

SWRP Outfall Restoration Site Design: A climate adapted approach to habitat enhancement projects in the Middle Rio Grande

Presented at the Middle Rio Grande Endangered Species Collaborative Program (MRGESCP), 2023 Science Symposium

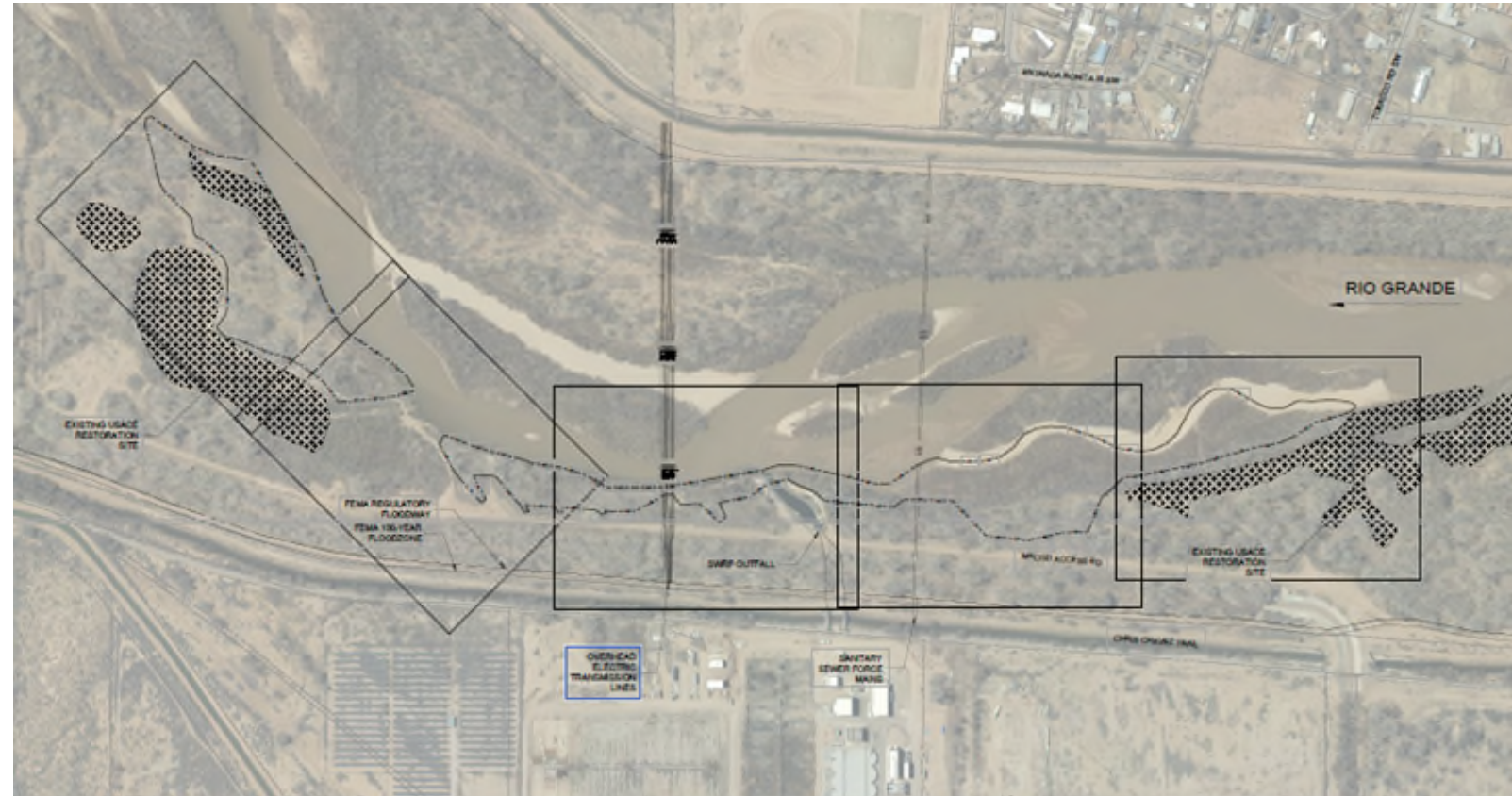
Cetan Christensen, Albuquerque-Bernalillo County Water Utility Authority (Water Authority)



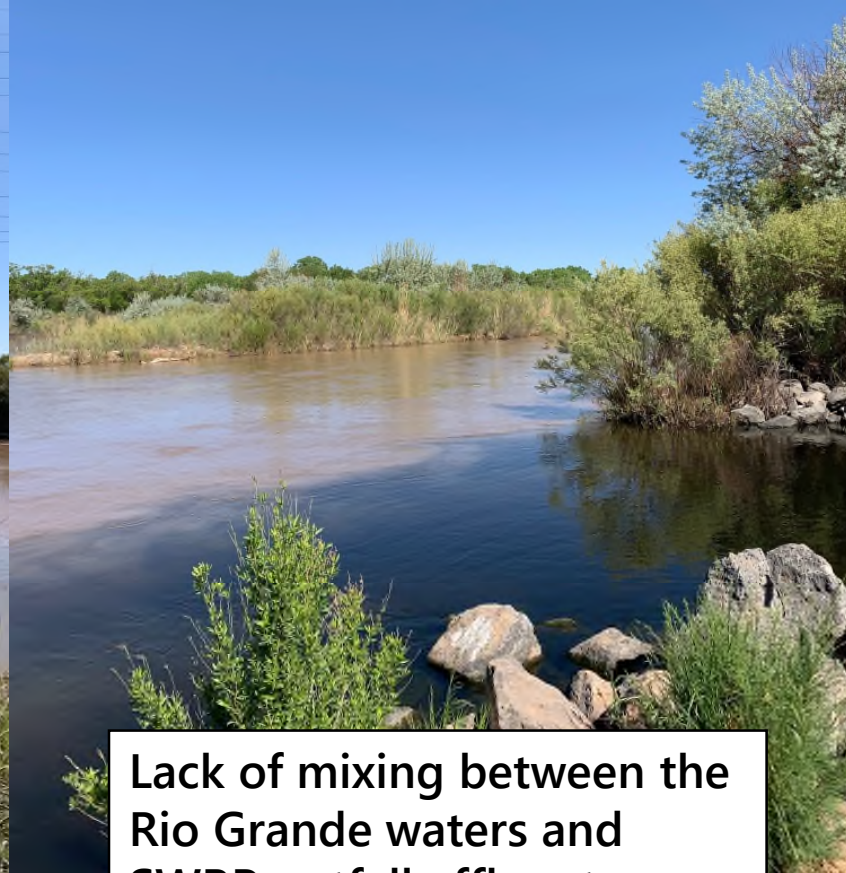
Albuquerque Bernalillo County
Water Utility Authority

Project Background

- The Southside Water Reclamation Plant (SWRP) releases ~55 million gallons/day of high quality, treated effluent to the outfall channel which discharges to the Rio Grande.
- In 2020, the Water Authority solicited Hazen & Sawyer to evaluate design concepts for a habitat restoration site at the SWRP outfall.
- In 2022, design contract for the project begins.
 - There are two existing USACE restoration sites north and south of SWRP outfall.



Basis of Design Report, 60 percent design, 2023



Jetty Jacks prevent lateral migration of channel and pose a fire risk to the Bosque. Utility lines in the area.

Lack of mixing between the Rio Grande waters and SWRP outfall effluent.

Lack of inundation at high flows. Non-native species present at high densities.

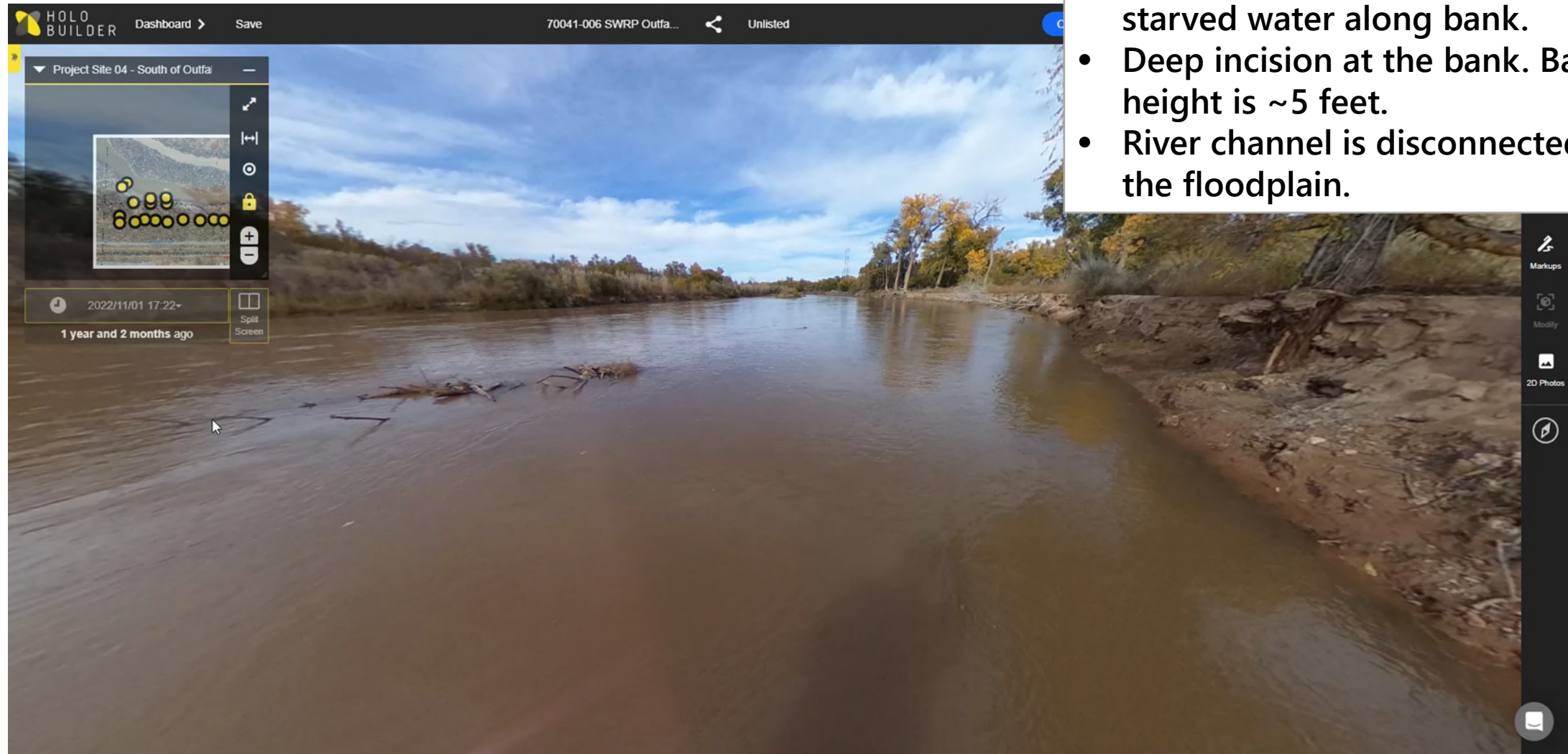
Current Site Conditions



Albuquerque Bernalillo County
Water Utility Authority

Current Site Conditions

- Lack of mixing of water, sediment starved water along bank.
- Deep incision at the bank. Bank height is ~5 feet.
- River channel is disconnected from the floodplain.



Project Objectives

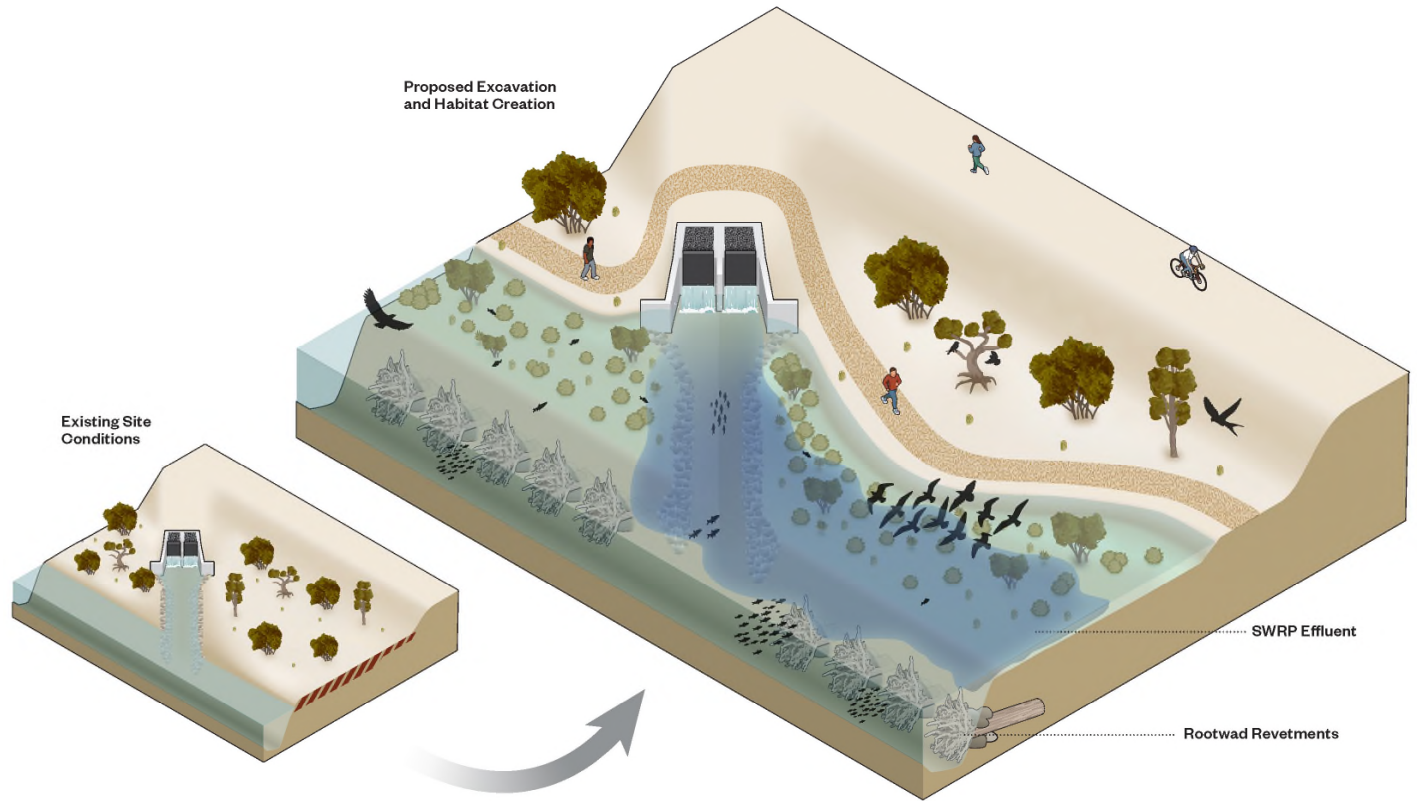
Make improvements to the outfall channel and surrounding areas to benefit water quality.



Facilitate public access to the Rio Grande and surrounding trail system.



Create additional habitat for the endangered Rio Grande Silvery Minnow (RGSM).



Project Objective: *Improve the outfall channel and surrounding to benefit water quality*

Existing Site Conditions:

based on geotechnical investigation and bank characteristics.

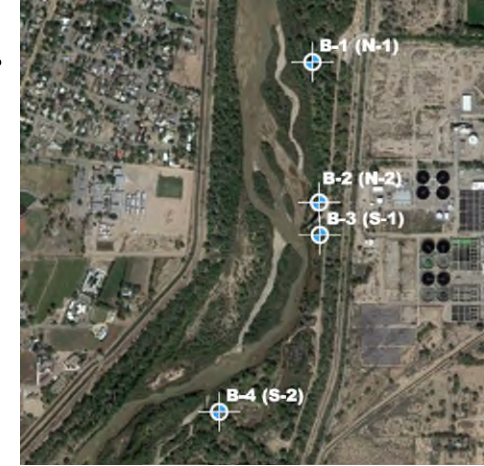
Bank Assessment for Non-point Source Consequences of Sediment (BANCS) analysis for 4,266 ft of length in project:

$$BANCS = \text{Bank Hazard Erosion Index} + \text{Near Bank Stress}$$

Criteria	Unit	East Bank (Project Area)
Streambank erosion	tons/yr	175
Total Phosphorus loading	lbs/yr	46
Total Nitrogen loading	lbs/yr	34

Geotechnical investigations:

- soil characteristics
- chemical properties
- depth to groundwater



Boring	Depth to Groundwater (ft)	Bulk Dry Density (lbs/ft ³)	Total Phosphorous (mg/kg)	Total Nitrogen (mg/kg)	Fecal Coliform (MPN/g)
B-1 (N-1)	5.1	--	123	--	<199.3
B-2 (N-2)	6.6	89.0	NA	NA	NA
B-3 (S-1)	6.9	94.2	NA	NA	NA
B-4 (S-2)	4.2	95.7	139	97	<200.1
Site Average	5.7	93.0	131	97	199.7

Project Objective: *Improve the outfall channel and surrounding to benefit water quality*

- Pollutant Load Reductions: Stream sediment and nutrient loading removal from restoration features



Structure
Coir Mat
Soil Encapsulated Lifts
Rootwad Revetment
Stone Key



Pollutant	Designed Load Reduction
<i>Total Suspended Solids</i>	<i>62.8 tons/year</i>
<i>Total Nitrogen</i>	<i>16.3 pounds/year</i>
<i>Total Phosphorus</i>	<i>11.9 pounds/year</i>

2023, Final Basis of Design Report

Project Objective: *Facilitate Public Access*



Southside Water Reclamation Plant Outfall Restoration Design Conceptual Trail and Access Plan

PROJECT GOALS

The Pedestrian Trail and Access Plan reconnects the adjacent community to the Rio Grande and Paseo del Bosque trail system. This project benefits the natural and human environment by increasing recreational capacity while preserving, expanding, and responding to existing ecological conditions. The Pedestrian Trail and Access Plan is one facet of a larger ecological design effort spearheaded by the Albuquerque Bernalillo County Water Utility Authority to benefit water quality by reducing pollutant loads, facilitate public access, and create habitat adjacent to the Southside Water Reclamation Plant (SWRP) outfall. These improvements open future opportunities for educational signage, overlooks, and designated fishing areas.

FUTURE EDUCATIONAL SIGNAGE



EXISTING TRAIL CONTEXT



TRAIL AND ACCESS PLAN



1. Construct new pedestrian trails.
2. Addition of trail markers.
3. Fishing access.
4. Public access point to river.
5. Remove social trails to ecologically sensitive areas.

Future Public Access Plan:

1. Educational Signage.
2. Connect restoration site to educational opportunities.

Project Objective: *Create additional habitat for RGSM*

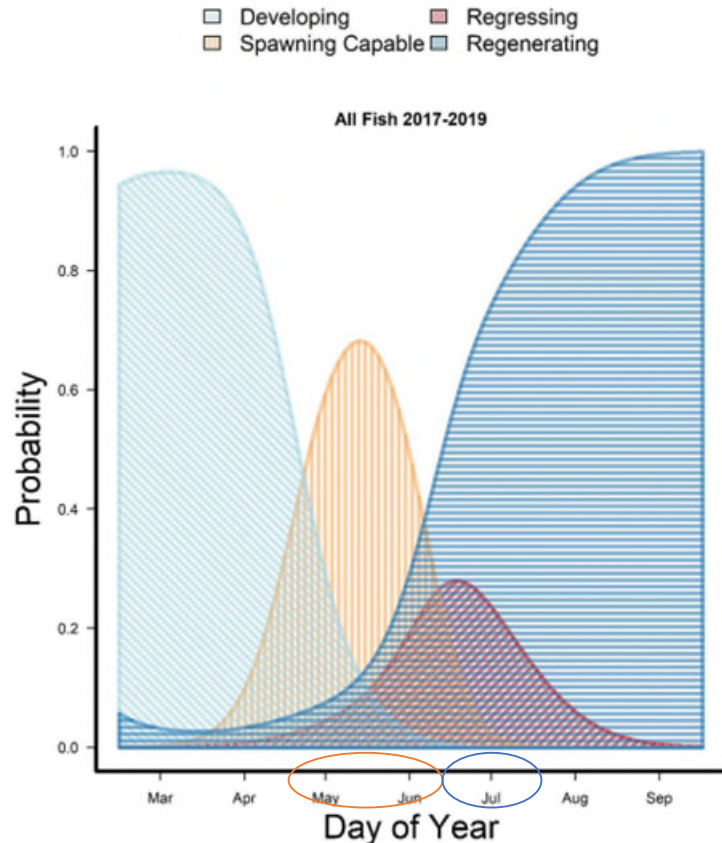
Rio Grande Silvery Minnow (RGSM):

- RGSM listed as an endangered species in 1993 by the U.S. Fish and Wildlife Service (58 FR 11821).
- The RGSM has designated Critical Habitat in the Albuquerque area, and at the project location.
- The SWRP Outfall provides a consistent source of water to the Rio Grande that can benefit the RGSM.



Project Objective: *Create additional habitat for RGSM*

Restoration Site Design Criteria



Archdeacon, et al., 2024.

- The majority of RGSM are spawning capable May – June and regenerating in July.



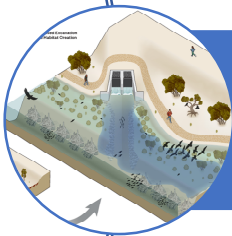
1. RGSM spawning period is 1 to 6 weeks from May through July.
 - 25 Days selected for required inundation duration
2. RGSM favor shallow (1.5 feet or less), slow-moving water (less than 0.5 feet per second).
3. During winter, RGSM are commonly found in nearly still water with debris cover.

Project Objective: *Create additional habitat for RGSM*

Methods



1. Analyze modern flowrates and flow durations



2. Selection of habitat design hydrology

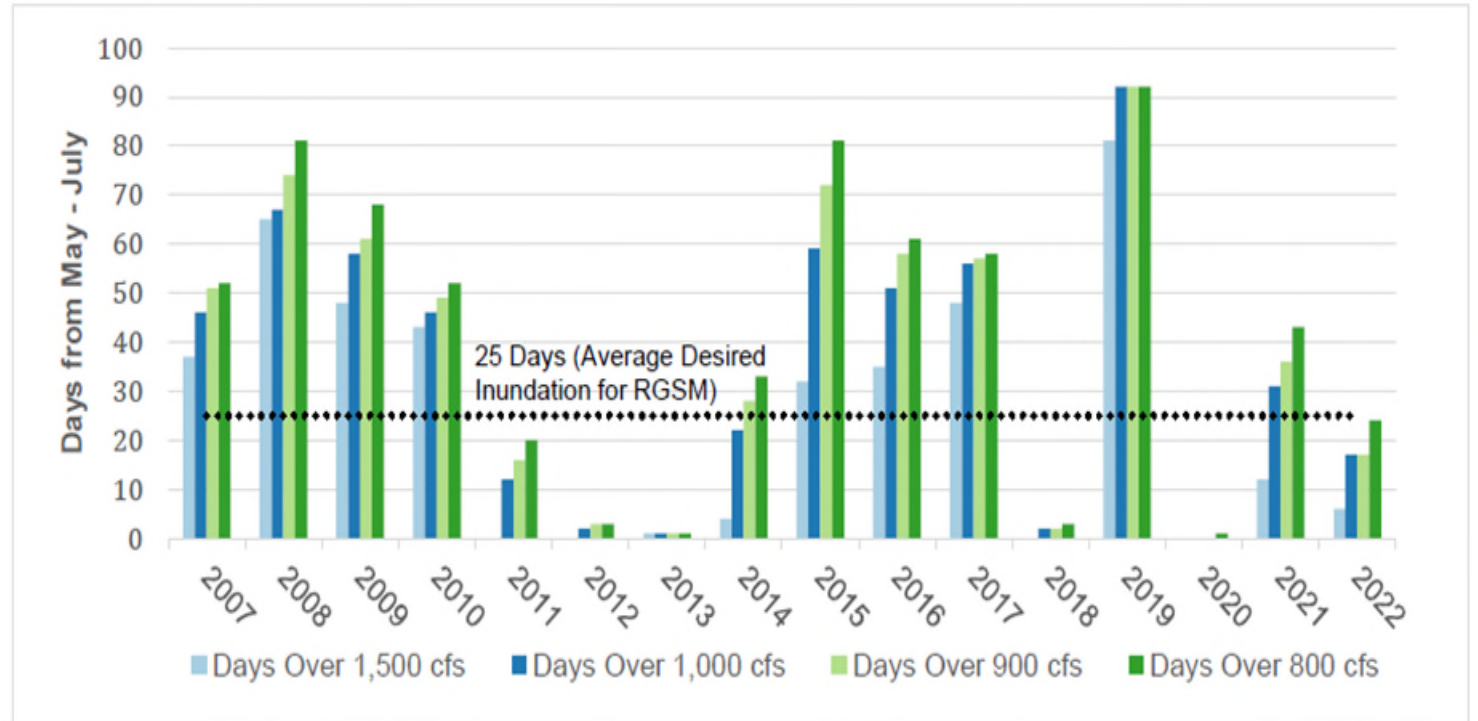


3. Seek feedback on design – throughout process

Project Objective: *Create additional habitat for RGSM*

Confirming Frequency & Duration of Modern Flowrates

- Existing RGSM habitat restoration projects designed for floodplain inundation at 1,500 cfs+ flood events between May and July.
- A target threshold of 25 days was set due to the life requirements of the RGSM.
- Flows that occurred for 25 days or more during the May to July period in recent years were further investigated for inclusion in the project design.

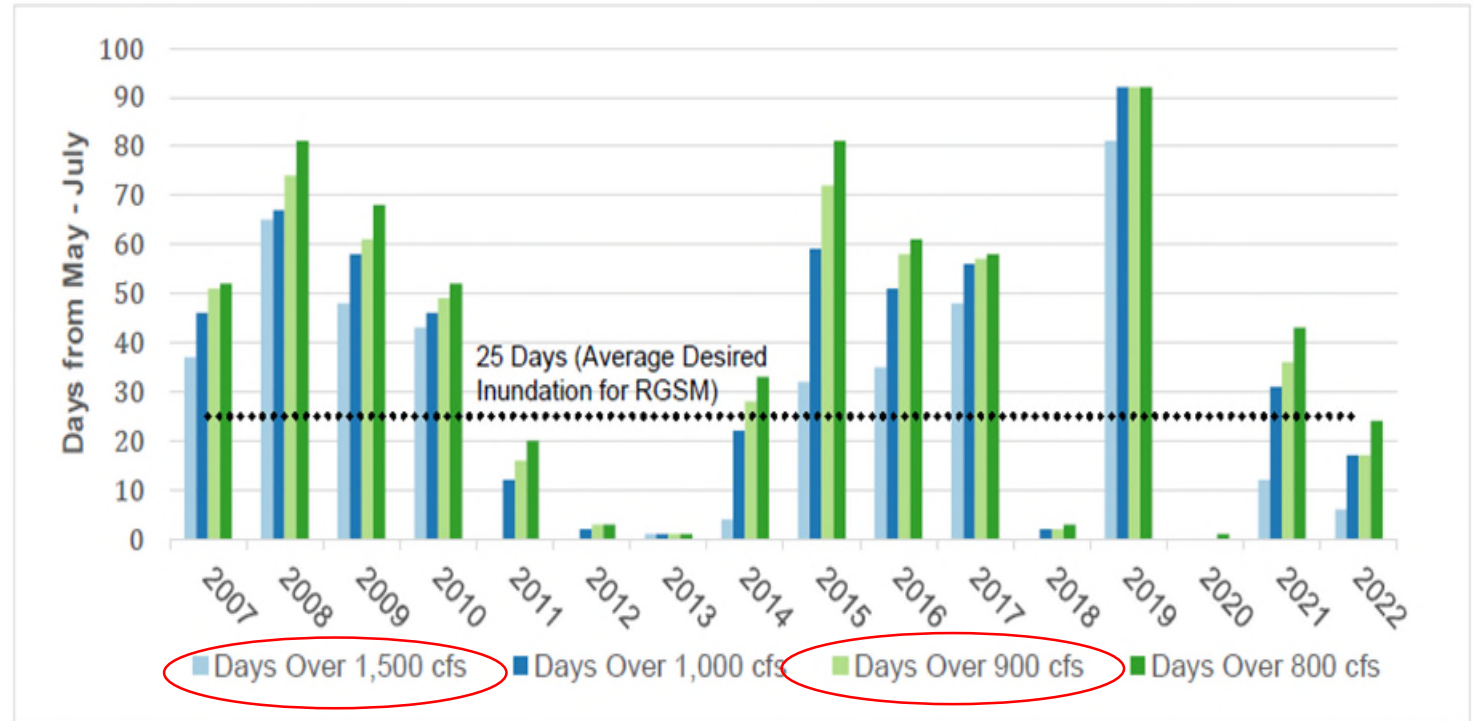


Annual Count of Flows from May 1 – July 31 at Central Ave USGS Gage Station

Project Objective: *Create additional habitat for RGSM*

Confirming Frequency & Duration of Modern Flowrates

- 1,500 cfs from May to July have been limited to less than 12 days annually since 2019, and generally have been less than 7 days.
- 1,500 cfs and 900 cfs selected for further analysis.



Annual Count of Flows from May 1 – July 31 at Central Ave USGS Gage Station

Project Objective: *Create additional habitat for RGSM*

Selection of Habitat Design Hydrology/ Flood-Frequency Analysis

A Hydrologic Engineering Center's River Analysis System (HEC-RAS) hydraulic model was developed for the project.

- Analyze typical peak flows (1 – Year to 100 – Year) to select Habitat Design Hydrology (HDH) for terrace inundation.
 - Central Gage (USGS 08330000) used for design purposes, due to:
 - period of record
 - data quality

Design Flood Event	Site Hydrology Selection (cfs)
HDH 1	900
1-Year	1,077
HDH 2	1,500
2-Year	5,477
5-Year	8,044
10-Year	9,469
25-Year	10,640
50-Year	11,914
100-Year	12,719

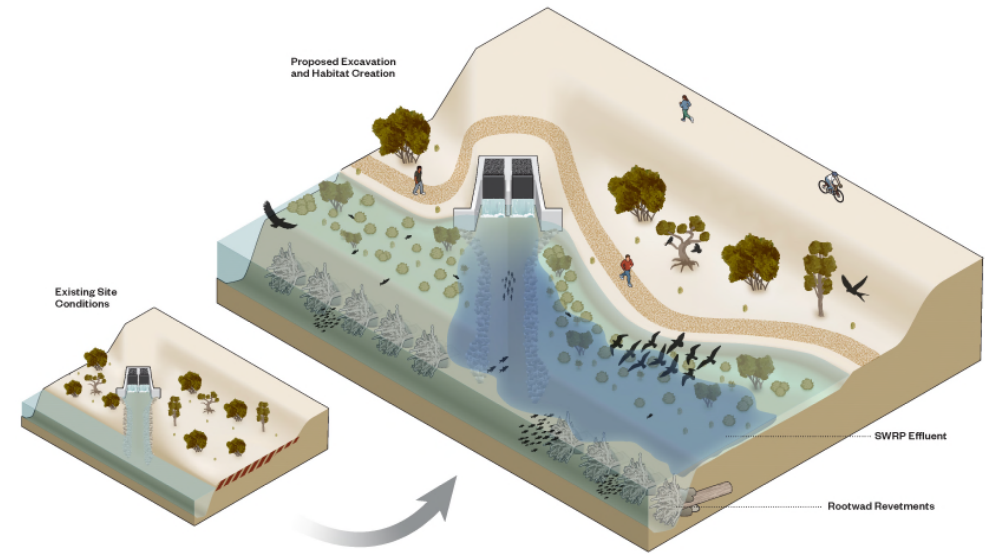
1 to 100-Year flood events based on USGS 08330000 (Central) Gage data

Project Objective: *Create additional habitat for RGSM*

Hydraulic Model – Flood Plain Terraces

The HEC-RAS hydraulic model developed for the project was used to refine terrace design for depth and velocity.

- Habitat design flows for the RGSM were predicted using the flood stage elevations for the selected 900 cfs and 1,500 cfs flood stage elevations.
 - Depth = 0.5 – 1.6 feet
 - Velocities = 0.5 – 1.6 feet per second

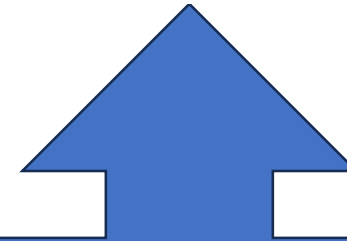
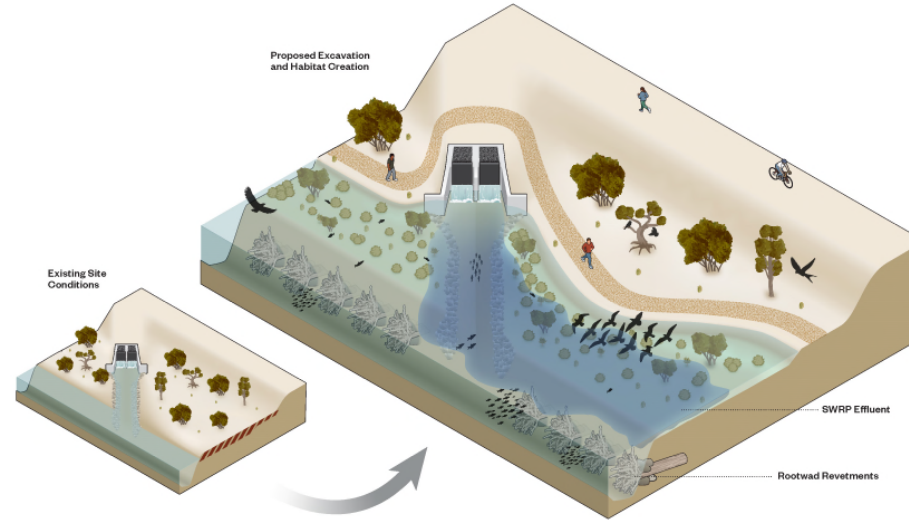


Project Objective: *Create additional habitat for RGSM*

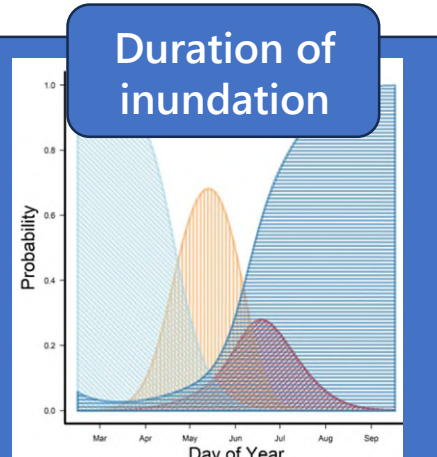
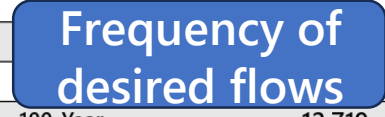
Final RGSM habitat feature design

Selection of terrace that partially inundates at 900 cfs and fully inundates at 1,500 cfs :

- The HEC-RAS results demonstrated desired depths and velocities.
- Flood frequency analysis shows that inundation will be achieved with 1-Year flows.
- Analysis of duration of flows shows that 25-days of inundation is better achieved with a 900 cfs terrace.



Design Flood Event	Site Hydrology Selection (cfs)
HDH 1	900
1-Year	1,077
HDH 2	1,500
2-Year	5,477
5-Year	8,044
10-Year	9,460
100-Year	12,719



Final Site Design

- Terrace
 - Partial inundation at 900 cfs
 - Full inundation at 1,500 cfs
- Sediment management considerations
 - 30% Design: Site includes upstream + downstream of outfall
 - 100% Design: Site includes downstream of outfall
- Rootwad revetments
 - Bank stabilization
 - Water Quality Improvements
 - In-channel woody debris, winter habitat
- Pedestrian trail
- Jetty Jack Removal
- Streambank Stabilization
- Invasive Species Removal
- Revegetation – hydrologic zones



Hazen rendering of site upon restoration treatments

Final Site Design

- Revegetation – hydrologic zones
 - 4 revegetation zones
 - Frequency of inundation
 - Depth to groundwater
 - Vegetation selection to benefit the Southwestern Willow Flycatcher (SWFL) & monarch butterfly

Zone 4: salt grass, torrey wolfberry, skunkbush sumac, golden currant, wood's rose, Rio Grande cottonwood, Fremont cottonwood, Arizona box elder, netleaf hackberry, velvet ash, stretchberry, custom seed mix

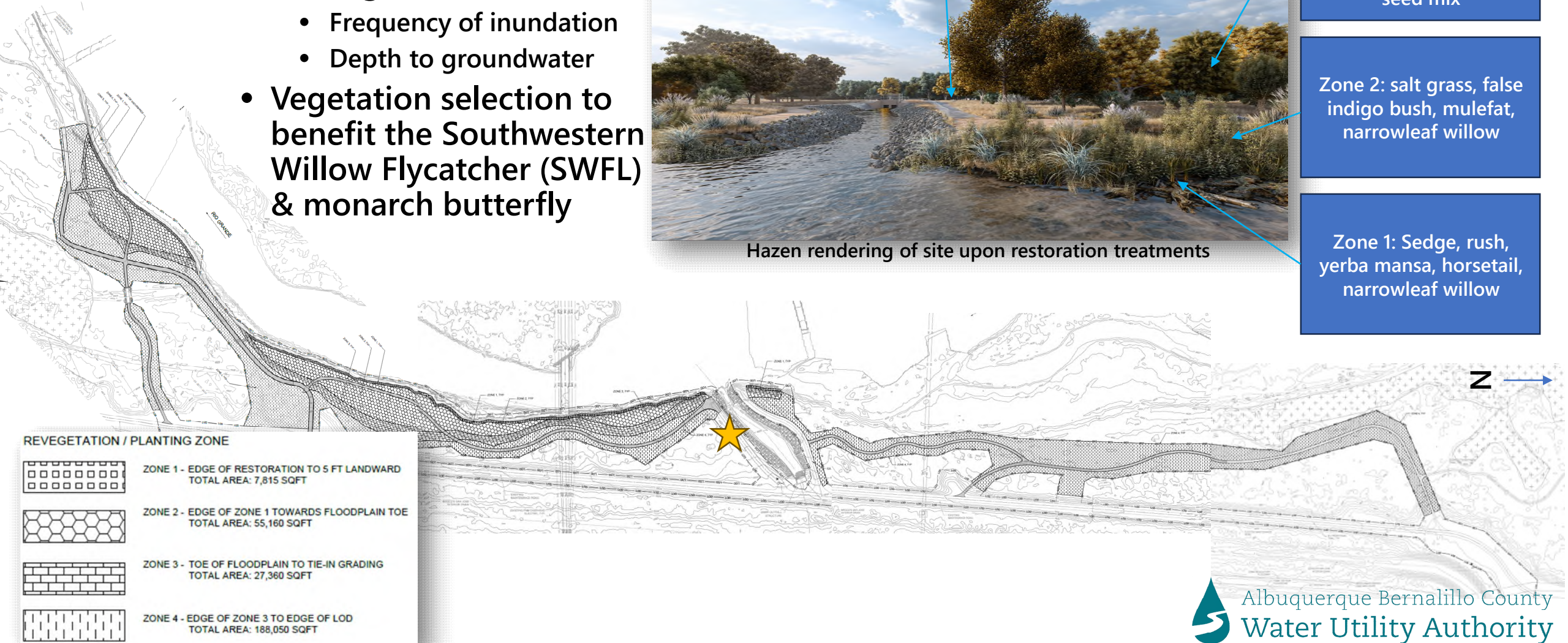
Zone 3: salt grass, false indigo bush, mulefat, skunkbush sumac, golden currant, wood's rose, Rio Grande Cottonwood, Gooding's willow, willow baccharis, stretchberry, custom seed mix

Zone 2: salt grass, false indigo bush, mulefat, narrowleaf willow

Zone 1: Sedge, rush, yerba mansa, horsetail, narrowleaf willow



Hazen rendering of site upon restoration treatments



REVEGETATION / PLANTING ZONE	
	ZONE 1 - EDGE OF RESTORATION TO 5 FT LANDWARD TOTAL AREA: 7,815 SQFT
	ZONE 2 - EDGE OF ZONE 1 TOWARDS FLOODPLAIN TOE TOTAL AREA: 55,160 SQFT
	ZONE 3 - TOE OF FLOODPLAIN TO TIE-IN GRADING TOTAL AREA: 27,360 SQFT
	ZONE 4 - EDGE OF ZONE 3 TO EDGE OF LOD TOTAL AREA: 188,050 SQFT

Cooperation and Partnerships

The final project design incorporated feedback on restoration site design elements from cooperating partners.

Thank you!

Hazen



— BUREAU OF —
RECLAMATION



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References used

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