Constructing the Nation’s Largest Ion Exchange PFAS Water Treatment Plant

Presenter: Kelsey Hakes
Co-Authors: OCWD and Yorba Linda Water District
Outline

• Introduction to OCWD
• Overall PFAS Program
• Yorba Linda Water District PFAS Treatment Plant
Introduction to OCWD and their PFAS Treatment Program
Orange County Water District

• OCWD was formed in 1933 to
  – Manage the OC Groundwater Basin
  – Protect rights to Santa Ana River water

• Provide groundwater to
  – 19 municipal and special water districts
  – 2.5 million residents

• Basin provides 77% of the water supply for north & central OC
Extent of PFAS Impact in OCWD Service Area

Current California DDW NL/RLs:

**Notification Levels:**
- PFOA = 5.1 ng/L
- PFOS = 6.5 ng/L
- PFBS = 500 ng/L

**Response Levels:**
- PFOA = 10 ng/L
- PFOS = 40 ng/L
- PFBS = 5,000 ng/L

*Public Health Goal (PHG) process has begun, as required initial step to develop Maximum Contaminant Level (MCL)*

- 11 water retailers (i.e., groundwater “Producers”) and over 60 wells in the OCWD service area impacted by 10 ng/L PFOA Response Level

- Up to ~ 1/3 of groundwater basin production (100,000 afy) unable to be served
Actions Taken

• 2019 - Planning Study for 10 impacted Producers

• 2019 - pilot testing of IX and GAC, phase I done, started phase II

• Late 2019, OCWD adopted a PFAS policy to design/construct

• Early 2020, pre-purchase of 55 vessel systems between two vendors and awarded 6 on-call consultants for design
Orange County Water District
PFAS Treatment Systems Planning Study

Producer Report
YORBA LINDA WATER DISTRICT

FINAL | August 2020
Actions Taken

- 2019 - Planning Study for 10 impacted Producers
- 2019 - pilot testing of IX and GAC, phase I done, started phase II
- Late 2019, OCWD adopted a PFAS policy to design/construct
- Early 2020, pre-purchase of 55 vessel systems between two vendors and awarded 6 on-call consultants for design
OCWD Pilot Program  Installed pre-fab building to house pilot

Phase I: 8 GAC (10-min EBCT) + 4 IX (2-min EBCT) + 2 alternative adsorbents
Actions Taken

• 2019 - Planning Study for 10 impacted Producers
• 2019 - pilot testing of IX and GAC, phase I done, started phase II
• Late 2019, OCWD adopted a PFAS policy to design/construct
• Early 2020, pre-purchase of 55 vessel systems between two vendors and awarded 6 on-call consultants for design
Yorba Linda Water District PFAS Treatment Plant
District History

• Established in 1909
• 25,000 service accounts
• 9 groundwater wells
• 14 reservoirs
• 12 booster pump stations
• 4 imported water connections
• 25 MGD PFAS Water Treatment Plant
PFAS Treatment Plant Tours

Granulated Activated Carbon (GAC)

Membrane (Reverse Osmosis or Nanofiltration)

Ion Exchange (IX)
PFAS Treatment Pilot Test
Option 1 – 3 PFAS Water Treatment Plants
Option 2 - Centralized Plant at YLWD Headquarters
## PFAS Water Treatment Plant Schedule & Budget

<table>
<thead>
<tr>
<th>Description</th>
<th>Dates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>May 2020 – February 2021</td>
</tr>
<tr>
<td>Construction</td>
<td>February 2021 – February 2022</td>
</tr>
<tr>
<td>Regulatory Approval</td>
<td>November 2021 (est.)</td>
</tr>
<tr>
<td>Resin Delivery (Staged)</td>
<td>December 2021 – February 2022</td>
</tr>
<tr>
<td>Substantial Completion (Serve Water)</td>
<td>December 2021</td>
</tr>
<tr>
<td>Project Completion</td>
<td>February 2022</td>
</tr>
<tr>
<td>Ribbon Cutting Celebration</td>
<td>Spring 2022 (est.)</td>
</tr>
</tbody>
</table>

### Total Capital Budget
- **$27 million**

### Annual O&M Budget
- **$150/Acre-ft**
Flyover of the PFAS Water Treatment Plant
<table>
<thead>
<tr>
<th>Equipment</th>
<th>Details</th>
<th>Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 Pre-filters</td>
<td>Diameter: 6 ft Height: 8 ft-8 in</td>
<td>5 MGD ea.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>40 Bag filters ea. (240 total)</td>
</tr>
<tr>
<td>11 IX Trains</td>
<td>22 Vessels</td>
<td>1.4 to 2.3 MGD each Train</td>
</tr>
<tr>
<td></td>
<td>Diameter: 12 ft Height: 14 ft 3/8 in</td>
<td>(14,000 gallons each vessel)</td>
</tr>
<tr>
<td>Resin for 22 Vessels</td>
<td>2 Minute EBCT per vessel</td>
<td>424 CF ea.</td>
</tr>
<tr>
<td>6 Vertical Turbine Booster Pumps, VFDs</td>
<td>100 Hp</td>
<td>5 MGD ea.</td>
</tr>
<tr>
<td>4 Surge Tanks</td>
<td>Headquarters</td>
<td>8,000 Gallons</td>
</tr>
<tr>
<td>- HQ</td>
<td>Diameter: 10 ft, Height: 19 ft</td>
<td></td>
</tr>
<tr>
<td>- Well 20</td>
<td>Wells</td>
<td>1,000 Gallons ea.</td>
</tr>
<tr>
<td>- Well 21</td>
<td>Diameter: 5 ft, Height: 13 ft-6 in</td>
<td></td>
</tr>
<tr>
<td>- Future Well 22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 (Level 2 Sound Attenuated) Generators</td>
<td>Length: 27 ft-6 in, Height: 11ft-6 in</td>
<td>1000 kW ea.</td>
</tr>
<tr>
<td>Chlorination Facilities</td>
<td>Brine Tank</td>
<td>12,690 Gallons - check</td>
</tr>
<tr>
<td>Brine Tank</td>
<td>Diameter: 12 ft, Height: 15 ft - check</td>
<td></td>
</tr>
<tr>
<td>2 Hypochlorite Tanks</td>
<td>Hypochlorite Tanks</td>
<td>???? Gallons</td>
</tr>
<tr>
<td>6 Water Softeners, 3 OSHG Trains</td>
<td>Diameter: 12 ft, Height: 15 ft - check</td>
<td></td>
</tr>
<tr>
<td>Perimeter Wall</td>
<td>Length: 780 ft, Height: 8 ft</td>
<td>n/a</td>
</tr>
</tbody>
</table>
Vessel Train Configuration (Lead/Lag)
Construction Challenges

- Covid:
  - Labor shortage
  - Supply chain issues
    - Early submittals or equipment pre-purchase are essential
  - Increased construction costs
  - Long lead time for power and gas agency reviews
- Schedules – Delays cost $
  - Frequent updates/ critical path items
- Conflicts with infrastructure
  - As-buils not accurate

- Geotechnical Investigation - Soils!
- Potholing
- Impact on Operations
  - Loss of gas/ electricity/ communications
  - Parking
  - Deliveries/ equipment
  - Staging area
- Operations impact on construction
- Vendors, contractors, consultants
Special Thanks to Our Team!

OCWD
Tetra Tech
Pacific Hydrotech
Purolite ECT2
AqueoUS Vets
Evoqua
RKI Engineering
Carollo Engineers