Water Education Foundation’s Bay-Delta Tour

The EBMUD Bay-Delta Nexus

Benjamin Bray, Ph.D. P.E
Senior Civil Engineer
Presentation Outline

• EBMUD Water and Wastewater System Overview
• Water Supply Considerations
• EBMUD Mission

Mokelumne Aqueducts
Who We Are

- Water & Wastewater Services
- Water service to 1.4 million people
- Wastewater service to 685,000 people
- Westside: Crockett to San Lorenzo

Eastside: Walnut Creek to San Ramon
A Little Bit About the East Bay Municipal Utility District (EBMUD)

WATER SUPPLY

MOCKELMINE RIVER WATERSHED

WATER SERVICE AREA

EBMUD RESERVOIRS

SACRAMENTO SAN JOAQUIN DELTA

WASTEWATER SERVICE AREA

RETAIL WATER SERVICE
Area served: 332 square miles
Population served: 1.3 million
Service to 20 cities and 15 unincorporated communities

WASTEWATER SERVICE
Area served: 885 square miles
Population served: 685,000

RECREATIONAL OPPORTUNITIES
Hiking: 166 miles of trails, boating, fishing, camping, and riding on 56,000 acres of watershed lands

MOCKELMINE RIVER WATER SUPPLY
Water rights: 264,000 acre-feet per year

PARDEE RESERVOIR
Capacity: 187,950 acre-feet
Provides water supply, hydroelectric power, and recreation

CAMANCHE RESERVOIR
Capacity: 415,320 acre-feet
Provides flood control, hydroelectric power, irrigation, recreation, fisheries, and supplemental storage

SACRAMENTO RIVER WATER SUPPLY
Supplemental supply for dry years from the Sacramento Regional Water Facility not to exceed 160,000 acre-feet over any 3-year period

WATER CONSERVATION
Target of 125,000 acre-feet (2050)

WATER RECYCLING
Target of 22,000 acre-feet (2040)
Mokelumne Watershed
Unimpaired Runoff

Unimpaired Flow Estimate at Mokelumne Hill (Million Acre-Feet)

Water Year

Normal and Above  Below Normal  Dry  Critically Dry

Drought Management Program

**Figure 3-2**

**Drought Management Program Guidelines**

<table>
<thead>
<tr>
<th>Total System Storage</th>
<th>Drought Stage</th>
<th>Supplemental Supply Needed</th>
<th>Customer Demand Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>500 TAF</td>
<td>Stage 0 Normal</td>
<td>0</td>
<td>Wise Water Use</td>
</tr>
<tr>
<td>450 TAF</td>
<td>Stage 1 Moderate</td>
<td>0</td>
<td>Voluntary 0–15%</td>
</tr>
<tr>
<td>390 TAF</td>
<td>Stage 2 Significant</td>
<td>0–35,000 AF</td>
<td>Voluntary 0–15%</td>
</tr>
<tr>
<td>325 TAF</td>
<td>Stage 3 Severe</td>
<td>35,000–65,000 AF</td>
<td>Mandatory 0–15%</td>
</tr>
<tr>
<td></td>
<td>Stage 4 Critical</td>
<td>&gt;65,000 AF</td>
<td>Mandatory ≥15%</td>
</tr>
</tbody>
</table>

TSS - Total System Storage
Includes Pardee, Camanche, Upper San Leandro, Briones, Lafayette, Chabot, and San Pablo Reservoirs

Source: EBMUD UWMP 2015 Update, Fig. 3-2, pg. 31.
Freeport Regional Water Project (FRWP)

**Partners**
- Freeport Regional Water Authority (FRWA)
- Sacramento County Water Agency (SCWA)
- East Bay Municipal Utility District (EBMUD)
- US Bureau of Reclamation (USBR)

**Project**
- 185 MGD Regional Facility
  - 100 MGD EBMUD
  - 85 MGD SCWA
- 3 Pumping Plants
- 36 miles of transmission pipelines
- Project complete Nov. 2011
BASED ON A TRUE STORY
1987 - Critically Dry Water Year

October 1987 - Fish mortality attributed to numerous WQ factors

October 4, 1988 - Camanche drops to historical low ~8,530AF

March 22, 1988 - Water Shortage
Emergency declared due to drought

July 1, 1991 - FERC issues license modification proceeding for LMR Project No. 2916-004

1992 - U.S. FWS Intervened in FERC proceeding
EBMUD Mission Statement

To manage the natural resources with which the District is entrusted; to provide reliable, high quality water and wastewater services at fair and reasonable rates for the people of the East Bay; and to preserve and protect the environment for future generations.

(c. 1991)
Historical Context

1987 - Critically Dry Water Year
October 1987 - Fish mortality attributed to numerous WQ factors
1988 October 4 - Camanche drops to historical low ~8,530AF

1992 - U.S. FWS Intervened in FERC proceeding
1993 - WQQRS 1D temperature model developed by Systech
1996 - Parties Execute POA

1993 - EBMUD $1.2M project to install HOS
July 16, 1993 - EBMUD proposes settlement offer

March 22, 1988 - Water Shortage Emergency declared due to drought
July 1, 1991 - FERC issues license modification proceeding for LMR Project No. 2916-004
July 16, 1993 - EBMUD proposes settlement offer
1996 - Parties Execute POA
March 23, 1998 - JSA signed
June 1999 - LMRP WQRMP signed

C. 1994 - EBMUD expands monitoring program esp. WQ data collection

2005 - model assessment of temperature modeling capabilities
2007 - 2D model development for Pardee and Camanche completed

EBMUD
In February 1996, EBMUD, USFWS, and CDFG reached consensus on Principles of Agreement that were the foundation for the 1998 Joint Settlement Agreement (JSA).

The JSA established a set of minimum flow criteria.

The JSA Established Water Quality requirements as well for Public Trust Resources.

JSA also has clauses establishing Adaptive management & Gainsharing for supplemental supplies.
Water Release *Pre vs. Post JSA*

### Year Type
- **Critically Dry**
- **Dry**
- **Below Normal**
- **Wet**

#### Acre-feet
- **Before Mid-1990s Flows**
- **Joint Settlement Agreement Flows**

The graph shows the comparison of water release before and after the Joint Settlement Agreement (JSA) for different year types.
## Release Criteria: JSA Contd.

<table>
<thead>
<tr>
<th>Period</th>
<th>Life Stage</th>
<th>Camanche Release (cfs)</th>
<th>Below Woodbridge Dam&lt;sup&gt;b&lt;/sup&gt; (cfs)</th>
<th>Year Type and Releases</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Normal and Above Normal</td>
<td>Below Normal</td>
<td>Dry</td>
</tr>
<tr>
<td>Oct 1-15</td>
<td>Adult migration</td>
<td>325</td>
<td>100</td>
<td>220</td>
</tr>
<tr>
<td>Oct 16-31</td>
<td>Spawning/incubation</td>
<td>325</td>
<td>100</td>
<td>220</td>
</tr>
<tr>
<td>Nov 1-Mar 31&lt;sup&gt;a&lt;/sup&gt;</td>
<td>Spawning—fry rearing</td>
<td>325</td>
<td>100</td>
<td>220</td>
</tr>
<tr>
<td>Apr 1-30</td>
<td>Fry rearing</td>
<td>325&lt;sup&gt;c&lt;/sup&gt;</td>
<td>150</td>
<td>220</td>
</tr>
<tr>
<td>May 1-31</td>
<td>Fry and juvenile rearing</td>
<td>325&lt;sup&gt;c&lt;/sup&gt;</td>
<td>300</td>
<td>220</td>
</tr>
<tr>
<td>Jun 1-30</td>
<td>Outmigration</td>
<td>325&lt;sup&gt;c&lt;/sup&gt;</td>
<td>300</td>
<td>250&lt;sup&gt;c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Jul 1-Sep 30</td>
<td>Oversummer</td>
<td>100</td>
<td>25</td>
<td>100</td>
</tr>
</tbody>
</table>

<sup>a</sup> Approximate period when Woodbridge Irrigation District (WID) dam (Woodbridge Dam) boards are out and Lodi Lake is empty.

<sup>b</sup> When WID board dams are out, it is expected that flow downstream of Woodbridge Dam will be at least as high as the value shown, but East Bay Municipal Utility District (EBMUD) would not be required to release more than the specified amount from Camanche Reservoir. During the other periods, Camanche releases must be sufficient to meet the specified flow below Woodbridge Dam.

<sup>c</sup> For normal, above normal, and below normal years, extra flows will be released from Camanche Reservoir during April–June depending on the combined Pardee and Camanche storage for the end of the prior month as follows:

- < 10 thousand acre feet (TAF) below maximum allowable storage (BMAS), additional release is 200 cfs for subsequent month.
- 10 TAF ≤ BMAS < 20 TAF, additional release is 150 cfs for subsequent month.
- 20 TAF ≤ BMAS < 30 TAF, additional release is 100 cfs for subsequent month.
- 30 TAF ≤ BMAS < 40 TAF, additional release is 50 cfs for subsequent month.

<sup>d</sup> Outmigrating smolts will be trapped, tagged, and transported around the Sacramento-San Joaquin River Delta.
Water Supply Operations Criteria

Pardee and Camanche Reservoirs are operated in an integrated manner to meet and balance a myriad of obligations:

- Water supply
- Fishery Requirements
  - Joint Settlement Agreement (FERC)
  - SWRCB D-1641
- Water rights & obligations to downstream diverters
- Flood control
- Hydropower generation
- Recreation
# Lower Mokelumne River Fall-Run Chinook Salmon Annual Escapement, 1940-2018 and Contribution to Ocean Fisheries

<table>
<thead>
<tr>
<th>Year</th>
<th>Actual Mokelumne Fall-Run Chinook Returns</th>
<th>CVPIA Goal</th>
<th>In-River Spawning</th>
<th>Mokelumne Fishery’s Share of Total California Off-Coast Catch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Commercial</td>
</tr>
<tr>
<td>2017</td>
<td>19,954 fish</td>
<td>9,300 fish</td>
<td>5,635 fish</td>
<td>20%</td>
</tr>
<tr>
<td>2018</td>
<td>17,474 fish</td>
<td>9,300 fish</td>
<td>10,194 fish</td>
<td>43%</td>
</tr>
</tbody>
</table>

![Graph showing annual escapement and contribution to ocean fisheries from 1940 to 2018]