The Largest Progressive Design-Build Delivery in the United States

PLUS —

AWIA Highlight - Are You Ready?
Alternative Delivery Methods: Carollo’s Design-Build Group
Napa Earthquake: Installation of Trenchless Water Pipelines
Carollo’s EPIC® Group Highlights
Oak Harbor Facility Receives APWA 2019 Award

NEWPP EXPANSION

HOUSTON
AWWA STANDARDS AND THEIR INTERDEPENDENCIES DECIDED

With the adoption of the AWWA, the Environmental Protection Agency (EPA) established a much needed holistic, all-hazards approach to water system resilience. The Act requires communities serving more than 1,300 customers to complete a comprehensive risk and resilience assessment (RRA), followed by updates to their emergency response plan (ERP). If qualifying utilities do not complete the RRA and ERP by the designated dates (shown in Table 1), they can incur significant fines enforceable by the EPA. To avoid this penalty, utilities must complete the required evaluations and submit a certified letter to EPA acknowledging completion of their associated RRA and ERP prior to the noted deadlines.

Table 1. EPA Deadlines for Water Systems to Confirm Completion of RRAs and ERPs by Certified Letter

<table>
<thead>
<tr>
<th>Utility Size</th>
<th>Risk &amp; Resilience Assessment</th>
<th>Emergency Response Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;100k</td>
<td>March 31, 2020</td>
<td>September 30, 2020</td>
</tr>
<tr>
<td>50k-100k</td>
<td>December 31, 2020</td>
<td>June 30, 2021</td>
</tr>
<tr>
<td>3k-50k</td>
<td>June 30, 2021</td>
<td>December 31, 2021</td>
</tr>
</tbody>
</table>

The American Water Works Association (AWWA) previously published a series of standards, including J900, G300, G430, and G440, which provide guidance on addressing potential risks to water systems assets and operations. While these standards form an excellent baseline for completing various aspects of the evaluation, the holistic nature of the regulation requires additional approaches, tools, and processes to ensure all applicable risks of risk and resilience are addressed. In addition to physical security, the RRA and ERP updates must consider and address source water resilience, operational security, cybersecurity (for both process and business systems), source water and distribution system contamination, insider threats, and a variety of natural hazards. Each of these areas requires specific expertise, which must be combined with a thorough understanding of water resources, treatment, as well as delivery and system operations, to develop reasonable and defensible recommendations to reduce risk and increase resilience.

MAXIMIZING THE VALUE OF YOUR AWWA EXPERIENCE

While compliance with the AWWA can be a daunting task, the right mindset and approach can generate reductions in risk, increases in resilience, and add value that will help a utility continue to meet their mission of reliably delivering safe, high quality water to their customers.

Figure 1. These AWWA resilience-related standards provide guidance on addressing potential risks to water system assets and operations for inclusion in the RRA and ERP updates.
A JOURNEY OF A THOUSAND MILES begins with a single step, and sometimes that first step is taken in faith, trusting that the route forward will become clear and the journey’s end achievable. Carollo began such a journey in 2011, when Houston chose us as their project advisor/technical consultant for the Northeast Water Purification Plant’s (NEWPP) expansion. At the time, none of us dreamed that the project would ultimately become the largest progressive design-build delivery in the United States water market, costing nearly $2B for 320 mgd of capacity.

EARLY CHALLENGES
The fee for our first work order was $386,000. This was a modest fee, since the City, while optimistic of Carollo’s ability to deliver on our promises, needed proof we could serve as their trusted advisor, having never worked with the City before. To foster trust, we spent the next 6 months working closely with their staff and leadership to gain understanding, solve problems, overcome constraints, and cast a vision for the project, building a roadmap for the path ahead. More importantly, we earned the trust of our client while forging professional and personal relationships that have persisted through the ensuing 8 years of trials and triumphs.

Two early crises shaped future decisions for expanding the existing 80-mgd NEWPP. Storms in February and July 2012 severely degraded water quality in Lake Houston, and the plant was forced to shut down for several days. In both cases, plant staff worked around the clock to restore production, narrowly averting boil water notices while also reducing dissolved manganese below secondary standards.

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Making Progress
The next couple of years were spent evaluating the condition of the existing facilities and refining treatment, capacity, schedule, and delivery requirements for the expansion. Simultaneously, the City negotiated with four water authorities who eventually partnered on the project. To help guide the partnership toward a delivery decision, Carollo led a series of workshops. Visits to Denver Metro and Colorado Springs Utilities—two clients of Carollo that were early adopters of progressive design-build—provided real-life feedback. In the end, an accelerated schedule, coupled with risk considerations for this mega project, led the partners to select a progressive design-build provider.

The project is well underway. Approximately 23% of the nearly $2B project budget has been allocated through January 2020.

Looking Ahead
While we’ve journeyed far these last 8 years, much remains to be accomplished. We remain at the goal of final completion in 2026. Throughout the project, countless Carollo employees contributed their time and talent to help our local team serve Houston. When the journey ends in 6 years, we will all look back with pride and gratitude at the role we played in helping deliver this world-class project.

When completed in 2026, the Northeast Water Purification Plant will be capable of treating 320 mgd, 365 days a year.

Key Project Facts

| 108 | Diameter of dual raw water pipelines supplying plant |
| 17,400 | Ozone generation capacity (pounds per day) |
| 48,160 | Number of lamella settling plates in eight basins |
| 55,200 | Filtration area of 24 filters (square feet) |
| 42,000 | Total pumping power (motor horsepower) |
| 700,000 | Solids dewatering capacity (dry pounds per day) |
| 14 | Applied chemicals |
| 52,000 | Filter backwash rate (gallons per minute, equivalent to 75 mgd) |
| >200 | Number of Carollo personnel who have worked on the project |

Preliminary services, which included permitting, design, and construction of early work packages, stretched from 2018 through 2019. Collaboration between Carollo, Houston, Authority partners, and the design-builder was the key to progressing the expansion from initial concepts to the early construction of critical path facilities. Hundreds of meetings and workshops served as guideposts along the way, providing stakeholders the opportunity to make decisions with the benefit of cost, schedule, and risk considerations. After 9 months of negotiations, this phase of the project concluded with the execution of the Guaranteed Maximum Price (GMP) that fixed the final price, schedule, and scope of work.
The number of water and wastewater projects being delivered by alternative project delivery methods is increasing each year. As our clients are increasingly using alternative delivery methods, Carollo has expanded its expertise to serve our clients from planning through construction and operation. Our experience and expertise cover all types of alternative delivery:

- Progressive Design-Build (PDB)
- Fixed-Price Design-Build (FPDB)
- Design-Build-Operate (DBO)
- Construction Management at Risk (CMAR, CM/GC)

Carollo has been providing collaborative delivery services to our clients for over 15 years. As our clients have been increasingly using design-build and design/CMAR delivery methods, Carollo has gained expertise serving as the lead for delivering these types of projects. Since 2014, we have completed more than 12 design-build water/wastewater projects as the prime design builder, and more than 75 projects as the lead designer; for a combined construction value of more than $11 billion.

We have collaborated with all the major water/wastewater contractors in the US on alternative delivery projects and traditional delivery projects.

Our design-build staff includes seasoned design-build managers, cost estimators, procurement agents, and schedulers; all with extensive experience designing, constructing, and commissioning water/wastewater facilities. Through their design-build experience, our staff has earned accreditations as designated design-build professionals, project management professionals, and certified construction managers.

Carollo’s water and wastewater expertise extends beyond its industry-leading planning and design to leading progressive Design-Build and Fixed-Price Design-Build projects. Our collaborative project delivery mindset, alternative delivery expertise, and being a national leader in the water and wastewater industry brings unique expertise and project understanding to our clients.

On August 24, 2014, the 6.0-magnitude South Napa Earthquake struck Napa, becoming the largest earthquake to hit the Bay Area since the Loma Prieta earthquake in 1989. The earthquake caused an estimated $1 billion in damage and over 240 water pipeline breaks. Several breaks were beneath Highway 29 and limited the City’s ability to convey potable water across the highway, which bisects the City’s water distribution system.

To restore water service, Carollo designed four new highway crossings at strategic locations using horizontal directionally drilled pipelines with fusible PVC pipe. Each crossing was designed with a 12-inch diameter water pipeline within a 16-inch diameter casing pipeline so the same drilling equipment could be used at each location, reducing installation time and cost.

Geotechnical borings confirmed the soil was mostly silt, suitable for directional drilling, and did not include high-risk geology such as cobbles, boulders, and flowing sands. Due to site constraints, two of the four crossings were designed with a complex compound horizontal and vertical curve instead of a single vertical curve. To reduce risk during construction, these crossings included large curve radii, to provide construction flexibility, and drilling contractors were required to be prequalified. Prequalification also facilitated a good working relationship with the drilling contractor during construction that expedited decision making for minor adjustments to the drilling path. The pilot bore and pipeline operations went very smoothly.

This project was presented at the 2018 North American Society for Trenchless Technology (NASTT) No-Dig Show, the largest trenchless technology conference in North America, and was featured in the 2019 Western Regional Trenchless Review Journal.
The American Public Works Association (APWA) Public Works Project of the Year Award is given to infrastructure projects that promote excellence in construction management.

Carollo worked closely with the City of Oak Harbor, Washington, to replace two treatment facilities in an environmentally sensitive area with a single membrane bioreactor facility. The Clean Water Facility (CWF) project presented several technical challenges from the start, including a site that had 2,000 years of human habitation, physical constraints, liquefiable soils, large seismic differential settlement, and corrosive soils. Carollo provided effective solutions to these challenges, laying out a facility that “built in” future expansion to accommodate a land-locked site surrounded by commercial interests and a beloved waterfront park.

As part of the CWF project, the park directly adjacent to it had to be updated. However, due to early project successes, City Council was able to significantly redesign most of the park with public support. In the words of our client: “The project driver was a wastewater treatment plant, but the goal was to achieve a community vision. Many talented professionals applied their skills and commitment to the City of Oak Harbor. That dedication, teamwork, and understanding resulted in an outstanding project.”

Due to its location on Puget Sound, the CWF is becoming a benchmark water quality project, and will help guide Washington State regarding forthcoming nutrient regulations.

OAK HARBOR CLEAN WATER FACILITY Receives American Public Works Association 2019 Public Works Project of the Year Award

Our EPIC team of over 125 engineers, designers, and programmers is dedicated to serving our water and wastewater clients’ electrical, programming, instrumentation, and controls needs.

The Equation is Simple:

ELECTRICAL + PROGRAMMING + INSTRUMENTATION + CONTROL = EPIC® SOLUTIONS

JEFF MARTIN (jmartin@carollo.com) ■ MONTE RICHARD, PE

The world of electrical power, instrumentation, and control is constantly changing—given this context, innovation is the key to remaining ahead of the curve. Automation and a reliable power system are critical to the success of any utility, allowing for simplified, reliable, and efficient operations and maintenance.

EPIC® provides a one-stop shop for an array of electrical, programming, instrumentation and control services from planning to design to implementation, allowing us to design effective solutions for operational resiliency, efficiency, safety, and sustainability. EPIC® offers our clients the following benefits:

■ BEST-IN-CLASS SOLUTIONS. EPIC® combines Carollo’s EI&C design group with its programming services to find reliable power and control solutions customized to client needs.

■ EI&C INNOVATION. From high performance HMI to holistic power-saving techniques, our EPIC® team is focused on optimizing the efficiency of our clients’ operations and maintenance staff.

■ COLLABORATIVE APPROACH. The EI&C systems we design are ultimately our clients’ responsibility to operate and maintain. Thus, our approach is focused on listening to our clients’ needs and customizing solutions around them. Soliciting stakeholder input through workshops and field investigations is paramount to designing a system that our clients can be proud to operate.

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