

An aerial photograph of a large concrete dam situated in a deep, rugged canyon. The canyon walls are composed of layered, reddish-brown rock formations. The water behind the dam is a deep blue. The sky is clear and light blue. The text is overlaid on the upper and middle portions of the image.

Salt River Project Initiatives

WRRC Annual Conference

March 12, 2024

Audubon Southwest: Horseshoe Reservoir Habitat Restoration Study

Tice Supplee, Director of Bird Conservation

An aerial photograph of the Horseshoe Reservoir, showing the blue water of the reservoir curving around a peninsula. The surrounding landscape is arid with sparse vegetation and brownish soil. In the background, there are large, rugged mountains under a clear sky. The reservoir's edge is marked by sandy and silty banks.

OPPORTUNITIES FOR ESTABLISHING NATIVE BOTTOMLAND HABITAT IN HORSESHOE RESERVOIR

Study supported by Salt River Project and The Nature Conservancy

Water Resources and Research Conference

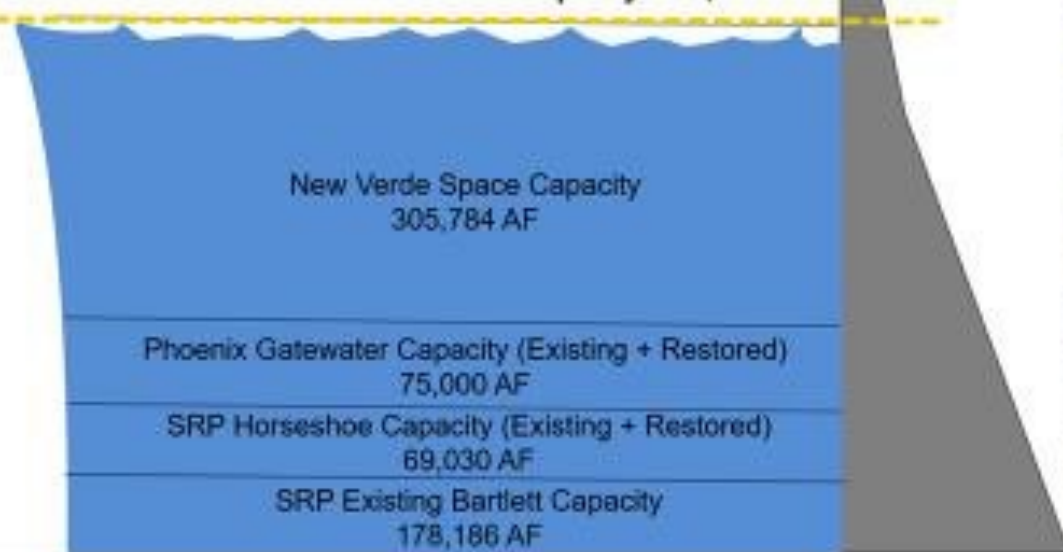
Tice Supplee and Mark Briggs
March 12, 2024

Bartlett Modification Options

Option 1: Increase dam height=97 Feet, 628,000 Acre-Foot Reservoir

Option 2: Increase dam height=62 Feet, 422,000 Acre-Foot Reservoir

Modified Bartlett Dam Total Conservation Capacity: 628,000 AF



4.25.23



Audubon Important Bird Area

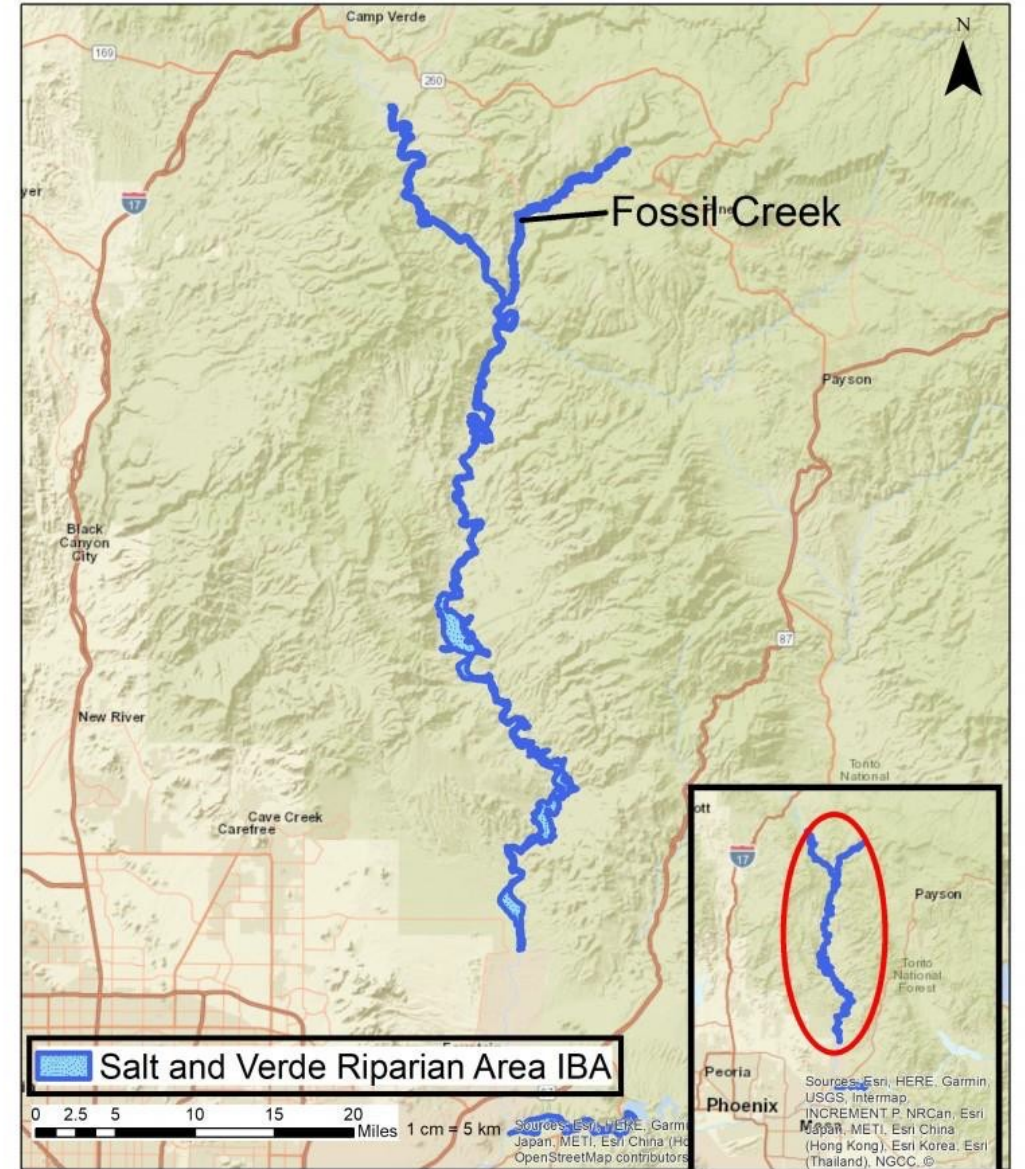
Site important to special status avian species (Bald Eagle – southwest population), Southwestern Willow Flycatcher, Western Yellow-billed Cuckoo

Rare, Unique, or Exceptional Habitat/Ecological Community (low-elevation riparian)

Important migratory stop-over/seasonal concentration for migratory land birds - Lucy's Warbler, Summer Tanager, Bullock's Oriole, Hooded Oriole, Gilded Flicker, Bell's Vireo, Yellow Warbler, Yellow-headed Blackbird

Arid lands birds - Abert's Towhee, Cactus Wren, Canyon Wren, Black-tailed Gnatcatcher, Bendire's Thrasher, Curve billed Thrasher, Phainopepla, Canyon Towhee, Black throated Sparrow,

Verde River Stretch of the Salt and Verde Riparian Area IBA



Central Study Questions:

- Would managing Horseshoe Reservoir under run-of-river management (inflows=outflows as possible) offer opportunities to establishment native bottomland habitat?
- Where within the Horseshoe Reservoir footprint would such opportunities have greatest potential?
- Understanding the restoration challenges and opportunities and what it will take to bring back vegetation where reservoir management is being re-thought/re-purposed



Methods

- **Review of reservoir restoration literature and all relevant literature on Verde River and Horseshoe Dam and Reservoir**
- **Review of aerial photography**
- **Analysis of streamflow data**
- **Analysis of Lidar and reservoir pool elevation data**
- **Field reconnaissance**
- **Case Studies (e.g., Elephant Butte Reservoir)**



THE RESERVOIR BATHTUB RING CHALLENGE



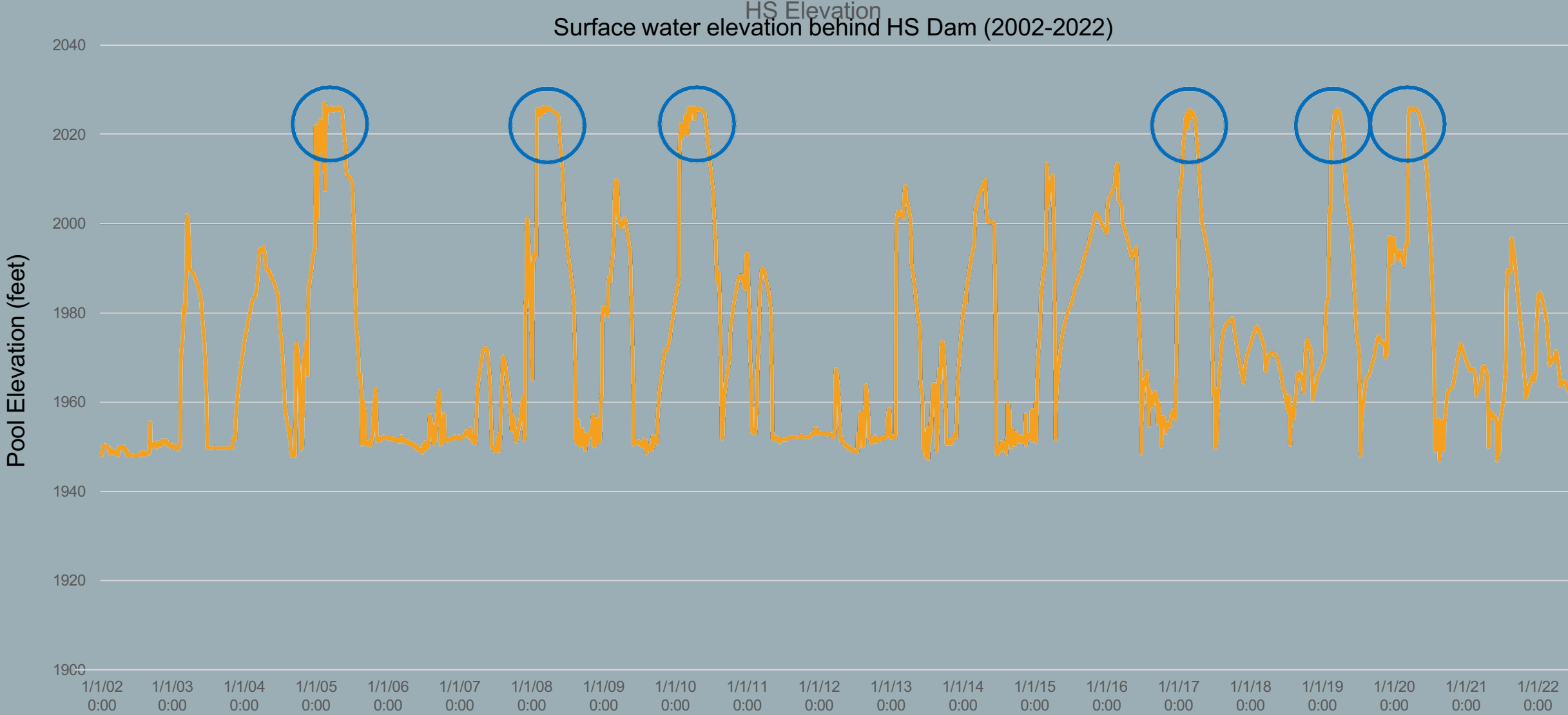
TWO CONTRADICTORY RESERVOIR RESTORATION REALITIES:

- Reservoir shorelines are priority areas when considering actions to restore native bottomland plant communities;

and yet

- are harsh environments under current management with biophysical and chemical characteristics not conducive for native bottomland plant communities

Conservation Pool Frequency and Duration



Data courtesy of SRP

LOW POOL ELEVATION



**HIGH POOL ELEVATION
(CONSERVATION POOL STATUS)**



Two central objectives of the Horseshoe Reservoir Study:

- 1) **Identifying potential restoration sites based on current understanding of the following factors under run-of-river management**
 - Water availability
 - Flood scour
 - Soil salinity
 - Competition from non-native plants
 - Prolonged inundation
- 2) **Identify key gaps in knowledge and strategies for addressing them**



Natural Alluvial River Bottomland Environment

Non-obligate Riparian Zone

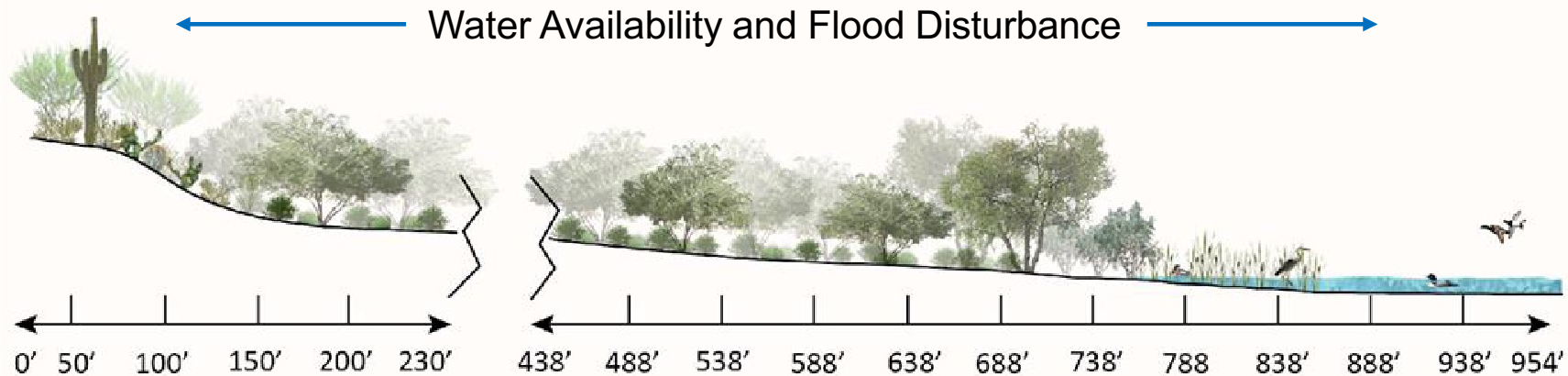
Prosopis spp., *Celtis* spp.,
Chilopsis linearis, *Acacia* spp.

Obligate Riparian Zone

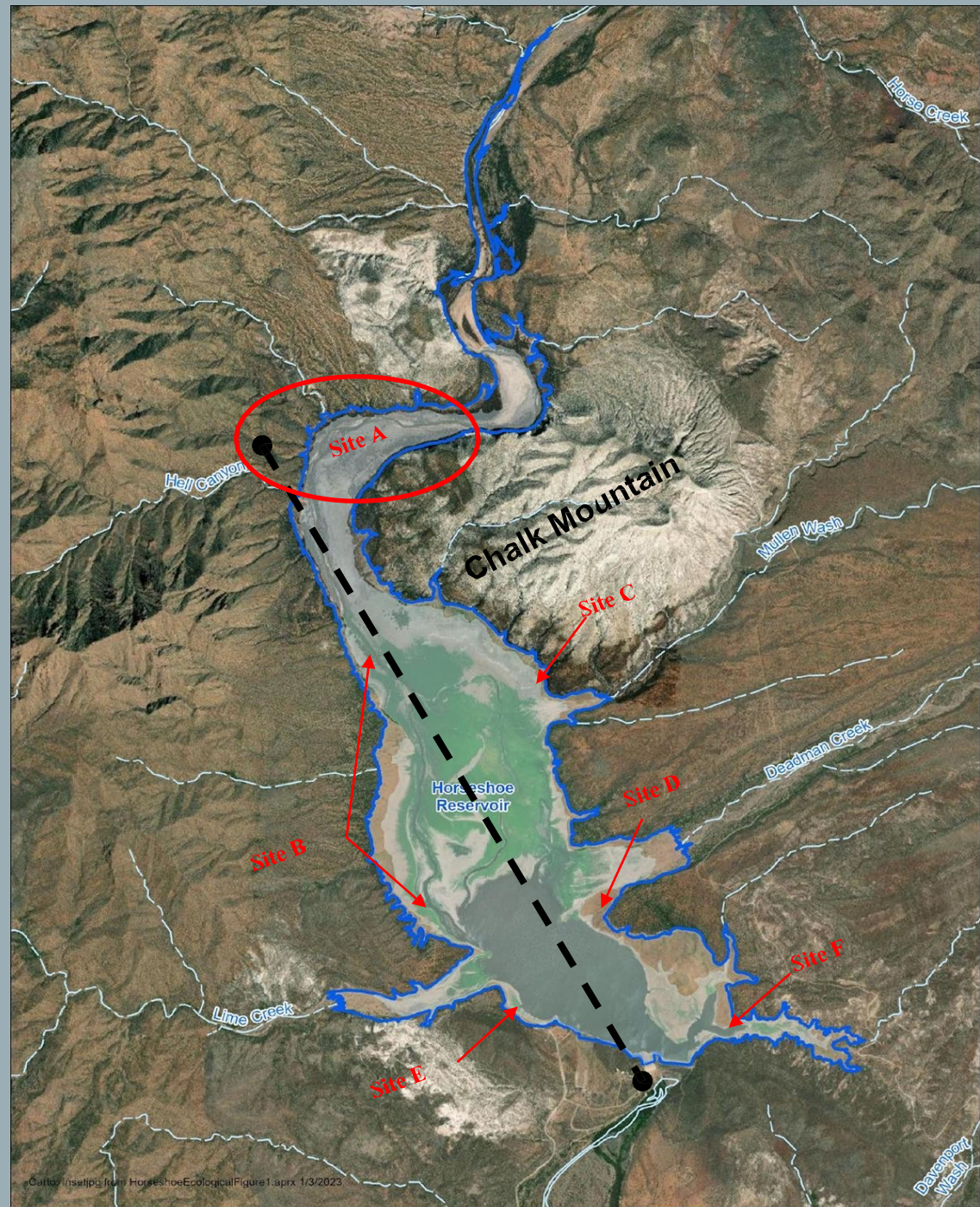
Salix spp., *Populus fremontii*.,
Juglans major, *Fraxinus*
velutina

Emergent Wetland Zone

Typha spp., *Carex* spp. ,
Scirpus spp., *Juncus* spp.



Restoration Site A



(image provided by SRP Cartographic & GIS Services).

Restoration Site A



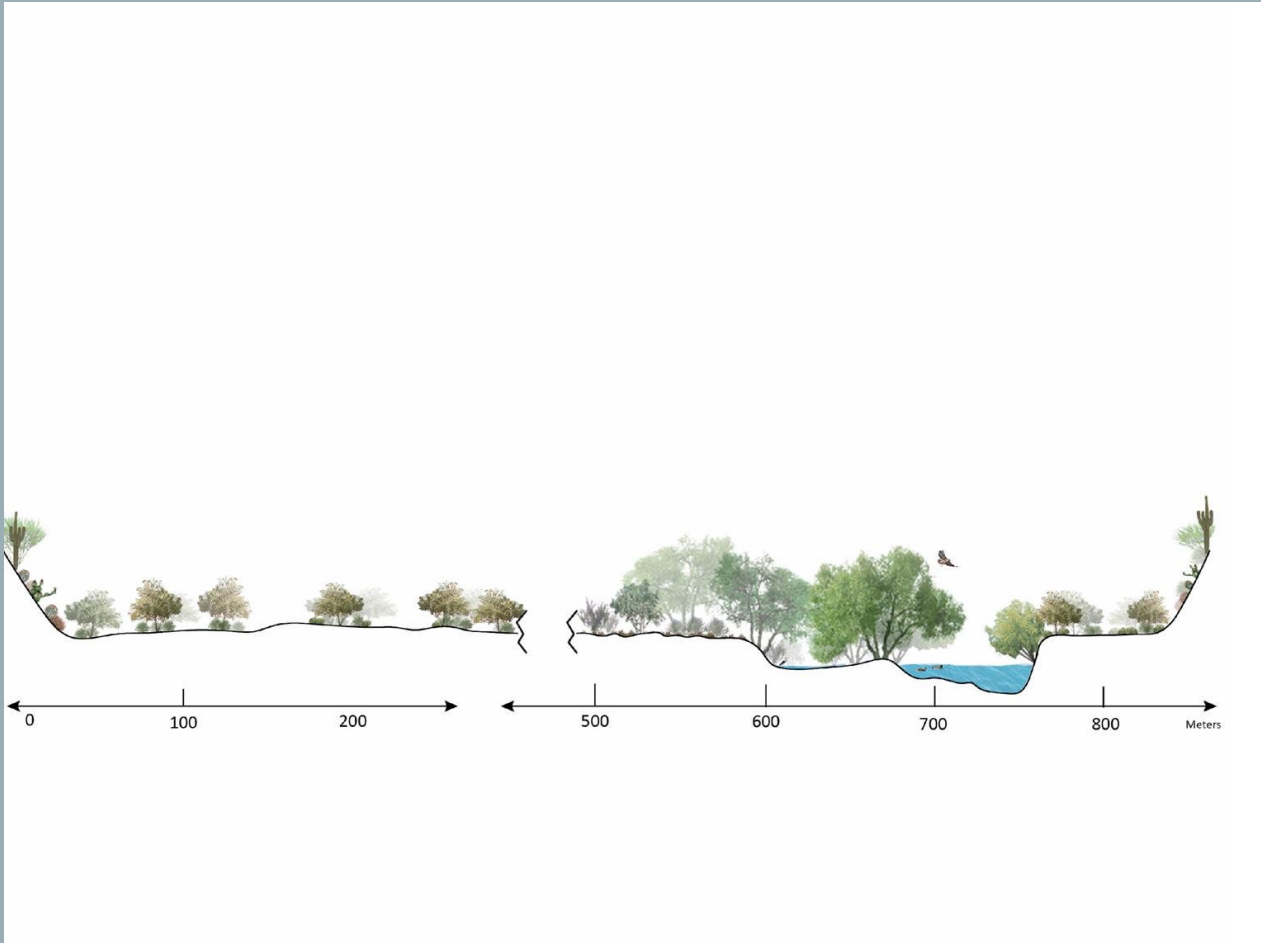
Pros

- Furthest upstream
- Dynamic natural hydrology (less impacted by dam impoundment)
- Inundated 9.1% of time between 2002 and 2022
- Frequency and duration of inundation likely much reduced under run-of-river management
- Natural process dominate and likely to be strengthened in future under run-of-river management

Cons

- ?

Restoration Site A



Digital Rendering of Restoration Objective at Site A (by Teresa Rene DeKoker)

Proposed Next Steps

- Additional analysis of aerial photography (e.g., to quantify impact of prolonged inundation and low flow)
- Mapping of morphology, soils and vegetation
- Development of inexpensive, qualitative monitoring program
- Develop site-specific management plan (emphasis on wait and see approach w small incremental management nudges)

Restoration Sites C & D & E

- On east shore of reservoir at confluence with Mullen Wash and Deadman's Wash
- E located below the boat ramp northwest of the dam
- Relatively large floodplain surfaces between 2,007 ft to 2,012 ft elevation
- Inundated over 12% of time between 2002 and 2022
- Locations appear highly protected from flood scour
- Under run-of-river management will presumably be inundated less





Thanks to Jen Wennerlund and Matt Russo (Cartographic and GIS Services, SRP) for direct image comparison viewer

Daily surface elevation data of Horseshoe Reservoir pool from 2001 to 2021 indicate that the majority of the surfaces that comprise Restoration Sites C and D were underwater 12% of the time

Given reduced frequency and duration of inundation of Site C and D surfaces, native bottomland vegetation (mostly non-obligate riparian species) of Mullen and Deadman's Wash likely to spur native plant establishment

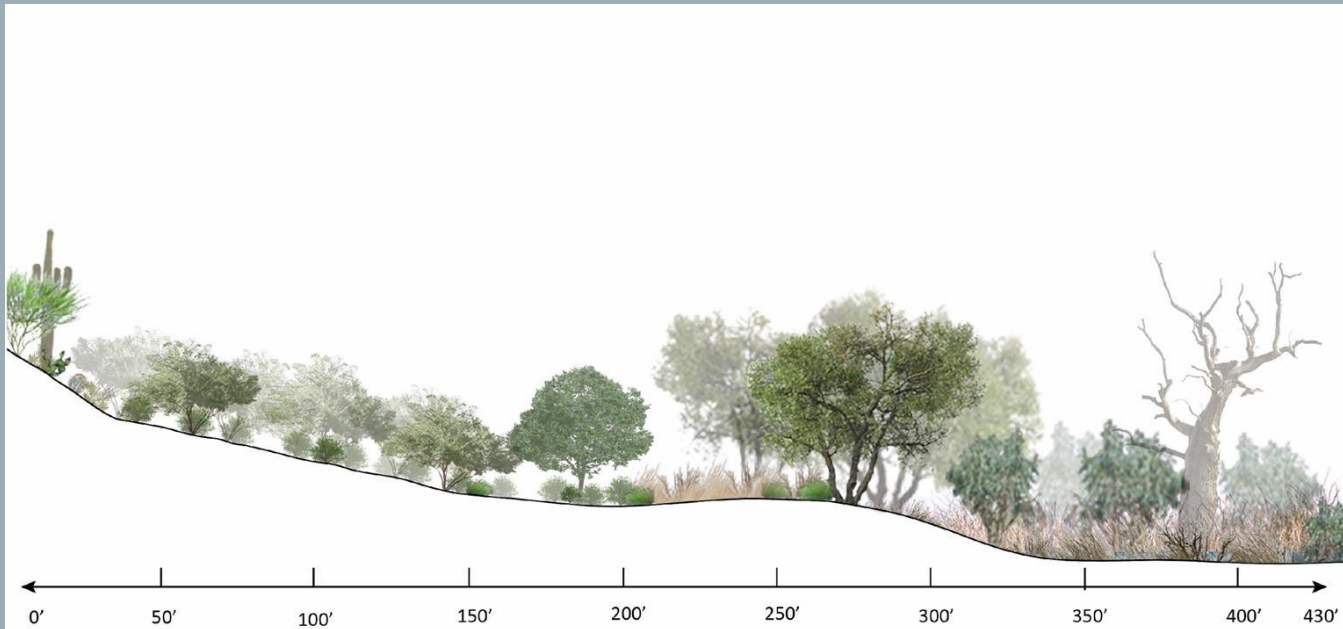


At Mouth of Mullen's Creek



Native Non-Obligate Riparian Plant
Communities Upstream

Restoration Sites C & D & E



Digital Rendering of Restoration Objective at Site C (by Teresa Rene DeKoker)

Pros:

- Broad floodplain surfaces that under run-of-river management will presumably be inundated less frequently
- Potential for natural regeneration due to native bottomland seed sources in associated washes (non-obligate riparian)
- Some topographic diversity = diverse native bottomland plant establishment (via natural and artificial means)

Cons:

- Potential low water availability could negate obligate riparian
- Changes in soil chemical and physical characteristics impede natural recruitment



Restoration Site F



Potential Complementary Benefit of Native Plant Establishment to Bringing Back the Razorback Sucker (*Xyrauchen texanus*)



Restoration Site F

Majority of the lower elevated surfaces that comprise Restoration Site F were inundated over 96% of the time during the 2001 – 2021 period



Thanks to Jen Wennerlund and Matt Russo (Cartographic and GIS Services, SRP) for direct image comparison viewer

Of all the Proposed Restoration Sites, Restoration Site F may have Conditions Most Suitable for the Establishment of Non-Obligate Riparian, Obligate Riparian, and Emergent Wetland

Non-obligate Riparian Zone

Prosopis spp., *Celtis* spp.,
Chilopsis linearis, *Acacia* spp.

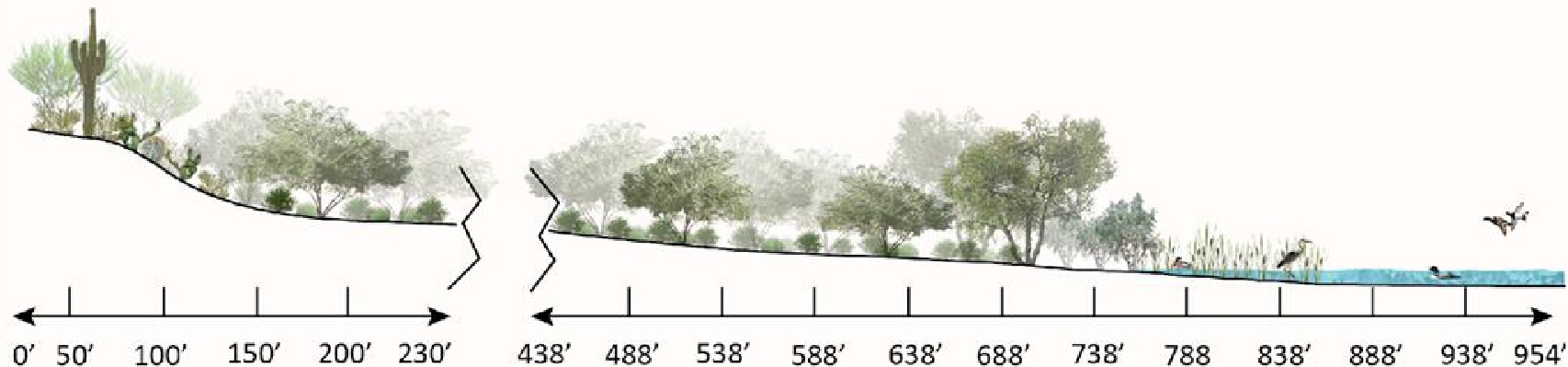
Obligate Riparian Zone

Salix spp., *Populus fremontii*,
Juglans major, *Fraxinus*
velutina

Emergent Wetland Zone

Typha spp., *Carex* spp.,
Scirpus spp., *Juncus* spp.

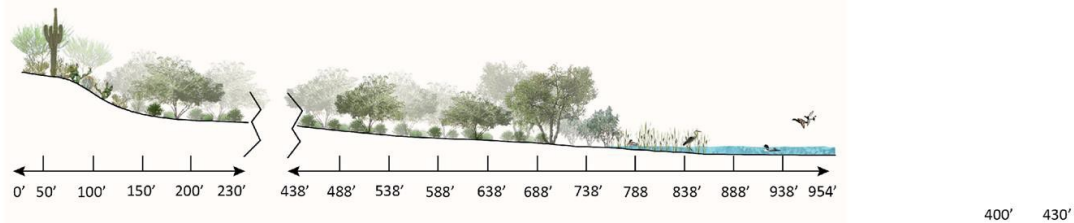
← Water Availability and Flood Disturbance →



400' 430'

Digital Rendering of Restoration Objective at Site F (by Teresa Rene DeKoker)

Restoration Site F



Digital Rendering of Restoration Objective at Site F (by Teresa Rene DeKoker)

Pros:

- Inlet backwater site that could hold water (or at least have higher water availability) during dry, hot periods
- Topographic diversity = diverse native bottomland plant establishment (via natural and artificial means)
- Potential opportunity to complement vegetation restoration with efforts to improve habitat for razorback sucker and other native fish

Cons:

- Potential low water availability could negate obligate riparian
- Changes in soil chemical and physical characteristics impede natural recruitment

THE HORSESHOE RESERVOIR

Opportunities for Establishing Native Bottomland
Habitat

