



ADVANCED PURIFICATION PILOT STUDY

CITY OF SPRING HILL, TN



502 Hazelwood Drive | Smyrna, TN 37167 | 615.220.5800 | thomasandhutton.com

FIRM INFORMATION

Established in 1946, Former US Army Corps of Officers, Hue Thomas and Joe Hutton, joined forces and opened an engineering firm in Savannah, GA. Today, Thomas & Hutton stands as one of the most well respected and established consulting and engineering firms in the Southeast with over 400 employees throughout nine regions in North Carolina, South Carolina, Georgia, and Tennessee. Headquartered in Savannah, GA, Thomas & Hutton also has 12 other office locations in Smyrna and Nashville, TN; Chamblee, Buford, Covington, and Brunswick, GA; Charlotte and Raleigh, NC; and Charleston, Columbia, Greenville, and Myrtle Beach, SC.

As we celebrate 75 years of experience, Thomas & Hutton proudly utilizes our technology and associated technical resources, providing innovative solutions to complex engineering and design challenges. Our talented people design infrastructure that breathes life into our communities, brings prosperity and jobs, and are catalysts in delivering our promises that cultivate meaningful relationships.



Thomas & Hutton provides comprehensive solutions to complex engineering and design challenges to a diverse group of private and public clients. We provide professional consulting; civil, environmental, structural and marine, transportation, water resources, and water and wastewater engineering; surveying; planning; landscape architecture; geographic information system (GIS), and construction administration services to clients in an array of markets in Georgia, South Carolina, North Carolina, Tennessee, and throughout the southeast.

DRIVEN FOR SOLUTIONS. POWERED BY PASSION.

Thomas & Hutton offers a multidisciplinary range of services to assist clients in project success. Our passion is providing civil engineering and related services to design places that become timeless, that transform into a vibrant place full of vitality, and that build a strong sense of community. Creating devices, techniques, and implementation strategies that help build a better vision and a healthier community are a part of our overall culture.

We are a tight knit privately held corporation that works efficiently on projects while maintaining close client professional relationships. Our principals are actively involved with client communications and project performance. Our project managers, surveyors, design engineers, landscape architects, and GIS professional personnel assure that each project is completed efficiently according to the scope, schedule, and budget.

**Thomas & Hutton projects are more than just job numbers. They are
Places. Communities. Foundations. Legacies. Life.**

QUALIFICATIONS

Thomas & Hutton provides a full array of engineering services to public and private clients throughout the Southeast. We provide water and wastewater services started from conceptual planning through close-out, start-up, and commissioning.

Thomas & Hutton designs water and wastewater infrastructure with the future in mind. Our talented staff are passionate and stand firmly behind designing facilities that ultimately create the essential framework of healthy and thriving communities.

Our scope of services includes:

- Surface Water Supply and Treatment
- Groundwater Supply and Treatment
- Industrial Water Supply
- Desalination and Reverse Osmosis Systems
- Water Transmission and Distribution Systems
- SCADA and Control Systems
- Horizontal Directional Drilling (HDD)
- Jack and Bore/Microtunneling
- Hydraulic Modeling, Conceptual Planning, and Route Selection
- Pipeline, Assessment, and Rehabilitation
- Survey, Easements, Plats, Record Drawings, and Construction Staking
- GIS, Cloud-Base GIS Management, and Data Collection
- Municipal Wastewater Treatment Systems
- Industrial Wastewater Systems
- Sanitary Sewer Collection and Conveyance Systems
- Force Main, Vacuum Sewers, and Low-Pressure Manifolded Systems
- Pump Station Design and Rehabilitation
- Water Reuse and Reclaimed Water
- Inflow & Infiltration (I&I) Analysis and Rehabilitations
- Sanitary Sewer Overflow Abatement
- Watershed Assessment and Protection Plan
- Odor Control
- Sludge/Biosolids Treatment, Dewatering, and Disposal
- NPDES/NS Permitting, Effluent Discharge, and Land Application Systems
- Operator Training, O&M Manuals, and Commissioning



TEAMING PARTNER



Carollo is an industry-recognized leader in potable reuse through planning, pilot testing, design, and implementation of advanced water purification processes. Their professionals are passionate about the success of Spring Hill and bring innovative solutions to global issues with water supply and across all facets of water management. Their clients range from a few thousand to a few million from all around the country. Their team has been leading applied research, planning, pilot testing, and design work for potable reuse in many different states.

Carollo's experience ranges from designing and operating small pilot-scale water purification facilities (20 liters per minute) to regional evaluations of water management and water supply. The technical challenges and community sensitivities of sourcing drinking water from nontraditional sources of supply. For example, their team is leading planning level work in San Francisco to find new water through direct potable reuse (DPR), facing a challenging public that has for years relied upon one of the most protected (and tasty) water supplies from the Hetch Hetchy Valley. Adding purified recycled water, no matter how high the quality, is a public outreach challenge.

300+ Recycled water and reclamation projects	7+2 Helped develop reuse guidelines and regulations for 7 US states PLUS the National Water Research Institute PLUS the World Health Organization
100+ Billion liters of recycled water each year	
60+ Potable reuse projects over the past 10 years	



Advanced Purification Pilot Study
City of Spring Hill, Tennessee

PROJECT ORGANIZATIONAL CHART

KEY

Thomas & Hutton

Carollo



**Principal-in-Charge &
Project Manager**
Jerome Dempsey, PE

Thomas & Hutton Team

Lead

Jerome Dempsey, PE

Environmental Project Coordinators/ Project Engineers

Ryan Chamblee, PE (Smyrna)
Lisa Muzekari, PE, ENV SP (Columbia)
Trent Thompson, PE (Savannah)

Process Engineers

Fred Sororian, PE
Chris Stovall, PE, LEED AP BD+C

Designer

Brianna Nugoy

Carollo Team

Lead

Chris Cleveland, PE

Regulatory, Water Quality, and Process Engineer

Eva Steinle-Darling, Ph.D, PE

Pilot Project Engineer

Sarah Clark, PE

Pilot Data Manager

Pranjali Kumar, PE



JEROME DEMPSEY, PE

Principal-in-Charge | Project Engineer

Jerome has 36 years of experience in various types of municipal projects with responsibilities including project management, client management, engineering design, quality assurance/quality control (QA/QC), and construction management. His projects include municipal water and wastewater treatment facilities, utilities, roadways, storm water drainage design, site design and development, and municipal facilities.

Project Experience

Smyrna Wastewater Treatment Plant Expansion (5.85 MGD to 9.0-MGD):

Expansion of the Smyrna Wastewater Treatment Plant (WWTP) consisted of upgrading all components of the existing wastewater treatment to process 9.0-million gallons per day, from 5.85-million gallons per day. Improvements included new and expanded components for the headworks screening-grease removal, influent lift station, anaerobic basin-flow splitter cells, oxidation basins-biological treatment processes, clarifiers, scum pumps and screening, tertiary filtration, UV disinfection, post aeration, returned activated sludge, waste activated sludge, aerobic digestion, centrifuge solids dewatering, and (Supervisory Control and Data Acquisition) SCADA system.

The expansion was designed based on flows of an average daily flow of 9.0-million gallons per day, peak daily flow of 16.0-million gallons per day, and peak hourly flow of 21.0-million gallons per hour. The project required applying for and obtaining an expanded NPDES (National Pollutant Discharge Elimination System) permit to allow an increased discharge into an existing 303d listed stream which has a 0.0 cubic feet per second, 7Q10 flow (lowest seven-day average stream flow occurring every ten years).

The key to keeping the project on track was facilitating constant communication with state regulators in implementing an advanced nutrient removal process. This process kept the same existing NPDES permit's nutrient waste load allocations/discharge poundage. To achieve this, an engineering design alternatives analysis report was performed to determine the most viable process that could achieve the required lower nutrient discharge concentrations of both total nitrogen and phosphorous.

After evaluating numerous treatment processes, the biological treatment process selected for the expanded portion (3.0-million gallons per day) of **the plant was the five-stage Bardenpho**

Advanced Nutrient Removal process. In addition, the existing WWTP components consisted of the extended-aeration activated sludge process which required an extensive conversion to a three-stage Bardenpho Advanced Nutrient Removal process, for a design flow rate of 6.0 million gallons per day. The effluent flows from each of these two similar processes are blended after secondary clarification is complete and prior to the tertiary filtration, to have a combined design flow of 9.0 million gallons per day.

Spring Hill, TN Wastewater Treatment Expansion:

Developed the biological process scope of the project for an advanced nutrient removal process and secured the NPDES Permit for expansion from 2.0 MGD to 5.0 MGD while decreasing the mass loading that discharges to Rutherford Creek. Developed the Preliminary Engineer Report, Alternatives Analysis, Facilities Plan, Green Business Model, and preliminary equipment selection to meet the State Revolving Loan (SRL) Funding Program requirements. SRL awarded \$2.0 million of principal forgiveness due to the project's Green Business Model which decreased the carbon footprint and nutrient loadings. The project consisted of increasing the plant capacity from 2.0 MGD to 5.0 MGD utilizing an advanced biological nutrient removal process (five stage Bardenpho process) consisting of anaerobic zone, anoxic zones, aerobic zone and post aeration zone within the oxidation ditches. Other components of the expansion include two clarifiers, oxidation basin to digester conversion, solids handling upgrades, deep bed denitrification filters, ultraviolet light disinfection, and cascade stair aeration process.

Spring Hill, TN Water Treatment, Raw Water Intake and Raw Water Transmission Line:

Design Engineer and Construction Manager for all three projects. The Water Treatment Plant has a design flow of 4.0 MGD with a peak flow rate capability of 6.0 MGD and consists of two Infilco Degremont Superpulsator

Education

MS, Civil Engineering, 1996,
University of Tennessee
BS, Civil Engineering, 1992,
Tennessee State University

Professional Registrations

Professional Engineer in TN

Professional Affiliations

- American Society of Civil Engineers
- Kentucky-Tennessee Water Environment Associate
- American Water Works Association
- Tennessee Society of Professional Engineers
- Tennessee Association of Utility Districts

Core Competencies

- Project Management
- Client Management
- Engineering Design
- Quality Assurance/Quality Control
- Construction Management
- Roadway Design
- Stormwater Design
- Site Development
- Site Design
- Recreational Facilities Design
- Municipal Planning Review
- Water Studies
- Wastewater Studies
- Environmental Studies

JEROME DEMPSEY, PE

Principal-in-Charge | Project Engineer

Upflow Clarifiers with four Greenleaf Filters, 520,000 gallon clearwell, chemical feed, gas chlorination/disinfection units, two 400 horsepower (2800 gpm each) high service pumps with variable frequency drives, one 40 horsepower (3,465 gpm) backwash pump, SCADA Control System, laboratory, offices, restrooms, and electrical controls room all of which are enclosed within a 100' x 150' building. The site contains two backwash lagoons, a front entrance decorative water fountain and an emergency generator. The Raw Water Intake Facility is located on the Duck River approximately 6.5 miles from the Water Treatment Plant and consists of a 38' x 22' intake building with chemical feed room, pump room, and electrical controls room. The facility also contains a 22' x 10' x 60' deep concrete wetwell, 18" raw water intake line with hydro-burst intake screen debris purge system, and zebra mussel resistant intake screen. The facility contains two 300 horsepower (2800 gpm) raw water pumps with variable frequency drives. The facility also contains an emergency generator. The Raw Water Transmission Line consists of 33,900 linear feet of 18-inch C-905 PVC and Class 350 ductile iron pipe, 355-linear feet of 30" steel casing bore and installation under Interstate 65, thirteen air/vacuum release valves and fourteen 18" butterfly valves. The construction of the Raw Water Intake and 18-Inch Raw Water transmission Line were completed in February 2003 and the water treatment Plant was put into operations in August 2003.

Spring Hill, TN Wastewater Treatment Plant Lift Station: Project Engineer and Construction Manager -The project consisted of a 15-foot by 15-foot by 32-foot wetwell, submersible pumps, controls, jib crane, emergency generator, approximately 26 feet of 18-inch ductile iron pipe, 26-feet of 30-inch ductile iron pipe and 375 feet of 8-inch PVC force main and appurtenances. The operating design capacity of the lift station is 1500 GPM (2.16 MGD).

Winchester, TN Municipal Wastewater Plant: Project Manager/Construction Manager - The project consisted of increasing the plant capacity from 1.2 MGD to 3.2 MGD utilizing an oxidation ditch, clarifiers, digester, ultraviolet light disinfection and cascade stair aeration process- Performed all hydraulic design calculations through the treatment plant from headworks to ultraviolet disinfection unit. Provided design of digester air/blower and diffuser system an assisted in all design phases. Provided construction management services to oversee the construction and initial start-up and operations of the 3.2 MGD wastewater treatment plant.

Alexandria, TN Wastewater Treatment Plant Improvements: Project Engineer and Construction Manager - Expanded the Wastewater Treatment Plant's capacity from 150,000 GPD to a design capacity of 300,000 GPD, with a peak demand capacity of 600,000 GPD. A Sequential Batch Reactor Treatment System was designed for the expansion. The plant's lift station capacity was increased utilizing suction lift pumps. A UV disinfection system was designed to replace the existing chlorine disinfection system. The existing concrete lagoon was utilized as post equalization.

Wartrace, TN Wastewater Treatment Plant Improvements: Project Engineer - Improvements to the lagoon included a floating weir to regulate effluent flow, utilized in conjunction

with USGS real-time stream flow data. Two manholes were installed to record flow and level measurements. This design was implemented to restore the treatment plant to its full design capacity of 0.13 MGD. Project has not currently been constructed due to funding constraints.

Marion County, TN I-24 Nickajack Lake Rest Area Wastewater Treatment Facility: Engineering Project Manager and Construction Manager: Developed the Design Report which evaluated the existing wastewater treatment facility and proposed a recirculating sand filter (RSF) type of sewage treatment process with ultraviolet disinfection unit. Designed construction drawings and specifications for a peak design flow of 19,000 gpd for the RSF and disinfection process.

Grant, AL Teledyne Firth Sterling: Design Engineer - Provided design services to replace an existing sewage disposal field serving 70 employees. The new design provided soils evaluation, regulations compliance, design report, specifications and construction plans for a 2,100 gpd pumping station, 3-inch force main and a 2,700 S.F. disposal field.

Spring Hill, TN Sewer Trunk Lines: Project Engineer and Construction Manager for three major sewer trunk lines. Grassy Branch Phases I, II, & III (30,500 L.F. of 8-inch through 30-inch gravity sewer); McCutcheon Creek (10, 439 L.F. of 10" gravity sewer line with removal of a sewerage lift station); and Aeon Creek Phases I, II, & III (24,589 L.F. of 18" and 24" gravity sewer line with removal of 3 sewage lift stations).

Spring Hill, TN Highway 31/Main Street Water Booster Station and Master Meter: Project Manager for design of a proposed water booster station to replace the existing Highway 31 Water Booster Station. The proposed booster station includes three 75-horsepower split case pumps, Variable Frequency Drives (VFDs), piping, equipment, concrete foundation and slab, building construction, site work, electrical, Supervisory Control and Data Acquisition (SCADA) System, site paving and fencing. The proposed booster station will allow Spring Hill to fully utilize the 2.88 MGD contracted water purchase agreement with Columbia Power and Water System (CPWS).

Spring Hill, TN Miles Johnson Bypass Water Booster Pumping Station and Highway 31 Twelve-Inch Water Line: Project Engineer and Construction Manager - This project consisted of a booster station building (30' x 25') with two horizontal end suction pumps with 125 Hp motors rated at 1440 gpm at 270-feet TDH each. The pumps are controlled by a SCADA system tied to the City's main SCADA control computer at the water treatment Plant. The pumps also have variable frequency drives to control the pumping rate as needed. The booster station is the main source of supplying water to the north side of the City and to the Northside and Buckner Road Water Storage Tanks. The project also consisted of approximately 16,000 L.F. of 12-inch water line.

Spring Hill, TN Port Royal Road 18" Water Line Project: Project Engineer and Construction Manager - This project consisted of approximately 7,900 L.F. of 18" water line (C-905 PVC) with casing pipe installation (under Saturn Parkway and Port Royal Road). **This line supplies water from the water plant to the**

JEROME DEMPSEY, PE

Principal-in-Charge | Project Engineer

Duplex Road and Old Kedron Road Bypass booster stations. Oak Grove, KY O&M Manual: Project Manager - Provided an Operation and Maintenance Manual for the Oak Grove Sewerage System Improvements which included 423 grinder pump stations, 113, 400+/- L.F. 1-1/4 inch - 6 inch pressure sewer lines, 16,900+ 8 inch - 12 inch gravity sewer lines, 25,900+ L.F. 4 inch - 10 inch force main lines and five sewer pumping stations.

Murfreesboro, TN Gravity Sewer Line Extension to Serve Community Care of Rutherford County: Project Engineer and Construction Manager: The project consists of approximately 5,440 L.F. of 18-inch PVC, 2,751 L.F. of 18-inch DIP, 1,074 L.F. of pier mounted 18-inch DIP, 300 V.F. of concrete pier supports, 26 manholes, 120 L.F. of 18-inch PVC with 28-inch steel casing pipe, 77 L.F. of 10-inch PVC, 347 L.F. of 8-inch PVC, 52 service tees, 1,220 L.F. of 6-inch PVC service line, and appurtenances. This project included partial installation across the Indian Hills Golf Course.

Fairview, TN Flying J Lift Station Modifications: Project Engineer and Construction Manager - Upgrade existing lift station to serve commercial truck and RV travel stop facility. Suction lift pumps and controls were utilized to expand the station's capacity to 60,000 GPD. An inline comminutor/grinder was installed to pulverize all solids discharged into the on-site system. The location of the proposed wetwell was relocated out of the exiting drainage ditch to reduce inflow into the lift station.

Stewart County, TN Standard Gypsum Sewer Line: Project Manager - The project consists of approximately 3,000 L.F. of gravity sewer line ranging in size from 8-inch to 15-inch and 11 manholes to serve Standard Gypsum located in Stewart -Houston County Industrial Park. The sewer line included 5 concrete pier supports, a railroad crossing and coordination with a proposed state access road.

Nashville, TN Paragon Mills Sewer Overflow Abatement Phase 1 and 2: Project Manager and Construction Manager - provided a design report and design input of 6,000+ L.F., 36-inch RCP; 2,000+ L.F., 15-inch PVC; 4,000+ L.F., 24-inch cured-in-place relief sewer lines to eliminate bypass/overflow occurrences. Provided construction management services during construction phases of the project.

Nashville, TN Paragon Mills - Phase 3 Sewer System Rehabilitation: Project Manager and Construction Manager - Performed wet weather flow monitoring activities to identify Inflow/Infiltration into the existing gravity sewer system. Performed field reconnaissance and T.V. log reviews to further identify Inflow/Infiltration. Construction drawings and specifications for the Sewer System Rehabilitation Project provided which identified approximately 30,000 L.F. of 8, 10 and 12-inch sewer line to be rehabilitated.

Nashville, TN Whittemore Branch Sewer Basin Planning Study: Project Manager and Construction Manager - Provided a planning study which evaluated the existing sewer system (39 miles of gravity sewer 8"-30") and the effects of Inflow/Infiltration into the system. Flow monitoring analysis, full pipe flow capacity analysis and design peak flow projections to

Year 2035 were performed, in which system deficiencies were identified and corrective design alternatives with cost analysis were recommended.

Nashville, TN Whittemore Branch Sewer System Rehabilitation: Project Manager and Construction Manager - Performed wet weather flow isolation activities to identify Inflow/Infiltration into the existing sewer system, reviewed internal inspection logs and developed construction drawings and specifications for rehabilitation of approximately 28,000 L.F. of 8, 10, 15 and 18-inch sewer line with associated manhole rehabilitation and service renewals.

Columbia, TN Monsanto Chemical Company: Project Manager and Construction Manager - Provided field survey, contract documents and construction drawings to serve public water for an existing 100,000-gallon elevated storage tank which feeds the plant. The project consisted of 13,000 L.F. 6-inch PVC water line (flow regulation - 200 gpm), mechanical building and booster station building. Nashville, TN Kenworth Trucking Company Industrial Study: Project Manager - Provided a study to identify waste problems and provide alternate solutions with cost estimates.

Spring Hill, TN Buckner Road 1.5 MG Water Storage Tank: Project consisted of removal of an existing 0.15 MG steel welded tank; site grading; construction of a perimeter segmental retaining wall; construction of a new (81' diameter x 41' high) 1.5 MG glass coated/steel bolted water storage tank with a self-supporting aluminum dome roof and solar powered mixer/aerator; construction of a valve vault with 10-inch altitude valve, bypass line and associated valves; installation of a 10-inch water line and new telemetry system integrated into the existing SCADA system.

Spring Hill, TN Hardin's Landing 1.50 MG Elevated Water Storage Tank: Project consisted of construction of a 1.50 MG Elevated Water Storage Tank (pedosphere welded steel) and concrete foundation. The water storage tank contains an 86' diameter bowl with a 46' head range depth and an overflow height of 117' to the overflow pipe elevation. The project also contained 1,000 +/- feet of 18-inch water line, altitude valve and vault, bypass line and associated valves, site work and telemetry system which is integrated into the city's existing SCADA system. The water storage tank serves the City's southside pressure zone as well as providing a supply for the Duplex Road and Miles Johnson Parkway water booster stations, both of which serve the northside pressure zone and northside water storage tanks. More than 600 tons of steel was utilized for the construction.

Spring Hill, TN North Side 1.5 MG Water Storage Tank: Project consisted of site grading; construction of a 1.5 MG glass coated/steel bolted water storage tank with a self-supporting aluminum dome roof; construction of a valve vault with 12-inch altitude valve, bypass line and associated valves; installation of a 12-inch water line and new telemetry system integrated into the existing SCADA system.

JEROME DEMPSEY, PE

Principal-in-Charge | Project Engineer

Smyrna, TN Mason Tucker 3.0 MG Water Storage Tank

Rehabilitation: Project consisted of rehabilitation of a concrete water storage tank which included high strength power pressure cleaning the of the ground level storage tank, performing tank preparation repairs, application of a coatings system, and associated items such as ladder and spill pipe replacement.

Spring Hill, TN City Hall 1.0 MG Water Storage Tank

Rehabilitation: Project consisted of a welded steel tank rehabilitation which included removal of the existing coating system by means of power sand blasting, performing tank preparation repairs, application of interior and exterior coating systems, and associated items such as ladder repairs.

Spring Hill, TN Rutherford Creek Sewer Trunk Line Phase 1:

Project Engineer and Manager for the design and construction of approximately 3,325 linear feet of 36-inch class 150 ductile iron pipe gravity sewer line installed across King's Creek Golf Course; 6-foot diameter manholes; concrete check dams; manhole vent assemblies; erosion control; and golf course restoration. This project required permitting and approval from TVA to cross their high voltage power lines and easement.

Spring Hill, TN Rutherford Creek Sewer Trunk Line Phase 2:

Project Engineer and Manager for the design and construction of approximately 3,318 linear feet of 36-inch class 150 ductile iron pipe gravity sewer line; approximately 2,282 linear feet of 30-inch class 150 ductile iron pipe gravity sewer line; approximately 100 linear feet of 10-inch SDR 26 PVC gravity sewer line; 6-foot diameter manholes; 5-foot diameter manholes; concrete check dams; manhole vent assemblies; erosion control; outside manhole drop connection; removal of existing lift station and components and convert the wetwell to a manhole.

Spring Hill, TN Rutherford Creek Sewer Trunk Line Phase 3:

Project Engineer and Manager for the design and construction of approximately 5,090 linear feet of 30-inch class 150 ductile iron pipe gravity sewer line; approximately 260 linear feet of 10-inch SDR 26 PVC gravity sewer line; 5-foot diameter manholes; 4-foot diameter manholes; erosion control; and restoration.

Smyrna, TN Olive Branch Sewer Trunk Line Phase 1: Project Engineer and Manager for the design and construction of approximately 8,179 linear feet of 24-inch ductile iron sewer main; 88 linear feet of 42-inch steel casing with 24-inch carrier sewer pipe installed by bore and jack; public and private sewer service lines and connections; installation of 29 precast manholes and castings; pre- and post-blast surveys, post-construction video inspection; pavement repair; one ARAP open-cut creek crossing; erosion control and appurtenances.

Smyrna, TN Olive Branch Sewer Trunk Line Phase 2: Project Engineer and Manager for the design and construction of approximately 3,067 linear feet of 24-inch ductile iron sewer main; 5,603 linear feet of 18-inch ductile iron sewer main; 889 linear feet of 12-inch ductile iron sewer main; 40 linear feet

of 42-inch steel casing with 24-inch carrier sewer pipe and 40 linear of 24-inch steel casing with 12-inch carrier sewer pipe installed by bore and jack installation; installation of 31 precast manholes and castings; pre- and post-blast surveys, post-construction video inspection; pavement repair; two ARAP open-cut creek crossings and two ARAP service line bore and jack creek crossings; removal of Woodmont Lift Station; erosion control and appurtenances.

Smyrna, TN Olive Branch Sewer Trunk Line Phase 3: Project Engineer and Manager for the design and construction of approximately 1,959 linear feet of 18-inch ductile iron sewer main; 5,262 linear feet of 16-inch ductile iron sewer main; installation of 28 precast manholes and castings; pre- and post-blast surveys, post-construction video inspection; pavement repair; three ARAP open-cut creek crossings and five ARAP service line bore and jack creek crossings; erosion control and appurtenances.

Smyrna, TN Jefferson Pike East (SR 266) Widening, Utilities Relocation (TDOT PIN 107045.00):

Project Engineer and Manager for engineering design and will provide CEI Services for utilities relocation of potable water, sanitary sewer, natural gas and reclaimed water components to allow widening of 3.75 miles of SR 266 (Nissan Drive/SR 102 to I-840) from a 2-lane section with drainage ditches to a 5-lane section and storm drainage system along with various improvements.

Smyrna, TN Sam Ridley Parkway Widening, Utilities Relocation (TDOT PIN 126769.00):

Project Principal/Manager for engineering design and construction administration for utilities relocation of potable water, sanitary sewer, natural gas and reclaimed water components to allow widening of 1.5 miles of SR 266 (I-24 to Old Nashville Hwy) from two 2-lane sections (with turn lanes) and drainage ditches to two 3-lane sections (with turn lanes) and storm drainage system along with various improvements.

Spring Hill, TN Duplex Road (SR 247) Widening, Utilities Relocation (TDOT PIN 103169.00):

Project Principal/Manager for engineering design and CEI Services for utilities relocation of potable water and sanitary sewer components to allow widening of 3.2 miles of SR 247 (Main Street to I-65) from a 2-lane sections with drainage ditches to a 3-lane section with storm drainage system with multi-use trail and sidewalk and various improvements.

*** Experience with previous firm(s)**



RYAN CHAMBLEE, PE

Smyrna Environmental Project Coordinator | Engineer

Ryan has over nine years of experience in the planning, design, permitting, and construction administration of various types of projects, including multiple major water distribution, storage and relocation projects, as well as sewer collection and transmission construction, relocation, and rehabilitation projects.

Project Experience

Highway 31 Water Booster Station and Master Meter, Maury, Spring Hill, TN, Project Manager for design of a proposed water booster station to replace the existing Highway 31 Water Booster Station. The proposed booster station includes three 75-horsepower split case pumps, Variable Frequency Drives (VFDs), piping, equipment, concrete foundation and slab, building construction, site work, electrical, Supervisory Control and Data Acquisition (SCADA) System, site paving and fencing. The proposed booster station will allow Spring Hill to fully utilize the 2.88 MGD contracted water purchase agreement with Columbia Power and Water System (CPWS).

WTP Expansion from 4.0 MGD to 6.0 MGD Facilities Plan, Maury, Spring Hill, TN, Project Engineer for the development of an engineering facilities plan following State Revolving Fund (SRF) Loan format for the near-term (4.0 MGD to 6.0 MGD) and long-term (10.0 MGD) expansion of the Spring Hill Water Treatment Plant (WTP), Raw Water Intake (RWI) and Raw Water Transmission Line (RWTL). The project included the evaluation of five (5) near-term alternatives and seven (7) long-term alternatives, which included estimated construction costs and life-cycle costs. The project included calculations of the RWI and RWTL hydraulics and pumping evaluation, evaluation of multiple advanced water treatment technologies and site visits to facilities with similar treatment processes. Technical data, exhibits, and tables were developed for the report along with design and capacity calculations. Recommendations for the near-term expansion were developed and presented to City Staff and BOMA.

Saturn Parkway Extension, Maury, Spring Hill, TN, Project Manager for the relocation of water and sewer facilities for the Saturn Parkway Extension Project. The Project encompassed relocating water, force main sewer and gravity sewer facilities along 1.5 mile stretch of Beechcroft Road to allow for the widening, realignment of the road and installation of a bridge over railroad tracks.

Beechcroft Road Widening, Maury, Spring Hill, TN, Project Construction Administration and Inspection for the relocation of water and sewer facilities for the Beechcroft Road Widening. The Project encompassed relocating water, force main sewer and gravity sewer facilities along Beechcroft Road and the Cleburne Road intersection to allow for the widening, realignment of the road.

WWTP Expansion from 5.85 MGD to 9.0 MGD, Rutherford, Smyrna, TN, Project Engineer for the engineering design, bidding, construction administration for the \$35,000,000 expansion of the Smyrna WWTP from 5.85 MGD to 9.0 MGD. The expansion includes upgrading the existing headworks with new screens, upgrading the existing raw water pump station with larger pumps, constructing a new anaerobic basin, constructing a new clarifier splitter box and two new clarifiers, constructing a new tertiary filter structure, upgrading the existing ultra-violet light disinfection facility, construction a new oxidation basin utilizing the 5-stage Bardenpho advanced biological treatment process, and miscellaneous piping and electrical improvements.

4R Sewer Lift Station Improvements, Rutherford, Smyrna, TN, Project Manager for the design, bidding and CEI Services of the improvements to the existing 4R Sewer Lift Station. The project includes replacement of the two existing dry pit pumps with three new Flygt submersible/dry pit non-clog sewage pumps, piping and valving modifications, system electrical upgrades, control upgrades, new generator and pad, hoist crane replacement, bypass pumping connection and valving and miscellaneous improvements. A 3D laser survey was provided to ensure accurate dimensions and as-built data was available for design, to include a 3D Revit model of the complete station.

1R Sewer Lift Station Improvements, Rutherford, Smyrna, TN, Project Manager for the design and bidding of the improvements to the existing 1R Sewer Lift Station. The project includes replacement of the three existing dry pit pumps with four new Flygt submersible/dry pit non-

Education

BS, Civil Engineering, 2009, Tennessee Technological University

Professional Registrations

Professional Engineer in TN

Professional Certifications

- NASSCO Cured-in-Place Pipe Inspector Certification

Professional Affiliations

- American Society of Civil Engineers

Core Competencies

- Project Management
- Project Planning and Development
- Construction Document Creation
- Hydraulic Calculations
- Environmental Permitting
- Facilities Plan Development
- Engineering Reports
- Specifications and Contract Documents
- Water Line Construction and Relocation
- Sewer Flow Study Analysis and Modeling
- Sanitary Sewer Evaluations
- Sanitary Sewer Rehabilitations
- Wastewater Collection/Conveyance
- Construction Administration
- Construction Inspection

RYAN CHAMBLEE, PE

Smyrna Environmental Project Coordinator | Engineer

clog sewage pumps, piping and valving modifications, system electrical upgrades, control upgrades, new generator and pad, hoist crane replacement, bypass pumping connection and valving and miscellaneous improvements. A 3D laser survey was provided to ensure accurate dimensions and as-built data was available for design, to include a 3D Revit model of the complete station.

Jefferson Pike East (SR 266) Widening, Utilities Relocation (PIN 107045.00), Rutherford, Smyrna, TN, Project Manager for engineering design and CEI services for utilities relocation of potable water, sanitary sewer, natural gas and reclaimed water components to allow widening of 3.75 miles of SR 266 (Nissan Drive/SR 102 to I-840) from a 2-lane section with drainage ditches to a 5-lane section and storm drainage system along with various improvements. \$12,865,000 estimated for utilities (water, sewer and gas) relocation only. The project includes approximately 12,755 linear feet of sewer force main ranging from 8-inch to 20-inch in diameter, 12-inch diameter force main bridge hanger system crossing an approximate 600-foot bridge over the Stones River and two (2) sewage pump stations. *

Sam Ridley Parkway Widening, Utilities Relocation (PIN 126769.00), Rutherford, Smyrna, TN, Project Manager for engineering and construction administration for utilities relocation of potable water, sanitary sewer, natural gas and reclaimed water components to allow widening of 1.5 miles of SR 266 (I-24 to Old Nashville Hwy) from two 2-lane sections (with turn lanes) and drainage ditches to two 3-lane sections (with turn lanes) and storm drainage system along with various improvements. \$1,350,000 for utilities relocation. *

Olive Branch Sewer Trunk Line Phase 1, Rutherford, Smyrna, TN, Project Engineer for the design of approximately 8,179 linear feet of 24-inch ductile iron sewer main; 88 linear feet of 42-inch steel casing with 24-inch carrier sewer pipe installed by bore and jack; public and private sewer service lines and connections; installation of 29 precast manholes and castings; pre- and post-blast surveys, post-construction video inspection; pavement repair; one ARAP open-cut creek crossing; erosion control and appurtenances.

Olive Branch Sewer Trunk Line Phase 2, Rutherford, Smyrna, TN, Project Engineer for the design of approximately 3,067 linear feet of 24-inch ductile iron sewer main; 5,603 linear feet of 18-inch ductile iron sewer main; 889 linear feet of 12-inch ductile iron sewer main; 40 linear feet of 42-inch steel casing with 24-inch carrier sewer pipe and 40 linear of 24-inch steel casing with 12-inch carrier sewer pipe installed by bore and jack installation; installation of 31 precast manholes and castings; pre- and post-blast surveys, post-construction video inspection; pavement repair; two ARAP open-cut creek crossings and two ARAP service line bore and jack creek crossings; abandonment of the Woodmont Lift Station; erosion control and appurtenances.

Olive Branch Sewer Trunk Line Phase 3, Rutherford, Smyrna, TN, Project Engineer for the design of approximately 1,959 linear feet of 18-inch ductile iron sewer main; 5,262 linear feet of 16-inch ductile iron sewer main; installation of 28 precast manholes and castings; pre- and post-blast surveys, post-construction video inspection; pavement repair; three ARAP

open-cut creek crossings and five ARAP service line bore and jack creek crossings; erosion control and appurtenances.

Genie Lane Extension, Utilities Extension, Rutherford, Smyrna, TN, Project Manager for the engineering design for the utilities extension and relocation as part of the Genie Lane Extension project, including water, sewer and gas utilities. The project includes extension and relocation of approximately 1,400 LF of 8-inch gravity sewer and abandonment of an existing sewer lift station, relocation of 800 LF of reclaimed water and 92 LF of 4-inch force main. The project also include extension and relocation of approximately 2,600 LF of 12-inch DIP water line and approximately 2,000 LF of 2-inch through 4-inch gas main.

Spring Hill Drive Extension - Utilities Extension, Rutherford, Smyrna, TN, Project Manager for the engineering design for utilities extension as part of the Spring Hill Drive roadway extension. The project includes extension of water, sewer and gas utilities including approximately 1,200 LF of 12-inch DIP water line, 24 service lines and connections to existing water line. The project also includes approximately 2,800 LF of 8-inch gravity sewer, 24 service lines and connections to existing sewer manholes and approximately 1,200 LF of 4-inch HDPE gas main.

Cedar Stone Park, Phase 1, Rutherford, Smyrna, TN, Project Engineer assisting in the water and sewer utility design and construction of Phase 1. Assisting in development and submittal of the Storm Water Pollution Prevention Plan (SWPPP) as part of erosion prevention and sediment control (EPSC) plan documents. Phase 1 encompassed approximately 20 acres of an 80-acre planned park. Phase 1 included (4) 225-foot little league baseball fields constructed of synthetic turf. Additional amenities include a restroom/concession building, a shade structure, a pavilion shelter, and a playground. Coordination was conducted with the playground equipment supplier for layout and ADA compliance. The site design included supplying all utilities to the site, underground drainage and detention, and parking lot design. Design services included the site design, coordination of architectural and MEP plans, and construction administration and inspection services.

Potomac Place Extension, Rutherford, Smyrna, TN, Construction Administration and inspection for the extension of Potomac Place from Sam Ridley Parkway (SR266) to Chaney Road. The project included the construction of 945 feet of new roadway, structural embankment, storm sewer, drainage improvements and sidewalks. The project also included the construction of new left turn lanes, in each travel direction, from Sam Ridley Parkway onto Potomac Place and addition of traffic signals on Sam Ridley Parkway.

*** Experience with previous firm(s)**



LISA MUZEKARI, PE

Columbia, SC Environmental Project Coordinator | Engineer

Lisa has 29 years of experience in environmental engineering and has managed a practice group focusing on water, sewer, and environmental permitting and compliance. She is recognized in her field for providing environmental assessments, permitting, planning, and compliance strategies for municipal and private clients. Lisa's experience includes water, wastewater, air, environmental planning, permitting and compliance, industrial and hazardous waste, air modeling, and safety and emergency planning.

Education

MS, Civil Engineering, 1992,
University of South Carolina
BS, Civil Engineering, 1991,
University of South Carolina

Professional Registrations

Professional Engineer in SC, NC,
GA, OK

Professional Affiliations

- Water Environment Federation
- American Water Works Association
- Water Environment Association of South Carolina
- Carolinas Air Pollution Control Association
- Institute for Sustainable Infrastructure

Core Competencies

- Project Management
- Air Permitting
- Air Modeling
- Environmental Compliance
- Environmental Assessments and Remediation
- Environmental Permitting
- Environmental Auditing
- Water and Sewer Master Planning
- Industrial Wastewater Permitting
- Funding Assistance
- Rate Studies
- Sustainability Planning
- Spill Prevention Control and Countermeasures
- Stormwater Pollution Prevention

Project Experience

County-Wide Wastewater System Study, Chester County, Chester, SC, Project Manager for an engineering study to address the existing wastewater infrastructure and potential future growth county-wide in determining alternatives for expansion of the wastewater collection system and treatment facilities. The study included preliminary cost estimates for proposed expansion of the existing system, population projections, and collection system mapping.*

County-Wide Wastewater Study, Clarendon County, Manning, SC, Project Manager for an engineering study to analyze alternatives to create a regional sewer system in Clarendon County, including the consolidation of existing municipal systems. The study included preliminary cost estimates for various alternatives, as well as population and flow projections.*

Water and Wastewater System Evaluation, City of Conway, Conway, SC, Project Engineer for the evaluation and financial planning of the City's water and wastewater systems. Responsible for data acquisition and evaluation of existing programs for the water distribution and sewer collection systems. Responsible also for determining future areas of growth and assisted in the determination of future capital improvement projects and prioritization. Served as the liaison to Raffelis Financial Consultants in the development of the rate model and financial plan for the water and sewer systems.*

Durbin Creek Wastewater Treatment Plant (WWTP) Reuse Water Feasibility Study, Renewable Water Resources, Greenville, SC, Project Manager for the Durbin Creek WWTP Reuse Water Feasibility Study for WCRSA, which included various alternatives for the reuse of effluent from the WWTP.*

Gilder Creek Wastewater Treatment Plant (WWTP) Reuse Water Feasibility Study and PER, Renewable Water Resources, Greenville, SC, Project Manager for the Gilder Creek WWTP Reuse Water Feasibility Study and Reuse Preliminary Engineering Report for ReWa which included various alternatives for the reuse of effluent from the WWTP.*

Berkeley County Water and Sanitation (BCWS) Program Management, SC, Program Manager for the BCWS for the Water and Wastewater systems. The overall objective was to assist the County in establishing the program and project priorities with multiple projects in various phases of implementation. Services included monitoring procurement procedures, design, construction, and other related activities; facilitating, coordinating, and managing the Projects identified; and monitoring the quality of services and recommended courses of action.

Upper Kinley Creek Sewer Replacement, Columbia, SC, Client Manager for replacement of sewer piping to upsize 4,400 linear feet of gravity line to a new 30-inch line.

Fairfield County Wastewater Master Planning and 208 Plan Amendments, Fairfield County, SC, Project Manager for the Utility Master Planning for Fairfield County. Assisted with the formation of the Fairfield Joint Water and Sewer System including master planning and development of a Preliminary Engineering Report for a new 4.0 MGD MBR WWTP. The planning includes the Amendment of the 208 Plan for the Central Midlands COG to include the new Management Area for the FJWSS and the inclusion of a new WWTP in the plan. Thomas & Hutton is responsible for the Amendment of the 208 Plan and attending all related COG and public meetings.

* Experience with previous firm(s)



TRENT THOMPSON, PE

Savannah, GA Environmental Project Coordinator | Engineer

Trent is a Project Manager for engineering, planning, and design of water and wastewater infrastructure projects. His 22 years of experience includes planning and design of water distribution/supply and wastewater collection/treatment systems for multiple municipalities, water & sewer authorities, and local governments. He has also worked on multiple large tract residential, commercial, and industrial development utility extension and supply/treatment infrastructure projects. Trent's experience includes environmental and civil engineering, consisting of conceptual design, computer modeling, master planning, feasibility studies, permitting, detailed design, contract document preparation, technical specification preparation, bidding, and construction coordination on projects in Georgia, South Carolina, North Carolina, and Florida

Education

BS, Environmental Engineering,
2001, Mercer University

Professional Registrations

Professional Engineer in GA, SC,
FL

Professional Affiliations

- National Society of Professional Engineers (NSPE)
- Georgia Society of Professional Engineers (GSPE)
- American Waterworks Association (AWWA)
- Georgia Association of Water Professionals (GAWP)
- National Fire Protection Association (NFPA)

Core Competencies

- Project Management
- Water Distribution Systems
- Water Storage Facilities
- Booster Pump Stations
- Wastewater Treatment Systems
- Wastewater Collection/Conveyance
- Wastewater Pump Station
- Water/Sewer Modeling
- Sanitary Sewer Evaluations
- Sanitary Sewer Rehabilitations
- Infrastructure Relocations
- Master Planning
- Funding Assistance
- Rate Studies
- Public Outreach/Speaking

Project Experience

I-16 Industrial Corridor Regional Water Transmission Main, Savannah, GA,

Project Manager on the planning, design, permitting, and construction observation of an extension of a regional water transmission main to serve industrial development in northwest Chatham County as well as industrial development along I-16 in Effingham and Bryan Counties. Worked with the City of Savannah and the Savannah Economic Development Authority (SEDA) to develop routing and sizing plans for approximately 19.7 miles of 36-inch, 30-inch, and 24-inch water main. The project included wetland permitting and horizontal direction drill (HDD) design of numerous wetland, creek, and canal crossings, as well as an HDD crossing of the Ogeechee River. Provided utility location, survey, geotechnical evaluations, and design services for the sections of 36-inch, 30-inch, and 24-inch main.

Savannah Manufacturing Center Regional Water & Sewer Improvements, Savannah, GA,

Project Manager on the planning, survey, design, permitting, bidding, and construction observation of regional infrastructure to serve the SEDA Savannah Manufacturing Center. Project included approximately 16,500 linear feet of 30-inch water main, 7,085 linear feet of 16-inch water main, 14,000 linear feet of 24-inch force main, 4,200 linear feet of 6-inch force main, 4,600 linear feet of 8-, 10-, and 15-inch gravity sewer. The project included a 2,500 gpm sewage pump station and a 242 gpm pump station. Project also included jack and bore installations of 42-inch and 36-inch steel casings, a 1,800 LF directional drill of 30-inch FPVC, and a 1,800 LF directional drill of 24-inch HDPE. To provide fire protection to the area a 1 MG elevated composite tank and 2,000 gpm Floridan Aquifer well system was included as part of the regional infrastructure design.

Volvo/Camp Hall Water and Wastewater Infrastructure, Berkeley County, SC,

Project Manager for the design, permitting, bidding, and construction administration for a 0.75-million gallon composite elevated water tank, approximately 50,000 linear feet of 20-inch water main, quadplex (expandable to six pumps) 5,000-gallon per minute capacity, 950 gpm regional sewage pump station, 5,500 linear feet of 10-inch force main, and temporary potable well system to serve the new Volvo Manufacturing Facility and Camp Hall industrial development area. The project team acquired \$4.65 million in state funding for the construction of this project through the SC Rural Infrastructure Authority (RIA) and SC Economic Development Administration (EDA).

Liberty Ridge Water Treatment Facility, Liberty County, GA,

Project Manager for the design and planning of water and sewer systems to serve a 10,000-acre commercial, industrial, and residential development, including the design of Miocene and Upper Floridan production wells, a 300,000-gallon ground storage tank, water treatment facility, regional pump station, and conveyance and distribution systems. The project included the design of a high service pump and control system to supply 2,500-gallon per minute fire protection to large industrial/commercial tenants within the industrial park, such as Target and Tire Rack Distribution Centers. The project included Economic Development Administration (EDA) funding and National Environmental Policy Act (NEPA) permitting, which required the completion of an Environmental Assessment (EA) and Environmental Impact Statement (EIS).



FRED SORORIAN, PE

Project Engineer

Fred has 39 years of experience in project engineering, project management, and construction management in power plant, civil/environmental studies, and design of industrial waste treatment facilities; including textile plant, metal plating, tobacco industries, and finishing plants. He worked as a lead engineer, designer, and project manager for projects involving process wastewater, sanitary sewer systems, pumping stations, and chemical storage tank farms and also provided construction

Education

BS, Civil Engineering, 1981, Florida Agricultural and Mechanical University

Professional Registrations

Professional Engineer in GA
GSWCC L2

Professional Affiliations

- American Society of Civil Engineers
- Water Environment Federation
- Georgia Association of Water Professionals
- Southeast Desalting Association

Core Competencies

- Project Management
- Water Distribution Systems
- Water Storage Facilities
- Booster Pump Stations
- Wastewater Treatment Systems
- Wastewater Collection/Conveyance
- Wastewater Pump Station
- Water/Sewer Modeling
- Sanitary Sewer Evaluations
- Sanitary Sewer Rehabilitations
- Infrastructure Relocations
- Master Planning
- Funding Assistance
- Rate Studies
- Water Plant & Well System

Project Experience

South Mainland Water System Improvements, Glynn County, GA, Project Engineer for the design of a 500,000-gallon elevated water storage tank, 200,000 Gallon ground storage tank, 1,500 gpm production well, and 1,500-gpm service pump station and chlorination system. The project included pumps, pump house building, electrical, SCADA and controls, and site civil work.

Travis Field Water Reclamation Facility, Savannah, GA, Project Engineer for the design of a new 8.0 MGD Water Reclamation Facility (WRF) to include construction of an MBR facility, headworks, 2.0 MGD EQ tank, anaerobic, anoxic, aeration, and digester tank. The facility also included UV system, DO injection system, effluent pump station, aerobic digester, solid removing facility, blowers, piping, and sludge-return pumps.

Beaufort Jasper Water & Sewer Authority Water Main Extension, Beaufort/Jasper County, SC, Project Engineer for 12,000-linear feet of 24-inch water main extension, including 450 feet of directional drilling.

Secession Golf Club Reclaimed Water Main, Beaufort, SC, Project Engineer for 1,500-linear feet of 10-inch reclaimed water main, including 600 feet of directional drilling.

Hopewell Creek Water Treatment Plant, Glynn County, GA, Project Engineer for the design of a 1,500-gpm duplex distribution pumps, chemical feed systems, 1,000-gpm well, and 200,000-gallon pre-stressed concrete ground storage tank.

Isle of Palms Wastewater Treatment Facility, SC, Project Engineer for the design of a new 0.6-mgd wastewater treatment facility to include construction of an MBR facility, aerobic digester, odor control facility, and reclaimed water storage and distribution.

Dublin Wastewater Treatment Plant, City of Dublin, GA, Project Engineer for the evaluation of the existing anaerobic digestion system, including digestion gas production and gas flare system and sludge dewatering facility and disposal.

St. Simons Island Wastewater Treatment Facility, St. Simons Island, GA, Project Engineer for the upgrade of the wastewater treatment plant for a 4.0-mgd system, including SBR treatment process, aerobic digester, and bio-solids removal system at St. Simons Island, GA.

Egret Landing Wastewater Treatment Plant, Camden County, GA, Project Engineer for the design of a wastewater treatment plan and sludge disposal facility.

American Tobacco, Company Hopewell, VA, Project Engineer/Lead Designer for the upgrade of a 2-mgd treatment plant, including the Bardenpho process to remove phosphorus and excess nitrate. The design also included bio-solids handling and removal system to include dissolved air flotation thickener (DAFT), anaerobic digestion tank, gas flare system, and belt filter press.

GNB Technologies, (Automobile Battery Plant), Columbus, GA, Project Engineer and Construction Manager for design of a collection system to contain contaminated storm water and transfer to the wastewater treatment. The upgrade included a new pump station, storage tank, Lamella clarifier, membrane system, and sludge filter press.

Volvo Industry, Berkeley County, SC, Project Engineer for the design of a 750,000-gallon elevated water storage tank and 2,000-gpm booster pump station to boost water pressure from 55 psi to 67-100 psi. The project included pumps, pump house building, electrical, SCADA and controls, and site civil work.



CHRIS STOVALL, PE, LEED BD+C

Process Engineer

Chris is an Environmental Group Manager for water and wastewater projects. He has 34 years of experience in civil engineering with an emphasis on regional and project conceptual master plans, centralized and decentralized wastewater treatment, collection and distribution systems, and potable water supply and distribution.

Education

BS, Civil Engineering, 1988,
Georgia Institute of Technology

Professional Registrations

Professional Engineer in GA, SC
GSWCC L2

Professional Affiliations

- National Society of Professional Engineers
- Georgia Society of Professional Engineers
- American Water Works Association
- Water Environment Federation
- American Council of Engineering Companies

Core Competencies

- Project Management
- Water Distribution System
- Water Storage Facilities
- Booster Pump Stations
- Wastewater Treatment Systems
- Wastewater Collection/Conveyance
- Wastewater Pump Station
- Water/Sewer Modeling
- Sanitary Sewer Evaluations
- Sanitary Sewer Rehabilitations
- Infrastructure Relocations
- Master Planning
- Funding Assistance
- Rate Studies
- Public Outreach/Speaking

Project Experience

Rate Studies, GA, Project Manager for multiple rate analyses of municipal water systems across Georgia, including review of historical usage trends, water and sewer fund operational costs, and incorporation of capital improvement programs. Determination of the fee structure based on computer model projections from multiple user rate categories and the impacts caused by the various rate structures (flat, stepped, connection fees, etc.) on usage trends over time.

Funding Experience, Chris has completed numerous infrastructure projects utilizing various funding sources. These include GEFA, EDA, CDBG, EIP, USDA Rural Development, RDLEG, One Georgia and EDGE funds, and various bond sources.

General Water & Sewer Experience, Southeastern US, In addition to funding, rate study, and master plan projects, Chris has designed over 50 water supply/treatment facilities, 30 new or upgraded wastewater treatment facilities, and numerous water main, water booster pump, gravity sewer, sewer pump station, and force main projects throughout the Southeastern US. The following are several example projects of each.

South Bryan County Water & Sewer Study, Bryan County, GA, Project Manager for the Study and implementation of a comprehensive plan to share resources in southern Bryan County between the City of Richmond Hill and Bryan County. The County has designed a new stand-alone advanced wastewater treatment plant to replace an existing pond and LAS system as it is almost at capacity. T&H was requested to review options for both discharge from the facility as well as connection to the neighboring City of Richmond Hill system and defer construction of the County treatment facility. After a review of the options, the regional approach was recommended. Plans are currently under design to reverse flows from the Warren Hill pump station, which pumps to the County treatment plant, and transport to the City system as the master County station. This will also

include reversing two other pump stations for an ultimate of 1.0-mgd flow reversed to the City.

East Liberty County Regional Water & Sewer, Liberty County, GA, Project Manager for a study to review a new regional solution to water and sewer infrastructure in a 40,000-acre area of eastern Liberty County. The Liberty County Development Authority has been approached by an existing industry who plans to expand operations that will require a total of 3-mgd of water and 0.45-mgd of sewer over the next 20 years. The LCDA system does not have adequate capacity to meet these needs and due to being in an area of the state with a moratorium on additional aquifer withdrawals has limited options. T&H was requested to complete an analysis of options for providing water and sewer to serve not only the expanded industry but to look at the general growth in the region. A concept of expanded groundwater withdrawals in neighboring McIntosh County, which is outside of the groundwater withdrawal moratorium area, will provide water along with pooled resources between the LCDA, the City of Riceboro, and the City of Midway. For sewer, each entity has a relatively small pond/LAS system but are limited in capacity. For a first phase, two of the facilities can be upgraded to provide the first ramp up of flow needs of the industry. Long term, the LCDA intends to construct a new 3-mgd tertiary treatment facility to be the regional provider to both cities once their capacity is used up.

Wayne Commerce Center Water & Sewer, Jesup, GA, Extension of 12" water and 8" sewer mains to serve new industrial site. Project funded through a One Georgia grant.

Interstate Centre Water & Sewer Improvements, Bryan County, GA, Design of new 12" water main, 350 gpm sewer pump station, 6" force main, 8" gravity sewer, and upgrade of existing wastewater treatment facility. Funded through One Georgia grant and GEFA.



BRIANNA NOGOY

Project Designer

Brianna has one year of experience in designing, permitting, and engineering water and wastewater infrastructure projects. Her experience includes performing capacity analyses and developing operation and maintenance reports for wastewater treatment plants. Brianna utilizes programs such as Autodesk AutoCAD, WaterCAD hydraulic modeling, and Microsoft Office software.

Project Experience

Smyrna Wastewater Treatment Plant Expansion (5.85 MGD to 9.0 MGD), Smyrna, TN, Project Designer for the production of engineering reports for the \$35,000,000 expansion of the Smyrna WWTP from 5.85 MGD to 9.0 MGD. The expansion includes upgrading the existing headworks with new screens, upgrading the existing raw water pump station with larger pumps, constructing a new anaerobic basin, constructing a new clarifier splitter box and two new clarifiers, constructing a new tertiary filter structure, upgrading the existing ultra-violet light disinfection facility, construction a new oxidation basin utilizing the 5-stage Bardenpho advanced biological treatment process, and miscellaneous piping and electrical improvements.

Bryan County Mega Site Septic Field Design, Bryan County, GA, Project Designer for providing engineering design for proposed new sewer system on mega site. Wastewater system design includes sizing the on-site septic tank and septic drainage field to treat approximately 10,000 gallons per day of waste and effluent disposal.

Hardeeville Water and Sewer Master Planning, Hardeeville, SC

Project Designer for the preparation of exhibits displaying the residential, water, and sewer layouts. Performed calculations of existing water and sewer demands for Morgan Tract, West Argent, and Karr Tract developments.

Travis Field Effluent Force Main, Savannah, GA

Project Designer for the production of record drawings of proposed 30-inch effluent force main to convey treated effluent from the Travis Field MBR water reclamation facility to a discharge point near the outfall of Pipe Makers Canal. The project included locating the proposed main and obtaining easements along the route.

Pasco County Wastewater Treatment Plant Permitting, Pasco County, FL

Project Engineer for the permitting renewal, capacity analysis, and operation and maintenance report production of four wastewater treatment plants in Pasco County.*

** Experience with previous firm(s)*

Education

BS, Civil Engineering, 2022,
University of South Florida

Core Competencies

- Wastewater Treatment Systems
- Water Distribution Systems
- Permitting
- Water & Sewer Capacity Analysis

Carollo's Potable Reuse Expertise & Experience

Carollo is the industry-recognized leader in potable reuse through planning, pilot testing, design, and implementation of advanced water purification processes.

FIRM PROFILE

WATER
OUR FOCUS
OUR BUSINESS
OUR PASSION

At Carollo, water is all we do, and we do all water like no one else. What does this focus mean for you? Uncompromising expertise across a vast range of services. A smart,

experienced and innovative staff passionate about what they do. With Carollo on your team, you will be collaborating with the best in the industry—professionals who are passionate about the success of Spring Hill and bring innovative solutions to global issues with water supply.

With 1,300 staff across more than 50 offices, Carollo brings a breadth and depth of expertise across all facets of water management. For more information about the suite of water services we provide, please visit <http://carollo.com/expertise>.

We serve clients and communities from a few thousand to a few million from all around the country. Proposed project team members Eva Steinle-Darling and Andy Salvesson have been leading applied research, planning, pilot testing, and design work for potable reuse in many different states from California to Utah, Texas, and Florida. Pranjali Kumar was responsible for managing

our international award-winning demonstration project in Altamonte Springs, Florida, and is now supporting similar projects around the State of Florida and beyond.

ADAPTING PROVEN PROCESSES TO INNOVATIVE APPLICATIONS

Carollo's experience ranges from designing and operating small pilot-scale water purification facilities (20 liters per minute) to regional evaluations of water management and water supply.

We understand the technical challenges and community sensitivities of sourcing drinking water from nontraditional sources of supply. For example, our team is leading planning level work in San Francisco to find new water through direct potable reuse (DPR), facing a challenging public that has for years relied upon one of the most protected (and tasty) water supplies from the Hetch Hetchy Valley. Adding purified recycled water, no matter how high the quality, is a public outreach challenge.

Advanced Treatment

Our team is leading or assisting with the most challenging advanced treatment projects on the planet, including direct potable reuse in Big Spring, Texas, and El Paso, Texas, 100 percent water reuse in Los Angeles, California, and advanced purification for water reuse for Mekorot in Israel, along with many other potable reuse projects in between.

By the Numbers

300+

Recycled water and reclamation projects

100+

Billion liters of recycled water each year

60+

Potable reuse projects over the past 10 years

7+2

Helped develop reuse guidelines and regulations for 7 US states PLUS the National Water Research Institute PLUS the World Health Organization

CAROLLO'S KEY REUSE TEAM MEMBERS



Chris Cleveland

Chris is a senior project manager with 26 years of experience, and has managed water, wastewater, and reuse projects totaling more than 900 mgd of capacity. He was responsible for the first potable reuse pilot project in New Jersey in 2005 and has managed reuse projects ranging from 0.5 to 330 million gallons per day. Chris is in the process of relocating to the Spring Hill area and will be Carollo's local lead for the project.

Eva Steinle-Darling

Eva is Carollo's National Water Reuse Practice Director. She earned her PhD at Stanford understanding the removal of unregulated chemicals in advanced treatment for potable reuse and with Andy Salveson co-lead the development of Carollo's approach to carbon-based advanced treatment now being applied in Florida, California, Utah, and beyond. She has also played a critical role in the development of potable reuse regulations in Arizona, Texas, Colorado, and Florida and is responsible for water quality review and equipment validation at the DPR projects in Big Spring and El Paso, Texas.





Andy Salvesson

Andy is a pioneer in potable reuse and has been engaged in over 100 reuse projects from research to planning, design, and startup. In his role as Chief Technologist, Andy is at the forefront of potable reuse research on a wide range of topics, including enhanced source control, machine learning to reduce chemical use, and cost-efficient reuse treatment process design – and makes sure that the best of that work is translated to our projects.

Pranjali Kumar

Pranjali serves as Carollo's Southeast Regional Reuse Lead. Her expertise includes navigating potable reuse projects where regulatory guidance is unavailable and developing solutions unique to a utility. Her notable work includes the national and international award-winning potable reuse project "pureALTA" at the City of Altamonte Springs in Florida. She is now managing similar projects for several utilities in Florida who are following the same approach carbon-based advanced treatment approach to potable reuse.



Sarah Clark

Sarah is a dedicated engineer who has worked on many aspects of reuse projects, including treatment selection, pilot testing, and permitting. She uses her perspective from working in both the private and public sectors to effectively work with clients and deliver unique reuse solutions.



Christopher T. Cleveland, P.E.

Chris Cleveland, a senior vice president with Carollo Engineers, has more than 26 years of experience planning, designing, and delivering water treatment and infrastructure projects throughout the United States.

Education

MS Civil and Environmental Engineering, Clarkson University, 1999

BS Civil Engineering, Clarkson University, 1994

Licenses

Civil Engineer, California, Delaware

Professional Engineer, Pennsylvania

Professional Affiliations

American Water Works Association – National Disinfection Committee, Biological Treatment Committee

Relevant Experience

→ Project manager for the Sacramento Regional County Sanitation District, California, EchoWater Project \$350 million Tertiary Treatment Facilities Project (TTF). TTF will provide filtration and disinfection of secondary effluent to a level equivalent to Title 22 requirements for tertiary disinfected recycled water for unrestricted reuse. Tertiary facilities include a 330-mgd filter influent pump station, 217 mgd of granular media filters, backwash equalization and treatment, chemical feed systems, covered disinfection contact basin, and 5 ancillary pump stations.

→ Project engineer for design of a 0.7-mgd wastewater treatment facility at the California Department of Corrections and Rehabilitation Deuel Vocational Institution, Tracy, California. DVI's existing wastewater treatment plant is not currently meeting the permit requirements for California's Title 22 effluent reuse. Furthermore, the existing treatment facility is not currently protected from inundation from a 100-year flood event, as is required in its discharge permit. The membrane bioreactor process concept was selected for its high treatment potential and its small footprint. The new wastewater treatment facility will consist of headworks, aeration tanks, four membrane bioreactor tanks, in-vessel medium pressure UV disinfection, effluent cooling towers, solids handling facility, and support facilities including a standby generator to serve the entire new wastewater treatment plant.

→ Project engineer and technical project manager for a joint feasibility study for addition of a 4-mgd Title 22 compliant advanced water treatment facility to produce reclaimed water for unrestricted reuse at the City of Daly City, California, Wastewater Treatment Plant. This joint project between Daly City and the San Francisco Public Utilities Commission (SFPUC) involved evaluation of membrane filtration and advanced disinfection

processes including in-vessel UV, ozonation, and pasteurization. The project included plant support facilities for upgraded switchgear, site planning, and chemical feed systems, as well as two new pump stations. The water will be used for irrigation of Daly City and SFPUC parks, golf courses, and other irrigation needs.

→ Project manager for the Logan Township Municipal Utilities Authority, New Jersey, Indirect Potable Reuse Demonstration Project. This project, partially funded by New Jersey Department of Environmental Protection, will be the first of its kind in the northeastern United States. The project involves taking wastewater effluent, treating it to better than potable water standards, and injecting it into a local potable water aquifer. Local water purveyors would then use existing potable water wells to extract additional potable water from their current allocations equal to the injected water volume. This project involved process modeling and design and pilot testing of the proposed treatment system, which included membrane bioreactors, reverse osmosis, and advanced oxidation process with UV and hydrogen peroxide to destroy emerging organic contaminants, as well as aquifer modeling and injection well construction. Special attention was paid to designing the treatment process to treat for emerging contaminants.

→ Project manager for the East Bay Municipal Utility District, California, Orinda Water Treatment Plant Disinfection Enhancements. The project provides design services the District's 200-mgd Orinda Water Treatment Plant. The project includes new low-pressure UV disinfection facilities, chlorine contact basin, electrical building and standby generator, and filter effluent and electrical modifications, and will allow significant reduction of disinfection byproduct formation to continue producing high-quality potable water.

Christopher T. Cleveland, P.E.

→ Principal-in-charge for a 15-month biodenitrification pilot study for the Cucamonga Valley Water District, California. The project involved confirming anticipated design criteria for nitrate removal, attaining California Division of Drinking Water conditional approval for biotita®-based dibromochloropropane treatment, demonstrating the stability of the system under forced system disturbances, and familiarizing District staff with the system.

→ Principal-in-charge and design manager for a West Valley Water District, California, and Department of Defense project focused on implementing fixed-bed biotreatment (FXB). The objective of this work is to evaluate the efficacy of using FXB biological treatment and post-treatment to remove perchlorate from groundwater and produce water that meets all drinking water standards. Using over 19 years of bench and pilot-scale experience as a foundation, Carollo is providing a 950-gpm demonstration of FXB biological treatment for removing perchlorate from the District's Well No. 11 and the City of Rialto's Well No. 6 under a design-build delivery model. The fixed-bed process would be implemented in parallel with a fluidized-bed biological treatment process and would undergo a six-month demonstration phase as part of the requirements to earn a full-scale drinking water treatment facility permit with the California Division of Drinking Water.

→ Project manager for the City of Sacramento Department of Utilities, California, Water Treatment Plants Rehabilitation. The project objective was to rehabilitate and replace facilities at the 100-year-old Sacramento River Water Treatment Plant (SRWTP) to maintain its 160 mgd capacity and provide new mechanical residuals handling systems for it and the 200-mgd E.A. Fairbairn Water Treatment Plant (EAFWTP) to improve and increase the solids handling capacity. Key components at SRWTP included 80 mgd of flocculation/sedimentation; high-rate granular media filters; 7,000-hp high-service pump station; spent backwash handling and mechanical dewatering-based solids handling systems; disinfection system expansion; new plant

electrical substation and electrical system improvements; large-diameter piping; and clearwell improvements. Key components at EAFWTP included spent backwash handling facilities and new mechanical dewatering-based solids handling systems.

→ Principal-in-charge/project manager for the City of Sacramento, California, Long-Term Water Treatment Capacity Evaluation (WTPs Master Plan). The City currently operates two surface water treatment plants. The EAFWTP, located on the American River, is rated at 200 mgd. To meet the projected future demand of 410 mgd, the City will need to develop 150 mgd of additional treatment capacity. This study evaluated the costs and challenges associated with alternatives for increasing capacity, including pumping back to EAFWTP (150 mgd), expanding the Sacramento River Water Treatment Plant (150 mgd of additional capacity), building a new water treatment plant in North Natomas on the Sacramento River (150 mgd), and a combination of these alternatives.

→ Project engineer for the City of Sacramento, California, 110-mgd Fairbairn Water Treatment Plant Expansion to the existing 90-mgd conventional plant. The new process included four-stage flocculation basins, sedimentation basins with mechanical sludge collection, dual media granular filters, 7-MG CT basin and clearwell, and 100 mgd of additional high service pump station capacity. The project also added a new chemical storage and feed building, new two-story maintenance and control building, and solids handling facilities. Special considerations were made in the design for future implementation of UV disinfection facilities. This \$53-million project bid below the engineer's estimate. Unique project challenges included habitat requirements for endangered species and large pipeline construction in the City's flood control levee. The project also required coordination with an expanded and upgraded intake structure on the American River.



Eva Steinle-Darling, Ph.D., P.E.

Dr. Eva Steinle-Darling is Director of the Water Reuse Technical Practice at Carollo. Her areas of technical expertise include membrane processes, advanced oxidation, filtration, disinfection, and other advanced treatment processes for microconstituent removal and management of microbial risks and she has been responsible for over \$3 million in applied research on those topics. As a member of the Water Reuse Association's Regulatory and Policy Committee and former WRA Board Member, she is also leading education and advocacy efforts related to reuse in across the U.S. and abroad.

Education

PhD Civil and Environmental Engineering, Stanford University, 2008

MS Civil and Environmental Engineering, Stanford University, 2004

BSE Chemical Engineering, Princeton University, 2003

Licenses

Professional Engineer, Texas

Professional Affiliations

WaterReuse Association
Board Member, 2018-2020

Texas President, 2018-2020

Texas Vice President, 2016-2018

Texas Trustee, 2013-2016

National Legislative Committee Texas Delegate

Water Research Foundation

Water Reuse Advisory Committee

American Water Works Association

Water Environment Federation

Water Environment Association of Texas

Reuse Committee

Relevant Experience

→ Project manager for the City of Dripping Springs, Texas, Direct Potable Reuse Feasibility Study. Provided alternatives for wastewater treatment plant upgrades, several advanced treatment options, conveyance plans and evaluated backup effluent disposal alternatives. Obtained preliminary TCEQ concurrence with a novel carbon-based advanced treatment (CBAT) approach for DPR that does not employ reverse osmosis membranes.

→ Technical advisor for the City of Altamonte Springs, Florida, Direct Potable Reuse Demonstration Pilot pureALTA. Building on the approach developed for the City of Dripping Springs (see above), this international award-winning, permanent demonstration project implemented a new carbon-based advanced treatment approach to direct potable reuse. Provided key technical insights and sampling support for innovative water quality testing across a wide range of conventional and emerging contaminants, surrogates, such as bioassays, and other advanced analytics. T

→ Technical leadership for various carbon-based Permanent Direct Potable Reuse Demonstration Pilots, building on the work conducted for the City of Altamonte Springs, including for Clay and Polk Counties in Florida, City of South Jordan in Utah, and City of Fallbrook in California. The purpose of these demonstration projects is to optimize the application of carbon-based advanced treatment for IPR and DPR using small variations of the original treatment train to accommodate different feed water conditions.

→ Technical advisor for ozone/BAC optimization for City of Rio Rancho, New Mexico, Full-scale Indirect Potable Reuse

project. Reviewed technical memoranda documenting upstream nitrite control challenges and its detrimental effects on downstream ozone AOP and recommendations for simplified operation for bromate control through sub-residual ozone dosing based on ozone:TOC ratio principle.

→ Validation lead, permitting lead, and technical advisor for the El Paso Water, Texas, Advanced Water Purification Facility. This multi-phase project consisted initially of alternatives evaluations, conceptual design, and cost estimate of the proposed 10-mgd facility for *direct* potable reuse. Subsequent roles include development of regulatory path to acceptance for various advanced treatment processes and supporting preliminary and final design.

→ Technical and permitting lead for the City of Tampa, Florida, Tampa Augmentation and PURE Projects. The City proposed a unique 50 mgd indirect potable reuse project involving groundwater and surface water augmentation. Oversaw major technical and public health decisions, including reviewing the basis of design and the full-scale sampling approach, implementing a Quantitative Microbial Risk Assessment (QMRA), and providing permitting support.

→ Co-author for the Valley Water, California, Silicon Valley Advanced Water Purification Center "Potable Reuse Test Plan." Developed comprehensive water quality testing and monitoring protocol to evaluate Valley Water's existing advanced purification facility for its ability to meet potable reuse industry standards and requirements set forth by the State of California.

Eva Steinle-Darling, Ph.D., P.E.

Awards

Carollo Innovation Award, 2021.

Fellowship, Joint National Water Research Institute/American Membrane Technology Association, 2007-2008.

School of Engineering Fellowship, Stanford University, 2003-2004.

Ernest F. Johnson Distinguished Service Award, Princeton University, Chemical Engineering, 2003.

Other

Appointments

Expert panelist for confidential regulator evaluating IPR project in Australia, 2021-present.

Chair, Independent Advisory Panel for OneWater Nevada Potable Reuse Project, 2020-present.

Member, Research Advisory Committee for The Water Tower at Gwinnet County, 2021-present.

Member, Industrial Advisory Board for NSF-funded Engineering Research Center "ReNUWit" 2015-2022.

Invited participant, WaterReuse Association's comments supporting development of the U.S. Environmental Protection Agency's 2019 Water Reuse Action Plan

Expert panelist, Arizona DEQ, Recycled Water Work Groups Final Report, January 2018.

Co-Author, WHO Potable Reuse Guidelines, 2017

Co-Author, WEF Reuse Roadmap, 2017

→ Technical lead for the Los Angeles Department of Water and Power (LADWP), California, Donald C. Tillman Water Reclamation Plant Quantitative Microbial Risk Assessment (QMRA) of Potable Reuse Alternatives. Completed the QMRA using real operating datasets from LADWP to develop and incorporate statistically valid process models for a Monte Carlo simulation. Responsible for establishing the significant margin of safety achieved by three common direct and indirect potable reuse scenarios selected by LADWP.

→ Principal investigator for the Water Research Foundation, Colorado, Project 4833: Understanding the Impacts of Wastewater Treatment on Advanced Treatment for Potable Reuse. Leading a multi-disciplinary team of consultants and academic partners to understand key aspects of the interrelation between wastewater treatment and advanced treatment. This project systematically reviewed operational and cost trade-offs between effluent water quality and downstream advanced treatment impacts across a wide range of treatment processes and developed recommendations for utilities contemplating potable reuse.

→ Principal investigator for the Water Research Foundation, Colorado, Project 17-30: Demonstration of Real-Time Monitoring of Collection Systems as part of Enhanced Source Control for Potable Reuse. The study determined the readiness of online sensors to detect illegal dumping events with a focus on protecting the source water for potable reuse. Oversaw 6-month field demonstrations of real-time monitoring sensor systems in three utility partners' collection systems that highlighted the important potential benefits of the monitoring approach, as well as the significant remaining hardware challenges related to this approach.

→ Principal investigator for the Water Environment & Reuse Foundation, Virginia, Project 14-10: Enhanced Pathogen and Pollutant Monitoring of the Colorado River Municipal Water District Raw Water Production Facility at Big Spring, Texas. The project included a demonstration of a

molecular marker-based direct integrity test for reverse osmosis (RO) membranes. This will be a key step to obtaining microbial log inactivation credit for RO membranes in Texas and other states.

→ Principal investigator for the Texas Water Development Board, Texas, Priority Research Topic Study: Testing Water Quality in a Municipal Wastewater Effluent Treated to Drinking Water Standards. Developed and implemented a detailed testing protocol at the Colorado River Municipal Water District's Raw Water Production Facility (RWPF) at Big Spring. This advanced treatment facility constituted the nation's first instance of direct potable reuse (DPR). The project also developed monitoring guidelines—based on in-depth parallel study of pathogens, chemicals, and appropriate surrogates—for use at DPR facilities, such as the RWPF and others across the nation.

→ Technical advisor for the Water Research Foundation, Colorado, Project 14-16: Pathogen Risk Evaluation of Treatment and Monitoring System Performance for Potable Reuse. This project established the viability and methodology for assessing microbial risk in potable reuse using Quantitative Microbial Risk Assessments (QMRA). Roles included providing overall review, operating dataset evaluation, and specific guidance on the use of that actual operating data in the context of QMRA implementation.

→ Project manager for the WaterReuse Research Foundation, Virginia, Project 12-06: Guidelines for Engineered Storage for Direct Potable Reuse Systems. Developed framework to safely minimize the need for large storage volumes, providing a safe and practicable solution for direct potable reuse.

→ Project manager for WaterReuse Research Foundation, Virginia, Project 11-02: Equivalency of Advanced Treatment Trains for Direct Potable Reuse. Developed an Excel-based treatment train toolbox to model the effectiveness and cost of advanced treatment trains for disinfection and chemical removal.



Andrew T. Salveson, P.E.

Education

MS Water and Wastewater Engineering, University of California, Davis, 1994

BS Civil Engineering, San Jose State University, San Jose, California, 1993

Licenses

Civil Engineer, California, New Mexico., Hawaii

Professional Engineer, Texas

Awards

2022 WateReuse Outreach and Education Award (Colorado Springs Utilities)

2022 WateReuse Transformational Innovation Award (Yokogawa)

2021 WateReuse Transformational Innovation Award (LVMWD)

2021 CASA Award of Excellence for Innovation and Resiliency (LVMWD)

2020 CWEA Engineering Achievement Award (LVMWD)

2019 WateReuse Outreach and Education Award (Central Coast Blue)

2019 CWEA Research Achievement Award (Soquel)

2018 IWA Project Innovation Award (Altamonte Springs)

2017 WateReuse Innovative Project of the Year (Altamonte Springs)

2016 WEF Leadership Award

2015 Carollo Innovation Award

2007 WateReuse Person of the Year

Andrew Salveson is an internationally recognized expert in water reuse treatment and regulations and provides guidance and expertise on potable reuse and reclaimed water purification. Andy has been working on reclaimed water purification (and potable reuse) projects since 1998 and is part of teams implementing projects as small as <1 mgd and greater than >300 mgd (>1,000 megaliters per day). Andy's work spans the United States with select expert support in Europe, the Middle East, Asia, and Australia. Andy is a proud contributor to NWRI, WHO, and WRF expert potable reuse regulatory panels in California, Nevada, New Mexico, and Colorado, as well as international (WHO & Israel) and national (NWRI) efforts. Andy has also authored key technology guidance texts for water reuse and disinfection, including for WEF and NWRI.

Relevant Experience

→ Process and regulatory engineer for the City of Altamonte Springs, Florida, Direct Potable Water Demonstration Center project. The City is looking for new water supplies, and potable water reuse has the most potential. The use of RO-based treatment for potable water reuse is well proven, but also results in a 40% cost premium, higher energy use, and the generation of RO concentrate. The City hired Carollo to examine alternative treatment to RO, then design, install, and test the chosen processes. The treatment train utilizes ozone, BAF, ultrafiltration, granular activated carbon (GAC), and UV AOP. Twelve months of continuous operation has proven highly successful that a non-RO alternative exists for potable water reuse.

→ Process lead and project manager for the evaluation and optimization of Ozone and Biofiltration for the Rio Rancho New Mexico, New Mexico, MBR/Ozone/BAC system for potable reuse via groundwater recharge. Work included extensive evaluation of bromate mitigation and reduced chemical use while providing a robust pathogen and chemical barrier.

→ Project lead for the Pure Water (potable quality reclaimed water) analysis for Mekorot, Israel. Work includes examination of tertiary MBR, Ozone, BAC, and UV. Water to be used for critical non-potable water reuse in the Negev desert.

→ Technical leadership and Project Engineer for Ventura, California, Pure Water IPR/DPR program, including two demonstration systems, a Basis of Design,

and potable water reuse permitting with the State of California.

→ Evaluation of real-time monitoring of pathogens through potable water reuse systems. Andy was the chair of a National Water Research Institute Expert Panel examining qPCR based online monitoring systems.

→ Regulatory and process engineer for the Pismo Beach, California, Predesign of Indirect Potable Reuse. This work effort includes a pure water demonstration with conventional and emerging technologies, the develop of a Basis of Design for full scale implementation, preliminary design, and studies examining groundwater recharge and chemical leaching.

→ Process and regulatory engineer for the City of Morro Bay, California, Indirect Potable Reuse System. This is the first MBR/RO/UV AOP system in California. Carollo's role is as the Owner's Advisor, overseeing the design/build team.

→ Principal investigator for a Metropolitan Water District, California, FSA grant, partnered with the LVMWD, exploring the use of AI and ML for optimizing wastewater treatment and potable reuse treatment system energy use and operational efficiency.

→ Project manager for the design, construction, and operation of the Las Virgenes-Triunfo Joint Powers Authority, California, Pure Water Demonstration system.

→ Principal-in-charge and senior technologist for two grants from the

Key Industry Publications

2021 National Water Research Institute
Implementation of Direct Potable Reuse: A Guide for California Water Utilities

2020 Water Environment Federation Peracetic Acid Disinfection Implementation Considerations for Water Resource Recovery Facilities

2017 WaterReuse Colorado Developing DPR Regulations in Colorado

2017 World Health Organization Potable Reuse Guidance for Producing Safe Drinking-Water

2016 National Water Research Institute Recommended DPR General Guidelines and Operational Requirements for New Mexico

2015 Water Environment Federation Ultraviolet Disinfection for Wastewater

2015 National Water Reuse Institute Framework for Direct Potable Reuse

2012 National Water Research Institute Ultraviolet Disinfection Guidelines

Andrew T. Salveson, P.E.

Japanese Ministry of Economy, Trade, and Industry to evaluate AI and ML systems for wastewater treatment and potable water reuse (2019 and 2020).

→ Principal investigator for a US Bureau of Reclamation (USBR) grant investigating Semi-Autonomous Operation of potable reuse systems using AI and ML coupled with a novel "coaching" system for operations support.

→ Regulatory and process engineer for the City of San Diego, California, Pure Water Potable Water Reuse Design. This project, at 35 mgd, represents the first potable water reuse via surface water augmentation in the State of California. The process train includes O₃/BAF/UF/RO/UV AOP.

→ Technical support and client management for the Qualitative Microbial Risk Assessment and other IPR and DPR efforts for the only potable water reuse system in Australia, the Beenyup plant owned and run by Water Corporation.

→ Project engineer for New Hampshire Department of Environmental Services, New Hampshire, evaluation and development of non-potable water reuse regulatory guidance for the State of New Hampshire (in general) and the Star Island Corporation (in particular).

→ Project manager for the Valley Water (formerly Santa Clara Valley Water District), California, Potable Reuse Study. Carollo evaluated numerous approaches to implement indirect potable reuse (IPR) and direct potable reuse (DPR) within its service area.

→ Project manager, project engineer, and lead investigator for numerous San Francisco PUC, California, PureWaterSF projects. Efforts include the design, operation, testing, and reporting on a demonstration scale direct potable reuse system and planning and predesign efforts for full-scale water reuse systems.

→ Principal investigator for Water Research Foundation, Colorado, Project 14-16: Pathogen Risk Evaluation of Treatment and Monitoring System Performance for Potable Reuse. The project examined full- and pilot-

scale treatment and monitoring system performance, subsequently used for QMRA.

→ Regulatory and process engineer for the Zone 7 Water District, California, Planning of Potable Reuse. This effort, a collective project with DSRSD, Livermore, Pleasanton, Cal Water, and Zone 7, is looking for the most cost-effective method for a regional potable water reuse program in the "Tri-Valley."

→ Regulatory and process engineer for the El Paso Water, Texas, Direct Potable Reuse predesign. This project represents the first "Direct to Distribution" potable water reuse system in the US, and the second such system globally. Robust multiple barriers of treatment coupled with precise and accurate online monitoring and engineered storage allow for reliable production of high-quality water.

→ Co-principal investigator for the WaterReuse Research Foundation, Virginia, Project 11-02: Equivalency of Advanced Treatment Trains for Potable Reuse. Work includes a search for lower energy and lower cost treatment technologies that meet the public health objectives for potable water reuse.

→ Principal investigator for Water Research Foundation, Colorado, Project 4536: Blending Requirements for Water from Direct Potable Reuse Treatment Facilities. This project examines pathogens, pollutants, and subsequent water quality impacts to drinking water quality due to blending reclaimed water with other raw water supplies.

→ Regulatory expert to WaterReuse Colorado and their effort to develop a regulatory and public outreach framework for direct potable reuse in Colorado.

→ Regulatory and process engineer for the UV/AOP pilot testing and process engineer for UV/AOP design for the City of Los Angeles Bureau of Engineering, California, Terminal Island Advanced Water Purification Facility Ultimate Expansion Design-Build project. Project includes MF, RO, and UV AOP for potable reuse.



Pranjali S. Kumar, P.E.

Pranjali Kumar is an environmental engineer experienced in process design and operation of advanced water treatment systems. She serves as project manager/engineer for pilot-scale and demonstration-scale direct and indirect potable water reuse facilities, tertiary wastewater, and water treatment projects. In her current role, she provides assistance to utilities exploring alternative water supply solutions, where she brings her expertise in navigating regulatory pathways and innovative solutions unique to each utility.

Education

MS Civil Engineering,
University of Colorado,
Boulder, 2015

BE Civil Engineering,
Nagpur University, 2013

Licenses

Professional Engineer,
Florida

Professional Affiliations

WaterReuse Association
Florida

Trustee, 2019-Present

Chair – New Technology
and Innovation
Committee, 2020 –
Present

Water Environment
Federation

Water Reuse
Committee, 2018 –
Present

American Water Works
Association

Water Reuse
Committee, 2019 –
Present

National Young
Professionals
Committee, 2020-
Present

Non-Profit Affiliations

Water For People

Relevant Experience

→ Project manager for the Orange County Utilities, Florida, EWRP Potable Reuse Basis of Design. Orange County Utilities serves the greater Orlando area and is investigating alternative water supplies to meet future demands. This project is the first step in a potable reuse program to augment their supply. This stage of the program focuses on characterizing wastewater effluent, and identifying feasible advanced treatment options. Pranjali's role as project manager is to provide technical direction, review data and deliverables, and participate in decision-making with leaders and key stakeholders.

→ Project manager for the Reedy Creek Improvement District, Florida, Indirect Potable Reuse Source Water Characterization. This project includes the characterization of source water to a future advanced water purification facility by quantifying the concentration of regulated and unregulated contaminants and pathogens. Project effort includes being on the forefront of emerging chemicals in the industry and monitoring regulatory developments. In her role, Pranjali provides technical direction, reviewing project deliverables, and managing project resources.

→ Technical expert for One Water Florida and WaterReuse Florida, Florida. One Water Florida is a state-wide initiative to promote recycled water for sustainable supplies in Florida. Pranjali shares her technical expertise in advanced treatment and details of removal of pathogens and contaminants at many events/efforts undertaken by this initiative. She participates in public outreach events to effectively communicate the science behind treating wastewater effluent for drinking water purposes. Pranjali also

serves on the regulatory committee of WaterReuse Florida, an advocacy group working closely with the Florida Department of Environmental Protection to develop direct potable reuse rules in the State. Her contributions include providing technical input on rule language, reviewing rule drafts for applicability to ongoing and upcoming potable reuse projects.

→ Permitting and regulatory expert for the City of Tampa, Florida, PURE project. The City proposed a unique 50 mgd indirect potable reuse project involving groundwater and surface water augmentation. Role included providing input on permitting pathways amidst evolving regulatory frameworks and rules.

→ Lead project engineer for the Clay County Utility Authority, Florida, Potable Reuse Treatability Study and Pilot Design. This project progresses through a feasibility analysis of treating two different source water at Authority, process design of advanced treatment for potable reuse, economic analysis of treatment alternatives, development of public outreach and stakeholder engagement materials, followed by design and construction of a pilot facility for demonstration of treatment. The treatment train includes ozonation (O₃), biologically active carbon filtration (BAC), ultrafiltration (UF), granular activated carbon (GAC) adsorption, followed by UV and chlorine disinfection. In her role as project engineer and assistant project manager, Pranjali is integral to delivery of each component of this project.

→ Project manager for Polk County Utilities, Florida, Potable Reuse Project – Potable Reuse Pilot Project. This project investigated the feasibility of soil aquifer treatment as a treatment barrier for indirect potable reuse at Polk County. Owing to

Awards

2018 WaterReuse Association Up and Comer Award

2018 Best Poster, Florida Water Resource Conference

2017 Most Innovative Project of the Year, Direct Potable Reuse Pilot Study "pureALTA"

Pranjali S. Kumar. P.E.

unfavorable hydrogeology, this concept has now morphed into a direct potable reuse (DPR) project augmenting the raw water supply of a water treatment plant. The treatment train includes enhanced coagulation, O₃/BAC, UF, GAC, UV, and chlorine disinfection. In addition to overall project management, Pranjali's role involves process design of advanced treatment required for pathogens, regulated and unregulated contaminants, design of a pilot facility for successful demonstration of treatment.

→ Consulting engineer for the Potable Reuse Commission, Florida, Framework for Implementation of Potable Reuse in Florida. To advance rulemaking for direct potable reuse in Florida, the Potable Reuse Commission developed a guidance document for the Florida Department of Environmental Protection and legislators for their use. Pranjali assisted in the capacity of a consulting engineer on technological needs for potable reuse treatment schemes. She also assisted by authoring portions of the guidance document.

→ Project engineer for the Toho Water Authority, Florida, Indirect Potable Reuse Project - Pilot Study Investigations. Building on a previously completed feasibility study by Carollo Engineers, this project aims at determining the increase in level of treatment for pathogen and contaminant removal by pre-ozonating reclaimed water prior to discharge to rapid infiltration basins (RIBs) which ultimately will recharge the aquifer, hence adding to Toho's water supply portfolio. The pilot involves ozonating reclaimed water based on an O₃:TOC operating ratio, and applying it to soil columns where the unsaturated and saturated zones of the sub-surface at the RIBs site is simulated. Currently in operation, this pilot is being monitored for pathogens, regulated and unregulated contaminants for indirect potable reuse.

→ Project engineer for the City of Altamonte Springs, Florida, Potable Reuse Demonstration Pilot. The project involved design and operation of a 20-gpm advanced treatment train for augmenting the water supply portfolio of central Florida.

The treatment train includes ozone/biologically activated carbon filtration (O₃/BAF), ultrafiltration (UF), granular activated carbon filtration (GAC), and ultraviolet light with advanced oxidation process (UV AOP). Pranjali's role included design and operations of the pilot, on-site testing, data analysis, and making design decisions for process optimization. The results of this project continue to serve as an example for water purveyors to explore a local, and sustainable option of water reuse, and aid in future rule-making process with the Florida Department of Environmental Protection.

Selected Publications/Presentations

→ Kumar, P., and Steinle-Darling, E. "Putting Florida's DPR Rules Into Context: Regulatory Development Across the US." Florida Section American Water Works Association, Orlando, Florida, Nov 28-Dec 2, 2021.

→ Kumar, P. "Understanding the New Florida Potable Reuse Regulations." Proceedings of the *Florida Section American Water Works Association*, Orlando, Florida, Nov 28-Dec 2, 2021.

→ Kumar, P., Beatty, D., Ammerman, D., Salveson, A., Steinle-Darling, E., and Rauch-Williams, T. "Investigation of Enhanced Soil Aquifer Treatment for Indirect Potable Reuse in Florida Utilizing Rapid Infiltration Basins to Our Benefit." Paper presented at the Florida Water Resources Conference, West Palm Beach, FL, April 26-29, 2020.

→ Nyfennegger, J., Brown, J., Salveson, A., Parker, A., Whyman, D., Kumar, P., and Ammerman, A. "Notes from the Field: Lessons Learned from Extensive Testing of Ozone/Biofiltration for Potable Reuse Across the US." Presentation at the International Symposium on Biological Treatment, Austin, TX, January 24-25, 2018.

Kumar, P., Jackson, J., Torres, E., Ammerman, D., Salveson, A., and Steinle-Darling, E. "Innovative Potable Water Purification without RO - DPR Demonstration Pilot in Central Florida." Paper presented at the *WaterReuse Symposium*, Phoenix, AZ, September 10-13, 2017.



Sarah Clark, P.E.

Sarah Clark, hired by Carollo in 2021, is an environmental engineer with more than 7 years of experience. She has worked in both consulting and within a large utility, with a focus on water reuse, water quality, water resources planning, and water and wastewater treatment processes.

Education

MS Environmental Engineering and Science, Stanford University, 2013

BS Chemical Engineering, University of Virginia, 2012

Licenses

Civil Engineer, California

Relevant Experience

→ Project engineer for the City of Montecito, California, Enhanced Recycled Water Feasibility Study. Activities include developing treatment trains, layouts, and cost estimates for indirect and direct potable reuse concepts; establishing framework for project evaluation; and supporting client with effective technical materials for key decision-makers.

→ Project engineer for the City of San Luis Obispo, California, Potable Reuse Implementation Plan. Project includes developing non-RO based treatment trains and defining timelines and key steps for potable reuse implementation.

→ Project engineer for the Central Marin Sanitation Agency, California, Direct Potable Reuse Evaluation. Provided regulatory expertise to guide development of direct potable reuse concepts; develop cost estimates and layouts for potential treatment trains; conducted analysis of RO concentrate discharge and potential permitting challenges.

→ Project manager and water reuse specialist for the San Francisco Public Utilities Commission (SFPUC), San Francisco, California. While employed by SFPUC, Sarah managed a variety of water supply projects and program activities. Sarah's activities for SFPUC included:

- Project engineer for PureWaterSF potable reuse research project. Sarah helped develop the water quality test plan for the pilot-scale research project and supported pilot operation.
- Project manager and technical permitting lead for the San Francisco Zoo Recycled Water Project. The project entailed the planning and design of a pipeline to serve recycled water produced by SFPUC to the SF Zoo. Sarah led the effort to develop a multi-agency agreement on terms for recycled

water use at the SF Zoo and served as technical lead for environmental permitting and regulatory compliance.

- Program lead for the Onsite Water Reuse Program. Sarah developed technical assistance materials about designing onsite reuse treatment trains to meet water quality goals. She also provided technical support to design engineers.

→ Environmental engineer for Trussell Technologies. Sarah provided engineering support on water reuse and water treatment plant projects, including field and lab work.

- Engineering support for the Water Treatment Evaluation and Optimization at the City of Santa Cruz, California, Santa Cruz Water Treatment Plant. Sarah supported performance evaluation and improvements at the Santa Cruz Water Treatment Plant, including evaluating treatment train hydraulics to reduce DBP formation. She developed a model of DBP formation based on water quality parameters and developed jar testing protocol to assess treatability of winter source water. Sarah also conducted pilot testing of filter media configurations to increase filter capacity.
- Engineering support for the City of San Diego, California, PureWater San Diego Demonstration Project. Sarah developed a demonstration facility test plan for UV/AOP 1,4-dioxane and NDMA reduction testing. She also managed pathogen reduction performance data and led development of a QMRA for the facility using MATLAB. Additionally, Sarah conducted quantitative characterization of the demonstration facility mechanical reliability, looking at parameters such as Mean Time Between Failures and Preventive and Corrective Maintenance.

Sarah Clark, P.E.

- Engineering support for the Monterey Regional Water Pollution Control Agency, Monterey, California, Pure Water Monterey Groundwater Replenishment Project. Sarah supported water quality analysis for NPDES permitting of RO concentrate discharge. She evaluated biological treatment alternatives for ammonia reduction and conducted water quality sampling of alternative source waters and at demo facility. She also conducted lab water quality testing for post-treatment stabilization protocol.

- Engineering support for the WaterReuse Foundation's Analysis of California Potable Reuse Regulations. While with her previous engineering firm, Sarah assisted in evaluation of California's draft Surface Water Augmentation regulations on behalf of the WaterReuse Foundation, including development of a report to Division of Drinking Water.

- Engineering support for Innovative Alternative Water Supplies guideline and standards development for a San Francisco, California brewery. While with her previous engineering firm, Sarah developed guidelines for implementation of risk-based treatment standards for building-scale reuse. She also developed novel water quality and treatment standards for brewery process water reuse treatment systems, which are currently being implemented at a brewery in San Francisco.

Conferences/Webinars

- *PureWaterSF: The Final Chapter*, WaterReuse California Conference, 2020
- *Decoding the Log Reduction Targets and Pathogen Crediting*; Water Reuse Wednesdays Webinar Series, 2020
- *San Francisco's Non-Potable Water Program*; Water Conservation Showcase, San Francisco, California, 2019
- *Mechanical Reliability Analysis of a Direct Potable Reuse Facility*; Water Research Foundation Conference, Atlanta, Georgia, 2018

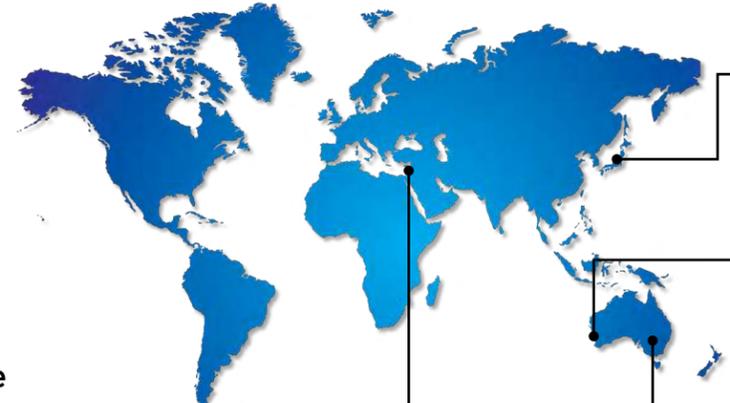
- *Public Health Protection in DPR: Results from the DPR Demonstration Project*, WaterReuse NorCal Chapter Meeting, Palo Alto California, 2017

Publications/Presentations

- Weeks, B., Triolo, S., et al., *Building-scale Potable Water Reuse Research in Downtown San Francisco*. *World Water*, 43(4), 30-32. (2020)
- Pecson, B., Triolo, S., et al., *Examining Reservoirs in Potable Reuse, Part 2: Surface Water*
- *Augmentation and Direct Potable Reuse*. *Journal AWWA*, 110(9), 49-54. (2018)
- Pecson, B., Triolo, S., et al., *Examining Reservoirs in Potable Reuse, Part 1: Groundwater*
- *Recharge and Surface Water Augmentation*. *Journal AWWA*, 110(8), 34-40. (2018)
- Pecson, B., Triolo, S., et al., *Mechanical Reliability in Potable Reuse: Evaluation of an Advanced Water Purification Facility*. *Journal AWWA*, 110(4), 19-28. (2018)
- Pecson, B., Triolo, S., et al., *Reliability of Pathogen Control in Direct Potable Reuse: Performance Evaluation and QMRA of a Full-Scale 1 MGD Advanced Treatment Train*. *Water Research*, 122, 258-268. (2017)
- Triolo, S., Pecson, B., Trussell, S., *Path to DPR: Benefits of Enhanced Treatment and Monitoring*. *Water Reuse & Desalination*, 8(4), 24-28. (2017)

POTABLE REUSE PROJECTS – US

 = Project writeup provided



i **Regulatory Framework, Outreach Plan, and PureWater Colorado Demonstration**
Colorado Water Conservation Board, CO
REGULATORY GUIDANCE, OUTREACH

i **Mobile Demonstration of Carbon-based Advanced Treatment DPR Process Train**
Colorado Springs Utilities, CO
DEMONSTRATION TESTING

i **Ministry of Economy, Trade, and Industry of Japan (METI)**
Japan
TECHNOLOGY ASSESSMENT

i **Clean Water Services Pure Water Demonstration**
Hillsboro, OR
PROCESS, TESTING

i **PureSoJo Non-RO DPR Demonstration Facility**
South Jordan City, UT
PURE WATER DEMONSTRATION DESIGN AND TESTING

i **Water Corporation of Western Australia**
Perth, Australia
REGULATORY, PROCESS

i **Confidential State Regulator**
Australia
EXPERT PANEL ADVISORY SERVICES FOR PURIFIED RECYCLED WATER PROJECT

i **Water Reuse Feasibility Study**
City of Santa Fe, NM
PLANNING

i **Multi-Use Water Reuse Feasibility Study**
City of Guyman, OK
PLANNING, MODELING

i **Rio Rancho Pure**
Rio Rancho, NM
PROCESS ANALYSIS

i **Mekerot (Israel) Shafdan Effluent Enhanced Treatment for IPR Quality**
Israel
REGULATORY, PROCESS

i **National Water Research Institute Framework for DPR**
Orange County, CA
REGULATORY GUIDANCE

i **National Water Research Institute Technology Validation Panel for IDE's SARP Water Reuse Technology**
Israel
TECHNOLOGY ASSESSMENT

i **Phoenix Advanced Purified Water Plan**
City of Phoenix, AZ
PLANNING

i **DPR Evaluation in WWMP**
Cape Fear Public Utility Authority, NC
PLANNING

i **Direct Potable Reuse Guidance in Arizona**
WaterReuse Arizona and AZ Water Association, AZ
REGULATORY GUIDANCE

i **Advanced Water Purification Facility (DPR)**
El Paso Water, TX
ADVANCED TREATMENT DESIGN/PERMITTING

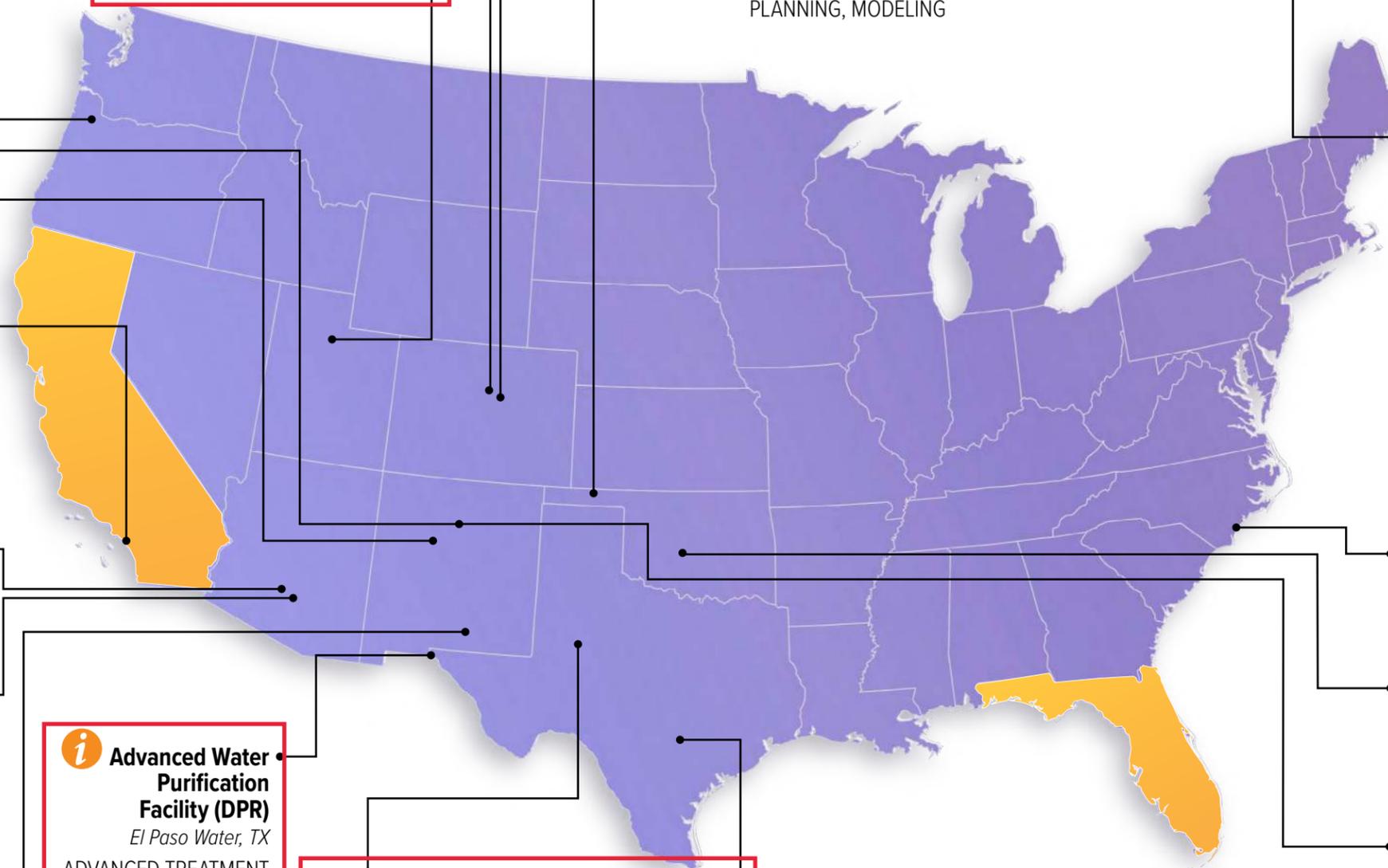
i **2060 Strategic Water Supply Plan**
City of Norman, OK
PLANNING

i **New Mexico DPR Regulations**
New Mexico Environment Department, NM
REGULATORY GUIDANCE

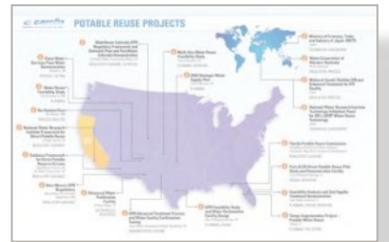
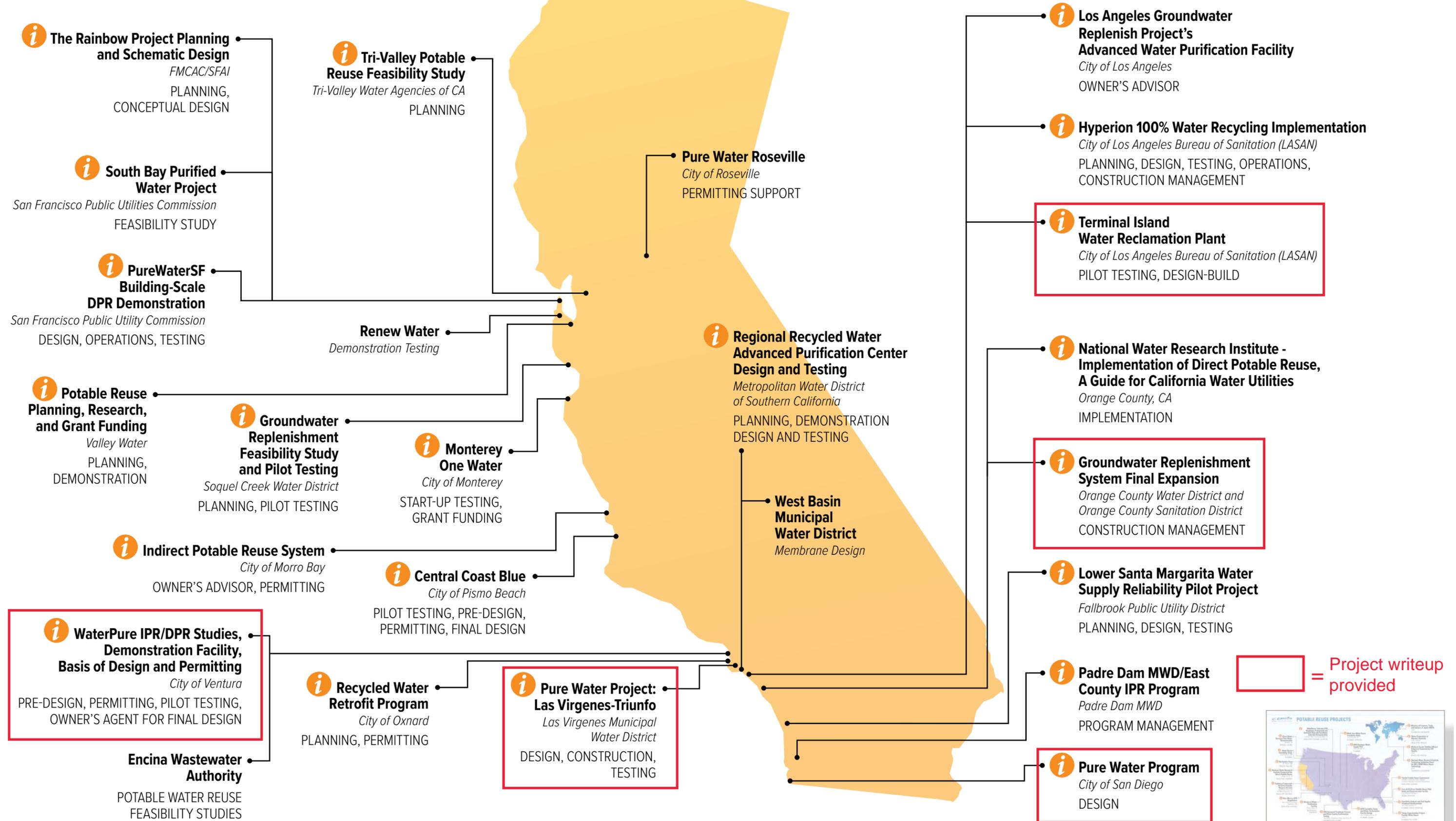
i **DPR Advanced Treatment Process and Water Quality Confirmation Testing**
Texas Water Development Board, Big Spring, TX
DEMONSTRATION TESTING

i **DPR Feasibility Study and Water Reclamation Facility Design**
City of Dripping Springs, TX
PLANNING, DESIGN

i **Santa Fe Water Reuse Feasibility Study and Return Flow Pipeline**
City of Santa Fe, NM
PLANNING, TESTING, PERMITTING, PREDESIGN

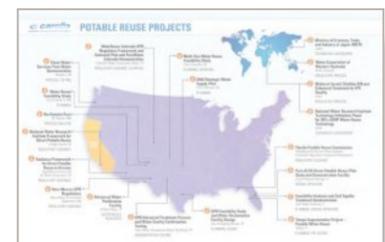
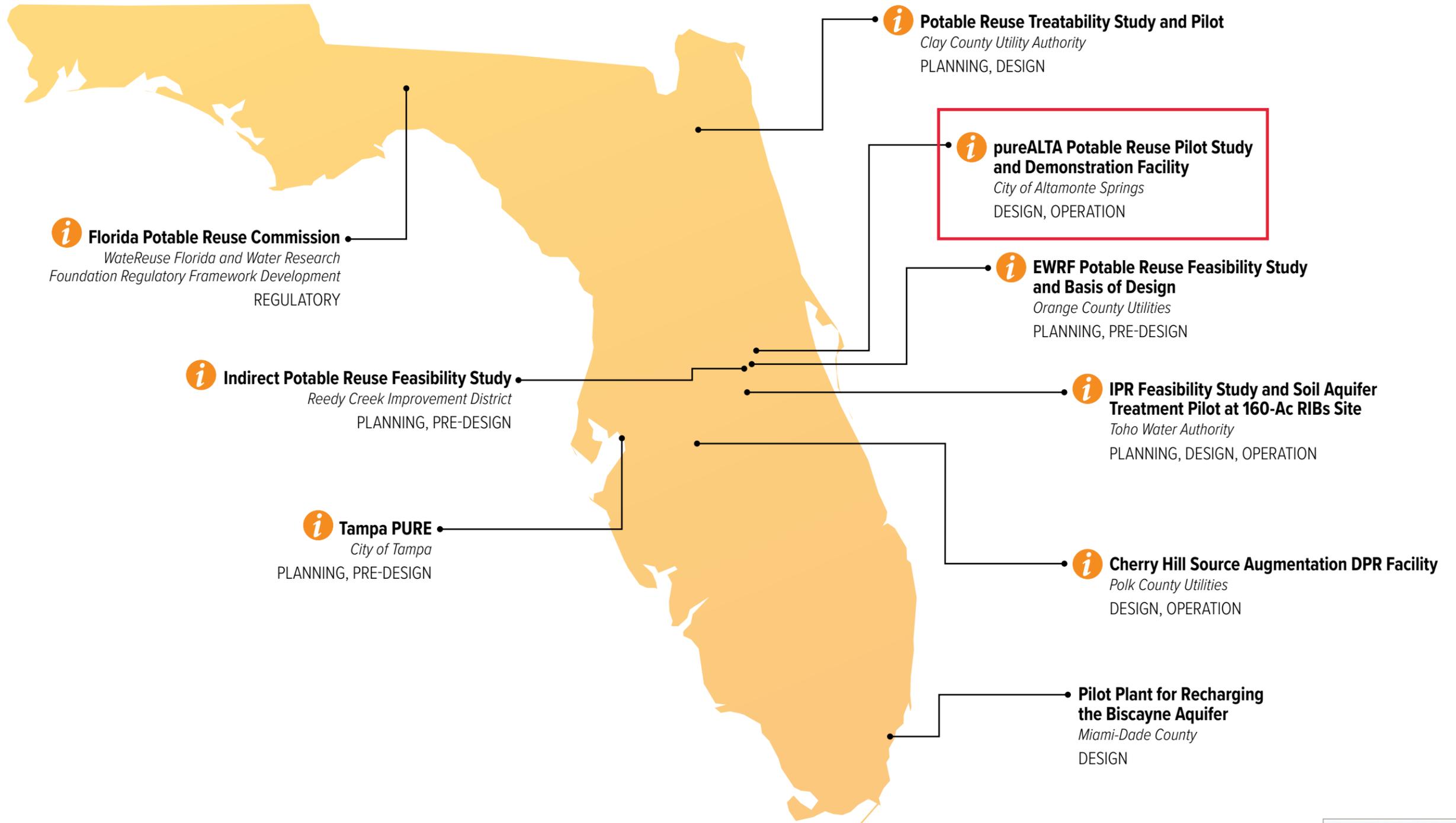


POTABLE REUSE PROJECTS – CALIFORNIA



POTABLE REUSE PROJECTS – FLORIDA

 = Project writeup provided





pureALTA Potable Reuse Pilot Study and Demonstration Facility

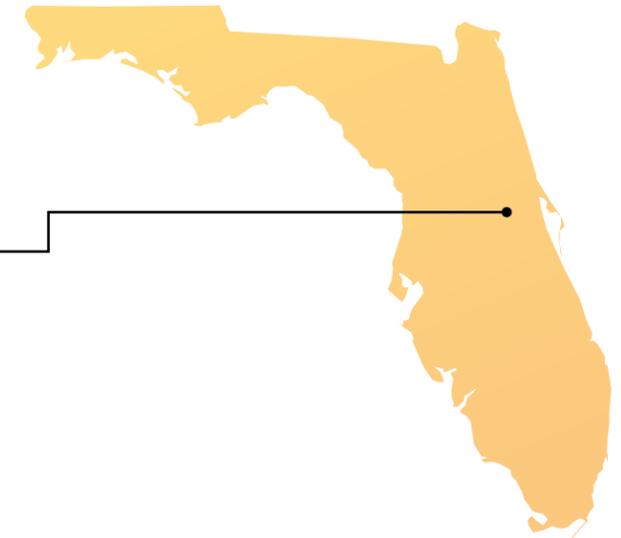
City of Altamonte Springs

DESIGN, OPERATION

The City of Altamonte Springs is developing an alternative water supply to maximize the use of existing resources and improve the robustness and resilience of their high quality water supply. However, the City is located in Central Florida with no easy way to manage brine produced by membrane based treatment. Carollo worked with the City to select a non-RO purification process for potable reuse that meets all regulated standards and unregulated water quality goals. The process included ozone followed by biologically activated carbon filtration, ultrafiltration, granular activated carbon, and UV disinfection.

The 12-month demonstration effort included treatment process design, equipment procurement, installation, operation, and testing. After a year of continuous operation, the treatment train was shown to provide high purity water at a fraction of the cost of RO-based systems and without the waste products (RO concentrate). Completed in October 2017, the project demonstrated the safety of a carbon-based (i.e., non-RO) process train for direct potable reuse. The multiple barrier performance for removal of pathogens, regulated chemicals, and constituents of emerging concern was proven through online monitoring systems and advanced analytical monitoring.

pureALTA continues to operate on a daily basis producing safe water and hosting educational tours for the public, building confidence in their water supply for a sustainable future.



PROJECT HIGHLIGHTS

- » *Awarded the 2017 Innovative Project of the Year award from the WaterReuse Association and the 2018 Market Changing Water Technology from the International Water Association.*
- » *Proved the ability to meet potable water quality requirements at a reduced cost and without the generation of a concentrate waste or brine stream as is the case in RO-based projects.*
- » *Provided support to the City in their public education efforts.*





PureSoJo Non-RO DPR Demonstration Facility

South Jordan City, UT

PURE WATER DEMONSTRATION DESIGN AND TESTING

South Jordan City, Utah, has no culinary water rights of its own and currently obtains all of its drinking water from its regional wholesaler Jordan Valley Water Conservancy District. The City has been on a decade-long mission to develop a drought-tolerant, year-round, local supplemental supply to help meet their rapidly expanding population.

Carollo worked with the City to complete a predesign study for a Direct Potable Reuse Demonstration Facility using a non-RO based process train that relies on ozone, biological filtration, ultrafiltration, granular activated carbon and UV. This project is the first step in a long journey to introduce DPR to Utah. The demonstration facility, and a potential future DPR facility, will treat high quality, membrane bioreactor-treated and UV-disinfected wastewater from the Jordan Basin Water Reclamation Facility. The purified water from the demonstration facility will meet all drinking water regulations and be available for tasting (pending permit), but will be discharged back to the front of the plant.

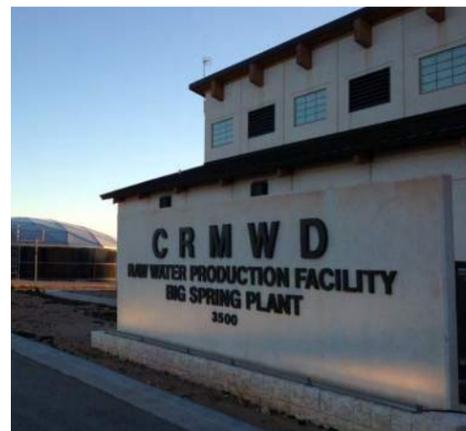
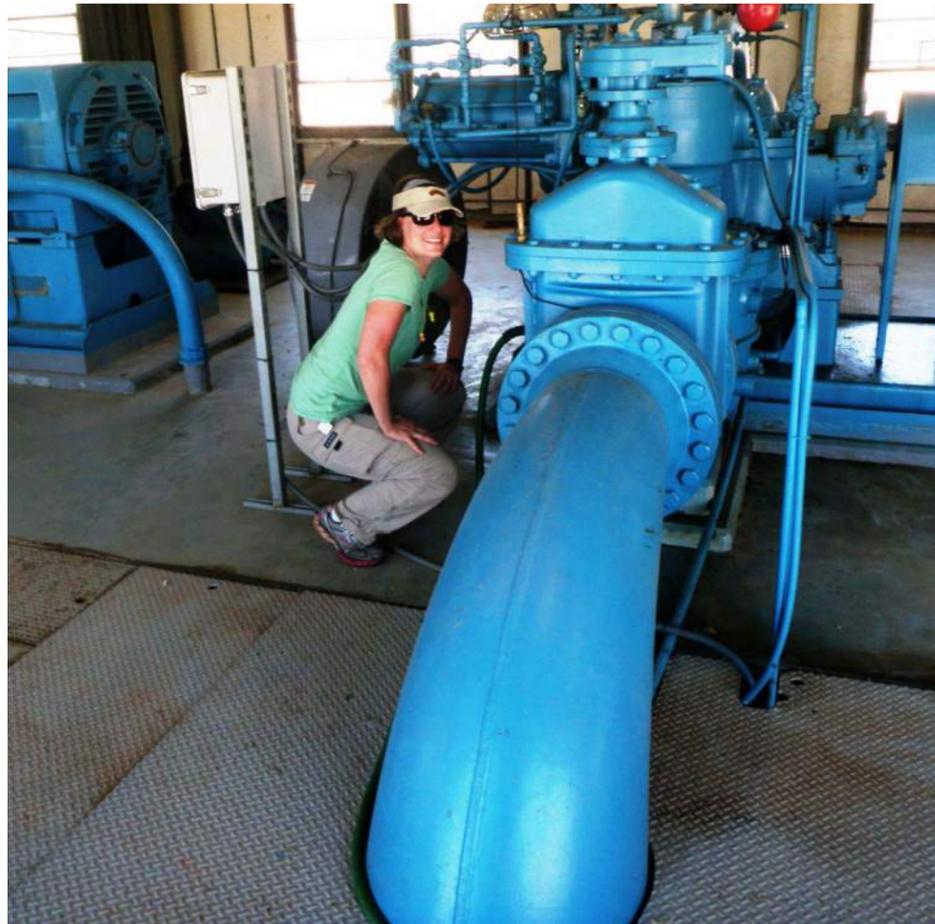
The demonstration project will educate state officials, water managers, and the public on DPR, and generate critical information to help forge a regulatory path for DPR in Utah. Carollo completed the design and pre-purchase equipment packages and City staff installed, wired, and plumbed in the equipment for this critical pilot project. Carollo is providing piloting assistance for the first year of operations.



PROJECT HIGHLIGHTS

- » *Non-RO DPR demonstration facility.*
- » *First step towards introducing DPR to regulators and the public in Utah.*
- » *MBR-based potable reuse treatment train.*



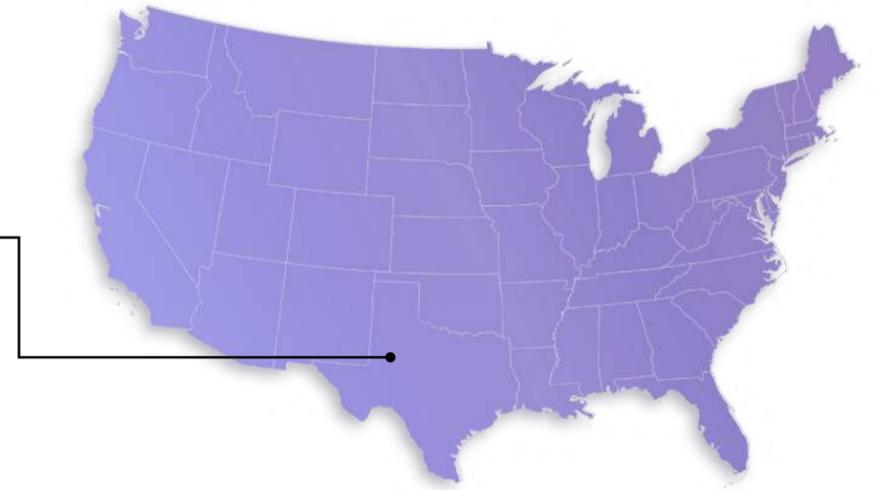


DPR Advanced Treatment Process and Water Quality Confirmation Testing

Texas Water Development Board, Big Spring, TX

DEMONSTRATION TESTING

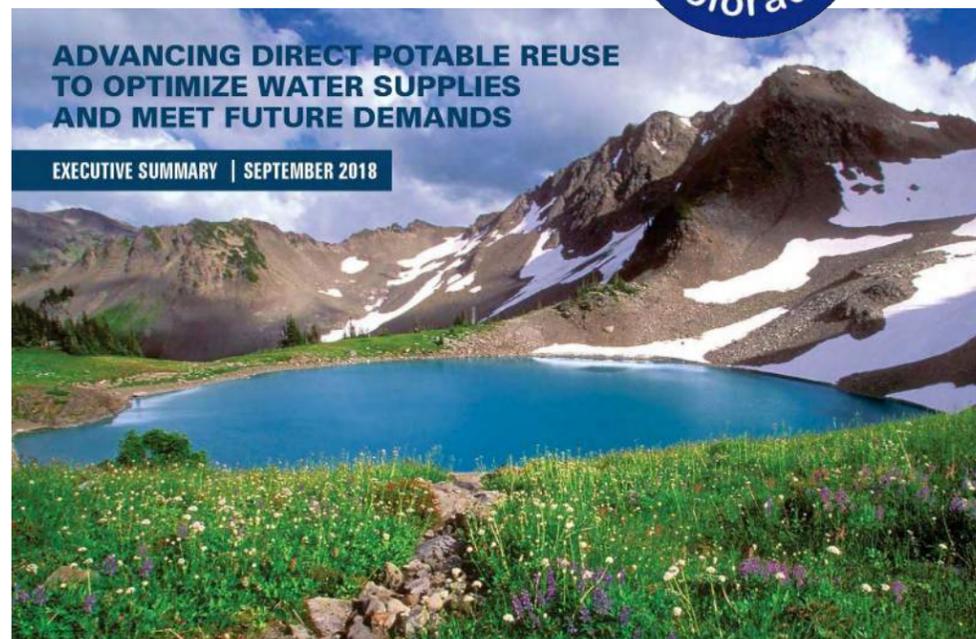
The Texas Water Development Board selected a team led by Carollo to perform a comprehensive evaluation and monitoring study of the first DPR facility in the U.S. The advanced treatment processes implemented at the Raw Water Production Facility consist of microfiltration, reverse osmosis, and UV advanced oxidation. Unlike similar indirect potable reuse projects across the US, the RWPF is unique in that its product water is sent directly to conventional surface water treatment plants prior to distribution for drinking. Carollo assessed the existing operations of the facility and developed and implemented a water quality testing protocol that includes direct measurement of pathogens and trace chemicals, as well as a number of indicator and surrogate measurements that can be used to monitor treatment performance. The study showed that RWPF was producing a high-quality raw water that already met standards for drinking even before further treatment. The results were compiled into a monitoring guidance document for DPR projects and is available for download from the TWDB web site.



PROJECT HIGHLIGHTS

- » *2 Year water quality evaluation of the only operating DPR system in the US.*
- » *Extensive results demonstrate high quality purified water.*
- » *Project results provide confidence in development of DPR regionally and nationally.*





Regulatory Framework, Outreach Plan, and PureWater Colorado Demonstration

Colorado Water Conservation Board, CO

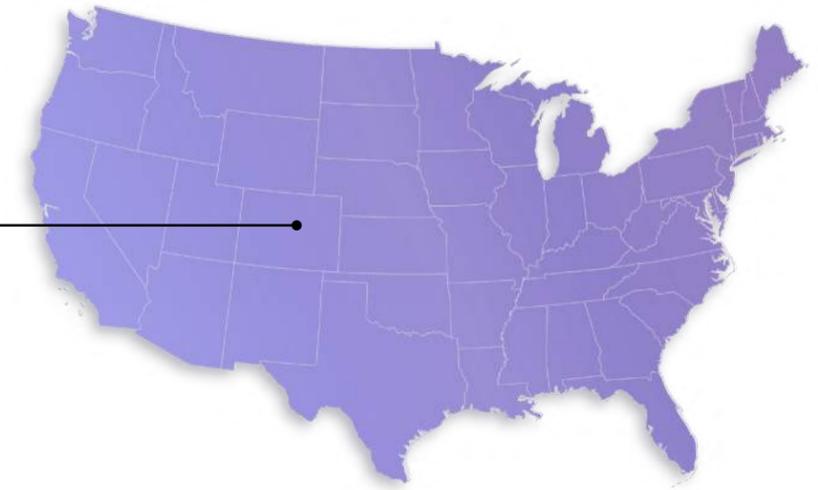
REGULATORY GUIDANCE, OUTREACH

DPR REGULATORY FRAMEWORK AND OUTREACH PLAN

Carollo led a diverse stakeholder team to position Colorado for the implementation of DPR in the state, establishing a framework for utilities that choose to investigate or implement DPR as part of their supply portfolio. The project combines Carollo's national potable reuse expertise with a local work group-driven process to develop a framework for potable reuse regulations in Colorado and a program for focused outreach to help support utilities in planning and implementing potable reuse. The results of this effort spurred a subsequent phase of detailed DPR regulatory development in partnership with the Colorado Department of Public Health and Environment, continuing on through fall 2019.

PUREWATER COLORADO DEMONSTRATION

The PureWater Colorado demonstration, operated in Denver from January through April 2018, relied upon O₃/BAC as a core treatment process (instead of RO) and plays a key role in preparing Colorado for future DPR projects by providing a fun, physical context for regulatory development and public outreach. Outreach resources include a video tour of the demonstration facilities, a project overview video, and TV and print media coverage. A wide variety of audiences were reached through a total of 178 attendees who toured the demonstration facility and tasted the finished water over four weeks of active tours. Water produced from the demonstration was used to produce beer at Declaration Brewing for Denver Water's centennial celebration – with all proceeds benefiting WaterReuse Colorado scholarships – and to produce wine at InVINtions Winery for WaterReuse Colorado outreach events.



PROJECT HIGHLIGHTS

- » *Developed a potable reuse regulatory structure in a state where no regulations exist.*
- » *Considered realistic implications of non-potable versus potable reuse options*
- » *Focused the Outreach and Communication Plan on fostering public understanding and support.*
- » *Collaborated on the demonstration project with Denver Water, the Colorado Water Conservation Board, Xylem, Pall Corporation, and Calgon Carbon.*





Pure Water Project: Las Virgenes-Triunfo

Las Virgenes Municipal Water District

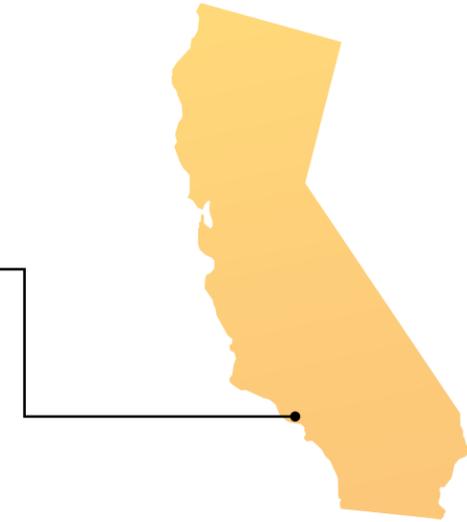
DESIGN, CONSTRUCTION, TESTING

Las Virgenes Municipal Water District (LVMWD) and the Triunfo Sanitation Districts (TSD) jointly own and operate, through a Joint Powers Authority (JPA), the Tapia Water Reclamation Facility (TWRF), which produces roughly 6.5 mgd of Title 22 recycled water. However, only 60 percent of that recycled water is beneficially reused.

After reviewing a number of alternatives, the JPA decided to construct an advanced water treatment (AWT) plant to provide a new local water supply for the region.

Carollo was contracted to construct a purified water demonstration facility, which required establishment of design and operational criteria, development of a public outreach strategy, and demonstration of purified water in accordance with existing regulations. Each of these key elements was incorporated into the process design and demonstration scale procurement of UF/NF, RO, and UV/AOP.

The 100 gpm AWT demonstration facility is currently operating. It consists of an open platform UF that allows 3 different MF/UF modules to be compared in parallel; a flexible RO system that can be run as either 2 or 3 stage 2; and a UV AOP that can operate with either chlorine or hydrogen peroxide as the oxidant.



PROJECT HIGHLIGHTS

- » *Permanent pure water demonstration facility.*
- » *Focused on water quality demonstration, design optimization, and operator training.*
- » *Includes public engagement and demonstration gardens.*





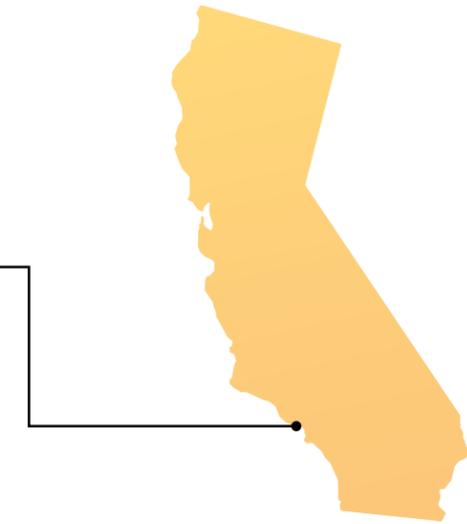
WaterPure IPR/DPR Studies, Demonstration Facility, Basis of Design and Permitting

City of Ventura

PRE-DESIGN, PERMITTING, PILOT TESTING, OWNER'S AGENT FOR FINAL DESIGN

Based on years of studies, the City of Ventura determined that potable reuse is the best use of wastewater to augment supplies in a region that has suffered due to prolonged drought. Recognizing the need to prove the concept, a DPR demonstration pilot (WaterPure) was initiated under the combined efforts of the City of Ventura, Carollo Engineers, and members of the Water Research Foundation Project 4536 team. The goal of the demonstration facility was to document the high quality of purified reclaimed water through extensive water quality testing, and to understand the impact of blending this purified water with the conventional finished potable water.

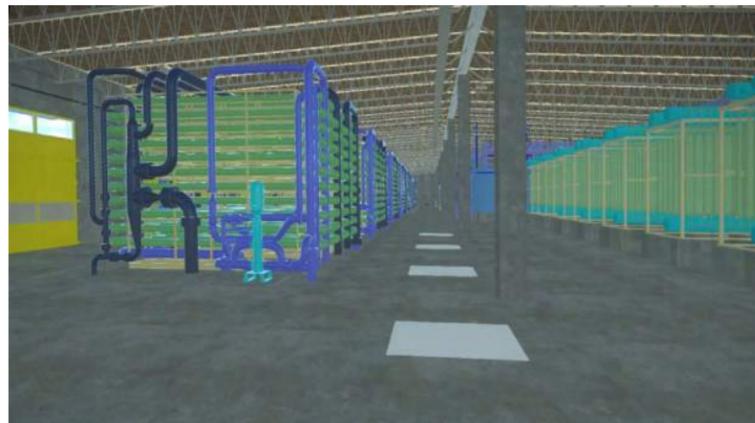
Following completion of the demonstration, Carollo began additional studies further implementation of WaterPure including brine disposal studies, stakeholder workshops, regulatory meetings, and diversion scenarios (to define how much water would be available for DPR). In 2017, Carollo started the Basis of Design and permitting activities required in the State of California to permit a potable reuse project. In parallel Carollo has provided detailed technical analyses and review for the City's environmental documentation (environmental impact report or EIR) which was adopted in early 2019. Carollo was subsequently selected as the Owner's Agent to help the City oversee the final design and permitting for a 4 mgd advanced treatment facility, which is to be operational by 2025.



PROJECT HIGHLIGHTS

- » *Pilot-scale demonstration provided treatment through pasteurization, ultrafiltration, reverse osmosis, and an ultraviolet light advanced oxidation process and served as a community education opportunity.*
- » *Completed Basis of Design and permitting of full advanced water treatment train for DPR of wastewater treatment plant effluent.*
- » *Selected as Owner's Agent to oversee final design of 4 mgd potable reuse advanced purification facility.*





Pure Water Program

City of San Diego

DESIGN

One of the largest water recycling programs in the nation, the Pure Water Program seeks to produce 83 mgd of potable recycled water through designing and constructing new advanced water purification, pumping, and conveyance facilities, and completing upgrades to existing facilities. In addition to creating a drought-proof, locally produced replacement for imported water supply, the program will reduce the flow of treated wastewater effluent to the Pacific Ocean.

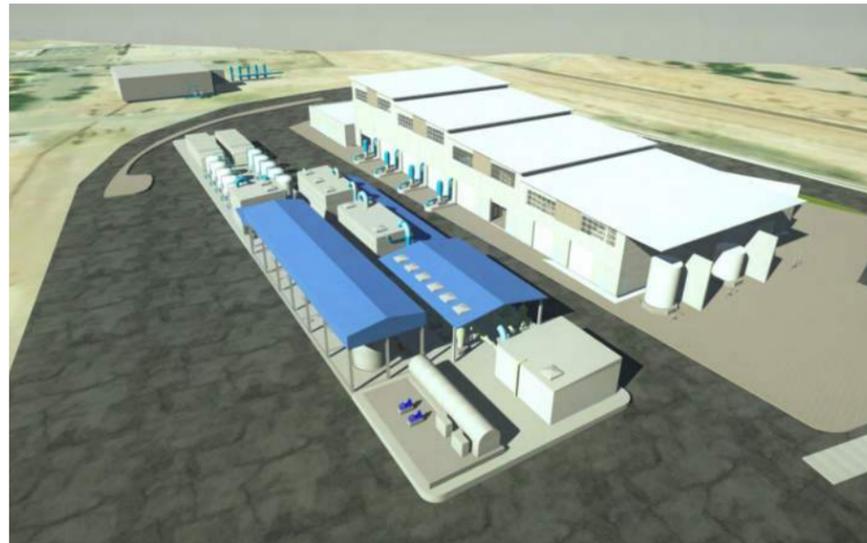
In April 2018, Carollo delivered the final design of North City Pure Water Facility (NCPWF), the Program's premier project. Through the implementation of several design refinements, Carollo was able to both improve NCPWF with enhanced safety and operational features and save the City well over \$30 million in capital costs. The \$367 million NCPWF will purify 34 mgd of tertiary effluent from the North City Water Reclamation Plant (NCWRP) to meet the recently published (July 2017) Title 22 California Code of Regulations for surface water augmentation indirect potable reuse (IPR). While groundwater recharge IPR facilities have been in operation in California for decades, the NCPWF is the first that augments surface water for potable reuse.



PROJECT HIGHLIGHTS

- » *Delivered the final design of North City Pure Water Facility (NCPWF), the Program's premier project and the first project of its kind in California.*
- » *Designed a proven, five-step water purification process of ozonation, biological activated carbon filters, membrane filtration, reverse osmosis, and UV disinfection with advanced oxidation.*
- » *Designed to produce 34 mgd, NCPWF will send 30 mgd to the Miramar Reservoir and 4 mgd back to NCWRP to reduce the total dissolved solids (TDS) concentration in the chlorine contact tank effluent.*





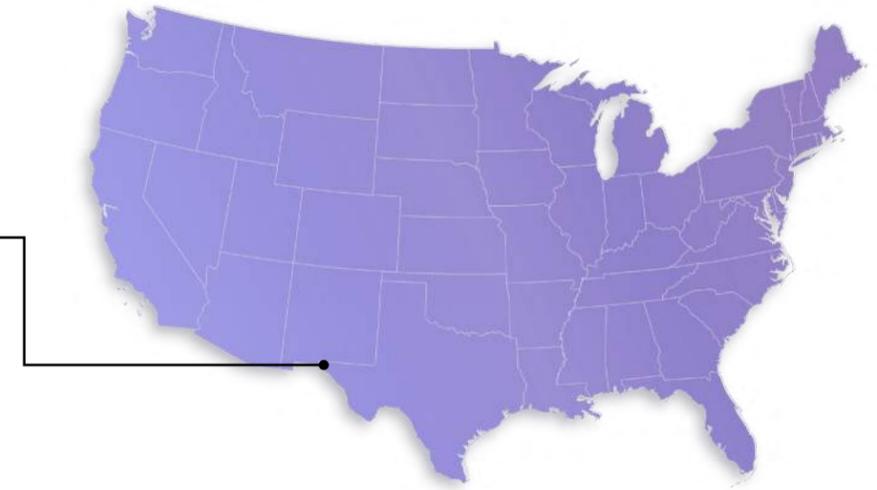
Advanced Water Purification Facility (DPR)

El Paso Water, TX

ADVANCED TREATMENT DESIGN/PERMITTING

Carollo is currently designing the first direct-to-distribution direct potable reuse (DPR) facility in the U.S., the Advanced Water Purification Facility in El Paso, Texas. The AWPf will provide a new, drought-proof, and completely renewable source of drinking water for this Chihuahuan Desert community by producing up to 12 mgd of blended drinking water at build-out.

In 2017, El Paso Water selected Carollo to guide this project through major permitting and pre-design milestones, and ultimately through final design and commissioning. The design will be completed in late 2022 and go to construction in 2023.



PROJECT HIGHLIGHTS

- » *Ongoing TCEQ coordination.*
- » *Technical evaluation through 30% design package completed.*
- » *Performing source water characterization on effluent from El Paso Water's Roberto R. Bustamante Wastewater Treatment Plant (RBWWTP).*
- » *Coordination with upstream improvements at RBWWTP*
- » *\$3.5M in grant funding.*





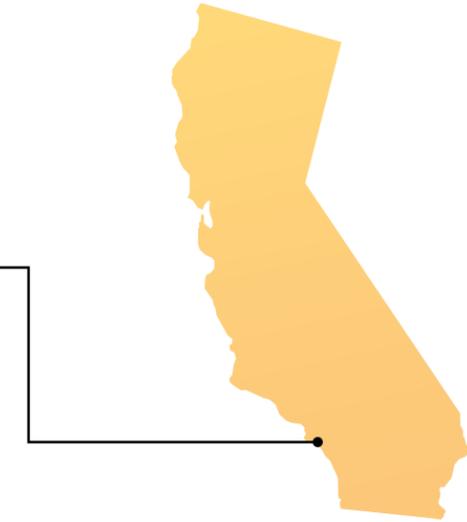
Terminal Island Water Reclamation Plant

City of Los Angeles Bureau of Sanitation (LASAN)

PILOT TESTING, DESIGN-BUILD

Carollo worked closely with Los Angeles Bureau of Sanitation (LASAN) on its Terminal Island Water Reclamation Plant, from pilot testing to design-build and startup. Carollo's services included an MF/RO evaluation, the analysis and piloting of potable reuse technologies, and, most recently, serving as design lead for the plant's expansion from 6 mgd to 12 mgd.

The \$41.5 million design-build expansion features an upstream 2 million gallon tertiary effluent equalization tank, additional MF and RO systems, an Advanced Oxidation Processes (AOP) system that includes a combination of UV and sodium hypochlorite (NaOCl) for disinfection, pump upgrades, a chemical system addition, auxiliary systems, and utilities. The design optimizes reuse and more than doubles prior recycled water production levels by allowing 100 percent of the plant's flow to receive advanced treatment. Carollo was able to achieve cost-effective purification solutions for the client without compromising performance through the use of extensive pilot testing of the first UV/NaOCl system for potable reuse.



PROJECT HIGHLIGHTS

- » *As one of the world's most technologically advanced water treatment systems, the project was awarded the "California's 2017 Best Projects" by ENR.*
- » *Held a number of partnering and value engineering workshops to identify additional cost and time saving solutions.*
- » *Worked closely with City Engineering, Plant staff, and two different consultant owner's advisors through pilot-scale demonstration, design, and construction.*





Groundwater Replenishment System Final Expansion

*Orange County Water District and
Orange County Sanitation District*

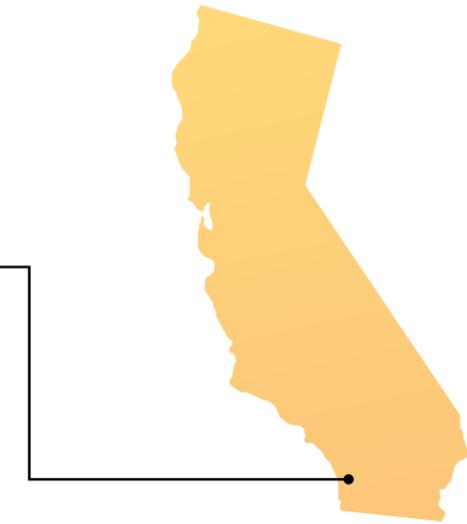
CONSTRUCTION MANAGEMENT

The \$310 million Groundwater Replenishment System Final Expansion (GWSFE) project will increase the system treatment capacity from 100 to 130 million gallons per day (MGD). In order to produce 130 MGD of purified water through the GWRS, additional secondary effluent from the Orange County Sanitation District (OCSD) is required for source water. This additional secondary effluent source water must be received from OCSD's Treatment Plant Number 2 (OCSD P2) which is located in the city of Huntington Beach approximately 3.5 miles south of the GWRS facility. The GWSFE project includes:

- » Addition of 30 MGD of additional capacity.
- » Constructing Plant No 2 Secondary Effluent Conveyance Facilities
- » Rehabilitating an existing pipeline between Plant No. 2 and Plant No 1 to bring secondary effluent to the GWRS

The project is being financed in part with a low interest rate U.S. EPA WIFIA loan of \$135 million. Construction on the final expansion began in 2019 and will be completed by 2023.

Carollo is providing construction management and engineering services during construction.

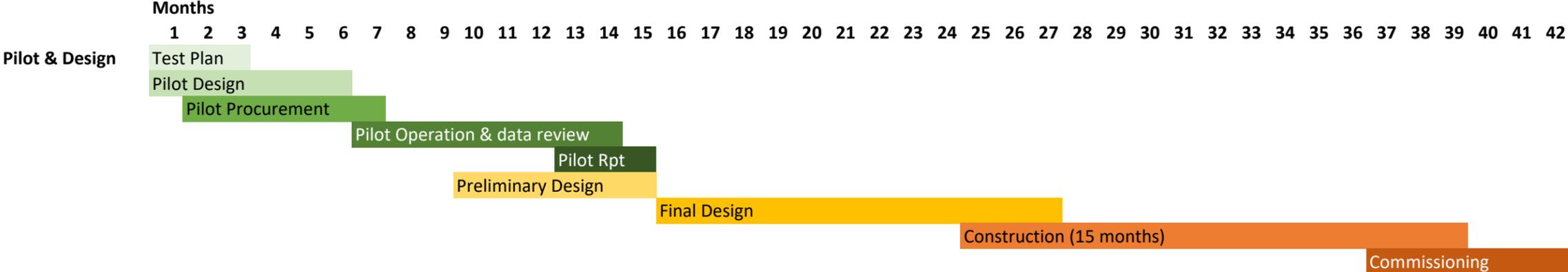


PROJECT HIGHLIGHTS

- » *Modify major pipeline tie-ins to reduce GWRS downtime by providing isolation valve additions, line stops and fit-up spools.*
- » *New MF system quality assurance testing and coordination to reduce risk of membranes system failure.*
- » *Pipeline rehabilitation fabrication quality assurance to minimize rework.*
- » *After completion, the 130 MGD facility will provide enough water to serve 1 million annually.*



Target Schedule: 42 Months (3.5 years) to Operational Full-Scale Facility





thomasandhutton.com