Salinas Valley
Distributed Water Treatment Project

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Goals of the Salinas Valley Distributed Water Treatment Project

A reliable and affordable option for supplying safe drinking water to disadvantaged communities (DACs) where consolidation or alternate local well(s) are infeasible/impractical.

**Issues:**
- DACs do not have the expertise to operate water treatment facilities
- The operation of water treatment systems must be affordable

To demonstrate that geographically separate but virtually networked (autonomous but remotely monitored/operated) treatment systems can be operated in several communities with economies of scale at affordable operating costs.

Work with the Regional Board to:

- Demonstrate septic tank suitability for residuals discharge from water treatment systems in small rural disadvantaged communities.
Wellhead water treatment in small disadvantaged agricultural communities

Major steps in deployment and field operation of RO Treatment for Nitrate removal from impaired groundwater in Small Remote Communities:

- Integrated efforts (government, industry, academic sectors) for RO field deployment
- Establish sustainable operating conditions in harmony with site-specific conditions (e.g., source water characteristics, septic tank capacity) and regulatory compliance
- Field operation to establish cost effectiveness and performance of distributed RO treatment systems
- Demonstrate the use of community septic tank for handling nitrate-laden RO residual stream

Pilot Communities in Northern California

- Site A: Population: 16 (11 residential units)
- Site B: Population: 36 (8 residential units)
- Site C: Population: 34 (10 residential units)
### Pilot Project: Distributed membrane-based water treatment in disadvantaged communities

<table>
<thead>
<tr>
<th>Community</th>
<th>No. Single Family Units</th>
<th>Population</th>
<th>Average/Max Water Consumption (gal/day) (^{(a)})</th>
<th>Nitrate Level in Source Water (mg/L NO3-N)</th>
<th>Salinity (mg/L Total Dissolved Solids)</th>
<th>Septic Tank Capacity, Gallons</th>
<th>Retention time, days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site A</td>
<td>11</td>
<td>16</td>
<td>1013/1996</td>
<td>52.2-55.6 (2019-2020) 26.4-39.6 (2016 - 2018)</td>
<td>1126-1500</td>
<td>4,500</td>
<td>(2.3 - 4.44)</td>
</tr>
<tr>
<td>Site B</td>
<td>8</td>
<td>36</td>
<td>2520/3597</td>
<td>22.6 (Well #6) ((Old well: 83.5))</td>
<td>1160 (Well #6) ((Old well: 2085))</td>
<td>5,000</td>
<td>(1.4 – 2)</td>
</tr>
<tr>
<td>Site C</td>
<td>10</td>
<td>34</td>
<td>1246/2826</td>
<td>~10-11</td>
<td>554-594</td>
<td>5,000</td>
<td>(1.8 -4)</td>
</tr>
</tbody>
</table>

\(^{(a)}\) Determined via smart water meters (installed in 2016)
Impaired Groundwater: Nitrate Removal & Salinity Reduction via RO Treatment

- Treatment system design and operational attributes:
  - Satisfy water quality requirements
  - High recovery operation
  - Self-adaptive operation
  - Remotely monitored/controlled

Temporal variability of water quality & demand

Feed → RO → Permeate → Storage Tank → Pressure Tank → Concentrate

Discharge of community wastewater & treatment residual stream to septic tank

Septic Tank → Bacteria → Nitrification → NO₃⁻

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Choi et al., J. Env. Management, 250, 109487. doi.org/10.1016/j.jenvman.2019.109487
Project stakeholders

- UCLA Project team
- Property owner
- Residents
- Greater Monterey community
- State and local elected representatives
- State Water Resources Control Board, Division of Drinking Water
- Central Coast Water Quality Control Board
- Monterey County Health Department, Environmental Health Department, Drinking Water Program
- Monterey County Resources Management Agency, Building Services Department

Significant community outreach activities have been ongoing since the beginning of the project with the objectives of:

• 2015-2019:
  • Informing the residents of the basic treatment technology
  • Demonstrating the water treatment technology
  • Respond to questions by the residents
  • Coordinate scheduling of site visits to carry out various elements of the project work
  • Informing the residents and owners regarding the project status project along its various stages

• 2020-2021
  • The COVID-19 pandemic has impacted our Outreach Program more than any other part of the project
  • In-person outreach has been postponed since the beginning of the COVID-19 Pandemic (~March 2020)
  • The project team maintained communications, with three owners regarding infrastructure upgrade, by phone, Zoom and in-person (adhering to PPE and social distancing guidelines); Also, unplanned encounters with residents while onsite.
  • It is crucial to re-energize the project outreach program in order to build confidence in the drinking water program.
Blue Rock Water Treatment System & Monitoring

- Feed filtration, high recovery RO, high nitrate rejection & salinity reduction, permeate remineralization, chlorination
- 10 grab sampling locations
  - Water quality, water use and discharge
  - 36 analytes
  - Frequency - M:5; Q: 15; SA: 11; A: 4
- Real-time monitoring:
  - Flow rates (7 sensors)
  - Conductivity (feed, product water, discharge)
  - Product water nitrate concentration
  - Pressure (7 sensor locations)
  - Tank water levels (feed, product & residual)
- Monitoring frequency
  - Online sensors (every 2 seconds)
  - Data logging range: every 5 s – 30 s
  - Data logging every 5 min during idle time
  - Water use meter: data logging every 5 min
Remote Monitoring and System Control

Remote system/process monitoring:
Example of monitored process parameters: water production, consumption, storage · water quality parameters · Operating parameters · RO operational states (e.g., on/off, flushing, product delivery)
### Septic Tank Influent and Effluent Nitrate Sampling

<table>
<thead>
<tr>
<th>Date</th>
<th>RO residual Brine (mg/L as N)</th>
<th>Septic tank Influent (mg/L as N)</th>
<th>Septic tank Effluent (mg/L as N)</th>
<th>Septic denitrification (% removal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/28/2020</td>
<td>133</td>
<td>31.9</td>
<td>1.4</td>
<td>95</td>
</tr>
<tr>
<td>8/25/2020</td>
<td>158</td>
<td>44.5</td>
<td>0.5</td>
<td>98</td>
</tr>
<tr>
<td>9/29/2020</td>
<td>146</td>
<td>52.1</td>
<td>ND</td>
<td>~100</td>
</tr>
<tr>
<td>10/27/2020</td>
<td>129</td>
<td>126.4</td>
<td>0.1</td>
<td>99.9</td>
</tr>
<tr>
<td>11/24/2020</td>
<td>135</td>
<td>133</td>
<td>0.4</td>
<td>99.7</td>
</tr>
<tr>
<td>12/29/2020</td>
<td>147</td>
<td>142.5</td>
<td>0.1</td>
<td>99.9</td>
</tr>
</tbody>
</table>

**ND:** non detect

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Blue Rock View
Water Treatment system
Summary of Monitoring Results
July, 2020 – January 2021

• **Operation**
  – No alarms or emergencies since the operation of the water treatment system commenced on July 4, 2020
  – The required local back up operator was not needed during since the beginning of commissioning

• **Compliance monitoring data**
  – Nitrate levels in well water have doubled since 2016 (from ~25 mg/L to ~50 mg/L NO3-N)
    • Daily average product water nitrate level range: 5.05 – 6.3 mg/L NO3-N
    • Range of daily max nitrate level in product water: 5.39 – 7.4 mg/L NO3-N
  – Lead and copper tap monitoring indicated that lead and copper have not leached out of the pipe distribution system.
    • Lead conc <2.3 µg/L (MCL=15 µg/L); Copper conc <190 µg/L (MCL=1300 µg/L)
  – No bacteria detected in well water, RO product water or delivered
  – Nitrate influent into the septic tank is denitrified in the Septic Tank by up to 95%-100%
2020-2021 Accomplishments: Safe Drinking Water Delivery at Blue Rock and Beginning of Site Development at Santa Teresa and Pryor Farms

January – June 2020
Installation, cyberinfrastructure, system dry/wet testing

October 16, 2020
Building Permits Issued for Santa Teresa Village and Pryor Farms

June 30, 2020
Completed pre-commissioning at Blue Rock

July 4, 2020 – November 5, 2020
Completed commissioning the Blue Rock Water treatment system
Water Service to residents started on August 29, 2020—Bottled Water Order lifted

August 2019 – July 2020
All three License Agreements between UCLA and Water System Owners were signed, notarized and recorded

September- December, 2020
Subcontracts for site upgrade finalized and site upgrade details completed for all three sites

January 8, 2021
Site construction begins at Santa Teresa and Pryor Farms communities, under contracts) and site infrastructure upgrade components procured and delivered.

January 8, 2021
Fabrication and initial testing of water treatment systems for Santa Teresa and Pryor Farms completed (presently in storage at factory).

January 13, 2021

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Site Infrastructure Upgrades

- Site investigation & community engagement
- Permits from State and County
- Design of treatment system layout/piping/electrical systems
- Plumbing/electrical work contracts
- Piping infrastructure
  - Treatment system & storage tanks
  - Concrete pad for treatment system
  - Trenching and Piping network (feed, product and residual streams)
- Electrical
  - Power to shed/treatment system
  - Power meters, tank level sensors
  - Controls for well & delivery pumps
Plans for 2021

January 8 - March 31, 2021
Site infrastructure upgrades completed in Santa Teresa Village and Pryor Farms
Approval of site infrastructure upgrades

April 1-15, 2021
Santa Teresa Village and Pryor Farms water treatment systems shipped to the two sites and installed

April 16 – May 15, 2021
Onsite pre-commissioning of water treatment systems (testing of hardware and cyberinfrastructure)

August-September 2021
Monterey County Lifts the Bottled Water Order on Santa Teresa and Pryor Farms and Residents are allowed to drink the water.

May – August, 2021
Commissioning of water treatment systems at Santa Teresa Village and Pryor Farms

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This Project Defies the Typical in Regulatory Practice

**Typical**

1. Owner of the System is the Applicant or Consultant
2. Applicant for Permits is the Owner or Consultants
3. Traditional Operations are by Onsite Water System Operator
4. Waste Flows from a Water Treatment system are never discharged to a septic system
5. Permits are issued one at time for each location; each treatment system is unique.

**This Project**

1. Owner of the System is the University
2. Permit Applicant is the UCLA
3. Operations are managed remotely
4. Waste Flows are discharged and denitrified in a septic system
5. One permit is the template for the rest: single operating system
Regulatory Requirements and Guidance

Regulatory Requirements

- CEQA Compliance
- County Building Permits for Site Improvements
- County of Monterey Drinking Water Permit for the Treatment System in collaboration with Statewide DDW
- Discharge Permits from the Central Coast Regional Water Quality Control Board

Regulatory Guidance

- Biweekly Meetings with DDW, County of Monterey Drinking Water Program and Division of Financial Assistance to Report and Receive Guidance each step of the process
- Regional Board participation in project briefings
- Extraordinary Level of Guidance by Regulators
Future Goals:

• Drinking Water Permits for all Three Systems
• Reports of Waste Discharge for all Three Systems
• Economies of scale analysis
• Search for permanent operator
Questions?