WATER AND WASTEWATER EXPERTS

Carollo Engineers is an environmental engineering firm specializing in the planning, design, and construction management of water and wastewater facilities. Carollo’s reputation is based upon client service and a continual commitment to quality. We currently maintain 44 offices throughout the United States.

During our 86-year history, Carollo has successfully completed more than 25,000 projects for public sector clients. Carollo is currently ranked within Engineering News Record’s (ENR) top 500 design firms. More importantly, ENR’s annual Source Book ranks Carollo among the top 10 firms for water and sewer/wastewater. Unlike our competitors, Carollo only provides water and wastewater engineering services. We recruit nationwide and hire technical staff with extensive background and training specific to this field. For that reason, the quality and professional standing of our core group of water and wastewater professionals equals or exceeds that provided by some of the largest engineering firms in the country.

We have recently completed or are performing ongoing water/wastewater projects for many of the country’s major municipalities or special districts.
RESOURCES
Carollo’s staff numbers more than 1,050 employees, including more than 500 registered engineers. We are a full-service company with the experience and qualified professionals to successfully manage projects of any size. Our staff includes civil, sanitary, environmental, electrical, mechanical, chemical, structural, control system, and corrosion control engineers, as well as architects, planners, and specialists in other areas. Consultants are retained as needed in specialized fields depending on the specific needs of the project.

USING ADVANCED TECHNOLOGY TODAY
Carollo is in the forefront of developing and using new tools for our clients. These include innovative uses of the internet for project management, an array of information management services, computational fluid dynamics, and a suite of unique Web-based software packages not available elsewhere in the water and wastewater industry.

Innovative New Tools

Computational Fluid Dynamics
Hydraulix® Hydraulic Model
Clariflux® Activated Sludge Solids Model
Master Plan Manager
Computational Fluid Dynamics

Carollo also uses computational fluid dynamics (CFD), a modeling technique by which flow patterns within a hydraulic facility, such as a pump station’s wet well or a downstream flow splitting box, can be simulated numerically. This tool allows us to fully understand the flow streams within these facilities in an effort to minimize short circuiting, reduce vortex formation, and address sedimentation. The foundation for the CFD models is based on a highly accurate and advanced modeling technique called the finite element method. Such high-accuracy models were previously used by the aerospace, biomedical, and defense industries. With the advent of high-speed computers, and in response to our clients’ optimization needs, Carollo has refined and adapted these high-accuracy models for application within the water and wastewater industry.

Hydraulix® Hydraulic Model

Hydraulix® is a hydraulic modeling tool developed by Carollo to evaluate plant hydraulics. What sets Hydraulix® apart from other hydraulic models is its integration of a sophisticated graphical user interface with an easy-to-use computational format.

The development of the Hydraulix® model bridges the gap between non-user-friendly design spreadsheets and complicated commercial models. It is an acknowledgment of a common theme we have heard from clients over the past few years—a desire on the part of the plant staff to have an easy-to-use hydraulic tool that will help them optimize plant operation. Hydraulix® utilizes advanced graphical user interface features and can be used effectively even by non-experts. The pictorial format allows the user to “click” process units on or off and to evaluate the resulting impact on the plant hydraulics. The model can be used to answer the many “what if” questions that typically emerge during the day-to-day operation of a treatment plant. Hydraulix® can also be used to analyze different operational configurations and to establish hydraulic capacities under these configurations.

Carollo applied CFD to model the hydraulic characteristics of the 300-mgd Columbia Boulevard Wastewater Treatment Plant headworks in Portland, Oregon. Team members used the model to locate baffles and minimize turbulence and pump cavitation.

Our hydraulic evaluations are augmented by our powerful Hydraulix® model.
Key features of Master Plan Manager include:

- Graphical user interfaces that are easy to use and understand.
- Demographic, financial, engineering, and stakeholder models incorporated into one comprehensive solution.
- Four- to six-week development periods for planning scenarios reduced to just minutes.
- Options for growth rates, service area expansion, water conservation, source control, biosolids recycling/disposal, water reuse, and watershed management.

**Clariflux® Activated Sludge Solids Model**

Clariflux® is an activated sludge simulation model developed by Carollo that provides a visual depiction of the solids interactions occurring between the aeration basins and the secondary clarifiers in an activated sludge process. Understanding these interactions can be critical for both design and operation because the overall success of the process depends on the ability to capture solids to prevent their escape in the effluent, and to adequately thicken in the clarifiers. Solids flux theory provides the theoretical background that describes these interactions; however, because of the complicated nature of the theory and the mathematical analysis involved in its application, it is generally not used in operational practice. As a result, the solids interactions in the activated sludge process are often poorly understood, and operational decisions relating to these interactions tend to be made on a trial-and-error basis.

Clariflux® removes the guesswork by providing a user-friendly tool for investigating the impact of different operational changes at a desktop level. The user-friendly graphical user interface allows the model to be easily used, even by non-experts. Using a click-and-configure approach, plant operations staff can easily configure the input screen to match the actual plant operational setup, and observe the resulting impact of operational changes on solids inventory in the activated sludge process. The model allows the user to analyze the impact of different parameters, including mixed-liquor suspended solids concentration, return rate, and sludge settleability.

**Master Plan Manager**

Carollo developed Master Plan Manager to guide wastewater treatment plant planners and managers through the development of master plan scenarios, and to provide critical information for making informed decisions in managing water, wastewater, and water resources projects.

This software package allows the user to select a set of master planning options from a Strategy Table. Master Plan Manager incorporates these selections into a master plan scenario and within minutes displays capital improvement plan results including financial, environmental, stakeholder, and other critical planning information.
CAROLLO RESEARCH GROUP

Carollo’s R&D Practice, also known as the Carollo Research Group (CRG), is a diverse team of engineers, scientists, and researchers located throughout the country, who are focused on bridging the gap between fundamental research and practical, innovative, and reliable solutions in the water industry. We believe that creativity, science, and technology must be integrated with sound engineering to meet the complex challenges facing our industry. Challenges like aging infrastructure, increasingly stringent water quality and discharge requirements, the movement toward sustainability, and growing water supply shortages require innovative thinking: thinking that bridges the gap from research and development to the application of advanced processes, technologies, and tools for real-world solutions.

Research Solutions is a quarterly publication of the Carollo Research Group. Research Solutions is distributed to over 2,500 readers. It features articles that demonstrate Carollo’s capabilities to develop and implement advanced processes, technologies, and tools in the water industry.
In the last five years alone, the CRG has conducted over 100 applied R&D projects for agencies such as the Water Research Foundation, Water Environment Research Foundation, WateReuse Research Foundation, U.S. EPA, U.S. Bureau of Reclamation, Army Corps of Engineers, National Water Research Institute, U.S. Department of Defense, and many municipal clients. The industry-wide knowledge base of technologies is constantly expanding. Participating in cutting-edge R&D projects allows the CRG to remain plugged into that knowledge base and to recognize, anticipate, and influence major trends in the water and wastewater industry. This gives Carollo the capability to readily integrate advanced processes into full-scale, municipal project work to facilitate the consistent delivery of high-value solutions to our clients.

**Carollo Research Group - Select Focus Areas**

- UV Disinfection Performance & Validations
- Membrane Filtration
- Desalination
- Concentrate Management & Minimization
- Engineered Biofiltration™
- Advanced Oxidation Processes
- Energy Audits & Energy Recovery
- Direct & Indirect Potable Reuse
- Advanced Secondary Wastewater Treatment
- Biosolids
- Disinfection & Disinfection By-Products
- Microconstituents
- Distribution System Audits
- Infrastructure Condition Assessments
- Computational Fluid Dynamics
- Master Planning Tools / Programming

**CAROLLO’S MANAGEMENT PHILOSOPHY**

Carollo’s management philosophy and the success of our company are founded on simple precepts:

Seek out, hire, and hold onto the best people in the business. We recognize that the most critical element for a successful project is the project team. Carollo aggressively recruits the top candidates from the leading engineering schools across the country. We train and mentor these engineers to become the next generation of leaders for Carollo and the industry. This long-term commitment to developing excellent engineers has resulted in a depth of talent unmatched by other consulting firms.
Specialize in the planning, design, and construction management of water and wastewater projects. This is our business. Our success hinges solely upon our ability to provide responsive service to our municipal clients.

Commit our partners to an active role in every project. This provides our clients with top management interest, clear accountability, responsiveness, and talent, which helps to ensure that the necessary staff and resources are committed to each assignment.

Focus on client service. Carollo knows the value of listening to our clients and recognizes that successful projects result from the combined expertise of our staff and the client’s staff. This commitment of listening and valuing client input is one of the cornerstones of Carollo’s success.

Our firm takes pride in the large number of clients with whom we have maintained continuing working relationships. We have worked with some clients for more than 80 years—a clear indication of the quality of our work, our control of costs, and our ability to meet schedules. This whole-hearted dedication to quality results in tangible benefits to our clients and is demonstrated by our record of low change orders during construction.

QUALIFICATIONS

Carollo has provided planning, design, and construction management services for water and wastewater agencies serving populations ranging from less than 10,000 to more than 2 million. Our capabilities span the following areas:

Water Planning
- In the last 15 years, Carollo has performed water planning services for more than 70 municipal clients with service area populations from 5,000 to over 1 million.
- We have completed water treatment plant evaluations for over 100 facilities treating a wide variety of surface water supplies in 25 different states.

Water Treatment
- Carollo has provided planning and design services for over 100 water treatment plants with a total capacity of more than 3.5 billion gallons per day.
- Water treatment plants designed by Carollo range in size from less than 1 mgd to more than 600 mgd in capacity.

Water Infrastructure
Carollo has provided design and construction management services for:
- More than 700 miles of water pipeline ranging in size from 6 to 108 inches in diameter.
> Over 100 water pumping stations with capacities as high as 600 mgd.
> More than 150 water storage reservoirs with capacities ranging from less than 1 million gallons to 60 million gallons.

**Wastewater Master Planning**
> We have provided master planning services for municipal utilities with wastewater treatment facilities ranging in capacity from 1 to 300 mgd.
> Our 1992 Master Plan for the Sacramento Regional County Sanitation District was awarded the American Academy of Environmental Engineers’ Engineering Honor Award and the California Water Environment Associations’ Engineering Achievement Award.

**Wastewater Treatment**
> Carollo has designed new or improved facilities for over 200 wastewater treatment plants.
> We have performed major projects for 10 of the 14 wastewater treatment plants in the western U.S. treating greater than 100 mgd.
> Wastewater treatment plants designed by Carollo range in size from less than 1 mgd to over 300 mgd.

**Water Reuse**
> Carollo has provided engineering services for more than 50 reclamation and reuse projects. Much of our work has been in the planning and design of facilities to meet California Department of Health Services Title 22 requirements for unrestricted reuse.
> We have provided water reuse planning and design services for agencies currently using over 20 billion gallons of reclaimed water each year.
> We have performed detailed market assessments for large-scale reuse projects for major municipalities.
> Our experience spans water reuse for a variety of purposes, including landscape/golf course irrigation, agricultural irrigation, industrial reuse, wetlands/stream enhancement, and groundwater recharge.

**Wastewater Infrastructure**
> Carollo has provided engineering services for over 2 million linear feet of wastewater pipeline, ranging in diameter from 6 inches to 120 inches.
> We have designed pumping facilities capable of handling flows ranging from less than 1 mgd to over 600 mgd.
Combined Sewer Overflow/Sanitary Sewer Overflow Facilities

- Carollo has been involved in planning, permitting, design, and construction of combined sewer overflow (CSO) and sanitary sewer overflow (SSO) facilities to handle peak flows up to 300 mgd.
- We have planned and designed sewer separation and rehabilitation projects using a variety of construction techniques.

Biosolids Management

- Carollo has provided planning and/or design of facilities to accommodate more than 750,000 tons of biosolids per year.
- Our experience includes extensive involvement in permitting of biosolids application sites.
- We understand the new regulatory arena associated with biosolids and are committed to encouraging the beneficial reuse of biosolids as a valuable resource.

Construction Management

- Carollo has provided construction management services for over $1 billion in municipal water and wastewater facilities in the last 10 years.
- Nearly one-third of our revenues are attributable to construction-related services.
- We have provided construction management services for both Carollo-designed facilities and facilities designed by others.

Applied Research

- Carollo maintains a centralized water research and development department for the advancement and direct application of water treatment technologies. Current research is funded through contributions from the Water Research Foundation and the Electrical Power Research Institute (EPRI).
- Recently, Carollo had as many as 14 pilot plants operating concurrently to evaluate a wide variety of water treatment issues.
Carollo Offices

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CONTACT CAROLLO

Please contact us at any of our office locations for more information about our qualifications or services. We would be pleased to provide client references for the projects highlighted in this qualifications statement.