San Joaquin River Restoration Program

Program Overview

Donald E. Portz, Ph.D.
Program Manager

Water Education Foundation
Central Valley Tour
April 5, 2019
BACKGROUND
Reaches of the San Joaquin River under evaluation include the following:

- **Reach 1** – Friant Dam to Gravelly Ford
- **Reach 2** – Gravelly Ford to Mendota Dam
- **Reach 3** – Mendota Dam to Sack Dam
- **Reach 4** – Sack Dam to the confluence of Bear Creek and the Eastside Bypass
- **Reach 5** – Eastside Bypass/Bear Creek confluence to the Merced River confluence
• Construction begins on Friant Dam in 1939.

• Built for water supply to downstream users and secondary uses for flood control and recreation.

• 520,000 acre-feet, 15 miles north of Fresno, CA
• Friant Dam completed in 1942 as part of the Central Valley Project, effectively trapping the full flow of San Joaquin River.

• Historic spawning habitat of largest and southern-most spring-run Chinook salmon eliminated.

• Spring-run extirpated from the river.
Settlement History

Fast forward 46 years…

1988
Lawsuit filed challenging Reclamation’s renewal of the long-term contracts with Friant Division contractors.

2004
Federal Judge rules Reclamation violated Section 5937 of the California Fish and Game Code:

“The owner of any dam shall allow sufficient water at all times to pass through a fishway, or in the absence of a fishway, allow sufficient water to pass over, around or through the dam, to keep in good condition any fish that may be planted or exist below the dam…”
Settlement History

2005
Settlement negotiations reinitiated

2006
Settlement reached; implementation begins

2009
Federal legislation enacted (Public Law 111-11) to fund the Program
The “Players”

Settling Parties

- NRDC Coalition
  - 14 organizations
- Friant Water Authority
  - 17 water agencies intervened
- Federal Government
  - Department of the Interior
    - Bureau of Reclamation
    - Fish and Wildlife Service
  - Department of Commerce
    - National Marine Fisheries Service
- State of California
  - Department of Water Resources
  - Department of Fish and Wildlife
- Restoration Administrator
- Third Parties

Implementing Agencies
Settlement Goals

• **Restoration Goal**
  – To restore and maintain fish populations in “good condition” in the main stem of the San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish.

• **Water Management Goal**
  – To reduce or avoid adverse water supply impacts to all of the Friant Division long-term contractors that may result from the Interim Flows and Restoration Flows provided for in the Settlement.
Key Restoration Goal Activities

• Increase flows from Friant Dam
• Improve channel and structures to convey flows and improve fisheries habitat
• Reintroduce spring-run and fall-run Chinook salmon
Key Water Management Goal Activities

- **Water Accounting and Recovery**
  - Restoration Flow Guidelines (Completed 12/2013)
  - Recapture and re-circulate Restoration Flows

- **Physical Projects**
  - Friant-Kern Canal Capacity Correction
  - Madera Canal Capacity Correction
  - Friant-Kern Canal Reverse Flow
  - Part III Groundwater Projects
Key Water Management Goal Activities
How Restoration and Water Management goals are implemented:

• Settlement & Act (legally binding)

• 2015 Revised Framework for Implementation
  – Provides timeline for Program implementation in 5-year increments

• 2017 Fisheries Framework
  – Outlines fish reintroduction strategy

• 2017 Funding Constrained Framework
  – Program priorities into next decade given budgetary constraints (through 2024)
Funding Constrained Framework -
Stage 1: FY 2017 to FY 2024

• Goal: Beginning the reestablishment of spring-run and fall-run Chinook salmon

• Construction / completion of the following:
  – Mendota Pool Bypass, Fish Screen, and Reach 2B Project
  – Seepage and levee stability projects to achieve up to 2,500 cfs capacity in all reaches
  – Arroyo Canal Fish Screen and Sack Dam Fish Passage Project
  – Conservation Facility construction
  – Fish passage and levee improvement actions in the Eastside Bypass
  – Friant-Kern Canal and Madera Canal Capacity Restoration projects
## Funding Constrained Framework - Stage 1: FY 2015 to FY 2024

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Stage 1 Costs</td>
<td>$643,255,000</td>
</tr>
<tr>
<td>Federal Stage 1 Costs</td>
<td>$540,912,000</td>
</tr>
<tr>
<td>Federal Stage 1 Funding Authorized</td>
<td>$525,745,000</td>
</tr>
<tr>
<td>Federal Stage 1 Shortfall</td>
<td>($15,166,000)</td>
</tr>
<tr>
<td>State Stage 1 Costs</td>
<td>$102,343,000</td>
</tr>
<tr>
<td>State Stage 1 Funding Authorized</td>
<td>$93,709,000</td>
</tr>
<tr>
<td>State Stage 1 Shortfall</td>
<td>($8,634,000)</td>
</tr>
</tbody>
</table>
# Funding Sources

<table>
<thead>
<tr>
<th>Source</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Friant Surcharge (average collected)</td>
<td>$5.6 million/year</td>
</tr>
<tr>
<td>Recovered Water Account Receipts (average collected)</td>
<td>$0.8 million/year</td>
</tr>
<tr>
<td>Unreleased Restoration Flows sales</td>
<td>$23 million (est.)</td>
</tr>
<tr>
<td>Sales of Other Water and Property</td>
<td>$0 to date</td>
</tr>
<tr>
<td>Friant Capital Repayment (est. collected)</td>
<td>$225 million</td>
</tr>
<tr>
<td>Non-Federal Contributions</td>
<td>$0 to date</td>
</tr>
<tr>
<td>CVPIA Restoration Fund (maximum)</td>
<td>$2 million/year</td>
</tr>
<tr>
<td>New Federal Appropriations (maximum)</td>
<td>$300 million</td>
</tr>
<tr>
<td>State Funding (stated commitment)</td>
<td>$200 million</td>
</tr>
</tbody>
</table>

Deposited into the San Joaquin River Restoration Fund
Funding Constrained Framework -
Stage 1: FY 2015 to FY 2024

<table>
<thead>
<tr>
<th>Year</th>
<th>2017</th>
<th>2018</th>
<th>2019</th>
<th>2020</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>2026</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seepage</td>
<td><em>500 cfs</em></td>
<td><em>700 to 900 cfs</em></td>
<td><em>1,300 to 1,500 cfs</em></td>
<td><em>1,500 cfs to 2,000 cfs</em></td>
<td><em>2,000 to 2,250 cfs</em></td>
<td><em>2,250 to 2500 cfs</em></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reach O Levees</td>
<td>1,070** to 2,500 cfs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Stage 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mendota Pool Bypass and Reach 2B</td>
</tr>
<tr>
<td>Eastside Bypass Fish Passage Improvements</td>
</tr>
<tr>
<td>Arroyo Canal/ Sack Dam Project</td>
</tr>
</tbody>
</table>

Unimpeded Fish Passage

* The magnitude of flow that is addressed by seepage actions are approximate and subject to change.

**This channel capacity assumes that the weir boards will be removed from the Merced National Wildlife Refuge weirs. With boards in the weirs, capacity is 580 cfs.
Flows
An Altered Hydrograph

Annual Unimpaired Hydrograph of San Joaquin River at Friant (modeled) and Regulated Flows at Friant (measured) for Approximately Average Water Year Conditions

SJRRP Draft PEIS/R (SJRRP 2011).
Friant Release Schedule with Fisheries Migration Timing

- Interim Flows began in 2009
- Restoration Flows began in 2014
Runoff Forecasting

- Determining how much water is available for flows is critical
  - Determines water year type
  - Restoration Flows
  - Water User availability

- Use a number of tools including:
  - Blended forecasts from DWR and NWS
  - NASA’s Airborne Snow Observatory. Accurate and early warning of runoff addresses multiple challenges across all four realms
Seepage Management

- Rewetting the San Joaquin River increases shallow groundwater elevations.
- Can effect crop productivity (i.e. increased salinity and water logging of crops).
Approximately 25,000 acres needs to be addressed between Mendota Pool and Merced National Wildlife Refuge.
Data Reporting

- Real-time wells online
- Weekly measurements for key wells
- Monthly or quarterly for all other wells depending on site conditions
- Pressure transducers gathering hourly data
- Well Atlas provides well locations, groundwater elevations, topography and similar items and is updated about quarterly

Installed more than 200 wells
Red dots are monitoring wells, both Reclamation wells and CCID wells
Levee Stability & Channel Capacity

- Flood control project designed and built assuming only flood releases from Friant Dam
- Levee improvements needed to address long-term flows
- Channel capacity limits flow levels that meet USACE Safety Factors for Levee Slope Stability and Underseepage

<table>
<thead>
<tr>
<th>Reach</th>
<th>Flood Design Flows (cfs)</th>
<th>2017 Then-Existing Channel Capacity (cfs)</th>
<th>How Capacity is Determined</th>
</tr>
</thead>
<tbody>
<tr>
<td>2A</td>
<td>8,000</td>
<td>6,000*</td>
<td>Geotechnical</td>
</tr>
<tr>
<td>2B</td>
<td>2,500</td>
<td>1,120</td>
<td>In-channel</td>
</tr>
<tr>
<td>3</td>
<td>4,500</td>
<td>2,860*</td>
<td>In-channel</td>
</tr>
<tr>
<td>4A</td>
<td>4,500</td>
<td>2,840*</td>
<td>Geotechnical/In-channel</td>
</tr>
<tr>
<td>4B2</td>
<td>10,000</td>
<td>930</td>
<td>In-channel</td>
</tr>
<tr>
<td>5</td>
<td>26,000</td>
<td>2,350</td>
<td>In-channel</td>
</tr>
<tr>
<td>Middle Eastside Bypass</td>
<td>16,500</td>
<td>580 (0)</td>
<td>Geotechnical</td>
</tr>
<tr>
<td>Lower Eastside Bypass</td>
<td>18,500</td>
<td>2,890</td>
<td>In-channel</td>
</tr>
<tr>
<td>Mariposa Bypass</td>
<td>8,500</td>
<td>350</td>
<td>In-channel</td>
</tr>
</tbody>
</table>
Unreleased Restoration Flows

- After January 1 2014, Restoration Flows not able to be released into the river are banked, stored, sold, or exchanged with first priority to Friant Contractors
- Sales price varies from $20/AF to about $647/AF based on water year type and follows market prices
- Proceeds deposited into the San Joaquin River Restoration Fund

<table>
<thead>
<tr>
<th>Contract Year</th>
<th>URF Water Sold</th>
<th>$/AF Range</th>
<th>Total Proceeds</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>151,966 AF</td>
<td>$20-$150</td>
<td>$9,790,790</td>
</tr>
<tr>
<td>2017</td>
<td>367,967 AF</td>
<td>$20-$150</td>
<td>$6,934,380</td>
</tr>
<tr>
<td>2018</td>
<td>124,791 AF</td>
<td>$20-$150</td>
<td>$6,618,362</td>
</tr>
</tbody>
</table>
Recapture and Recirculation

Water Recapture Locations:
- Mendota Pool (temporary)
- In Delta
- Along San Joaquin River at existing pumping plants
- New pumping plant along the river (considered in PEIS/R)

Recirculation Options:
- Exchanges
- Direct Deliveries (AEWSD/SWID)
- Transfers

Total Contract Year 2010 to 2017: 350,000 acre-feet or 33% of releases
Passage and Habitat
Key actions for fish survival

• Volitional movement up and down the river through life stages

• Eliminate stranding and entrainment potential

• Create habitat needed for life stages
Reach 2B and Mendota Pool Bypass Project

- Area between Chowchilla Bypass and Mendota Pool
  - Most is not part of Flood Control Project
  - Original design capacity was 2,500 cfs
  - Current capacity is ~1,300 cfs
  - Levees built by landowners of native soil and will need to be rebuilt
Mendota Pool Bypass and Reach 2B Channel Improvements Project

- Create bypass channel around the Mendota Pool (about 3/4 mile of new river channel)
- Expand Reach 2B capacity to convey at least 4,500 cfs (11 miles of new levee and flood plain habitat)
- **Current Schedule**: ROD – October 2016
- Land acquisition 2017/2018
- Construction start date – 2019
- **Cost**: $336 million
Arroyo Canal Fish Screen and Sack Dam Fish Passage Project

Sack Dam – Modify for fish passage

Arroyo Canal – Screen to prevent fish entrainment

NEPA and CEQA completed

Construction – Redesign for project underway to address subsidence.
Arroyo Canal Fish Screen and Sack Dam Fish Passage Project
Eastside Bypass
Fish Passage Projects

Mariposa
Dan McNamara Rd
Eastside Bypass Control Structure
Upper Weir
Lower Weir
ESBP Control Structure Rock Ramp

Eastside Bypass Control Structure - Full Rock Ramp Concept

- Outfall Structure
- ESM - Type 2 (Sized larger for erosion protection)
- EBES - Remove sill, blocks, and boards
- Engineered Streambed Material (ESM) - Type 1
- Low-flow Channel
- 1% SLOPE
- Boulder Weir (highest section of rock ramp)
- Sheet Pile Wall (20' into banks)
- RSP

Dimensions:
- 100' length
- 330' width
- 50' height
National Wildlife Refuge

Weirs

- Upper Weir
- Lower Weir
Salmon Reintroduction
Salmon Reintroduction

• Settlement requires reintroduction of spring-run and fall-run Chinook salmon

• Spring-run broodstock efforts began in 2012 at the Interim Salmon Conservation and Research Facility

• April 2014: First direct release of juvenile spring-run into the river for study purposes; continued annually since then.
Salmon Reintroduction

• 2012 – 2016: Adult fall-run Chinook salmon trapped and transported from Reach 5 to spawning habitat in Reach 1

• 2016 – 2018: Adult spring-run Chinook salmon released to holding areas below Friant Dam to begin to assess holding and spawning habitat

Fall-run Chinook salmon released to Reach 1

Spring-run Chinook salmon equipped with acoustic telemetry transmitters before release
Juvenile Salmon Monitoring

Juvenile Releases

• 2014: 60,114 (FRFH)
• 2015: 54,924 (FRFH)
• 2016: 57,320 (FRFH) and 47,560 (SCARF)
• 2017: 38,106 (FRFH) and 51,044 (SCARF)
• 2018: 207,848 (SCARF)
• 2019: 206,295 (SCARF)

• Coded Wire Tag Implantation
• Rotary screw trap monitoring
• Juvenile Salmon Acoustic Telemetry Transmitter Surgery
Smolt index used to categorize life stage of captured Chinook Salmon:

<table>
<thead>
<tr>
<th>Smolt Index</th>
<th>Life Stage</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Yolk-sac Fry</td>
<td>• Newly emerged with visible yolk sac</td>
</tr>
</tbody>
</table>
| 2           | Fry         | • Recently emerged with sac absorbed (button up fry)  
• Seam along mid-ventral line visible  
• Pigmentation undeveloped |
| 3           | Parr        | • Seam along mid-ventral line not visible  
• Scales firmly set  
• Darkly pigmented with distinct to slightly faded parr marks  
• No (to slight) silvery coloration |
| 4           | Smolt       | • Parr marks highly faded or absent  
• Bright silver or nearly white coloration  
• Scales easily shed (deciduous)  
• Black trailing edge on caudal fin  
• More slender body |
Chinook Salmon Emergence Study

- Quantify the spawning success of translocated females and determine the spatial and temporal distribution of spawning.

- Estimate the number of translocated adult salmon that spawned.

- Determine the number of fry produced among observed redds.

- Relate fry production within observed redds to environmental

- Emergence traps set on 10 redds November through January

- Fry captured in 6 out of 10 traps
Chinook Salmon Emergence Study

• Quantify the spawning success of translocated females and determine the spatial and temporal distribution of spawning.

• Estimate the number of translocated adult salmon that spawned.

• Determine the number of fry produced among observed redds.

• Relate fry production within observed redds to environmental

• Emergence traps set on 10 redds November through January

• Fry captured in 6 out of 10 traps
Juvenile Salmon Monitoring

2017 – 2018: First Confirmed Successful Spawning of spring-run Chinook salmon on the San Joaquin River in over 60 years
Salmon Conservation and Research Facility (SCARF)

- Broke ground in April 2017 with anticipated completion in 2020
- Construction Cost = $23.7 million (state $)
- Develop captive broodstock
- Create experimental population (Feather River stock)
- 1M juvenile salmon annually
Not just Chinook Salmon…

Over 12,000 Pacific lamprey were detected in the Restoration Area in 2018.

White sturgeon captured in fyke net near Merced River confluence in March 2019
Questions?