
Laguna Conceptual Restoration Design
Task 4:
Final/Preferred Habitat Restoration Concept
Natural Channel Design, Inc.
Fred Phillips Consulting
SWI
Shephard Wesnitzer, Inc.
Engineering an environment of excellence
Lower Colorado River
Multi-Species Conservation Program

Presentation Outline

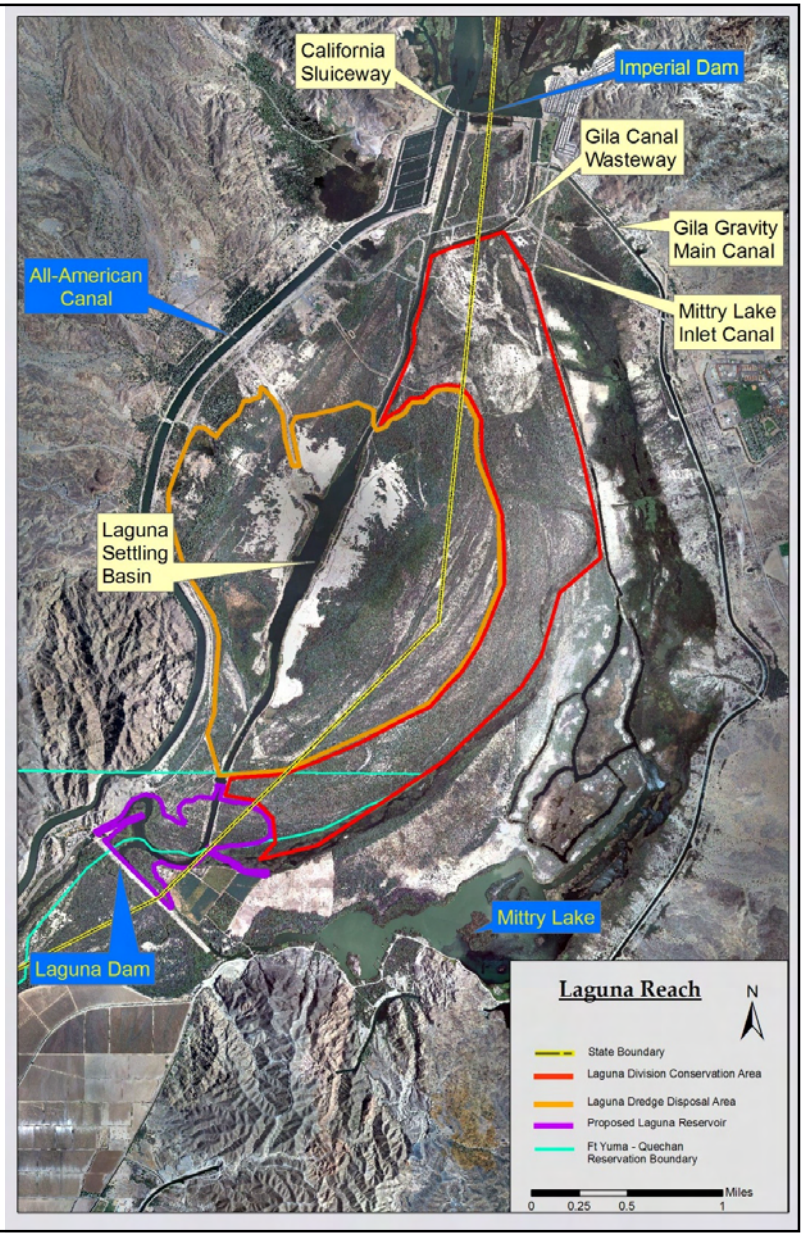
- Purpose and Objectives
- Site Map
- Project Design Considerations and Alternative Analysis
- Preferred Alternative Overview
- Wetland Channels
- Levees & Roads
- Firebreaks
- Water Delivery & Water Control Structures
- Re-vegetation and Habitat
- Water Operations Management
- Cost Summary
- Additional Information Needs
- Timeline for Project Development

Purpose & Objectives

- Large Scale Riparian and Marsh Restoration/Enhancement
- Determine the cost effectiveness and technical feasibility of a mosaic of habitat types
- Provide evaluation of three enhancement alternatives
- Provide detailed analysis of preferred enhancement alternative

Project Site Map

- Project Area – 1050 acres
- Reach Length – 4.3 miles
- Existing Conditions
  - Extensive/dense tamarisk monoculture



Project Design Considerations

- Up to 100 cfs available for project use
- Habitat Targets
    - Open Water/Marsh: 50 – 100 ac
    - Cottonwood/Willow: >200 ac
    - Upland(mesquite): <500 ac
    - Include specific habitat for T&E species
- No detrimental effect on existing Mittry Lake or Old River Channel Habitats
- Minimize impacts to existing operations (sluicing, dredge disposal, water delivery, etc.)
- Minimize both initial construction and long-term operating costs

Target Habitats

Target Species

California Black Rail

Yuma Clapper Rail

Southwestern Willow Flycatcher

Yellow Billed Cuckoo

Yuma Hispid Cotton Rat

Colorado River Cotton Rat

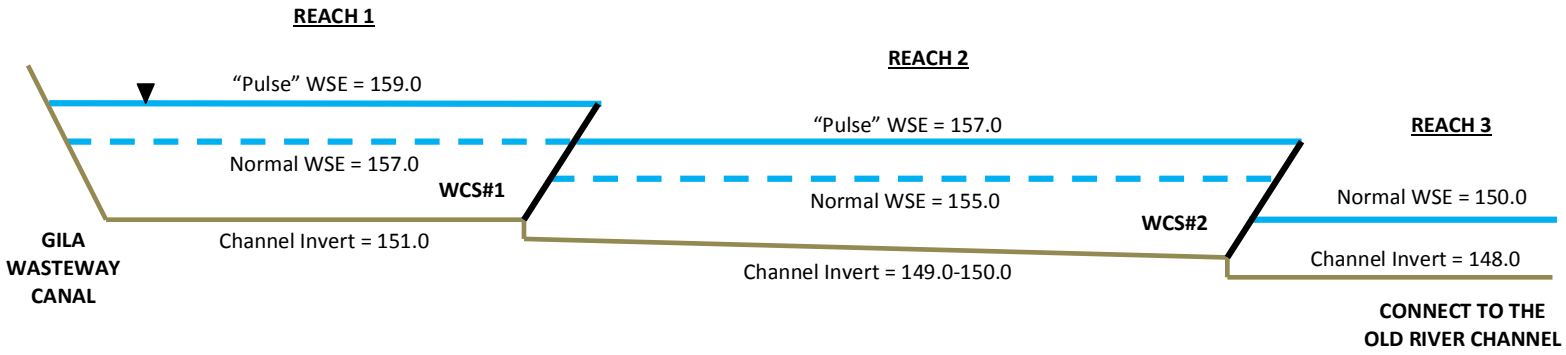
Western Least Bittern

Alternative Analysis

- **Task 1** – Provide 3 draft conceptual alternatives to BOR
  - Water Delivery and Control
  - Grading and Habitat Layout
  - Planting
- **Task 2** – Refine alternatives and present to MSCP planning team
- **Task 3** – Refine and present draft preferred concept to MSCP planning team
- **Task 4** – Address comments and present to MSCP Steering Committee

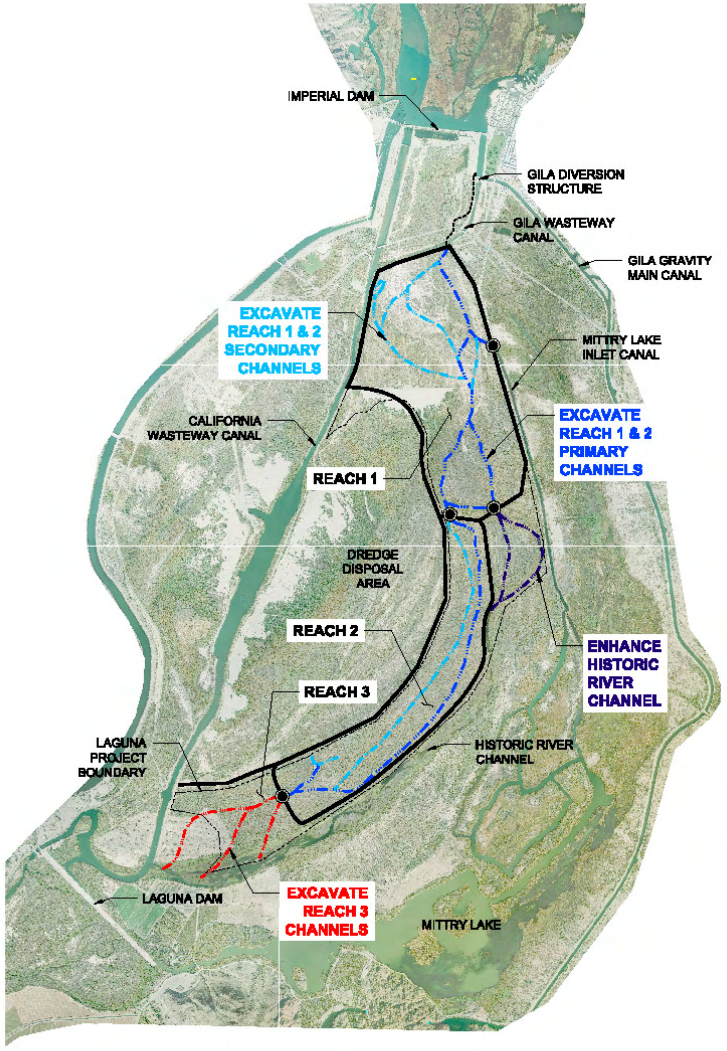
Preferred Alternative Overview

- Operate as a managed, leveed wetland rather than a river system to maximize limited water resource
- Use existing overflow channels through project area to minimize excavation
- Use pulse flows to mimic flooding
- Requires water control structures to manage water levels

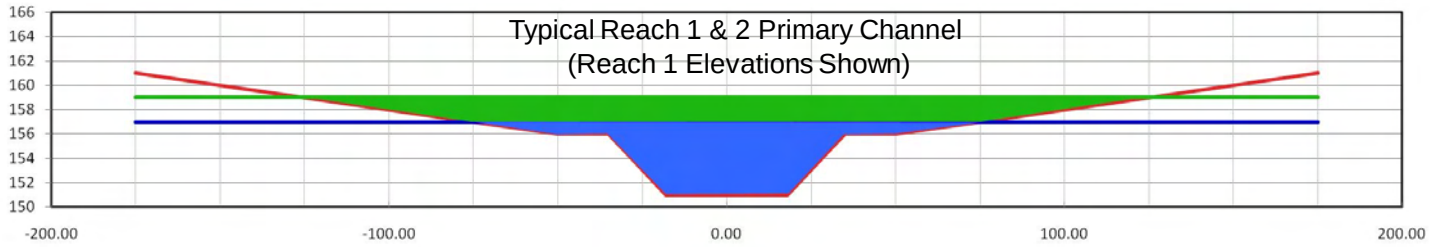


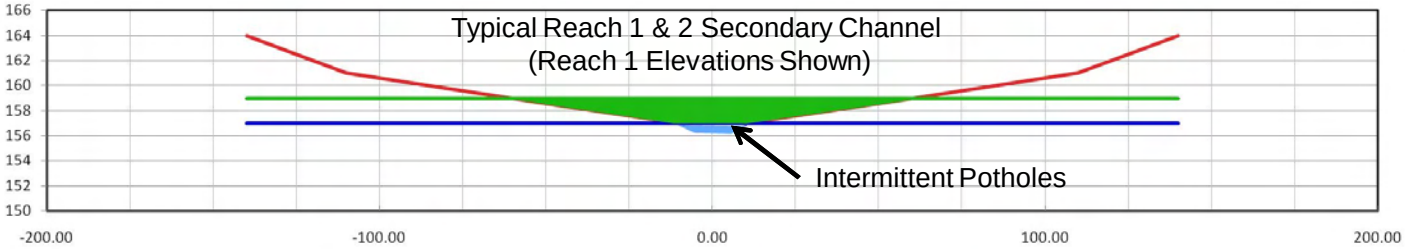
Wetland Channel Improvements

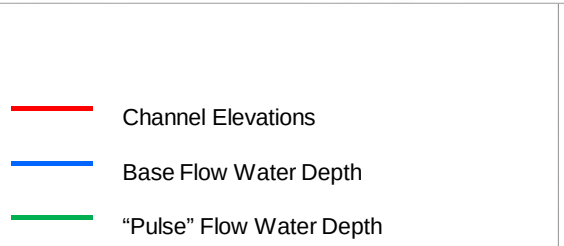
- Provides the topography to support water conveyance and vegetation/ habitat
- Reach 1 & 2 primary and secondary channels
- Reach 3 channels
- Enhance Historic River Channels
- Channel layout utilizes existing channel topography

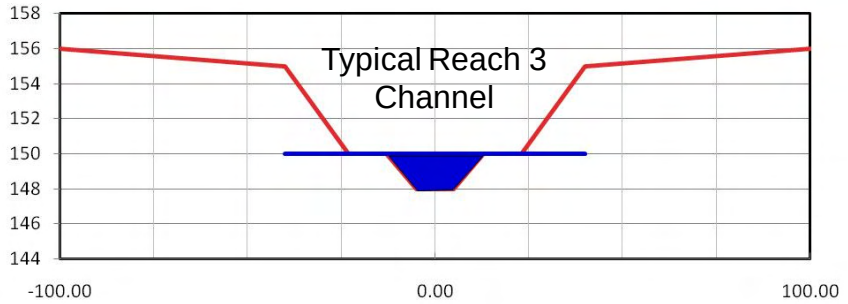


Reach 1, 2, & 3
Typical Cross Sections

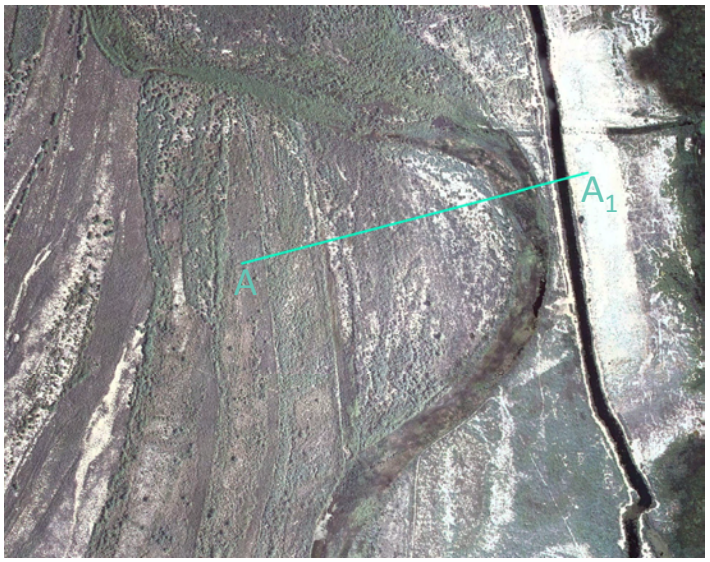




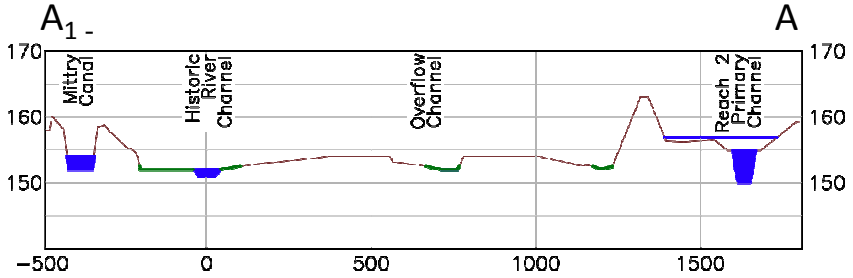




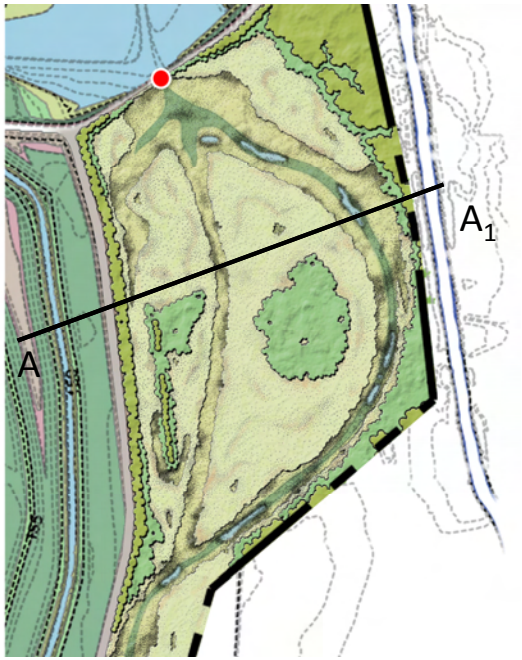
Historic River Channel Improvements



Existing Condition



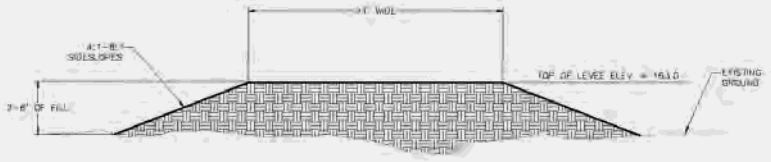
- Provide ~80 acres of shallow marsh habitat with no flow fluctuations
- Moderate grading to deepen and widen existing channel
- Soil moisture supported by existing water table
- Can be flushed with occasional flows from Reach 1 (optional steady flow)



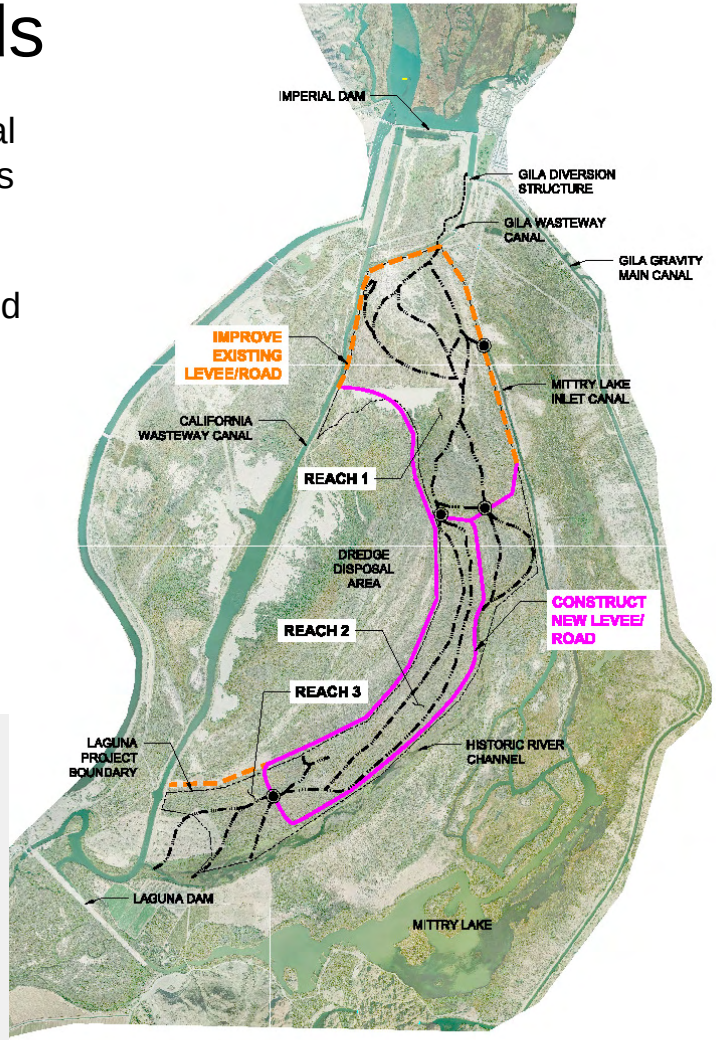
Planned Condition

Levees and Access Roads

- New levees & roads constructed using material from channel excavation (additional spoil areas between braided channels)
- Provides access to water control structures and the interior of the site and ties into existing access road system
- Allows Reaches 1 and 2 to be operated at different water levels
- Provides separation between Historic River Channel and the Project Area
- Provides separation between Laguna Dredge Disposal Area and the Project Area while providing additional access to the Dredge Disposal Area



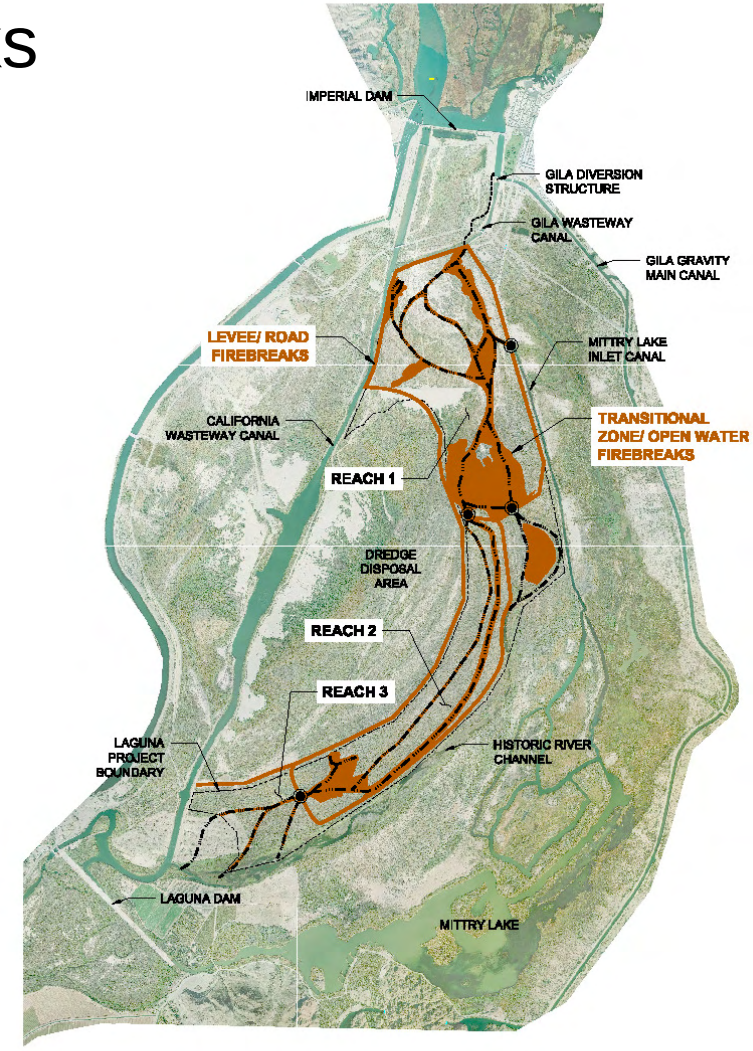
Typical Levee/Road Section



Fire Control/Fire Breaks

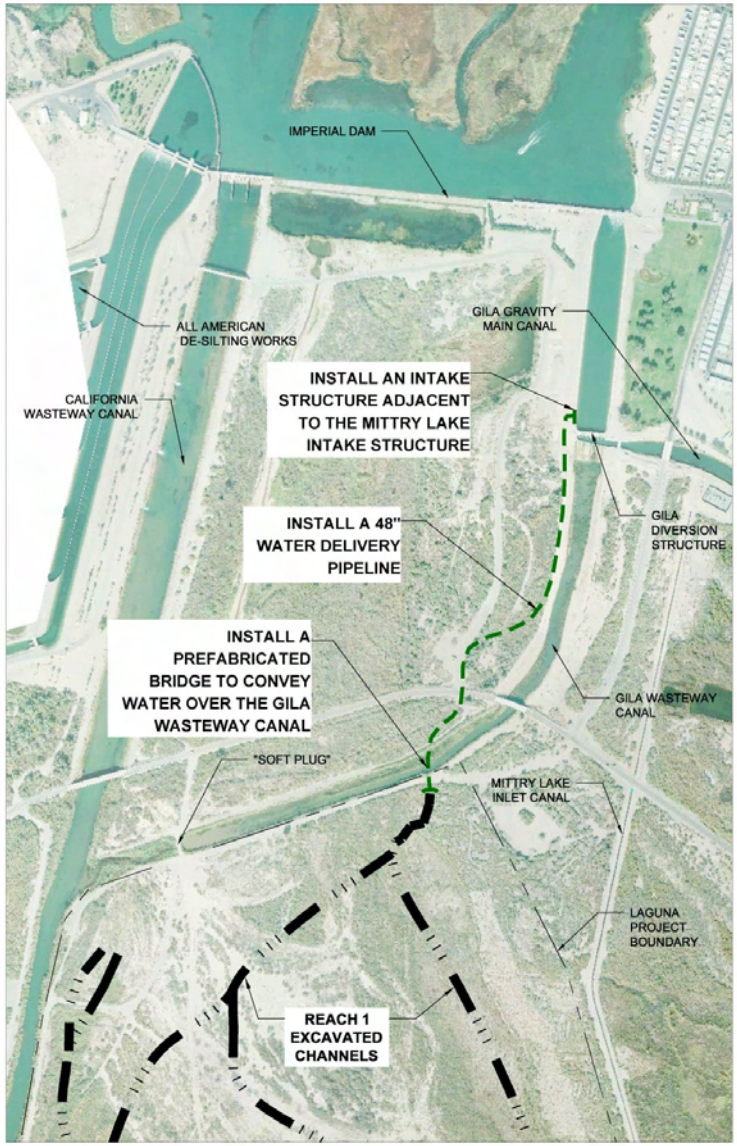
- Roads and levees provide equipment access and fire breaks
- Transitional zone vegetated primarily with salt grass acts as a firebreak
- Open water zone provides additional firebreak

Salt Grass & Open Water



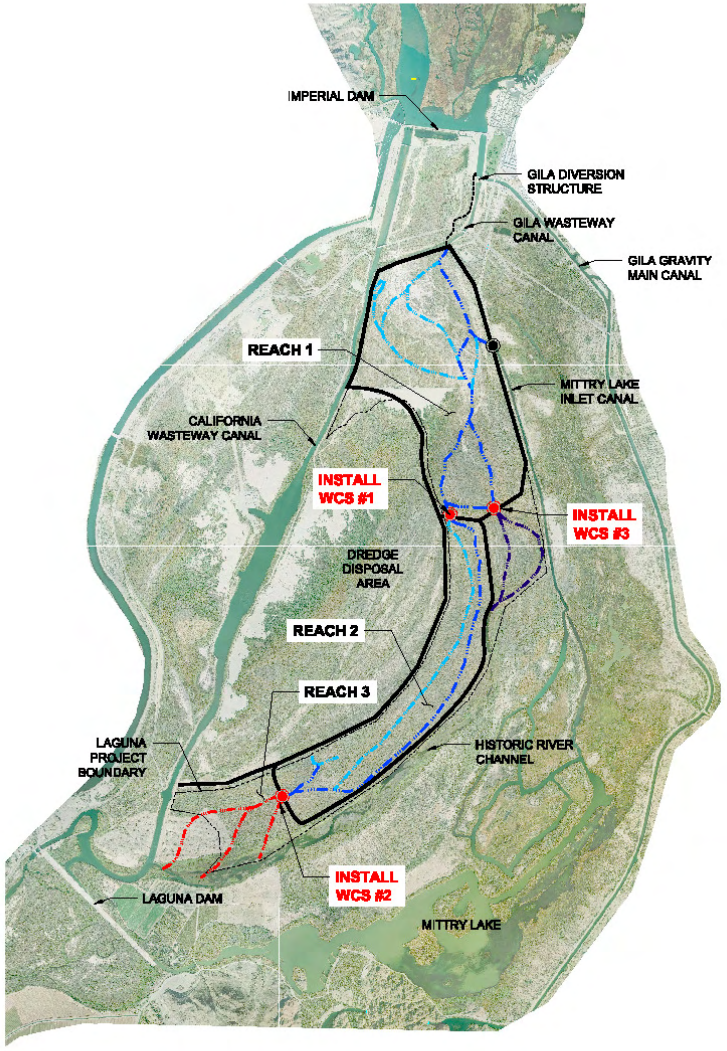
Water Delivery System: Gravity Pipeline

- System conveys 100 cfs base flow to the project site
- Low maintenance gravity system
- Independent delivery with limited impacts to the existing dam operations
- High quality water (low salinity/sediment load) at take out
- Piped system reduces evaporation and infiltration

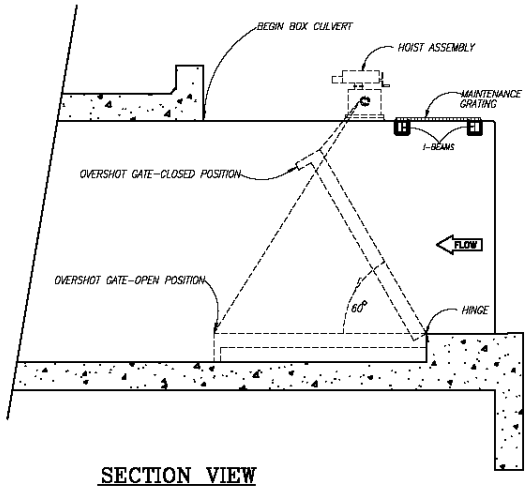


Water Control Structures: Plan View

- Three (3) structures to control water surface elevations within the new units
- WCS#1 and WCS#2: In-line with Reach 1, 2, & 3
- WCS#3: Turn-out for the Historic River Channel



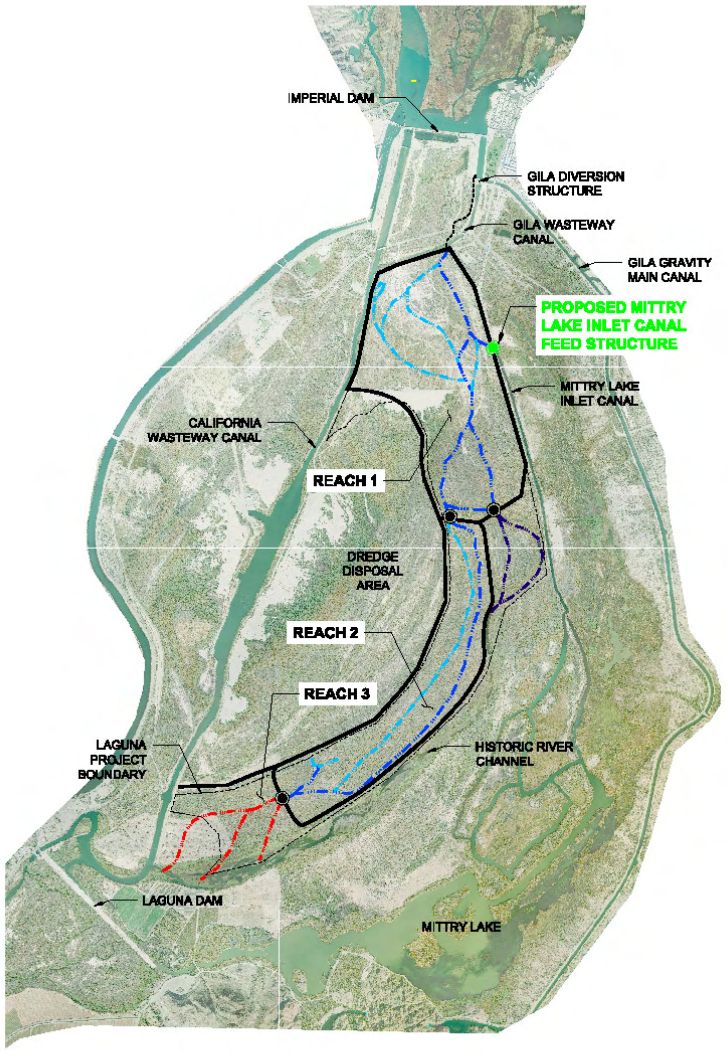
Water Control Structures: Overshot Gates



- Ease of adjusting water surface elevation (potential to automate)
- Precise water elevation control (0.25 inch increments)
- Minimal leakage
- Gate allows surge flows and debris to pass

Proposed Mittry Lake Inlet Canal Feed Structure

- Analysis requested by AZGFD to enhance Mittry Lake habitat
- Utilize smaller overshot gate structure
  - Would allow surplus water to be diverted from Upper Unit (Reach 1) to Mittry Lake Inlet Canal.
  - Would require automation to provide steady flows into Mittry Lake Inlet Canal.
  - May require modifications to Mittry Lake Outlet Control and/or the proposed Laguna Inlet Water Delivery Pipeline.

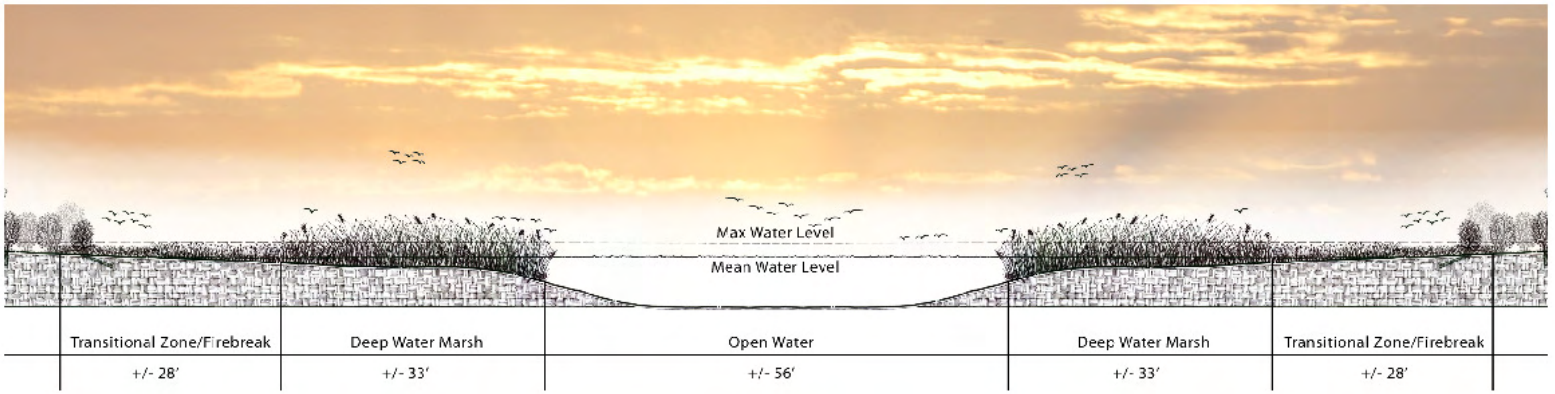


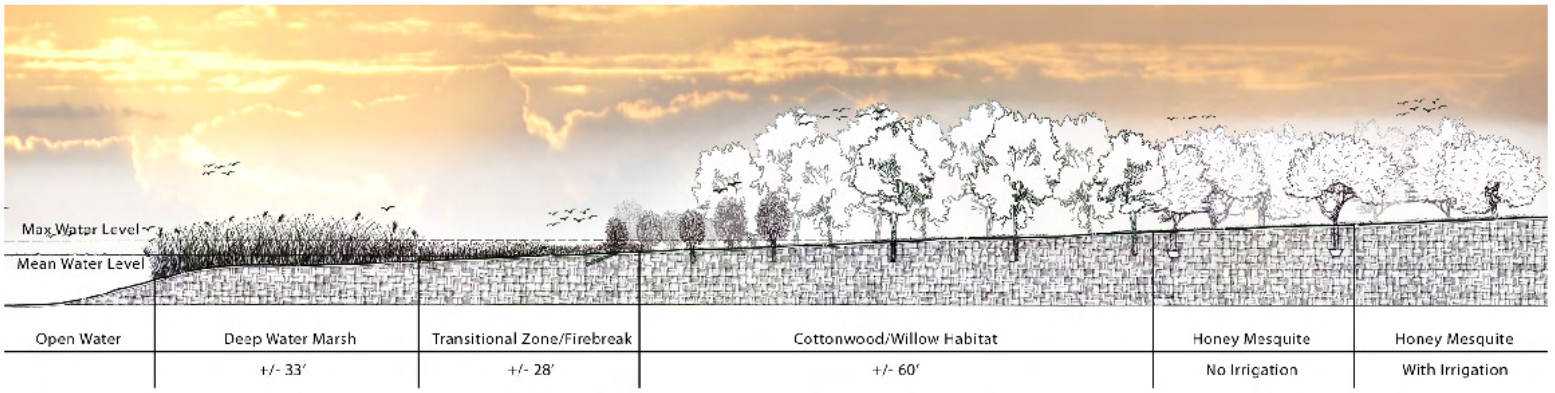
Revegetation Design

- Remove existing nonnative species
- Planting based on topography, moisture and salt tolerance of plants
    - Bands of vegetated communities relative to water level
- Utilize pulse flows as irrigation for cottonwood/willow
- Utilize temporary drip irrigation for mesquite planted on higher terraces
- High density planting of vegetation plugs, poles, seeds and rooted materials for rapid establishment of cover.
- Will require maintenance and weed management for 2 – 3 years
- Plantings are expected to be self sustaining in long-term
- Utilizes 15 years of experience with planting in LCR by Fred Phillips Consulting

Prosopis glandulosa var. torreyana	*Atriplex lentormis*	*Allenrolfea occidentalis*
Populus fremontii	*Salix exigua*	*Salix goodingii*
Distichlis spicata	*Scirpus olneyi*	*Anemopsis californica*
Sporobolus airoides	*Scirpus acutus*	*Schoenoplectus californicus*

Revegetation Design
Primary Channels





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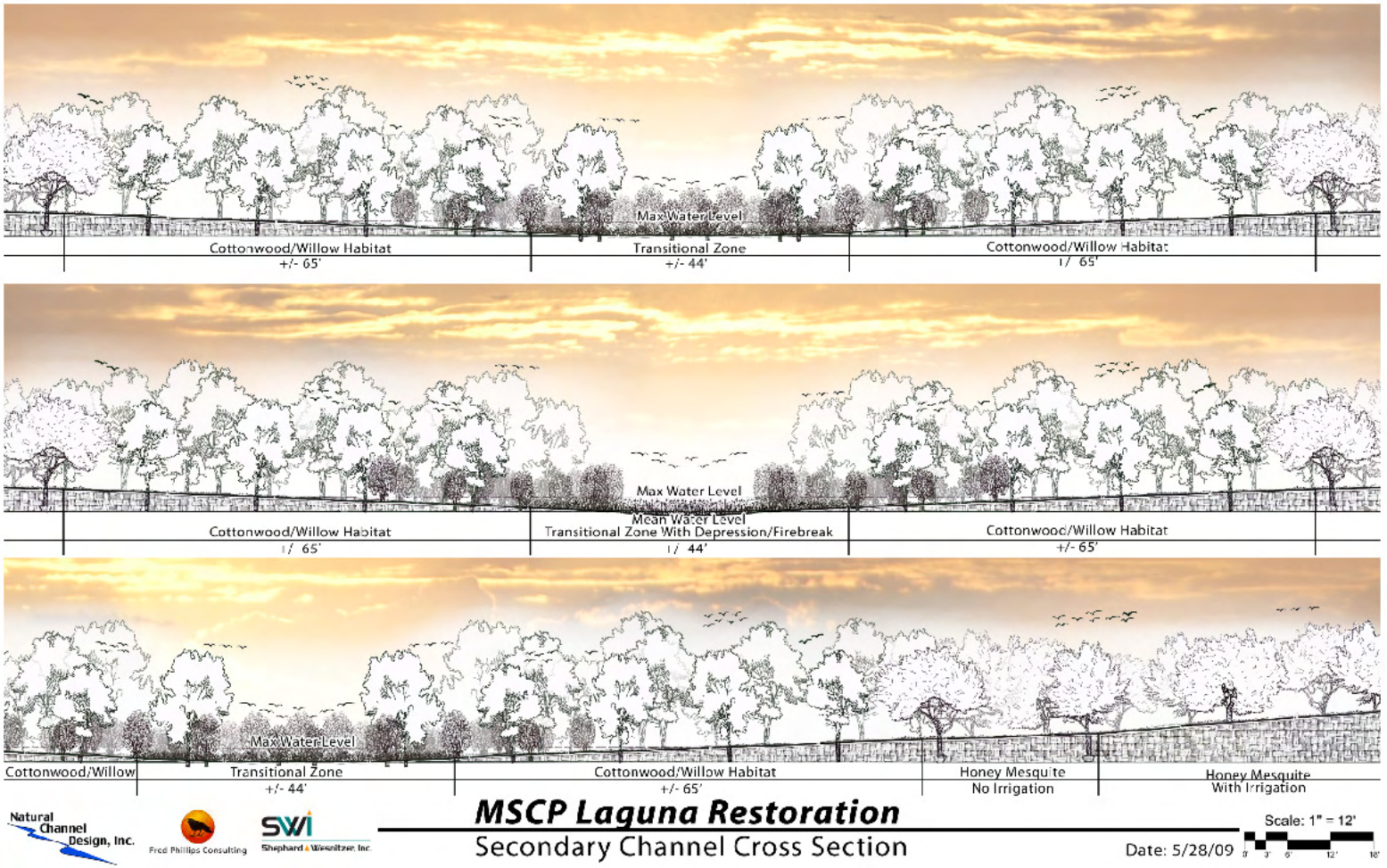
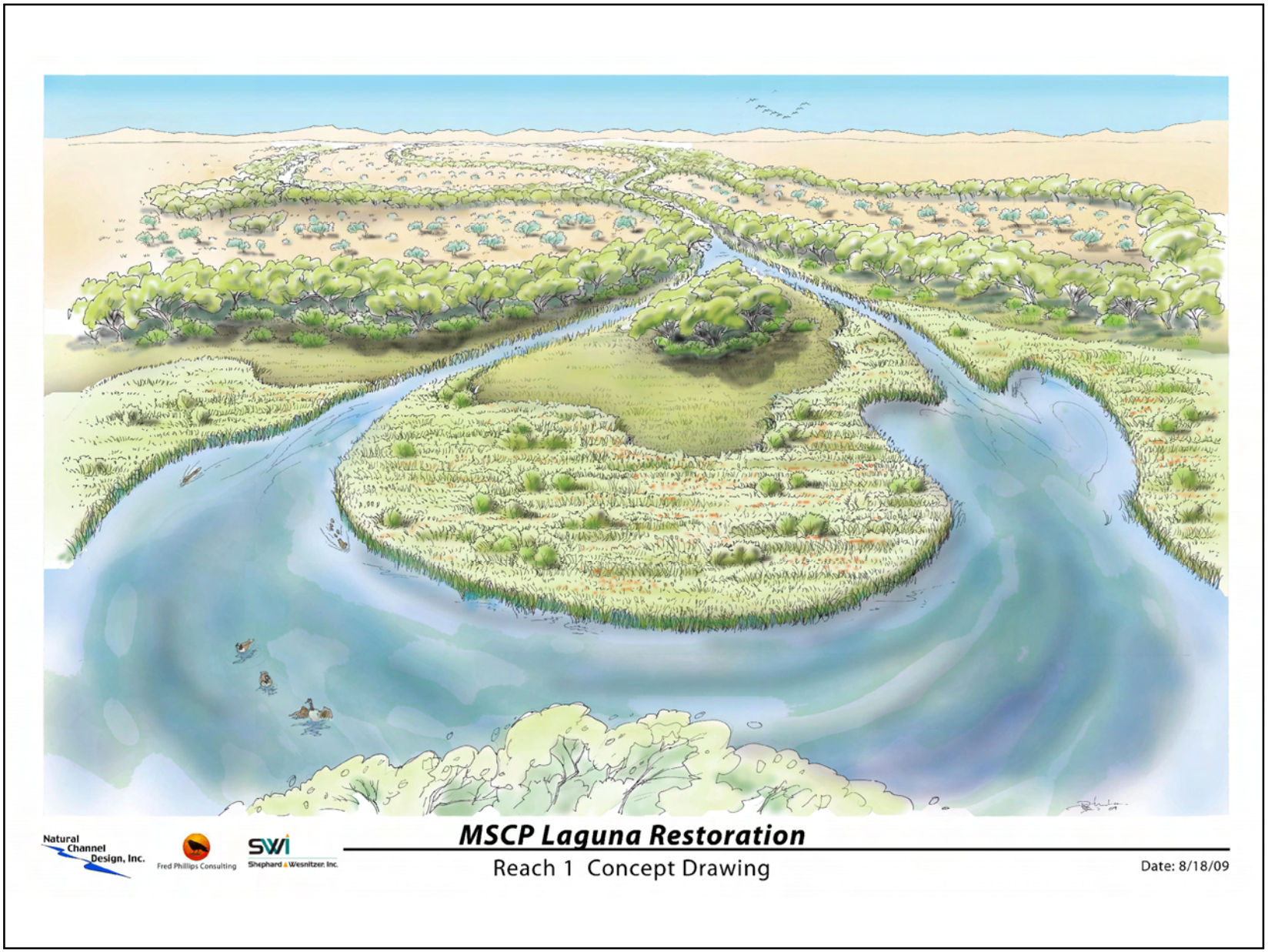
MSCP Laguna Restoration
Primary Channel Cross Section

Scale: 1" = 12'
Date: 5/28/09

Revegetation Design
Secondary Channels

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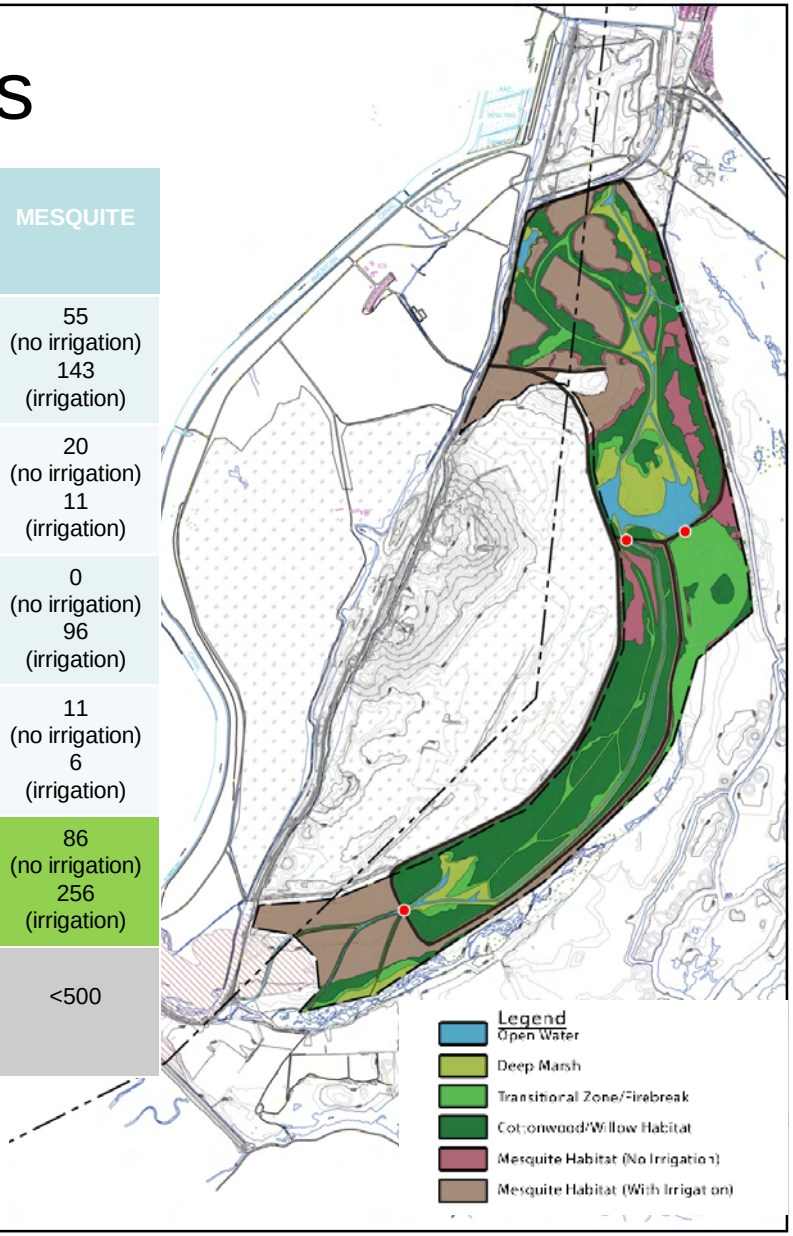
MSCP Laguna Restoration
Reach 1 Concept Drawing
Date: 8/18/09

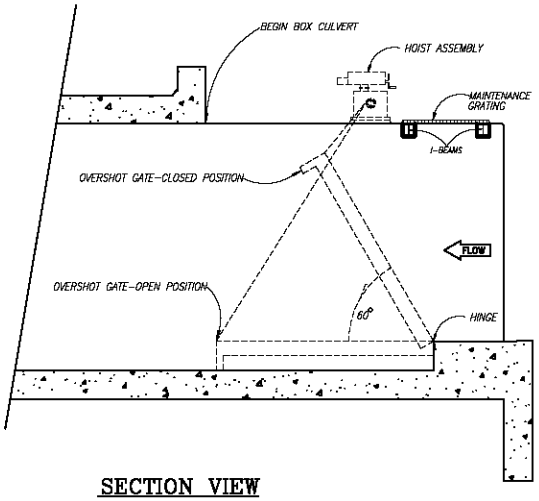
Habitat Acreages

	OPEN WATER	DEEP MARSH	TRANSITION ZONE/ FIRE BREAK	COTTONWOOD/ WILLOW	MESQUITE
Reach 1	46	63	35	150	55 (no irrigation) 143 (irrigation)
Reach 2	15	21	31	223	20 (no irrigation) 11 (irrigation)
Reach 3	4	10	8	14	0 (no irrigation) 96 (irrigation)
Historic River Channel	0	0	81	14	11 (no irrigation) 6 (irrigation)
Project Totals	65	94	155	401	86 (no irrigation) 256 (irrigation)
MSCP Targets	50-100			>200	<500

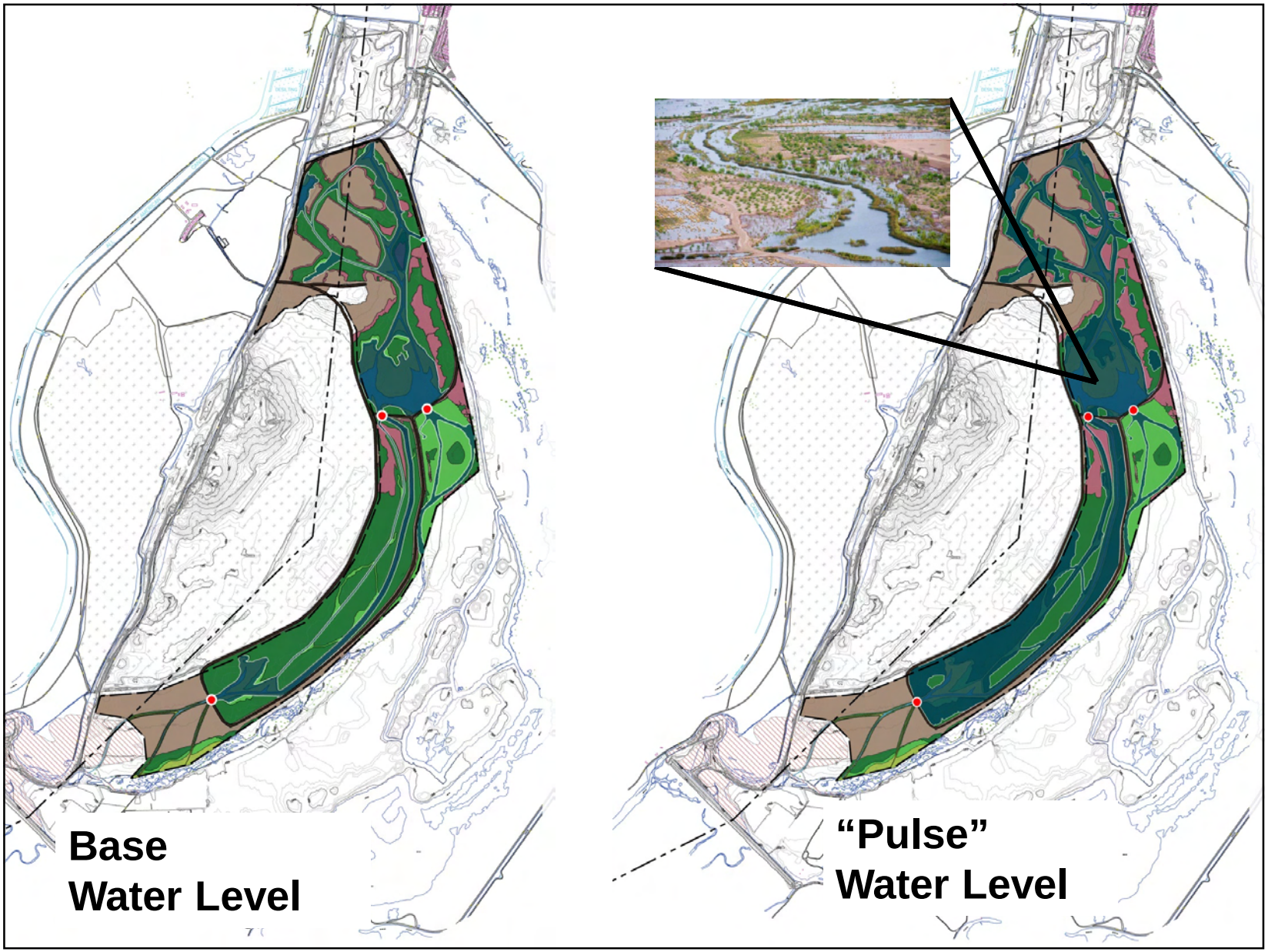


Water Operations Management Overview

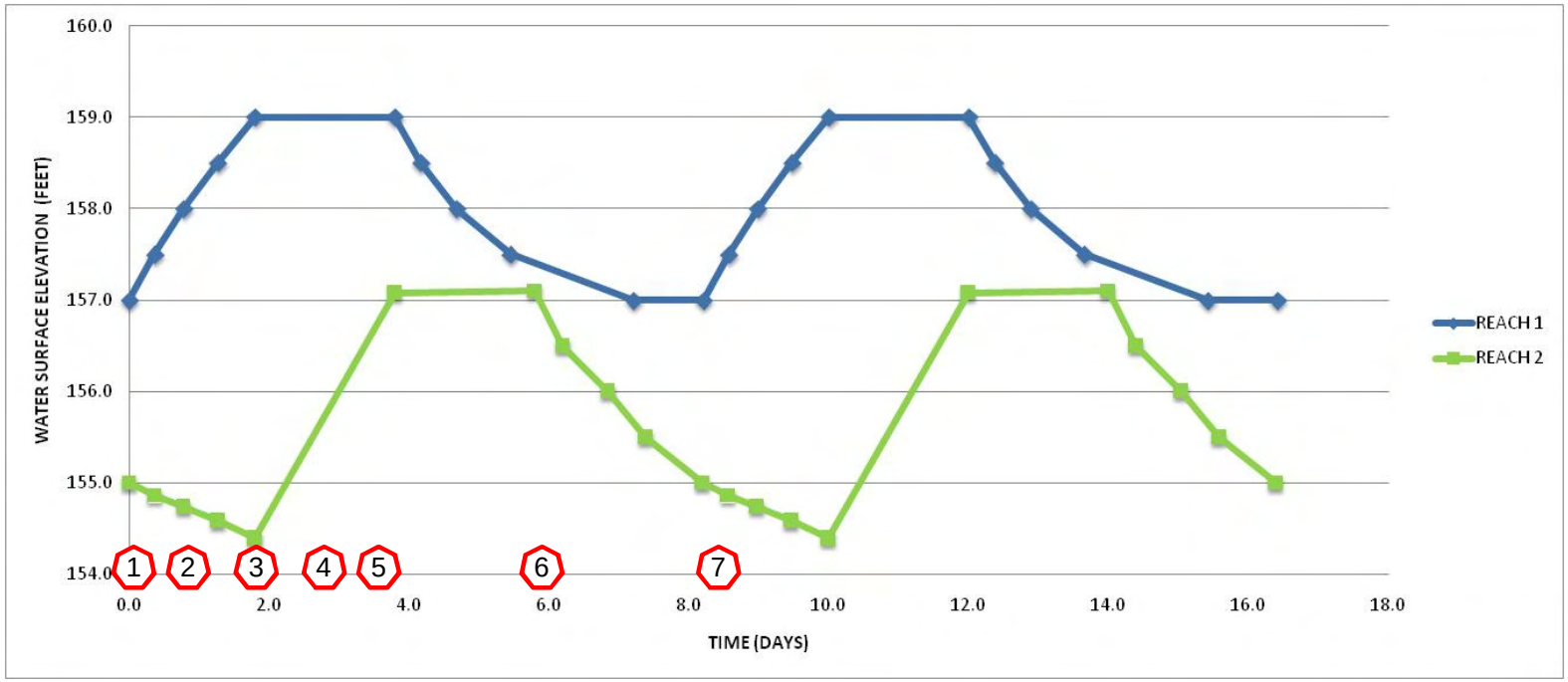
- Utilize overshot gates to manage water surface elevations in Reach 1 and Reach 2
  - Overshot gates allow easy water elevation adjustment
  - Will allow irrigation of cottonwoods & willows at higher elevations through simulated flood events (pulse flows)
  - Reach 1 and Reach 2 are in-series cells – water management will require choreography of Reach 1 and Reach 2 gates
- Adaptive management
  - Adjust operation as seasonal habitat and wildlife needs dictate
  - Adjust operation as vegetation matures



SECTION VIEW

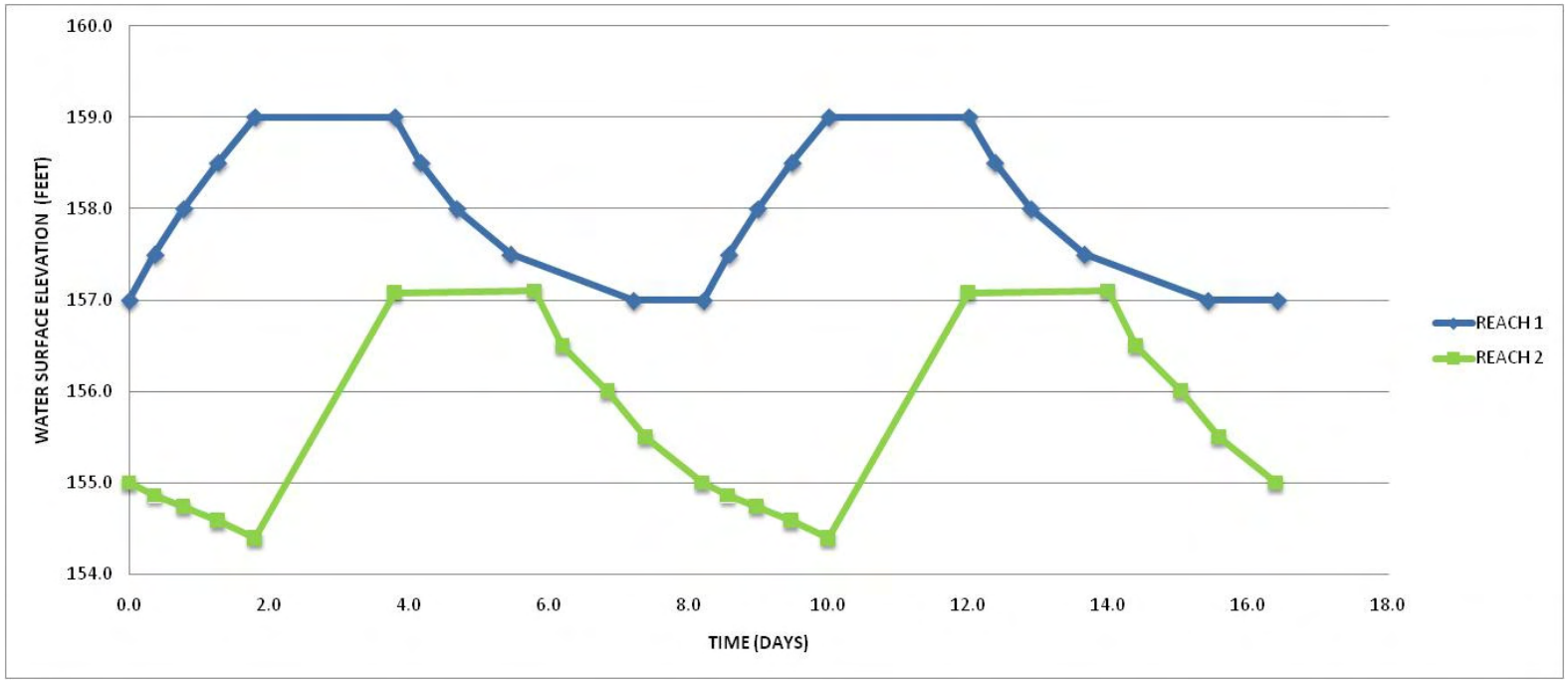

Base
Water Level
“Pulse”
Water Level

Conceptual Operation Hydrograph



1. Reach 1 overshot gate "closed". Flows to Reach 2 are cut-off.
2. Reach 1 fills. With no influx, Reach 2 loses water to ET/EVAP/Seepage
3. Reach 1 hits "pulse" water surface and begins to overtop its overshot gate. Reach 2 overshot gate "closed" and Reach 2 begins to fill with overflow water from Reach 1.
4. Reach 1 is kept at "pulse" water surface for two days, allowing soils to saturate and reach deep pot plantings of mesquite and cottonwood. Reach 2 fills to it's "pulse" water surface elevation.
5. Reach 1 overshot gate is adjusted to pre-pulse position and water in Reach 1 is drawn-down. Reach 2 is kept at "pulse" water surface for two days (see #4, Reach 1). Reach 2 gate is adjusted to maintain pulse water surface elevation and allow for additional draw-down flows from Reach 1.
6. Reach 1 continues to draw down. Reach 2 overshot gate is adjusted to pre-pulse position and water in Reach 2 is drawn-down.
7. Next irrigation cycle begins ~ 6.2 day gap between pulses

Conceptual Operation Hydrograph



- Conceptual Model
  - Modeled the month of July (highest ET/EVAP rates)
  - Fill rates will change with ET/EVAP/Seepage rates
  - System operation will require tweaking – overshot gates allow that
- Long-term Adaptive management
  - Once vegetation is established and can be stressed, pulse events can be decreased
  - Example: Steadier flows are beneficial for black rail nesting (April – June)

Conceptual Water Budget

POST-DEVELOP ET/EVAP (acre-ft/yr)*	POST-DEVELOP SEEPAGE (acre-ft/yr)**	POST-DEVELOP TOTAL (acre-ft/yr)	PRE-DEVELOP ET (acre-ft/yr)*
5900	1150	7050	5800

* Evaporation rates per Cooley, K.R., 1970, Evaporation from open water surfaces in Arizona: University of Arizona College of Agriculture, folder 159. Evapotranspiration rates for different habitat types provided by BOR (average of years 2005-2007)
** Seepage rate calculations for Reach 2 based on groundwater and soil log data for well AP-103-08. Reach 1 groundwater is at or above the proposed channel invert so seepage is assumed to be minimal.

Conceptual Level Cost Estimate Summary

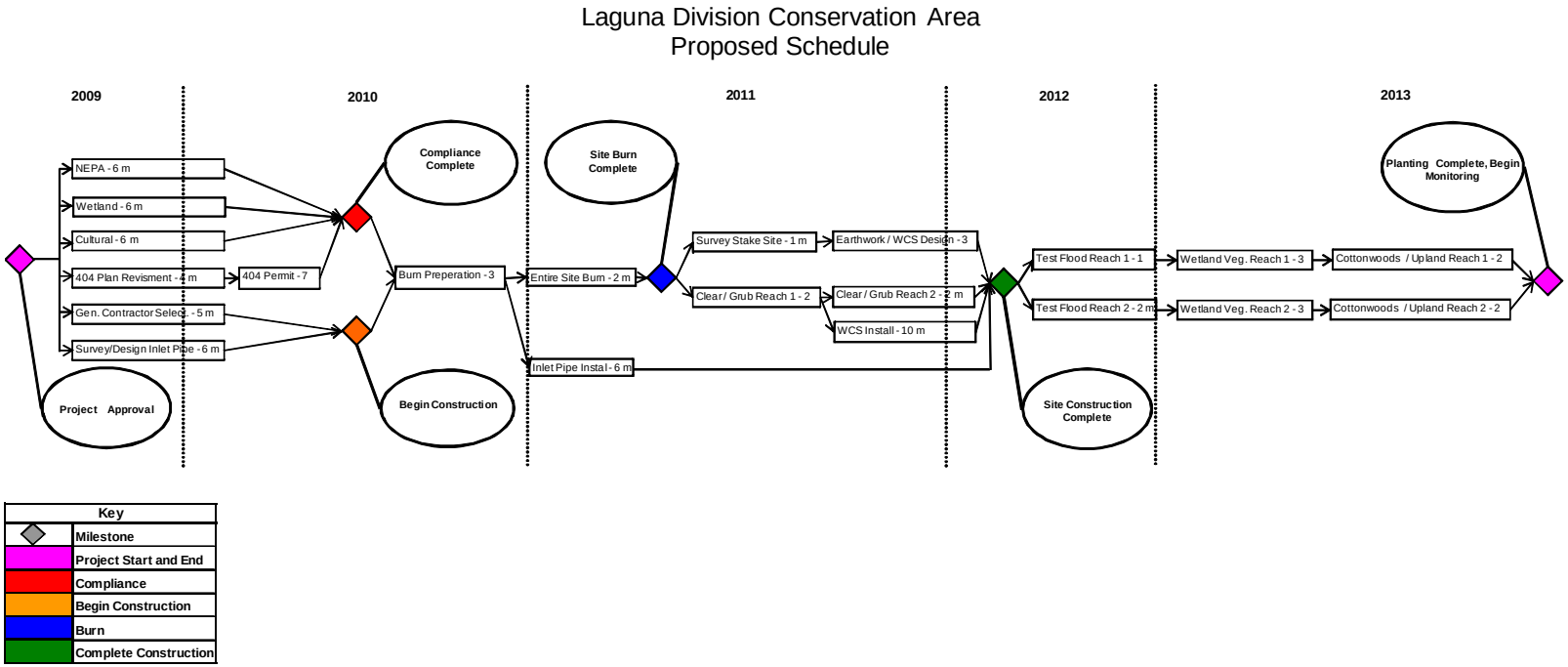
Project Component	Final Design & Construction Cost	O & M Cost (50-Year Life Cycle)	Component Total
Earthwork	$12.4M	$0.5M	$12.9M
Water Delivery & Control Structures	$2.3M*	$0.3M	$2.6M
Revegetation	$4.2M	$2.9M**	$7.1M
PROJECT TOTAL	**$18.9M**	**$3.7M**	**$22.6M**

* Does not include the Mittry Lake Inlet Canal Structure
** Assumes 5-years of intensive work at the beginning of the project, minimal work thereafter

Additional Information Needs

- Additional Monitoring Wells along Proposed Channels
  - Groundwater information
  - Soil Information (salinity, texture, nutrients)
- Existing Infrastructure Information
- Existing Vegetation information
- Detailed Topographic Survey
- Final Design and Bid Package

Timeline for Project Development




Questions?