the City will need to continue eliminating accumulated sediments from the LAA onto the Island area, the MOU Consultants recommend constructing a sediment debris basin below the spillway. This basin would collect LAA transported and dumped sediments and prevent the trained channel from continually plugging up as the present channel is now doing.

Figure 2.7.1. Map of the Island area depicting route of the proposed trained channel. Flow blockage areas highlighted in red.



11.2.8 Tule and Cattail Management

Background

Marsh vegetation in the Lower Owens River is made up predominantly of cattails (*Typha latifolia* and *T. domingensis*) and common tule or bulrush (*Schoenoplectus acutus*). The topic of control and management of marsh vegetation (commonly referred to as tules) has been a source of much debate since project inception and continues today. Recent work focused on the control of tules in the LORP has included an analysis of existing information on tule and cattail (LORP Adaptive Management Recommendations 2012), physical removal of plant material within the river channel and an analysis of LORP Hydraulics and Tule Distribution (LORP Annual Report 2013). The information in this section draws heavily on these recent efforts and is supported by additional analysis of the correlation between water depth and tule distribution within a reach (Plot 5) of the LORP.

The recent analysis of LORP Hydraulics and Tule Distribution by LADWP (LORP Annual Report 2013) concluded that stream velocities create shear stress values capable of moving sediment in the LORP. However, shear stress values fall well below the values needed to uproot tule rhizomes. The near-maximum boundary shear stress for all the plots has been calculated to be 1.3 lbs/ft^2 (LORP Annual Report 2013), compared with values from the literature for similar species of 3.4 lbs./ft^2 (Liffen et al., 2011) and 230 lbs./ft^2 (Pollen-Bankhead et al., 2001). The only conclusion that can be made about velocities and tule control is that they are likely one of many secondary factors responsible for tule distribution. It likely has an effect of tule distribution in localized areas where other control factors are operating. The primary factor in controlling marsh vegetation throughout the LORP is likely water depth, as has been shown in other systems. Numerous experimental studies have demonstrated that increased water depth negatively affects the growth of emergent vegetation in a number of ways, and will eventually kill them (Lieffers and Shay 1981, Stevenson and Lee 1987, Pip and Stepaniuk 1988, Grace 1989, Waters and Shay 1990, Squires and van der Valk 1992). Other factors likely include shade, nutrients, substrate, local flow velocities and flow regime (hydroperiod) (LORP Adaptive Management Recommendations 2012, LORP Annual Report 2013). The use of hydroperiod (flow regime) could be a useful tool in controlling tule distributions, as a natural flow regime, in which flooding and drying cycles are more extreme than current LORP conditions, may inhibit the tule and cattail growth, as tules and cattails are more adapted to stable flooded conditions (Seabloom et al. 2001). Drawdowns in the summer may reduce growth rates and will provide managers with opportunities to treat areas that prohibit access.

A common question among managers is "How deep does it have to be to preclude tule and cattail growth?" As with many other biological questions, there is no simple and absolute answer. One of the most common marsh species in the LORP, *T. domingensis* is known for being tolerant of deeper water than other marsh species, making the task of tule control in the LORP a challenge for managers. Given the effects tules and cattails have on the aquatic and riparian habitats of the LORP, expansion of this investigation to other reaches, as well as looking at substrate and velocities.

The depth of water required to kill an emergent plant depends partially on temperatures, the amount of energy stored from the previous year, and the vigor of the plant (Sojda and Solberg 1993). Any shoot that gets above the water level will start pumping oxygen to the root ball through the aerenchyma and increase plant vigor. High water levels for prolonged periods continually stress marsh plants, which may help in the next year's control efforts (due to less stored energy). By inundating the leaves of emergent vegetation, the rate of oxygen uptake is reduced, and this can result in inadequate oxygen delivery to the roots and rhizomes and the eventual death of the below ground structures (Sale and Wetzel 1983, Ball 1990, McKee et al. 1989). Numerous experimental studies have demonstrated that increased water depth negatively affects the growth of emergent vegetation in a number of ways, and will eventually kill them (Lieffers and Shay 1981, Stevenson and Lee 1987, Pip and Stepaniuk 1988, Grace 1989, Waters and Shay 1990, Squires and van der Valk 1992).

The depth that will achieve control of cattails and tules varies between systems and among species, making predictions of minimum control depths difficult. In general, emergent marsh species respond in the same general way to changing environmental conditions, but with different tolerances and parameters. For example, *T. latifolia* density and vigor decrease more rapidly than *T. domingensis*. However, the deeper the water, the more stress you put on both species. *T. latifolia* grows better at higher elevations than *T. domingensis*, which flourishes better at lower elevations. *T. latifolia* outcompetes *T. domingensis* in shallow water, while *T. domingensis* excels in deeper water (Grace 1985).

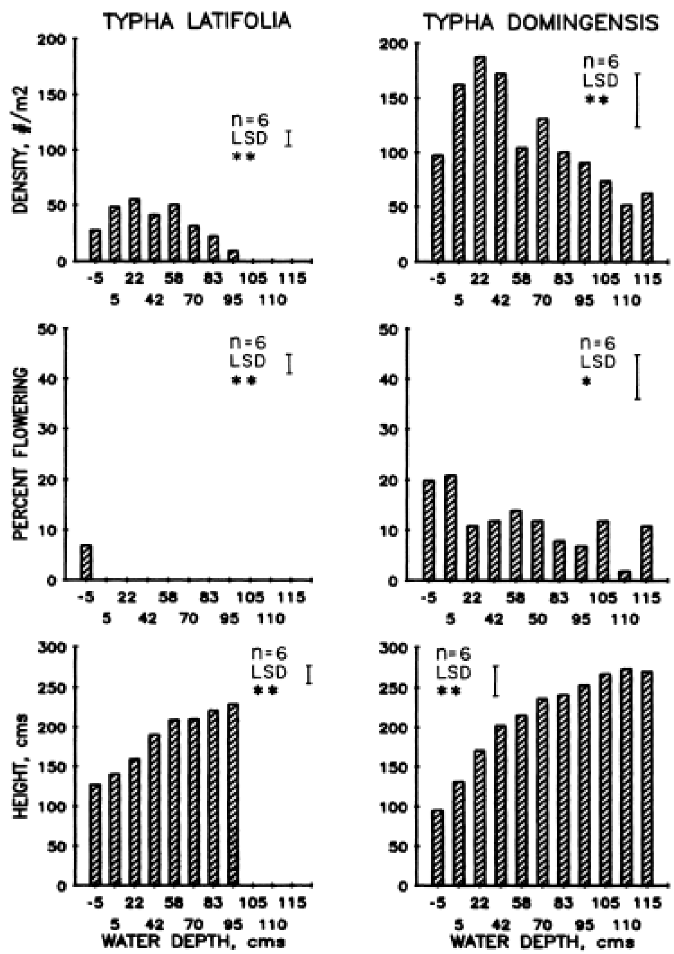


Fig. 2. Changes in shoot density, incidence of flowering, and maximum plant height as a function of water depth for September 1985. Water depths ranged from −5 (5 cm above the water) to 115 cm. The data for density, the incidence of flowering, and the height of plants came from measurements of all shoots in each of the six replicate water-depth gradients. Indicated on each figure is the sample size (number of replicate gradients), a vertical bar showing the Least Significant Difference (LSD) calculated for each parameter-species combination. The results of linear regression analyses for each trait and each species are indicated as follows: * = significant relationship at $P < 0.05$, ** = significant relationship at $P < 0.01$, and ns = no significant relationship.

Figure 2.8.1. Density, Percent Flowering and Height of two *Typha* Species in response to increased Depths (Grace 1989).

There are several studies that have been performed that can provide information as to the effectiveness of various depths on various species. In a controlled flooding experiment in Manitoba, *Typha* coverage in wetland cells decreased from 22.7% to 9.2% after one year of flooding (+ 1 m depth) and 8.7% after the second year of flooding. However, three cells actually increased their cover of *Typha* in the second year of flooding, indicating the ability of *Typha spp*. to adapt well to water depth, when held static for a period of time. However, after the second year of flooding, 81% of the area originally covered by Typha was open water (van der Valk 1994). In another manipulated experiment, *T. latifolia* grew best in shallow water, but exhibited little growth in water > 1 m deep. *T. domingensis* had peek shoot growth between 0.8 m and 0.9 m of water depth (Grace 1985).

In another manipulated experiment, *T. latifolia* died off almost completely at depths >95cm (37in). *T. domingensis'* depth limit was not reached; its density declined, but it still grew at 115cm (45in). It responds to deeper depths by growing taller. However, in deeper water, fewer flowers were produced and the stem and leaf density declined. Deeper water stresses both species, but *T. domingensis* is more tolerant. Deeper water reduced *T. domingensis'* density, leaf mass, and percent flowering, while increasing its height and biomass per ramet (Grace 1989 – Figures 2.8.1 and 2.8.2). However, this research has clearly shown that *T. domingensis* is capable of growing for sustained periods of time at inundation depths >1.2 m (Grace 1987, 1988, 1989). However, this work indicates that deep water will stress the *T. domingensis* and control it to some extent.

In a *T. latifolia* marsh, inundation to 26 inch depth showed a decline in cattail coverage and vigor, but it took two 2 years to see the effects. *T. latifolia* is more susceptible to flooding than *T. domingensis* or *T. angustifoia*, which require above 47 inches (Steenis et al. 1958). Solberg and Higgins (1993) recommend flooding 3-4 feet over the tops of the stems in the spring.

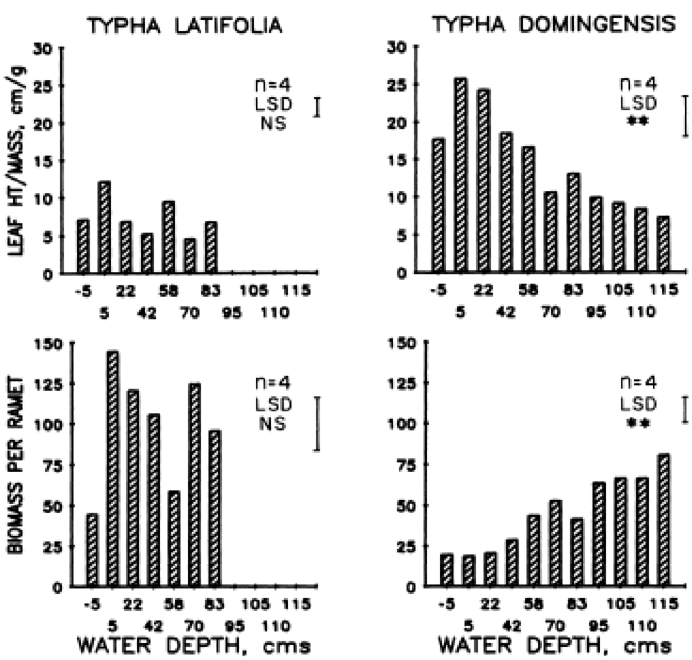


Fig. 3. Leaf height per unit leaf mass and biomass per ramet obtained from harvested plants. Notation is as described in Fig. 2.

Figure 2.8.2. Leaf Height/Mass and Biomass per Ramet of Two *Typha* Species in Response to Increased Depths. (from Grace 1989).

This background information provides a framework, but what depths prohibit tule and cattail growth in the LORP? Each system has its own individual suite of biological, physical and environmental conditions that determine the prohibitive depth. Of course, the combination of all of the factors discussed above (depth, shade, nutrients, velocity, flow regime, etc.) combine to determine the depths in the LORP. In an effort to provide managers with more information about the depths needed to prohibit tule growth, an examination of depths in relation to open water was performed on one reach of the river (Plot 5, near Keeler Bridge). The results presented below likely only apply to the southern part of the river (below the islands) where gradient, channel configuration, floodplain landforms and flow regime are similar to conditions in this plot. However, similar analysis or extrapolation may be made to reaches further upstream with additional effort.

Method

Four years of GIS data (2000, 2005, 2009, 2012) were examined to identify persistant open water areas within Plot 5 of the Lower Owens River. 2000, or baseline conditions, and 2010 data were taken directly from LORP Site Scale Mapping data. 2010 data was based on 2009 4-band aerial imagery acquired by LADWP and will be referred to as 2009 data for this exercise. 2005 and 2012 open water areas were mapped using remote sensing. 2005 Iknonos imagery was the medium for that years mapping, while 2012 NAIP 4band imagery was used examined to derive the 2012 open water dataset. These 4 open water layers (2000, 2005, 2009 and 2012) were intersected to derive one dataset that identified persistent open water areas in Plot 5. This persistent open water area polygon layer was then intersected with the NHC model survey data. This step identified survey and model data that corresponded to persistent open water areas. NHC model results for 48 cfs for plot 5 were examined. The NHC survey and model results that corresponded with persistent open water areas were then summarized to garner an understanding of what environmental conditions are in these unique areas, i.e., the plot 5 river reach only.

Results and Discussion

Acres of Open Water Over Time

Based on the mapping of open water areas, the amount of open water in Plot 5 has varied for both in-channel and off-channel areas over the years, but total acres of open water are at roughly the same levels in 2012 as in 2000 (Table 2.8.1). Off-channel open water areas declined sharply between 2000 and 2005, and have steadily been increasing since that time. In-channel open water peaked in 2009, but remains above pre-implementation levels.

Table 2.8.1. Acres of open water in Plot 5 from 2000 to 2012.

Year	In Channel	Off Channel	Total
2000*	**3.7**	**1.2**	**4.9**
2005	**3.0**	**0.3**	**3.3**
2009	**5.6**	**0.5**	**6.0**
2012	**4.0**	**0.8**	**4.8**

***Areas of water covered with duckweed (aquatic veg) mapped as open water**

Correlation between Water Depth and Open Water

The analysis of Plot 5 transects measured by NHC revealed that for the lower reaches of the LORP, open water areas are highly correlated with water depth at flows of 48cfs. The average depth for all transects was 2.85 ft. while the average depth for open water areas was 4.6 ft. These open water areas generally follow the thalweg depth (Figure 2.8.3) and are well above the average depth (NHC model hydraulic depth) for each transect.

How Deep Does Water Need to Be To Control Tules?

As stated earlier, there is no absolute answer to this question, but the empirical data from the mapping of plot 5 provides an indicator at what depths open water does occur within that plot. Based on the average depth of open water sections of the 31 transects measured, 94% of those sections had average depths greater than 3ft, with a min. average depth of 2.89ft. When compared to the average depths of all transects and transects with no open water, a clear pattern emerges as to the influence of water depth (Figure 2.8.4). Based on this empirical data, it would appear that tule control begins at depths of at least 3ft with effectiveness increasing as depth increases in the lower reaches on the LORP with channel form gradient similar to that in plot 5.

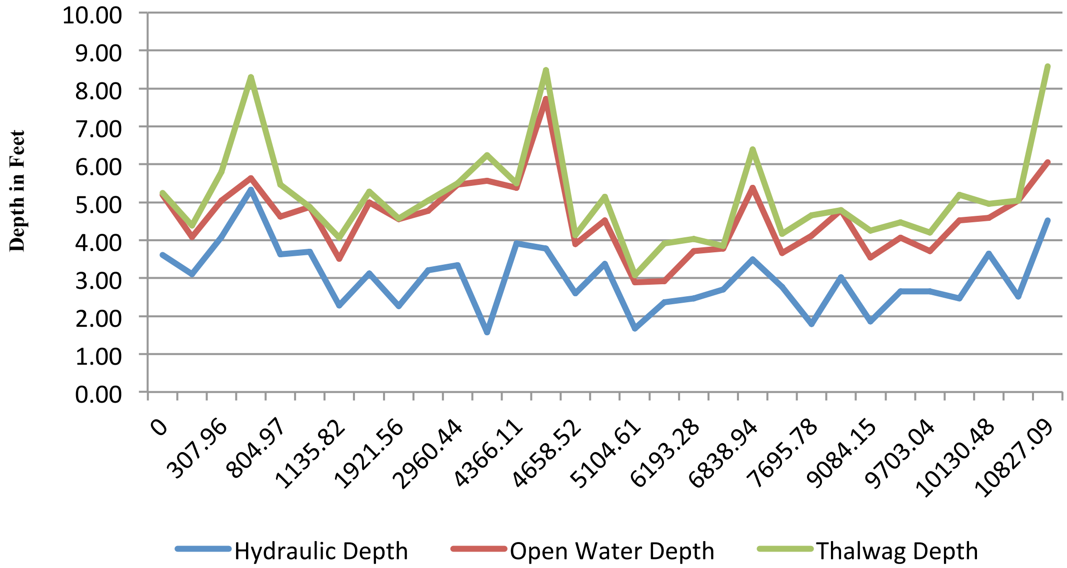


Figure 2.8.3. Hydraulic depth, open water depth, and thalweg depth in feet along NHC transects (0 being at the downstream end of the plot and increasing moving upstream).

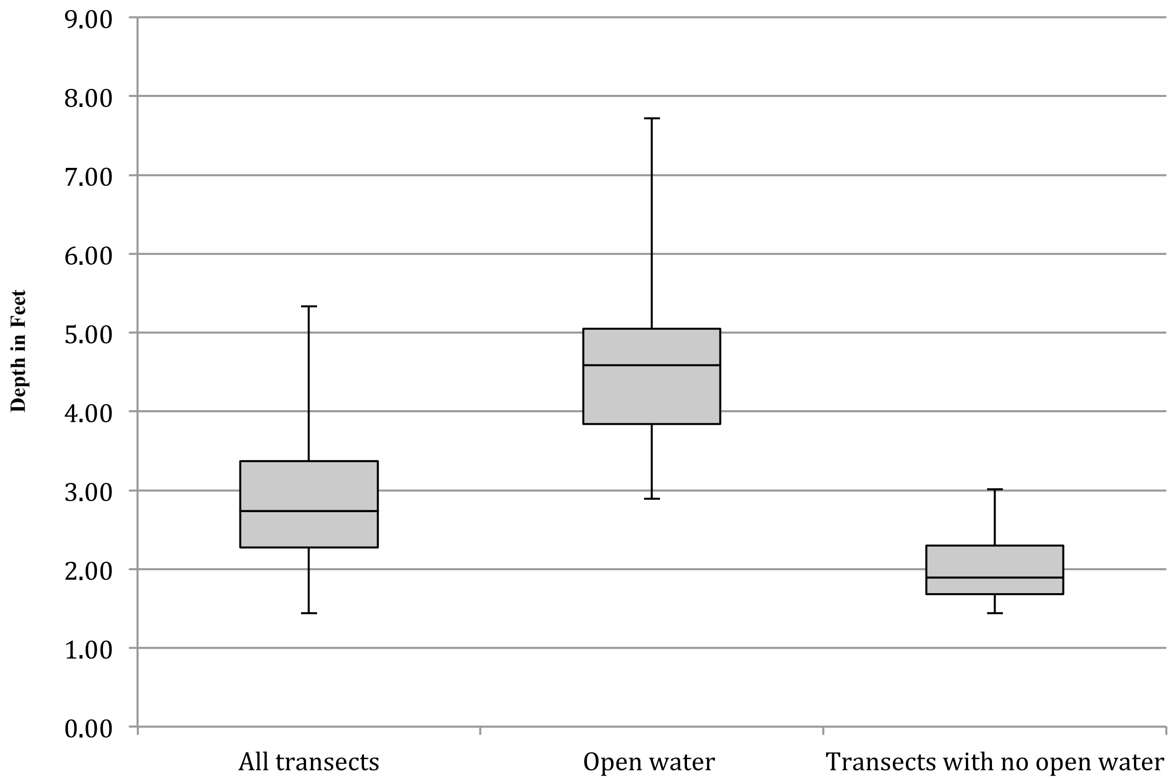


Figure 2.8.4. Box plot of average depths on all transects, open water areas and transects with no open water in plot 5. The bottom whisker line represents the minimum value, the bottom box the 25th percentile, the center line is the median, the upper box is the 75th percentile and the top whisker line represents the maximum.

The results of this analysis build on the results from the literature and clarify the specific criteria as they apply to the LORP. However, other reaches of the LORP may vary from the results for plot 5 and making broad generalizations for the entire project area should be done with caution.

The analysis performed for this effort was adequate to determine the preliminary results. A full analysis of all 5 of the plots, with a more complete look at the depths where tules occur and where they don't is warranted. Including substrate, channel form, and localized velocity measurements in the analysis would provide managers with key information on tule control parameters. In order to manage tules and cattails in the LORP, understanding the parameters which control their distribution is essential. The channel configuration, gradient, and substrate are fixed. Water depth and flow regime are within the control of managers to modify. Both of these factors must be understood in order to effectively manage the LORP to provide for the values associated with a mix of open water and emergent marsh vegetation.

MOU Consultants Recommendation

The MOU Consultants recommend that similar analysis be performed for the other four river reaches. The goal is to identify flows which provide a range of depths that create the greatest control on tules. Depth analysis includes the maximium-minium that drowns leaves and inhibits oxygen transfer, as well as the lower flows that can be attained to stress tules in the growing season without negatively impacting other environmental goals and parameters. This analysis is an essential part of identifying better flow regimes in the Lower Owens.

11.2.9 Blackrock Waterfowl Management Area

Background

As in past years, due to the run-off year and the Annual Report timing, it is difficult to make full recommendations for the Blackrock Waterfowl Management Area (BWMA) until the runoff forecast is available on April 1. Recommendations made below are based on the current available information and should be updated when the run-off forecast is available and the target number of acres is known.

The Drew unit currently provides adequate wetted acreage to meet the requirements for this year. If the forecast is similar next year, it may be able to meet requirements over the next run-off year as well. However, there is very little information available to assess the quality of the existing habitat at Drew. The Drew unit has supplied good habitat for a number of seasons. The percentage of open water to marsh vegetation provides managers with information as to the current utility of the habitat in the Drew unit. On-the ground observations are of little use in making an accurate determination. High resolution imagery or photographs from the FLIR equipped LADWP helicopter would provide high quality imagery that would enable managers to determine with greater accuracy the ratio of open water to marsh.

In the absence of this information, Ecosystem Sciences acquired Landsat8 satellite imagery (15M resolution) and utilized the near-infrared band to map the open water in the Drew unit from an image taken June 14, 2013. Using remote sensing software and professional judgment, the analysis identified 122 acres of open water in the Drew unit. Based on the 278 acre wetted area reported by DWP for June 3rd, 2013 mapping (LORP Annual Report 2013) the wetted area is currently approximately 44% open water.

The BWMA was designed to utilize wetting and drying cycles to meet annual acreage requirements, as determined by the Standing Committee, as well as create habitat for LORP indicator species. The MAMP established the criteria of about 50% open area and vegetation as the point to drain one wetland cell and flood another. The habitat in Drew contains valuable habitat. However, based on the data available, it is time to drain the Drew unit and begin a new cycle. If the Drew unit remains flooded for another year, open water percentage is likely to decrease further.

The wetting and flooding schedule has been modified through the flexibility of adaptive management. For example, the Drew unit has provided high quality habitat for indicator species as well as meeting requirements for wetted area for several years even though the 50% standard was not used to guide decision making and the MAMP schedule was modified. It is time for managers to prepare to drain the Drew unit and either the Winterton or Waggoner unit should be prepared for flooding.

Given our knowledge of tule and cattail growth within the LORP system, the BWMA provides an opportunity to treat one or part of these units with one or more treatments in an attempt to maintain open water cover through time. Excavating deep holes in several local locations will provide persistent open water habitat and likely improve diversity over time. Such treatments could preserve open water through time.

Units have been prepared in the past with controlled burns. Local treatments with herbicide and excavation would provide additional tools for managers to learn how to create longer lasting, preferred habitat conditions into the future.

MOU Consultants Recommendation

The MOU Consultants recommend continued analysis of the BWMA; build off of the remote sensing analysis based on large pixel imagery and assess the ratio of open water to emergent vegetation more accurately within the Drew unit. Managers should develop a plan to prepare the next unit for flooding. A plan that includes multiple treatments including excavation, burning and experimental use of herbicides in localized areas within the unit is recommended. When the run-off year is known the scientific team make an informed decision about flooding the newly prepared unit (Winterton or Waggoner) and the utility of retaining water inflows into the Drew unit based on the characterization of Drew habitat quality, the number of target acres, and the preparations made to the new unit.

11.2.10 Rapid Assessment Survey

Background

This years RAS effort cataloged observations and impacts in the following categories: woody tree recruitment, salt cedar, Russian olive, noxious weeds, beaver, elk, fences, grazing, recreation, roads, trash, slash, channel obstructions, dead fish and other miscellaneous observations.

Overall, the 2013 RAS results and data collected are consistent with past efforts. While there are concerning trends in several categories that warrant closer examination and correlation with other data sets to analyze trends, particularly with regards to woody riparian recruitment.

Revisit Sites
The RAS utilizes revisit sites, or returning to sites from previous years to observe changes in the character of an impact or area of significance. The 2013 RAS revisited 56 sites in total; 46 were woody recruitment sites and 10 were beaver activity sites detected in 2012. Of the 46 woody recruitment sites revisited 85% of last year's cohort was relocated, indicating a high level of persistence of last year's woody recruitment class. Only 3 of the 10 beaver sites revisited were observed as active.

Salt cedar revisit sites were either not done or not indicated for 2013. However, salt cedar is a significant problem with this year's observations documenting a concerning growth and abundance throughout the LORP. This is discussed below.

Willow Recruitment
There were fewer woody recruitment sites observed in 2013 than any of the past seven years, except 2010. This year a total of 41 woody recruitment sites were documented, down 40% from 2012 and down 72%

from 2011, marking this as a very low year for woody recruitment. 2013 is the latest trend marker in an overall decline in woody recruitment in the LORP.

Woody riparian, including willow and cottonwood trees, provides structural diversity and varied habitats that are critical to the restoration of riverine-riparian conditions. Woody riparian trees are essential to attracting key avian species that are indicators of overall ecological health. The RAS observations indicate a concerning trend in woody riparian recruitment throughout the LORP. 2013 was low water year in the Owens Valley. Consequently, the LORP had a reduced seasonal habitat flow event; both the volume and the duration of flows were attenuated. These low seasonal habitat flows likely did not access potential woody riparian recruitments sites (landforms), thus fewer sites were available for recruitment.

In 2013 tree willow recruitment was found at 35 sites, shrub willow seedlings at 5 sites and only one cottonwood recruit was located. The distribution of recruitment sites is much different than 2012 with over 70% of the sites found in Reach 2 of the river. In 2012, reaches 4 and 5 had by far the greatest number of woody recruitment sites. The majority of recruitment sites in 2013, by landform, were along the river banks, indicating that flows are not inundating many floodplain landforms outside of the river banks.

Salt Cedar
Salt cedar remains on ongoing management challenge and is the most abundant noxious weed in the LORP. Salt cedar is persisting in previously treated areas with a total of 104 re-sprout sites observed. This year's RAS observed a total of 454 salt cedar sites (seedlings, mature and re-sprouts); an increase of over 20% from the previous year. A more alarming trend is in the BWMA and the OLP where observations indicate a 70% increase in salt cedar from 2012.

Controlling salt cedar has posed a challenge to land managers throughout the west and the LORP is no exception. Proper control and management of salt cedar will require diligent and continual application of resources. This marked increase in salt cedar is concerning, particularly along the riverine-riparian corridor.

Beaver
The 2013 RAS documented 5 locations with evidence of beaver activity. This is down from the 13 locations observed in 2012. Though beaver continue to be a part of the system their presence appears to be attenuated, likely a result of a continued trapping program.

<u>MOU Consultants Recommendation</u>

This is the seventh year of RAS monitoring of the LORP and the overall trends indicate a need for increased discussion of the issues, comparison of data with other monitoring efforts, and for overall adaptive management changes to the LORP.

The RAS indicates that there is a significant reduction in woody recruitment sites observed in 2013 than any of the past seven years, except 2010. This year's woody recruitment sites were down 40% from 2012 and down 72% from 2011, marking this as a very low year for woody recruitment. 2013 is the latest trend marker in an overall decline in woody recruitment in the LORP. The MOU Consultants recommend that woody recruitment be examined more closely and with greater specificity that the RAS allows for, as these downward trends in recruitment are concerning.

Salt cedar control efforts should focus on the riverine-riparian system. Resources are not sufficient to control salt cedar in all areas of the LORP. Efforts made to control salt cedar along the river channel pay a much higher ecological reward than those efforts spent off-river in uplands and spreading basins. Proper control and management of salt cedar will require diligent application of resources. There is an abundant salt cedar seed supply that will not be easily reduced. However, direct cutting of salt cedar along the river provides an opportunity for a native riparian species to establish themselves. The MOU Consultants recommend that the primary focus of the salt cedar control program be on the riverine/riparian corridor above all other areas.

Although the Inyo Mono Agricultural Commission weed management program continues to treat previously identified pepperweed populations and LADWP provides their own control efforts, perennial pepperweed is continuing to spread throughout the LORP. The MOU Consultants recommend that control of this highly invasive species remain a management priority.

11.2.11 Monitoring

Background

As monitoring has progressed since 2008, there has been a growing propensity to make small or seemingly minor changes to the MAMP protocols, or simply not performing all elements of the protocols, or completely skipping scheduled monitoring efforts. This has occurred with the Rapid Assessment Survey, the BWMA surveys, Flood Extent, Quality Assurance/Quality Control (QA/QC) and data management protocols; and last year three important monitoring efforts were not completed at all.

Last year, after completion of the LORP Annual Report and Adaptive Management Recommendations, LADWP and ICWD determined that specific monitoring (three tasks) be canceled for the upcoming monitoring year, which was unsubstantiated scientifically and violates the LORP MAMP (2008) and the LORP EIR (2004). The three monitoring tasks that were canceled are significant to the LORP and include: 1.) Landscape Vegetation Mapping; 2.) Site Scale Vegetation Sampling and Evaluation; and, 3.) Evaluation of Indicator Species.

There is scientific need for data from these three tasks that was scheduled to occur this last monitoring season; landscape vegetation mapping is necessary to assess habitat for indicator species; site scale vegetation evaluation is necessary to assess riparian development on landforms and whether lack of development is a consequence of grazing or inadequate flows, amongst other variables; and, evaluation of indicator species habitat needs landscape vegetation mapping compared to bird surveys and other data to determine how habitat is trending and indicator species are faring. Each of these three efforts was postponed last season by ICWD and DWP, and the intention is to postpone them again this coming monitoring year.

Implicit in the LORP FEIR is establishment of a monitoring schedule in years 2, 5, 7, 10 and 15 for mapping and surveys of vegetation and habitat development, as well as acquisition of appropriate imagery for the LORP. Last year was year 5 of LORP monitoring. The LORP MAMP further codifies this schedule with specifics and details.

Problem

After six years (with both wet and dry years) its time to reevaluate delta, base and seasonal habitat flows. The need for winter seasonal habitat flows and variable base flows will require evaluating flows with water quality, riparian vegetation development and indicator species.

The LORP Monitoring and Adaptive Management Plan (MAMP) describes the field programs scheduled for each sampling year. The MOU Consultant notified both the County and the City last year that this fifth year of monitoring is one of the heavier monitoring years requiring substantial data collection, analysis and reporting. Consequently, it was imperative that LADWP and ICWD organize and schedule their efforts so that deadlines and protocols are met. The recommendations of the MOU Consultant as well as the directions specified in the guiding documents for the LORP (FEIR, MAMP) were disregarded by City who believed in their own estimation that this scheduled monitoring for the three efforts did not need to occur in 2013, and have indicated that they will not occurs in 2014 either, thereby delaying critical monitoring and data acquisition by two years. At this time the LORP is exhibiting many concerning issues and the monitoring data from these three efforts is important in understanding the ecological processes that may or may not be occurring.

Monitoring Requirements (FEIR, MAMP, MOU)

The LORP Monitoring is cited throughout all of the project agreements and documents. Beginning with the *Memorandum of Understanding* (MOU 1997), which directed the design and development of the *LORP Action Plan* (MOU, Attachment A 1997). The MOU directed the LORP Action Plan to develop several plans, including a *Monitoring and Reporting Plan* (p 8, MOU 1997). The MOU further describes the *Monitoring and Reporting Plan – Adaptive Management* to include specific program for data collection, analysis and reporting. (p 18, MOU 1997). The LORP Action Plan (MOU, Attachment A 1997) further developed the Long-Term Monitoring and Reporting Program for the LORP.

The MOU also directed the development of the LORP Environmental Impact Report (FEIR 2004). The FEIR includes specific provisions for LORP monitoring (Sec 2.10, FEIR 2004). Implicit in the FEIR is establishment of a monitoring schedule in years 2, 5, 7, 10 and 15 for mapping and surveys of vegetation and habitat development, as well as acquisition of appropriate imagery for the LORP.

Subsequently, the LORP Monitoring and Adaptive Management Plan (MAMP 2008) was developed and adopted for the project. The MAMP is developed specifically from the directives of the MOU, LORP Action Pan, and LORP FEIR. The MAMP specifies the monitoring schedule and conforms to the FEIR. Specifically the MAMP schedules monitoring of habitat, vegetation and mapping objectives in years 2, 5, 7, 10 and 15. This past year the LORP was in year five of the monitoring program.

Justification

LADWP and ICWD determined that three of the scheduled monitoring tasks for year 5*: landscape vegetation mapping, site scale vegetation evaluation, and indicator species habitat*, be delayed to some other monitoring year. Again, for this coming year 2014, LADWP has indicated their intention to postpone the monitoring for these three important efforts (it is not known what ICWD intentions are for the monitoring of these three objectives). Postponing these monitoring efforts for multiple years does not comport with any of the project agreements or documents and the MOU Consultants disagreed last year with this position and disagree again this year for several reasons.

First, this monitoring is required in the FEIR and the MAMP. To change the monitoring for policy reasons may require some CEQA action to step outside the FEIR and other project agreements.

Second, these monitoring tasks provide critical data for evaluating habitat and vegetation conditions at the five-year interval. The monitoring schedule was developed with careful consideration and based on credible scientific validity and an established monitoring program. If after five years the river is not showing any change we need to give serious consideration to our adaptive management recommendations. Now that the project is moving into year six we still do not have this monitoring data from which to refine our understanding of LORP conditions and inform management decisions.

Third, other MOU parties have expressed an interest in seeing the results of the indicator species habitat evaluation and whether habitat for indicator species has developed in the past five years. We agree with the need to understand the current conditions of indicator species habitat. This is a keystone element for the LORP.

These three monitoring tasks are critical to establish ecological trend and better understand evolving conditions in the LORP. These tasks should not be discounted, modified or pushed into other monitoring years. Furthermore, the MAMP describes and justifies in great detail the need for all monitoring programs and should be carefully reviewed before deciding upon any changes.

One of LADWP's arguments is that the aerial imagery needed for the landscape vegetation mapping should be taken in concert with their regularly scheduled imagery acquisition for all their lands. LADWP argues that gathering the imagery as required in the guiding documents is an unnecessary added cost. This argument is misleading because adequate imagery for the project area and for all of LADWP's land can be obtained for free through the National Agricultural Imagery Program (NAIP). NAIP imagery is 1 meter resolution with a near-infrared band (NIR). This imagery is more than sufficient to map the vegetation communities within the LORP. Additionally, the LORP monitoring program has been established for several years and LADWP have been aware of the need for imagery for an adequate amount of time to incorporate it into their planning. The imagery acquisition dates were established by the FEIR back in 2004.

LADWP's other argument is that it is too soon to do the landscape mapping and indicator species habitat monitoring. The justification given by LADWP was that their evaluation of range trend and RAS data from 2010 to 2012 indicated little vegetative change, thus there are not issues with the progress of the LORP that would be identified. The entire point of adaptive management is to measure changes *as well as no changes.* If there has been no change in vegetation in over five years, especially vegetation that is critical to LORP indicator species, then current management is not working, objectives are not being met, and intervention, adaptive management, is required. In order to make intelligent adaptive management recommendations such data as described in the MAMP (page 3-37) and landscape vegetation mapping and site scale sampling are combined with seasonal habitat flooding extent, rapid assessment, avian census, flow and wetland monitoring, irrigated pasture condition, utilization monitoring and range trend monitoring to develop a full picture of indicator species habitat and make necessary changes.

The MOU Consultants conclude that there was no compelling reason to alter or postpone any of the monitoring tasks scheduled by the LORP FEIR and MAMP for 2013-14 – the fifth year of LORP monitoring, and that there is no reason to further postpone this monitoring for another year.

MOU Consultants Recommendation

Perform the monitoring for: 1.) Landscape Vegetation Mapping; 2.) Site Scale Vegetation Sampling and Evaluation; and, 3.) Evaluation of Indicator Species this monitoring year.

11.2.12 River Summit

Background

Flows into the Lower Owens River were initiated in 2006 with the first seasonal habitat flow released in 2008. Since then the LORP has changed dramatically from an almost completely dry channel to a continuous flow river. As described previously, some of the initial goals and objectives set out for the LORP have been attained while others have not, and some may be trending in directions that are counter to LORP goals. Nevertheless, after six years of monitoring and some adaptive management actions, it is clearly time to revisit initial goals and expectations for the LORP.

As described in the LORP Monitoring and Adaptive Management plan (2008) to effectively manage the dynamics of ecosystem restoration, objectives must be adapted over time that cannot be predicted or even adequately anticipated at inception. Adaptive management is the specified and agreed upon approach for managing the LORP ecosystem in order to reach the desired goals of a healthy and functional ecosystem.

To achieve the goals of the LORP means using management tools over time in unique and flexible ways to adapt to changing ecosystem conditions. It also means adopting new tools and approaches from scientific advances over the course of the restoration process to constantly improve our understanding of ecosystem processes and the effects of management actions.

Neither LADWP, nor Inyo County, nor the MOU Consultants should work in isolation from one another or from evolving science and new resource management concepts. It befits the project and all involved to continually use quality data and observation in conjunction with innovation at the forefront of the LORP decision-making process. Assuming that the LORP will be successful with an ecologically stagnate vision is a recipe for failure. New ideas and approaches should be welcome from all sources, and adaptive management needs to be given the respect and resources needed to effectively manage the ecosystem through time.

When interested parties and management entities don't have a clear understanding of each other's desired outcome, or share a common vision, conflicts inevitably arise. In an effort to increase understanding and reset the goals and objectives for the LORP as may be necessary, a river summit is needed. At this summit each LORP entity would present their vision for the river. Such a summit will allow each participant to understand the other and hopefully lead to a consensus of what the river should become. Then management can concentrate of attaining and over time maintaining these conditions. After six years of monitoring and observing the river and landscape conditions under the current management regime (which has not changed much since project initiation) many lessons and valuable insights can be shared and an evolved strategy for the future can be forged.

The MOU Consultants made this recommendation in 2012 in the draft Adaptive Management chapter. LADWP, however, did not believe a summit necessary and in response to the recommendation wrote…"LADWP staff does not agree that we need to meet with the MOU parties regarding flows. We have guiding documents and the responsibility of managing the LORP and ensuring that the goals of the LORP and MOU are being met lies with LADWP and Inyo County with input from the MOU Consultants".

The MOU Consultants certainly recognize and appreciate the management authority of the City and County, but given the condition of the Lower Owens River and the need to reevaluate goals and objectives, we urge inclusion of a broader base of user groups.

<u>MOU Consultants Recommendation</u>

We again recommend that during the first week of April 2014, the MOU parties meet and define expectations based on the guidance and direction given in the MOU (1997) and the FEIR (2004), supporting documents, and MOU Consultant's recommendations. We suggest that the summit be an open forum, allowing non-MOU parties an opportunity to participate.

11.2.13 Communication

<u>Background</u>

A fundamental problem that goes on year after year is poor, even lack of, communication between the MOU Consultants and most often the City. In recent years communication between the County and MOU Consultants has improved considerably.

The MOU requires the City and County to provide "direction and assistance" to the MOU Consultants. This does not mean that the MOU Consultants are instructed what to do, rather the intent is to work collegially to meet the goals and objectives of the MOU and the LORP. The scientific team described in the MAMP is also intended to further and strengthen a collegial, team approach. To some extent the scientific team process has worked, though communication continues to be an issue.

Each year decisions are made, in part, based on the annual report and the adaptive management recommendations from the MOU Consultants. This process starts with the report and recommendations with the next step being the development of an annual work plan. In the work plan, the Technical Committee makes recommendations to the Standing Committee to accept, reject, or defer adaptive management recommendations. The Standing Committee then makes the decisions regarding the work plan.

As has been described already, it is clear that this process breaks down at some point and critical adaptive management recommendations are not acted upon. The MOU Consultants should be able to assist in the development of the work plan and attend Technical Committee meetings and be available to answer questions from the Standing Committee as necessary. Currently the City and County discuss adaptive management recommendations with the MOU Consultants as part of developing the annual work plan; however, the MOU Consultants are not aware of further discussions in the Technical Committee or Standing Committee until the decisions to act on or ignore the adaptive management recommendations are made. If the MOU Consultants were allowed to attend the work planning and Technical Committee meetings than any objections or questions could be addressed. However, the MOU Consultants have not been allowed to attend these meetings and, therefore, cannot defend or clarify recommendations. This is a fundamental problem in the LORP Adaptive Management process.

Allowing the MOU Consultants to participate in the full process would create greater understanding on all sides and would give the Standing Committee more informed decision-making ability.

It is not necessary for the MOU Consultants to be on-site in Bishop or Los Angeles. Currently the MOU Consultants discuss the adaptive management recommendations with the City and County via conference calls, which is effective. There would be no significant cost for the MOU Consultants to attend these meetings via telephone.

The other issue related to communications is the handicap placed on the MOU Consultants that prevents them from talking with other MOU parties. The MOU Consultants talk independently and jointly with the City and County, however, MOU Consultants have been directed that any communication with other MOU parties should not be done and would not be considered as part of the work plan tasks that are budgeted for. However, the MOU does not constrain the MOU Consultants from talking with the other parties. In fact, this censorship is not in the best interest of the project and has often led to mistrust and misunderstanding amongst the MOU Parties. Typically, responding to inquiries from MOU parties is not time consuming and, therefore, is not a significant cost factor. This limitation should be removed to foster an open a collegial atmosphere for communication amongst all LORP interested groups.

MOU Consultants Recommendation

The MOU Consultants recommend that they be allowed to participate, by telephone, the work plan and Technical Guidance Committee meetings, to respond to questions and provide clarifications to adaptive management recommendations as necessary.

The MOU Consultants recommend open dialogue between them and all MOU parties.

11.2.14 Range Monitoring

Background

The 2013 range monitoring was performed as prescribed. Data from irrigated pastures, utilization, range trend, rare plant, and streamside monitoring provide a summary of grazing throughout the LORP. Multiple use of the landscape is a key goal of the MOU and as grazing has been managed for the past eight years this appears to be trending in a positive direction. Unfortunately, continued drought conditions have and will stress range management and will be closely watched in the next growing season.

It should be noted that an arson fire took 525 acres of riparian pasture on the Lone Pine Lease last February. Over 80% of the trees were lost. Although both the City and County initiated restoration efforts, distributing willow seed and using pole plantings; these appear to have been unsuccessful.

Results of the streamside monitoring confirmed the MOU Consultants earlier discussion that as the Intake release flows remained higher than SHFs all summer, many juvenile tree willows established at the very low SHF or lower base flows were submerged and tule expansion increased on landforms supporting wetland species.

MOU Consultants Recommendation

The MOU Consultants again recommend that LADWP develop and make public a robust controlled burn plan that prioritizes areas that will benefit from burning to remove dense vegetation stands that are undesirable. In addition to forage value to livestock, selective burning can also improve forage and habitat for wildlife. An effective burn plan should be developed with LADWP's range, wildlife and avian scientists, as well lessees.

The MOU Consultants recommend that the City and County review the results of their restoration efforts on the Lone Pine burn to determine why seeding and pole plantings had little success. Given the condition throughout the river corridor, there may be a need for such restoration actions in the future and what does or does not work should be evaluated.

We recommend continuing to monitor rare plant trend plots. Although it may be possible that grazing increases the occurrence of Sildalcea and Calochortus, it may not continue as such.

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11.4 Appendices

Ecosystem Sciences

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May 24, 2007

Via Email or Mail:

Gene Coufal, Los Angeles Department of Water and Power
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Linda Arcularius, Inyo County Supervisor
Mark Bagley, Sierra Club
Carla Scheidlinger, Owens Valley Committee
Steve Parmenter, California Department of Fish and Game
Greg James, Attorney-at-Law
Don Mooney, Attorney-at-Law
Joe Brajevich, Attorney-at-Law
Larry Silver, Attorney-at-Law
Marian Moe, Asst. Attorney General
Hon. Lee Cooper, Inyo Superior Court Judge

Subject: Flow Certification in the LORP

Ladies and Gentlemen:

We were notified last week that the MOU representatives and attorneys met and developed criteria to lead to certification of the 40 cfs base flow in the Lower Owens River. We were also informed that this was negotiated between attorneys and managers with some technical input. We requested a meeting with LADWP (Gene Coufal) and ICWD (Tom Brooks) to clarify and discuss the proposed criteria. Unfortunately, the criteria and approach conflicts with the goals for the river and places the success of the restoration of the Lower Owens River at risk.

While we do not want to interfere in a rare occasion in which MOU parties find accord, we are obliged to inform you of the consequences of a Stipulation and Order that could inhibit management decisions and jeopardize the success of the project.

The MOU describes biological/ecological goals, some of which can only be attained through short-term and long-term flow manipulations. The proposed criteria you have apparently agreed to may meet political goals, but they do not compliment the biological goals. Setting aside for the moment the problem that the criteria have no foundation in biology or ecology, there is a fatal flaw in the criteria.

The criteria that measuring stations must record 40 cfs 3 days out of 15 is currently being violated, and will usually be unattainable. The flows above and at the pump back station do not meet the criteria right now. The flaw is that travel time from the last spill gate (where flow can be augmented) to the pump back station is not accounted for; consequently, it is impossible to predict in advance what affect evapotranspiration and other conditions will have on the flow two weeks downstream. Trying to adjust flow releases to anticipate changes and travel time will result in either too little or too much flow at some measuring stations. Although we have learned a great deal since flows were first implemented, there remains a substantial body of "unknows". Unknowns such as seasonal changes, temperature changes, evapotranspiration rate, and precipitation amounts in different water years all directly affect how water moves through the channel.

There has been an overall average base flow of 40 cfs and more in the river for several months, but that flow is now beginning to vary from point to point in the channel as a consequence of evapotranspiration and other influences described above. If criteria are to be imposed, certainly it must be correct, compatible, flawless and achievable. Our point is that we have insufficient knowledge and experience today to set the type of stringent criteria you are seeking. In fact, such criteria are not even realistic standards for managing a river ecosystem.

It is premature to set flow management in a Stipulation and Order. Our original plan allowed two years to adjust and manage flows in response to the assimilation of organics, replacement and decomposition of vegetation, protection of existing fisheries, etc. It is troublesome enough that we have lost the time to gradually re-establish flows, but it is even more troublesome that negotiations have now put the cart ahead of the horse by proposing to set flows in a Stipulation and Order before we even know how to respond to existing, let alone future conditions.

We ask the MOU parties to reconsider their decision by contemplating some examples of short-term and long-term flow management. These are not examples of emergency situations, but are typical of decisions and actions that must be taken as routine management to meet the goals of the MOU. We understand that the Stipulation and Order can contain language for emergency situations and notification, but we are not concerned about emergency situations so much as the necessary flow management that will come as more knowledge is gained over time.

A primary goal of the project is to create and maintain "a healthy warm water recreational fishery". As we all know, dissolved oxygen (DO) is becoming a serious problem in the lower river reaches where the primary fishery now occurs. This was a condition anticipated in the plan and is not a surprise. With a river flow of 40 cfs and less than 1 mg/l DO, releasing 5 or 10 cfs at a spill gate will have little value because the oxygen sag is so great. The best way to protect the fishery if the DO drops below 1mg/l throughout portions of the lower river is to reduce the intake flow to 20 cfs and increase spill gate discharge to 30 or 40 cfs, as described in our plan and the EIR, until river conditions improve. This would provide more mixing of water high in DO with a smaller volume of water low in DO. However, with a Stipulation and Order dictating other requirements, such flow changes would not be allowed, and, consequently, we risk damaging the fishery because hands will be tied. This is one example of a likely short-term management action that could well be needed in the next few months.

An example of long-term flow management to meet the biological and ecological goals in the MOU is a critical flow decision that is probably going to be necessary in about five years, maybe less. Based on monitoring and adaptive management, we can expect that a set flow of 40 cfs will create a canal not a river. Natural river flows fluctuate, canals do not. Although the intent has always been to initiate the project with a 40 cfs base flow and a 200 cfs pulse flow, this should not be viewed as the beginning and end. To achieve biological/ecological goals of the MOU, it will be necessary to create a river, not a canal, in the long-term.

How flows will need to be altered and reset will depend upon what we learn through time from monitoring and short-term adaptive management actions. The MOU appropriates about 29,000-acre-feet (40 cfs base flow) plus up to 2400-acre-feet (200 cfs pulse flow). This is the volume of water LADWP has obligated to the LORP. If we take the view that the LORP has an allocated volume of water which can be used as needed to meet biological goals, then it is possible, under adaptive management, to realign flows to more closely emulate river ecology. For example, in time with knowledge gained, it could be decided to set a winter flow of 25 cfs (when most biological activity is dormant and high flows provide less value) in order to "bank water" for a summer flow of 50 cfs for greater fisheries, habitat, or recreational benefits[1]. Or, knowledge might tells us that altering the pulse flow volume of water to extend the duration of the flow and "borrowing" water from the base flow allocation to increase the magnitude will create even more biological benefits. Such flow management changes are certainly long-term, but are very likely to be necessary. Again, a Stipulation and Order today is obviously premature and would simply complicate future management if not negate intelligent decision-making.

We are not opposed to the parties finding common ground for certifying the LORP flows, or criteria that gives everyone a comfort level. We are opposed to any agreement that limits the ability to meet the biological and ecological goals MOU parties have set for the river. Memorializing criteria in a Stipulation and Order will do exactly that. Managers and scientists will have to abide by a court directive that greatly limits the ability of future decision-makers to meet the project goals.

Because this is such a serious step and an important nexus in the LORP process, we request that the MOU parties convene to discuss all this and deliberate again on what, if any criteria, is needed to certify the flow and how best to impose such criteria. We therefore recommend an MOU meeting at the earliest possible date. We suggest the MOU parties meet at 9:00 am June 4th in the LADWP multipurpose room. Please respond at your earliest convenience via email, because we understand that legal processes are moving forward on a rather fast track to submit a Stipulation and Order to the court.

Sincerely,
Mark Hill, Project Leader
Dr. William Platts, Principal Scientist

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[1] While 60 or 70 cfs might give even greater ecological benefits, the 50 cfs capacity of the pump back station is the limiting factor on how much the base flow can be altered.

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From: Duncan Patten, Research Professor
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To: Mark Bagley, Policy Director
Owens Valley Committee

Date: January 29, 2012

Via Email

Subject: Comments on LORP Annual Report with Emphasis on Adaptive Management

Below is a brief commentary on several aspects of the LORP Annual Report. These comments are based on a fairly quick review of the document and emphasis was placed on Adaptive Management recommendations.

Non-Adaptive Management Comments

RE: RAS, pg 5-6. The RAS shows no cottonwood seedlings in 2011 as in 2010 and yet Table 6 indicates there were cottonwoods. Are these from prior years and not seedlings? This is not clear as there appears to be an obvious contradiction.
What is Table 7 on page 5-6? Not clear what this is showing.

Comments on Adaptive Management Section That Was Prepared by the MOU Consultants

It is important that the consultants point out the application of adaptive management "is not among LORP successes". They point out that difficult prescriptions are not followed nor are explanations given as to why they are not followed, whereas, the easiest and least restrictive prescriptions are followed. This highly selective approach taken relative to application of adaptive management should be challenged.

They recommend, and I support, that there should be action on adaptive management recommendations or justification of "no action".

Page 10-2 the consultants tabulate adaptive management processes that have or have not been implemented, and/or should be implemented in 2012.

They recommend that the river flow model be completed which is critical if the recommendations of changes in Seasonal Habitat Flows (SHF) are to be designed properly and implemented accordingly.

The MOU consultants recommend, and I support, changes in SHF timing, duration and magnitudes to ensure appropriate changes in channel development and improvement in riparian vegetation establishment and maintenance. Although woody recruitment is occurring along the Lower Owens, enhancing the potential for future recruitment with flows that are more conducive to riparian woody plant establishment, especially cottonwood that presently show limited recovery, would ensure a more stable long-term recovery of the Lower Owens.
I also support the MOU consultants' recommendation that SHF flows be augmented downstream from the primary inflow point in order to reduce the attenuation of flow volume downstream along the full LOR channel. This will help maintain the shallow alluvial water table that is supported by these flows and helps maintain the established riparian vegetation.

More Specific Comments.
1. River Flow Modeling: As pointed out above, this is critical to understand effects of actual flows and potential changes in flows (especially SHF) as these might, and probably should be adjusted in timing and magnitude. For example, 2011 was a very high snow pack year and flows above 200 cfs should seriously have been considered. Limits on higher flows might be due to the capacity of pump back but if that is an issue than the pump back capacity should be increased when possible.

2. The consultants present a good discussion of tule/cattail control along the LOR. Physical cutting seems to be the best control and the recommendation to avoid drawdowns during summer (another water management recommendation) is critical as this triggers invasion and expansion of cattail.

3. I also support the recommendations for consideration of modification of magnitude, duration and timing of the SHF. The EIR (2004) required two SHF flows. One initially of 200 cfs as a flushing, scouring flow in the winter, and then regular spring 200 cfs peak flows when the precipitation is equal or above normal. The consultants recommend that anytime the water year is equal or greater than normal a 200 cfs SHF be achieved. They also recommend that when water year runoff is less then normal the SHF be changed to include a peak of 200 cfs, but so designed to continue to use the same amount of water that the original EIR ramping schedule would have used at a given water year. These recommendations seem like a reasonable approach to creating some higher flows during most years.
I believe that serious consideration should be given to investigating SHF flows exceeding 200 cfs if and when the water year would allow it (that is, the water year is well above normal, for example, like 2011) and the river model shows the advantages of higher level flows on channel formation, tule and sediment scouring, and riparian vegetation recruitment and maintenance.

4. Augmentation:

SHF Augmentation: A 2010 addendum to the LORP EIR allows augmentation to maintain 200 cfs in the lower reaches when this is the SHF and "objectives" aren't met. When possible flows to augment flow below the River Intake should be seriously considered as a regular component of SHF. Compared with the original EIR SHF ramping and flow durations with releases only from the intake, this would allow an additional 928 af into the Delta which may be returned to the aqueduct through increasing the capacity of the pump station.

Augmentation should allow greater depth increases in the river over the base flow to create more inundation and recharge of the shallow groundwater, both enhance riparian recruitment and maintenance.

Base flow augmentation: There is also a need to augment baseflows to correct a water chemistry issue where there may be high BOD and low dissolved oxygen, a condition that is not good for river biota. I also agree with the MOU consultants recommendation to release flows aimed for the Delta from the Intake (March- April and Nov.-Dec.) rather than the pumpback in order to move fresh water through the system.

5. Delta Habitat Area Flows (DHA flows)

Recommended DHA flow changes are designed to reduce length of the "dry out" periods, a logical use of water. However, it is not apparent whether the DHA flows have been modeled (if not, they should be). If so, how do recommended changes in DHA flows fit the models?

It appears, however, that comments supporting each flow change recommendation are based on some level of model (conceptual or otherwise?). This is not clear.

The logic behind the recommendation of modifying the DHA flows through increased flows (pg 10-17) seems like a very useful recommendation designed to improve habitat conditions in the Delta.

6. Other recommendations:

RAS. I agree with recommendations on improvements in the RAS process (pg 10-19).

Salt Cedar. I agree that prevention of spread of salt cedar is desirable but it may be nearly impossible to completely eradicate salt cedar along the LOR. Consequently, accepting a few stands of salt cedar may not be ecologically disastrous as long as recruitment of cottonwood and willow stands are the paramount goal of riparian management along with prevention of salt cedar spread. This is because some literature shows that in established arid-region woody riparian stands salt cedar supports avian populations and provides some functions similar to other large native, woody riparian species ((e.g., Stromberg, JC 1998. Functional equivalency of salt cedar (*Tamarix chinensis*) and Fremont cottonwood (*Populus fremontii*) along a free flowing river. Wetlands 18:675-686)).

Beavers: I suspect beavers were ubiquitous over much of North America (pre-trapping in early 1800s) and thus native to the LOR (see, for example, Naiman, RJ, CA Johnston and JC Kelbey 1988. Alteration of North American streams by beavers. BioScience 38:753-762). They were reintroduced after extirpation, however, the fact that they might have been native doesn't mean that with early reestablishment of a riparian vegetation community, a community that is very susceptible to destruction by a rapidly expanding beaver community, beaver control should not be undertaken.

Consequently, I agree with the MOU consultants' recommendations on controlling beaver populations (pg 10-22). Beavers will build dams and/or establish colonies where there are appropriate resources which includes both proper river conditions and an adequate supply of woody plant material for food and structures. Beaver dams help elevate the water table which enhances riparian vegetation expansion and maintenance. Beavers may occupy one location for a while and then move on to other appropriate reaches of the river. Abandoned dams should be left alone to allow continued water table elevation, recognizing that high flows and/or time will eventually destroy them. During the early recovery of the LOR it is unlikely that many beaver colonies can be supported by newly establishing riparian vegetation and thus it would be fruitful to allow very few colonies during this early recovery period. It is difficult to recommend any particular number of beaver colonies to leave, however, annual surveys will offer some evaluation of beaver density and riparian losses which should guide adaptive management of beaver populations.

Range Belt Transects: The recommendations that the whole transect should be used for vegetation monitoring and widened to 10 m (pg 10-23) is an excellent one as it will allow sampling of more riparian woody habitat and allow better assessments of riparian establishment success.

General Comment: Several figures in the report (e.g., Fig 1, pg 10-26) do not have axes labels. This makes understanding the figures difficult. All figures should be appropriately labeled and those not so should be corrected accordingly.

LOS ANGELES DEPARTMENT OF WATER AND POWER
and
INYO COUNTY WATER DEPARTMENT

Response to Adaptive Management Recommendations

Response to 2013 LORP Annual Report Adaptive Management Recommendations

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Base Flow Modifications

- Recommendation: The MOU Consultants recommend that all requirements in the MOU (1997) and respective Stipulation and Orders that dictate how the 40 cfs flow is applied over all reaches of the Lower Owens River be rescinded. The MOU Parties can accomplish this by written agreement signed by all Parties and obtaining relief from the Courts as needed.

  LADWP is in support of this recommendation.

  County Response: The dictates of the legal decisions governing LORP base flow do not allow flexibility needed to experiment with flows and effectively manage the river. The County is working with LADWP and parties to the MOU to explore options to modify or remove some of these restrictions; however, that effort should be informed by quantitative information and analysis to determine revised baseflows that would further the project goals.

- Recommendation: A new Stipulation and Order be submitted to the Court for approval requiring the City to release annually an average flow of 55 cfs from the Intake Control Station into the Lower Owens River. The 55 cfs flow level is selected based on flows released from the Lower Owens River from March 21, 2007 through November 18, 2013. This 6 year period averaged 54.8 cfs.

  LADWP is in support of this recommendation. However, the new or revised Stipulation and Order will need to provide LADWP with enough flexibility to achieve the MOU Consultants objectives and must be cost/water neutral for LADWP.

  County Response: LADWP has stated their position that any change in flows would need to be "water neutral"; that overall water use remain at current levels. While the County does not see a legal mandate that the project be "water neutral", easing restrictions on the amount of water that can be pumped back to the Los Angeles Aqueduct would allow greater flexibility and satisfy LADWP's requirement. The County is working with LADWP and parties to the MOU to explore options to modify pumpback station restrictions.

  The value of 55 cfs was derived from the average flow of recent years that have not resulted in desired conditions. Logically, to improve conditions, flow management during the year would have to be altered, but now specifics how the flows should be managed through the year were provided by the Consultant. It is unclear whether the Consultant's recommendation of 55 cfs average flow is based on an assessment of the biologic and hydrologic requirements to accomplish the LORP goals or is simply trial and error with the added constraint to preserve water neutrality. It is difficult for the County to act on vague proposals with weak justification of the environmental benefits. Simply stated, the proposal may have merit, but the lack of specifics how flows through the year should vary and the environmental benefits expected is insufficient reason to endorse it. It is possible that the planning effort proposed below based on an average 55 cfs flow will result in a recommendation the County could support.

- Recommendation: The MOU Consultants, the County and the City develop a new Lower Owens River flow management strategy based on an average of 55 cfs of continuous water being available. This flow strategy will be presented to all MOU Parties for refinement and agreement. The plan would guide the management of future base, pulse, and seasonal habitat flows. The continuation of adaptive management will ensure that the plan maintains the river in a healthy condition and meets all applicable LORP and MOU (1997) goals.

LADWP is in support of this recommendation. However, any new flow management strategy has to be cost/water neutral.

County response: There is no evidence that increasing the base flow from 40 cfs to 55 cfs would better accomplish any of the LORP flow related management objectives. However; given that water gains and losses result in an average flow of around 55 cfs, it seems reasonable that this average be considered when calculating flow changes. The County agrees to work with LADWP and MOU parties in 2014 to derive a new flow management regime.

Seasonal Habitat Flow Modifications

- Recommendation: The MOU Consultants recommend that a SHF peak of 300 cfs or more be released during 2014. Water to accomplish this would come from the 55 cfs average annual base flow allotment (this is the average annual flow released from the Intake into the Lower Owens from 2008 to 2013) (Figure 2.2.2). Part of the needed water could come from implementing the 2010 Addendum to the EIR (2004).The Addendum allows an additional flow by-pass into the DHA of up to 928 afy over past required flow by-passes.

LADWP is in support of this recommendation. However, any new flow management strategy has to be cost/water neutral.

County response: The County supports experimenting with flows, including the SHF. The LORP Scientific Team (LADWP/Inyo County/MOU Consultant scientists) will be meeting soon to discuss these recommendations. Increasing the size of the Seasonal Habitat Flow may improve water quality, and possibly help limit the encroachment of emergent vegetation. Higher flows may also increase out of bank flooding, which may encourage woody recruitment; it may also introduce more organic material to the river, which may have a negative effect on water quality. County supports an effort redesign a flow regime that takes all of these considerations into account. At this point, the Consultant's recommendation lacks sufficient explanation on how specific flow changes will benefit the project.

- Recommendation: The MOU Consultants recommend that flow management changes be made to improve flow timing, flow duration, and flow magnitude. To provide the base for these changes an analysis and evaluation report of all past flows should be prepared that will describe and document reactions to past flow management. This evaluation and findings report should help determine the changes needed to improve LORP resources to be effective. This draft report would be available to the County and City prior to the MOU Consultants recommending the 2014 SHF.

    LADWP is in support of this recommendation. However, any new flow management strategy has to be cost/water neutral.

    County response: Knowing the physical and biological effects of past flows are necessary in setting new flows. Past hydrological monitoring could answer the physical questions, but it is not clear that we have data needed to link flows to biological response. A proposal on how this analysis could be conducted will be developed by the Scientific Team and released in 2014.

- Recommendation: The MOU Consultants recommend that during the winter of 2014, the MOU Parties eliminate and void all presently legal and mandated restrictions on the amount of water the Pumpback Station can pump out of the Lower Owens River, and the MOU Consultants recommend that the County, City, and the MOU Consultants meet prior to the MOU Consultants time-frame for recommending the 2014 SHF and discuss what can be done to increase the effectiveness of future SHFs.

    LADWP is in support of this recommendation.

    County response: The County is working with LADWP and MOU parties to explore options to alter legal requirements to allow flexibility when designing and setting flows.

- Recommendation: The MOU Consultants recommend that the MOU Parties, during the winter of 2014, revise the Stipulation and Orders that govern present base flow requirements in the Lower Owens River. This revision would be replaced with a Stipulation and Order requiring the City to release from the Intake Control Station, a 55 cfs average annual flow (this is the average annual flow released from the Intake into the Lower Owens from 2008 to 2013). The reason for selecting the 55 cfs average flow is because flows released from the Intake Control Station from March 21, 2007 through November 18, 2013, a period of about 7 years, averaged 54.8 cfs. The average annual flow could then be formed so that flow alternatives will be able to improve riverine-riparian conditions. Water would be available to release more efficient SHF's. The flow regime can be designed to more effectively manage the river seasonally.

    LADWP is in support of this recommendation.

County response: see previous response.

- Recommendation A late winter or early spring seasonal flushing flow, similar to the flushing flow released in February 2008, should be released during 2014. This will increase the annual SHF's applied each year from 1 to 2. This flushing flow would be evaluated to determine benefits received. It would provide experience and information to make future winter pulses more effective and help eliminate environmental problems in the Lower Owens River.

  LADWP is in support of this recommendation. However, any new flow management strategy has to be cost/water neutral.

  County response: Agreed; a cool water flushing flow should be implemented as an experiment to improve water quality. The Scientific Team will discuss this proposal and if implemented will design appropriate monitoring to gauge if a late-winter or early spring pulse flow mobilizes and removes organic material in the river channel, and what effect that might have on water quality.

Flow Management Changes to Minimize Future Fish Kills

- Recommendation: The MOU Consultants recommend that in the future the City coordinate with all MOU Parties and the MOU Consultants on any management activity that would or could influence any environmental condition in the LORP.

  LADWP will contact necessary parties as appropriate.

  County response: The County and the MOU Consultant need to be made aware in advance of all activities that can potentially affect the implementation of the LORP. In many cases the County is given advance notice of LADWP operations that could impact the project, this information should also be provided to the MOU Consultant.

- Recommendation: The MOU Consultants recommend that the City and the County develop Task Orders that allow Consultants to meet their responsibilities under their MOU (1997) mandates for the remainder of LORP implementation. This would specify the ability for the MOU Consultants to respond and work on unanticipated events as needed.

  LADWP contract administrators have many obligations regarding the contract with the MOU Consultants. The must ensure that there is adequate time and money to accomplish necessary evaluations and develop recommendations, but have to ensure that efforts are cost effective and appropriate. Open ended task orders are not allowable under LADWP contracting requirements.

  County response: Task orders follow the outline of work described in the LORP Monitoring, Adaptive Management and Reporting Plan (MAMP). Tasks related to adaptive management that are not described in the MAMP are developed jointly by LADWP, Inyo County, and the MOU Consultant each year. The MOU

Consultant describes these tasks in their budget proposal that is submitted to LADWP and the County. Approved tasks are to be conducted as proposed within the approved Annual LORP Work Plan and Budget. Any changes in task orders will be approved by both Inyo County and LADWP.

- Recommendation: The MOU Consultants recommend the City evaluate all past and current AMRs that apply to maintaining the warm water fishery in a healthy condition.

LADWP is unsure what this is in reference to?

County response: The Scientific Team will evaluate changes in flow timing, flow duration, and flow magnitude and other adaptive management recommendations that have been offered by the MOU Consultant.

Amending the MOU, FEIR and Stipulation Orders for more Effective Flow Management of the River

- Recommendation - Base Flows: The MOU Consultants recommend that all Court Stipulations and Orders and mandates appearing in the MOU (1997) and EIR (2004) that require a constant 40 cfs flow in all reaches of the Lower Owens River be eliminated. The flow requirements would be replaced with a new Court Stipulation and Order. The Order would require the City to release an annual average flow equaling 55 cfs over the year from the Intake Control Station into the Lower Owens River. The reason for the 55 cfs flow selection is because from March 21, 2007, through November 18, 2013, the average annual flow released from the Intake Control Station was 54.8 cfs. Because 55 cfs is the average flow requirement the base flow could then be increased or decreased (temporally and spatially) to better-fit environmental needs. The number and magnitude of pulse and SHFs could be increased. Base flows could be better formed to match seasonal requirements. High base flows now released during summer conditions that are eliminating willow seedlings could be reduced to match more appropriate flow conditions.

LADWP is in support of this recommendation. However, any new flow management strategy has to be cost/water neutral.

County response: Again, the County is working with LADWP and MOU parties to explore options to amend the 1997 MOU and revise the 2003 Stipulation and Order in order to allow more flexibility when setting flows.

- Recommendation - Seasonal Habitat Flows: The MOU Consultants recommend that 40 to 200 cfs SHF peak flow restrictions required in the EIR (2004) and the MOU (1997), based on forecasted annual runoff conditions, be eliminated. All present SHF restrictions on flow would be eliminated. Instead, a new Stipulation and Order would require the City to release an annual average flow equaling 55 cfs over the year from the Intake Control Station and follow an annual hydrograph. All water needed to release future SHFs and pulses would come out of the 55 cfs average annual flow allotment. Higher SHF's and additional pulse flows could then be planned and implemented.

LADWP is in support of this recommendation. However, any new flow management strategy has to be cost/water neutral.

County response: *See above.*

- Recommendation - Delta Habitat Area Flows: The MOU Consultants again recommend that three of the DHA pulse flows be released at the Intake Control Station instead of the Pump Back Station. For more information on the justification, procedures and processes to accomplish this, see the 2011, 2012 and 2013 Adaptive Management Recommendations. Future pulse flows need to be released much differently than how the single 2013 DHA habitat flow was released at the Intake Control Station.

  LADWP is in support of this recommendation. However, any new flow management strategy has to be cost/water neutral.

  County response: Any opportunity to disrupt static flow, which has the river functioning as a canal, would be welcomed. The County supports this recommendation. How these pulse flows will be implemented will be established by the Scientific Team when it meets to discuss adaptive management of flows.

- Recommendation - Pump Back Station: The MOU Consultants again recommend that all Lower Owens River pump-out limitations that appear in the MOU (1997), EIR (2004), or in any Court Stipulation or Order be eliminated. No limitations would be placed on the amount of water that can be pumped out of the Owens River at the Pump Back Station. An exception would be that water designated to pass by into the DHA, as required by the Court, could not be affected by any pump-out actions.

  LADWP is in support of this recommendation. However, any new flow management strategy has to be cost/water neutral.

  County response: This will be discussed by the MOU Parties. There are physical limitations to the capacity of the pumpback station that limit the amount of water that can be returned to the aqueduct. Currently, with all pumps operating, a return flow of 72 cfs can be achieved.

- Recommendation - Future Base and Seasonal Habitat Flows: The MOU Consultants recommend that the County, City, and the MOU Consultants meet during the winter of 2014 and draft example base, pulse, and SHF scenarios using water from the 55 cfs average annual flow release from the Intake Control Station. These flow plans would then be available for Technical Committee consideration.

  LADWP is in support of this recommendation. However, any new flow management strategy has to be cost/water neutral.

  County response: This meeting is anticipated.

Delta Habitat Flows Modifications

- Recommendation: The MOU Consultants again recommend improving Lower Owens River water quality and other environmental river conditions by releasing three of the DHA habitat flows from the Intake Control Station rather than the Pumpback Station. The three DHA flow periods recommended are Period 1 (March-April), Period 3 (September and add October), and Period 4 (November-December).

  LADWP is in support of this recommendation.

  County response: Agreed; The County supports releasing the DHA habitat flows from the intake this year.

- Recommendation: MOU Consultants recommend that in all future pulse flow releases that the City use the full amount of water called for and use the true LORP required base flow in determining all future flow allocations.

  LADWP Response: If the Consultants have a specific recommendation as to how the flow should be released, it should be in their recommendations. So far, the recommendation we received was that the pulse flows scheduled for release in the winter time should be released from the intake. That was done and the release was discussed at a meeting with the MOU Consultants in Bishop after their visit to the Lone Pine burn.

  County response: The Scientific Team will evaluate how water is best allocated to achieve the LORP goals for the DHA.

- Recommendation: The MOU Consultants recommend that during the winter of 2014, the County, the City, and the MOU Consultants meet and develop three DHA habitat pulse flow guides for release at the Intake Control Station. These guides would then be used by the County and the City for input into their future management decisions.

  LADWP is in support of this recommendation.

  County response: Agreed.

- Recommendation: The MOU Consultants recommend that in all future DHA habitat flow releases from the Intake Control Station, the City release the full amount of DHA habitat flow at this Station. Also, all the required water designated for release into the DHA for each flow Period should be released.

  LADWP Response: If the Consultants have a specific recommendation as to how the flow should be released, it should be in their recommendations. So far, the recommendation we received was that the pulse flows scheduled for release in the winter time should be released from the intake. That was done and the release was discussed at a meeting with the MOU Consultants in Bishop after their visit to the Lone Pine burn.

County response: Agreed; the Scientific Team will evaluate how water is best allocated to achieve the LORP goals for the DHA. No matter the release point, the full allocation of water required to maintain the health of DHA will be released.

- Recommendation: The MOU Consultants recommend that in the future the City not release DHA habitat flow from the Intake Control Station that resembles their 2013 March-April flow release. This insufficient pulse flow was completely ineffective.

LADWP Response: If the Consultants have a specific recommendation as to how the flow should be released, it should be in their recommendations. So far, the recommendation we received was that the pulse flows scheduled for release in the winter time should be released from the intake. That was done and the release was discussed at a meeting with the MOU Consultants in Bishop after their visit to the Lone Pine burn.

County response: This will be discussed and evaluated by the Scientific Team when they meet to discuss flows.

- Recommendation: The MOU Consultants recommend that the County and City use shorter pulse flow duration periods in all future pulse flow releases, as needed. The water saved could then be used to increase daily flow levels in all future DHA habitat flow releases. Much higher peak and daily flows could then the released at the Intake Control Station.

LADWP Response: If the Consultants have a specific recommendation as to how the flow should be released, it should be in their recommendations. So far, the recommendation we received was that the pulse flows scheduled for release in the winter time should be released from the intake. That was done and the release was discussed at a meeting with the MOU Consultants in Bishop after their visit to the Lone Pine burn.

County response: This recommendation has merit and will be considered when the Scientific Team meets to discuss flow management.

- Recommendation: The MOU Consultants again recommend that the MOU Parties eliminate all restrictions now appearing in the MOU (1997), EIR (2004) or any Court Stipulation and Order that limits the amount of water the Pumpback Station can pump-out of the Lower Owens River.

LADWP is in support of this recommendation. However, any new flow management strategy has to be cost/water neutral.

County response: *see response above*.

Creel Census

- The MOU Consultants recommend that the City conduct a Lower Owens River creel census in May of 2014 using the same methods, procedures, application levels, and number of fishermen called for in the Monitoring and Adaptive Management Plan (2008).

    LADWP is not opposed to considering this.

    County response: Given the recent fish kill, the County recommends a Creel Census be conducted in May 2014. The exact size and geographic extent of the July 2013 fish kill is unknown. This study would help us better understand dynamics of the fishery in response to poor water quality.

Alabama Gates Spillway

- Recommendation: The MOU Consultants recommend training the Alabama Gate release flow channel so that flow enters directly into the Lower Owens River below the Islands as shown in Figure 2.7.1.

    LADWP is not opposed to this. However, a thorough analysis needs to be conducted to determine exactly what this recommendation would mean in terms of total costs.

    County response: Agreed with conditions. The County agrees that water that is released from the Alabama Gates to augment river flows is less effective due to the lack of a proper conveyance and probably has adverse effects by promoting tule growth instead of riparian or meadow vegetation. However, we cannot endorse this recommendation without cost estimates for construction and maintenance as well as assessment of any environmental impacts, in particular those associated with the sediment basin. Methods to move the water to the western channel of the river should be investigated, and a plan generated. The merits of this recommendation will be discussed by the Scientific Team, but much of the planning and work involves LADWP engineering.

- Recommendation: Because the City will need to continue eliminating accumulated sediments from the LAA onto the Island area, the MOU Consultants recommend constructing a sediment debris basin below the spillway. This basin would collect LAA transported and dumped sediments and prevent the trained channel from continually plugging up as the present channel is now doing.

    LADWP is not opposed to this. However, a thorough analysis needs to be conducted to determine exactly what this recommendation would mean in terms of total costs.

    County response: *see response above.*

Tule and Cattail Management

- Recommendation: The MOU Consultants recommend that similar analysis be performed for the other four river reaches. The goal is to identify flows which provide a range of depths that create the greatest control on tules. Depth analysis includes the maximum-minimum that drowns leaves and inhibits oxygen transfer, as well as the lower flows that can be attained to stress tules in the growing season without negatively impacting other environmental goals and parameters. This analysis is an essential part of identifying better flow regimes in the Lower Owens.

  LADWP is in support of this recommendation.

  County response: This will be discussed by the Scientific Team when they meet to talk about setting river flows.

Blackrock Waterfowl Management Area

- Recommendation: The MOU Consultants recommend continued analysis of the BWMA; build off of the remote sensing analysis based on large pixel imagery and assess the ratio of open water to emergent vegetation more accurately within the Drew unit. Managers should develop a plan to prepare the next unit for flooding. A plan that includes multiple treatments including excavation, burning and experimental use of herbicides in localized areas within the unit is recommended. When the run-off year is known the scientific team make an informed decision about flooding the newly prepared unit (Winterton or Waggoner) and the utility of retaining water inflows into the Drew unit based on the characterization of Drew habitat quality, the number of target acres, and the preparations made to the new unit.

  LADWP is in support of this recommendation.
  Due to restrictions on burning the Winterton and Waggoner units will not be able to be prepared for flooding in 2014. LADWP will schedule the work to be conducted in the winter of 2015.

  County response: The County would support additional development of remote sensing methods to delineate wetted extent of BWMA units and to discriminate open water from emergent vegetation. Landsat 8 is good choice but the methods and ancillary data sources need discussion and testing, including selection of appropriate bands and transform; preprocessing for atmospheric effects and image registration; mixture, thresholds or other models to extract wetted perimeter as well as use of FLIR vs. other high spatial resolution sensors for or in addition to field ground-truth.

Rapid Assessment Survey

- Recommendation: The MOU Consultants recommend that woody recruitment be examined more closely and with greater specificity than the RAS allows for, as these downward trends in recruitment are concerning.

  LADWP concurs with the County on this issue.

  County response: The RAS is a quick method of measuring woody recruitment in an area as large and diverse as the LORP, but it is a course measure. It is not clear that recruitment is declining or whether the low numbers last year represent some error in the measurement. It is clear that the recruitment is not nearly as robust as had been predicted by the MOU Consultant. The Scientific Team will discuss the RAS and whether other studies can replace or augment woody recruitment detection.

  The February 23, 2013 Lone Pine Fire burned through about 500 acres of some of the best riparian woodland in the LORP; key habitat for LORP avian indicator species. The fire destroyed 80-90% of the riparian forest in the area. This loss represents a significant setback, given that since the beginning of the project a total 435 observations of woody recruitment have been recorded. Adaptive management efforts included sowing seed and placing willow pole plantings in the area, but these actions were largely unsuccessful. The Scientific Team will discuss what actions we could take to recover some of this crucial habitat.

- Recommendation: Salt cedar control efforts should focus on the riverine-riparian system. Resources are not sufficient to control salt cedar in all areas of the LORP. Efforts made to control salt cedar along the river channel pay a much higher ecological reward than those efforts spent off-river in uplands and spreading basins. Proper control and management of salt cedar will require diligent application of resources. There is an abundant salt cedar seed supply that will not be easily reduced. However, direct cutting of salt cedar along the river provides an opportunity for a native riparian species to establish. The MOU Consultants recommend that the primary focus of the salt cedar control program be on the riverine/riparian corridor above all other areas.

  LADWP concurs with the County on this issue.

  County response: ICWD Saltcedar program visits all locations of seedlings and resprouts observed by the RAS. Not all individuals are re-located or accessible for herbicide treatment. Preliminary analysis by the ICWD suggests that salt cedar observations are not untreated locations from the previous year's observations, but are likely new seedlings. The Saltcedar program will continue to treat all newly identified salt cedar locations in the river channel.

  We are concerned about the increase in tamarisk in the BWMA and adjacent river reach 2. Saltcedar crews will be finished clearing the spreading basins of tamarisk in 2014.

  Requirements that accumulated saltcedar slash be completely eliminated have reduced the number of days spent clearing tamarisk from the river. This year, because of the drought, crews have not been able to burn, so an increased effort may be possible in Reach 2 and BWMA in spring 2014. A plan to address the extensive stands of tamarisk in the BWMA will need to be developed.

Monitoring

- Recommendation: Perform the monitoring for: 1.) Landscape Vegetation Mapping; 2.) Site Scale Vegetation Sampling and Evaluation; and, 3.) Evaluation of Indicator Species this monitoring year.

LADWP will contract for new aerial imagery to be captured in 2014. Processing and mapping will begin in the fall of 2014. Indicator species monitoring will be budgeted to begin in the spring of 2015.

County response: LADWP is planning to acquire imagery in 2014 needed to conduct the Landscape Vegetation Mapping in 2015. The Evaluation of Indicator Species will also take place in 2015. The results from this work will be available in the summer of 2015. The County had hoped to have this work completed next fiscal year, but the task relies on LADWP's acquisition of imagery, which they state is purchased on a set schedule, which cannot be modified.

The Landscape Vegetation Mapping and Site Scale Vegetation Assessment are both designed to inform adaptive management decision-making based on Seasonal Habitat Flows, Terrestrial Habitat, Riverine-Riparian Habitat, Tule/Cattail Control, Exotic/ Invasive Plants, Range Condition and Recreation. Our experience during the RAS indicates that riparian vegetation development is stable and both LADWP (correspondence) and Inyo believe that the Site Scale study could not detect much change from the previous survey. At this time, both LADWP and Inyo believe that Site Scale monitoring would not be of value. The Scientific Team will discuss the need for this method of riparian development monitoring and decide to conduct the study as described in the MAMP, make revisions to the study, or replace it with other monitoring. The LORP EIR/EIS allows that, "Over the course of the restoration process, currently identified monitoring components may be modified, and new monitoring may be developed as necessary."

River Summit

- Recommendation: We again recommend that during the first week of April 2014, the MOU parties meet and define expectations based on the guidance and direction given in the MOU (1997) and the FEIR (2004), supporting documents, and MOU Consultant's recommendations. We suggest that the summit be an open forum, allowing non-MOU parties an opportunity to participate.

LADWP is in support of this recommendation.

County response: We agree to participate in a LORP River Summit with all MOU parties represented. The County is not opposed to having outside experts selected by the parties participate in the discussion.

Communication

Recommendation: The MOU Consultants recommend that they be allowed to participate, by telephone, the work plan and Technical Guidance Committee meetings, to respond to questions and provide clarifications to adaptive management recommendations as necessary. The MOU Consultants recommend open dialogue between them and all MOU parties.

LADWP is not opposed to this recommendation.

County response: The MOU Consultants in-person participation is limited by their physical distance from the Owens Valley. It is not feasible to have them travel 1000 miles round trip to participate in all the meetings we would like them to attend. They are however, consulted when new information is available, new observations are recorded, and whenever a management decision needs to be made. It is expected that they will attend the upcoming Scientific Team meetings and LORP Summit, examine the project on a regular basis, and participate by presenting Adaptive Management Recommendations at the LORP Annual Report meeting.

Range Monitoring

- Recommendations: The MOU Consultants again recommend that LADWP develop and make public a robust controlled burn plan that prioritizes areas that will benefit from burning to remove dense vegetation stands that are undesirable. In addition to forage value to livestock, selective burning can also improve forage and habitat for wildlife. An effective burn plan should be developed with LADWP's range, wildlife and avian scientists, as well lessees.

  LADWP is not opposed to this recommendation.

  County response: Agreed.

- Recommendation: The MOU Consultants recommend that the City and County review the results of their restoration efforts on the Lone Pine burn to determine why seeding and pole plantings had little success. Given the condition throughout the river corridor, there may be a need for such restoration actions in the future and what does or does not work should be evaluated.

LADWP is not opposed to this recommendation.

County response: Agreed; this will be discussed by the Scientific Team and raised at the LORP Summit.

- Recommendation: We recommend continuing to monitor rare plant trend plots. Although it may be possible that grazing increases the occurrence of Sildalcea and Calochortus, it may not continue as such.

LADWP is not opposed to this recommendation.

County response: Agreed.

12.0 GLOSSARY

Alakali Scrub - A chenopod dominated plant assemblage subdivided into halophytic and xerophytic phases.

Barren - Open areas devoid of vegetation typical as a result of edaphic conditions.

BLM – U.S. Department of Interior, Bureau of Land Management

BOD – Biological Oxygen Demand

Boundary Shear Stress – Is the force exerted on both the streambed and banks by the flow of water. When the force of boundary shear stress is equal to resistance (see Critical Shear Stress) of the streambed and banks no erosion occurs. When boundary shear stress does exceed this resistance erosion takes place.

BWMA – Blackrock Waterfowl Management Area

CDFG – California Department of Fish and Game

CEQA - California Environmental Quality Act

CEQA mitigation – Measures to reduce or avoid impacts identified through the environmental impact analyses performed for an EIR or Negative Declaration

cfs – cubic feet per second

COD – Oxygen Demand

County – Inyo County

Critical Shear Stress – Is the needed force needed to initiate the movement (erosion) of a particular size of sediment.

CWHR - California Wildlife Habitat Relationship System

DBH - Diameter at Breast Height

Delta Conditions - The amount of water and vegetated wetland within the Delta Habitat Area boundary existing at the time of the commencement of flows to the Delta under the LORP

Desert Riparian - A habitat associated with perennial running or standing water, typically consisting of shrubs and trees ranging in heights between 3-10 ft. Dominant trees are *Salix* sp. and Tamarisk

ES - Ecosystem Sciences

EIR – Environmental Impact Report

ET – Evaporation transpiration

Fresh Emergent Wetland - Saturated or periodically flooded zones which support Baltic rush, nutgrass, big leaf sedge. On wetter sites fresh emergent wetlands are comprised of mainly common cattail and tule bulrush.

Habitat Indicator Species - Wildlife species that are representative of a specific habitat type.

LAA – Los Angeles Aqueduct

Lacustrine - of or relating to lakes

LADWP – Los Angeles Department of Water and Power

LORP – Lower Owens River Project

Make Water –Shallow groundwater that returns to the surface (river flow or springs) following the cessation of evaporation transpiration.

MOU – Memorandum of Understanding amongst LADWP, the County, California Department of Fish and Game, State Lands Commission, Sierra Club, the Owens Valley Committee, and Carla Scheidlinger. The MOU specifies goals for the LORP, a timeframe for the development and implementation of the project, specific project actions, and requires that a LORP ecosystem management plan be prepared to guide the implementation and management of the project. It also provides certain minimum requirements for the LORP related to flows, locations of facilities, habitat and species.

RAS – Rapid Assessment Survey

SIP – State Implementation Plan *June 2004 Los Angeles Dept of Water & Power and the U.S. Environmental Protection Agency* 17-3 *Lower Owens River Project Final EIR/EIS*

SLC – California State Lands Commission

Wet Meadow - A semi-wetland meadow typically consisting of densely growing sedges, rushes, and grasses

WHA – Whitehorse Associates