Water Design-Build Council

A RESEARCH NEXUS

The water design-build industry has reached a pivotal point. During the past decade, the increased use of design-build delivery by utilities and agencies for water and wastewater projects has been dramatically increasing—to the point where many in the industry no longer consider it “alternative.” While the water industry is generally aware of this increase, market volume and growth trends have never been carefully evaluated.

To that end, WDBC’s goal for its latest research project was to determine the size and complexion of the U.S. municipal water market for completion of capital projects using the design-build project delivery method. Data were collected and analyzed for the 2014–2021 timeframe to evaluate both historical and prospective trends for design-build contracting by geographic region and by project type including water treatment, wastewater treatment, wastewater collection, water conveyance and storm water management. Furthermore, a standardized research methodology has been established to efficiently and economically update the analyses to complete annual market assessment surveys in the future. To the best of our knowledge, this is the first research ever completed to assess the size of the design-build market in the water space.

IMPORTANCE OF RESEARCH AND RELATIONSHIP TO COUNCIL’S MISSION

The pursuit of research is fundamental to the WDBC’s mission and core values. Our research serves to educate the water market and to promote capital project delivery best practices using collaborative methods including design-build contracting.

RESEARCH TEAM

To complete the research with a comprehensive, unbiased view and with high quality, the Council canvassed the market broadly and solicited competitive proposals from skilled market assessment firms. Consequently, WDBC engaged the services of Dr. Kenneth Rubin of the highly acclaimed Washington, D.C., firm Rubin Mallows Worldwide (RMW) to independently conduct the research study. RMW collaborated with the University of North Carolina’s Environmental Finance Center to add its considerable experience to this important research.

With over 40 years of experience in the U.S. and international water sectors, Dr. Rubin has produced numerous water sector analyses, market forecasts, and M&A engagements. He has also consulted regularly on matters of water resources management; markets for water and wastewater goods and services; and water/wastewater utility public-private partnerships (P3s).

The Environmental Finance Center (EFC), located at the University of North Carolina, Chapel Hill (UNC), provides applied research, educational programs, and advising services across the country that work with environmental systems, such as water and wastewater utilities. Led by Jeffrey Hughes, the EFC specializes in researching emerging financial challenges and developing and testing creative strategies for addressing those challenges.

On behalf of all the Water Design-Build Council members, I express the Council’s deep appreciation to the research team for its excellent work on this important, landmark project.

Stephen R. Gates, P.E., BCEE
Senior Vice President, Brown and Caldwell

RESEARCH FINDINGS

The results of the Council’s market research, summarized on the following pages, now forms the basis for production of an annual report on the State of the Demand for Design-Build Delivery in the Water/Wastewater Sector. It confirms that design-build project delivery is widely used by the nation’s public utilities for a variety of water/wastewater treatment and related infrastructure projects. Moreover, it confirms a clear trend of design-build’s increasing popularity in this market space. The Council intends to regularly update this market research, consistent with its core education and research mission.
In 2016, the Water Design-Build Council embarked upon a landmark research study that had never been attempted before in the water industry. Because of the complexities in obtaining these data, the WDBC decided against pursuing a traditional research format. Instead, research-oriented organizations were invited to submit proposals detailing how they would determine the size and complexion of the industry of capital projects within the U.S. in the next five years, specifically using design-build or other collaborative delivery methods.

With the promise of a unique and robust approach, the WDBC engaged the firm Rubin Mallows Worldwide and the University of North Carolina (UNC) to conduct independent research and produce these data. Dr. Kenneth Rubin, RMW Managing Partner, directed the project, supported by Amit Dalal, RMW Project Manager. Jeff Hughes of the UNC’s Environmental Finance Center participated as a Strategic Project Advisor, supported by Shadi Eskaf, responsible for the data analytics.

**RESEARCH OBJECTIVES**

The overall research goal was to establish an industry-standard methodology for use on a regular, ongoing basis. This is accomplished by assessing the demand for the use of design-build project delivery among the nation’s publicly owned water and wastewater utilities. To achieve this goal, the study had two objectives.

1. Employing a macro analysis approach, the first objective was to determine recent trends in the number and volume of design-build capital projects in the U.S. municipal water and wastewater industry. These data also provided one input toward projections for the next five years (2017–2021), by geographic region and by project type, e.g., water treatment, wastewater treatment, wastewater collection, water conveyance, storm water management, etc.

2. The second objective was to document specific capital improvement plans over the next five years (2017–2021) of major public water and wastewater utilities and within those projects designated for (or consistent with) design-build delivery.

**METHODOLOGY**

As illustrated below, the approach to achieve the research’s defined objectives incorporated the following actions.

- **Step 1**: National Aggregate Capex
  - Census Government Expenditures Series: most reliable and comprehensive time-series of local water and wastewater capex
  - Use to forecast the aggregate water and wastewater market

- **Step 2**: Project Segment Types
  - EPA’s Needs Surveys: provides relatively reliable detail on composition of future capex by project type and location
  - Use to segment aggregates

- **Step 3**: Design-Build Decision Rules
  - Multiple Sources: WDBC and DBIA project data & member input, proprietary datasets, Top 100 survey and interviews
  - Use to estimate percent of each segment, location, size of project, etc. that could go DB

- **Step 4**: Top 100 CIP Data Compilation
  - Top 100 CIP Scale Up
  - Top 100 CIP Data Compilation: survey of planned capex of top 100 water and wastewater utilities
  - Use as basis of scale-up to nation (second forecast) and contribute to DB decision rules

- **Step 5**: QC Method
  - Back Test Method
  - As QC: use above against historical aggregates as check against known DB market from past WDBC initiative and other sources

**RESEARCH RESULTS**

This 2017 State of the Demand for Design-Build Delivery in the Water/Wastewater Sector report confirms and documents trends that validate many of the assumptions held by water sector practitioners. Design-build delivery of water and wastewater projects has grown steadily since about 2013 and is expected to increase at an even faster pace at least through 2021 (the end of our research projections). Our research describes drivers behind this trend and verifies that design-build is now mainstream—no longer considered an “alternative” delivery concept.

**HISTORICAL TRENDS**

Between 1970 and 2000, water and wastewater projects were delivered predominantly through the design-bid-build approach. Since the early 2000s, however, design-build delivery grew in the water and wastewater sector, in part because cost and risk reduction as well as more rapid project delivery associated with design-build were demonstrated in the transportation industry where it was an accepted practice. Also, since about 2000, as water and wastewater projects became more complex and growing operating costs increasingly crowded out capital investment, state legislation and state and municipal/agency procurement practices explicitly authorized design-build delivery for water and wastewater projects. continued
as they sought project delivery alternatives to optimize risk management, improve cost efficiency, and accelerate schedules.

**2013–2016 Design-Build Industry Trends**

Historical trends in the design-build market for 2013-2016 were derived from two core data sources: (1) a compilation of actual design-build projects in the water and wastewater sector from the major suppliers of such projects, and (2) projected scale-up to the nation as a whole. This analysis showed that approximately 100 water and wastewater projects (including combined sewer overflows [CSOs]) occurred on an annual basis, representing $18.2 billion in total design-build projects during this period. While these figures do not include construction management at-risk projects, it is evident from other data sources that the use of this delivery method is also increasing.

The use of design-build project delivery grew steadily between 2013 and 2016, with 2016 the most active with 119 awards/starts for several projects of significant size and cost.

During this period, both water and wastewater utilities have tended to rely on design-build delivery for projects with new technologies or complex combinations of multiple technologies. Utilities also tend to rely on the use of design-build delivery when they are under regulatory or service-demand pressures to complete water or wastewater projects quickly. Within this trend, design-build was used to deliver nearly twice the number of wastewater projects than water projects. In addition, wastewater projects also lead in cumulative spending. These trends are evident as advanced treatment captures the largest share of design-build project volume, followed by repair and rehabilitation of conveyance networks.

**DRIVERS**

Historically, regulations and demographics have driven the U.S. market for water and wastewater services. After a prolonged period of declining investment (2009–2014), however, capital replacement also has emerged as a market driver, with many older plants catching up on deferred capital and others requiring upgrades and/or replacements because they are reaching the end of their useful lives.

These macro trends are important for design-build. After more than 40 years of regulations, the nation has achieved major gains in public health and water quality at average costs that are well below—perhaps by an order of magnitude—than the costs of meeting future requirements. Steadily growing operating costs demand steadily increasing proportions of utility revenues, leaving less and less for capital improvement and putting unprecedented upward pressure on user charges. With populations growing most rapidly in urban coastal regions of the U.S., primarily in the water-stressed West, Southwest, and South, we have seen unprecedented incidence of water shortages and water quality impairment from wet-weather events. Solutions to these emerging problems tend to be complex and often involve new technologies and control strategies.

**2017 Water Design-Build Market Conditions**

Data derived from the U.S. Environmental Protection Agency (EPA) and the U.S. Census Bureau, compared with the research team’s survey of recent water project activity, show that California leads the nation in terms of design-build projects, followed by Texas and Florida, each with multiple projects with capital spend estimated to be greater than $100 million each. Other states with similarly large capital projects include Arizona, Colorado, Georgia, Washington, Oregon, and Illinois.

States with the greatest number and volume of design-build projects tend to have the strongest legislative mandates and authority enabling design-build delivery in water and wastewater, such as California, Texas, Arizona, Colorado, and Florida. These states also have strong overall growth-related demands for new water and wastewater facilities, as do Georgia, Oregon, and Washington.

Our research reviewed and selected 100 major water and wastewater utilities throughout the U.S. and examined their planned project spending through 2020/2021. These results showed that projects using design-build delivery methods represent nearly 10% of total projects and nearly 13% of total spending. More than 750 projects are either designated or in serious consideration for design-build procurement.

Looking at the specifics of infrastructure type, the most active categories of design-build projects are those that include secondary and tertiary treatment or source water treatment. Specific facility operations and storm water projects also are active categories. Wastewater projects generally have a higher project cost, as compared to potable water treatment.
Forecasting utility procurement activity in the water/wastewater industry is complex, mainly due to the fragmented composition of the sector (16,000 wastewater entities and 55,000+ water systems). To address this characteristic, the research approach included a long-term forecast of financial outlays for water and wastewater infrastructure through 2021 using historical trends based on U.S. EPA, U.S. Census Bureau, and other data. The approach also integrated decision algorithms based on a sampling of capital improvement programs and related design-build trends at major utilities.

The future of design-build delivery for water and wastewater infrastructure projects trends positive, with total project spending set to grow from some $7.7 billion in 2017 to $9 billion in 2021—reversing the downward trend observed following the 2008 financial crisis and subsequent Great Recession.

Capital outlays for the use of design-build delivery are expected to rise from approximately 9% to 11% of total project spending through 2021.

Within this projection, wastewater projects account for 60% of the number and 57% of the value of design-build projects for 2017–2021.

**CONCLUSION**

U.S. water and wastewater utilities spend $40 to $50 billion a year to upgrade, rehabilitate, replace, and expand their water and wastewater infrastructure. By the end of the next decade, that figure will exceed $60 billion. Local and state governments finance more than 90% of these capital expenditures, with the federal government accounting for the remainder.

Our research shows that cost, risk, and delivery time drivers, that have resulted in increasing numbers and volume of design-build water and wastewater projects, will become even more important over the next decade and beyond as U.S. utilities confront increasing regulatory requirements, service demands of growing populations, and replacement of aging infrastructure. We conclude that the future for the use of design-build delivery methods for the water and wastewater infrastructure is a positive one.

**WDBC Research Projects**

2008 — *Research Comparing and Evaluating Design-Build vs. Design-Bid-Build*. Conducted by researchers at the Universities of Colorado, Iowa, and New Mexico, this study compared the performance of design-bid-build and design-build project delivery for public water and wastewater facilities.


2010 — *Customer Satisfaction Survey I*. This study shows owners’ levels of satisfaction with design-build delivery for their projects, and if they would use design-build delivery again.

2012 — *A Report on the Progress of Design-Build Projects for the Municipal Water and Wastewater Industry (WDBC member projects accomplished in 2010-2011)*. This report identifies the progress of the design-build projects for public water and wastewater facilities in this period.

2012 — *Customer Satisfaction Survey II*. This study provides the levels of satisfaction from a second set of owners in using design-build delivery methods and why they would use them again. This report also compares these responses with the first survey.

2014 — *WDBC’s 2013 Research on the Impediments to Using Design-Build Delivery*. This report documents the greatest impediments that owners find to using collaborative delivery methods. It emphasizes that the need for relevant education for project owners is a critical challenge.

2012 & 2014 — *State Statute Research on Progressive Design-Build Delivery (PDB)*. These two studies describe PDB projects in 13 states that have been successfully implemented (as reported by WDBC members) under enabling state legislation, documenting the growth of this delivery method in a two-year period.

2015 — *Lessons Learned by Owners and Project Managers in Using Design-Build Delivery*. This study provides important advice, from owners to owners, on how to successfully plan and implement design-build projects.
**BACKGROUND**

Figure 1 shows the annual spending for water and wastewater facilities in the United States since 1956. Notable is the point at which the 1972 Clean Water Act’s Construction Grants Program began to pump billions of federal dollars into state and municipal capital projects. This infusion of funds limited the need for local capital investments until the late 1980s, when the current State Revolving Fund Program took over and replaced the grants. Then, through the 1990s, locally raised and invested capital increased to support funding for water infrastructure until the financial crisis of 2008 occurred, which resulted in a significant deferral of local capital expenditures during the Great Recession.

Figure 1 also points out the increase of ongoing operating costs as new facilities came online. Since 1972, the operating and maintenance costs for the water and wastewater infrastructure have dramatically increased every year and have continued a steady upward trend ever since, even through the 2008 financial crisis.

New evidence suggests that capital investments by local governments in water and wastewater projects have re-accelerated. Regardless of the source of capital, new facilities are steadily coming online to comply with increased water quality regulations, to refurbish aged infrastructure, and to meet the economic needs of growing communities, especially along the coasts.

**TRENDS**

During the years when the U.S. EPA’s Construction Grants Program funded many wastewater facilities’ construction projects, most public agencies in the U.S. responsible for construction of water and wastewater projects predominantly used the design-bid-build method. It was only in the late 1990s that the use of design-build delivery began to be frequently used by public utilities in the water sector, even though it was a long-accepted practice in the transportation industry. The continuing growth in the use of design-build delivery methods over the past twenty years has been accompanied by an increasing trend in state and municipal agencies changing their procurement practices to achieve the potential risk management, cost benefits, and schedule efficiencies of design-build contracting.*

**DRIVERS**

Regulations and demographics have historically driven the U.S. market for water and wastewater services. However, after a prolonged period of under-investment (2008–2014), upgrades to plants have also emerged as a market driver. The turnaround in capital expenditures began to be evident in 2015 and 2016 when many older municipal facilities required upgrades and/or replacements because they were reaching the end of their useful lives.** These drivers are considered in the forecast of water and wastewater capital expenditures, represented in Figure 2.


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Figure 1. Historical water and wastewater spending.

Regulations and demographics drive the U.S. market for water and wastewater services, but it is not immune to macro perturbations, like the financial crisis of 2008, which resulted in deferral of capital investment.

Figure 2. Forecasted water and wastewater capital outlays in the U.S.

Local government investment in water and wastewater infrastructure peaked in 2009 at just over $50 billion a year. In the aftermath of the financial crisis, a tightening of credit in the capital markets created a widespread reluctance to borrow or lend funds for replacing or building new infrastructure. This situation took roughly 20% of investment capabilities out of this market, which bottomed in 2014 at about $40 billion a year, in total capital investment. Recent data confirm a turnaround in local capital investment. This financial turnaround is incorporated in the forecast of a new 5% to 6% real compound annual growth rate (CAGR) through 2021.
In researching the historical trends in the design-build market from 2013 to 2016, two core data sources were examined: (1) utility/agency project announcements, and (2) the projected total project costs as reported by WDBC member firms’ project records (Figure 3). This process identified approximately 100 water and wastewater design-build projects (including combined sewer overflows [CSOs]) that occurred on an annual basis, representing an estimated $18.2 billion in total annual costs.

Within this period, the data showed that design-build activity has steadily risen since 2013, with 2016 having the most activity with 119 awards/starts. Several of these projects were significant in their scope and cost. Throughout the 2013–2016 period, wastewater projects were more often completed using design-build contracting, with nearly twice as many design-build projects as with water systems. In addition, wastewater projects also led in cumulative spending (Figure 4).

Highlights
- 8 companies reporting
- 424 projects reported awarded and under construction
- Wastewater entities leading with 198 projects, Water entities at 110

**Figure 3.** Documenting the historical use of design-build delivery.
These findings are based on portal project profiles, sources providing data on commercial bids, web-based resources, and WDBC member survey data of design-build project activity in the post-recession period of 2013 to 2016.

**Figure 4.** Projects funded by public utilities and investor-owned utilities — 2013 to 2016.
In terms of total project volume, public utilities are more active in design-build markets than investor-owned utilities.
Announcements of 2017 design-build projects and estimated costs are presented in Figure 5. It should be noted that the project cost estimates shown are often front loaded as most large projects are multi-year. Also, in practice, most design-build announcements will be closer to project planned dates, indicating that new projects will convert to awards faster, rather than when projects are in active planning.

Using data derived from the U.S. Environmental Protection Agency and U.S. Census Bureau, together with the research team’s own survey of recent water project activity, it is noted that California leads the nation in terms of design-build projects, followed by Texas and Florida, each with projects greater than $100 million (Figure 6). Other states with projects of significant size include Arizona, Colorado, Georgia, Washington, Oregon, and Illinois. As previously noted, the trend of wastewater projects using design-build delivery also occurs in the front-runner states of California, Florida, and Texas (Figure 7).

**Figure 5. 2017 design-build market by type of project.**

Both water and wastewater utilities tend to rely on design-build delivery for complex projects with new or combinations of new technology. Utilities also tend to rely on the use of design-build delivery when they are under regulatory or service demand pressures to complete projects faster. These trends are evident in this figure which shows that advanced treatment captures the largest share of design-build project volume followed by repair and rehabilitation of conveyance networks.

**Figure 6. Top 10 state water design-build markets in 2017 (millions of dollars).**

One of the most significant influences and drivers in being able to use design-build delivery in the water sector is having the legislative authority to pursue it. Consequently, it follows that the states with the greatest market share of both water and wastewater design-build project activity are also the states with the strongest enabling legislation, including California, Texas, Arizona, Colorado, and Florida. These states also have strong overall growth-related demands for new water and wastewater facilities, as also found in Georgia, Oregon, and Washington.

**Figure 7. Top 10 state wastewater design-build markets in 2017 (millions of dollars).**

The trends in states' use of design-build delivery for wastewater projects are also those with the strongest enabling legislation, high-growth rates, and, in some cases, backlogged compliance needs.
The research included the selection of 100 major water and wastewater utilities throughout the U.S. to examine their planned project spending through 2020/21. The Capital Improvement Plans for each utility were examined in detail to determine the nature and extent of water and wastewater projects planned. In addition, an analysis was made to determine owners’ plans to use design-build contracting, on a project-by-project basis. Project announcements planned for 2017 are summarized in Figure 8. These results show that projects designated for the use of design-build delivery methods represent nearly 10% of total projects and nearly 13% of total spending. More than 750 projects are in serious consideration for design-build procurement.

Of those projects designated as design-build, or seriously being considered for this approach, these determinations are based on performance track records of industry practitioners, together with the organizational and institutional project drivers.

The categories projected to have the most activity for the coming years include secondary and tertiary wastewater treatment and those for potable water source treatment projects. Specific utility operations and storm water projects are also projected as active categories in the forecast.

Wastewater projects generally have a higher total project cost, as compared to potable water treatment.

Forecasting utility procurement activity in the water/wastewater industry broadly is complex, mainly due to the fragmented composition of the suppliers (16,000 wastewater entities and 55,000+ water systems). To address this challenge, the research method included a long-term forecast of financial outlays for water and wastewater infrastructure projects through 2021, using historical trends based on U.S. EPA, U.S. Census Bureau, and other data. The approach also integrated decision algorithms based on a sampling of capital improvement programs and related design-build trends at major utilities. See Figures 9 and 10.

These results show that the future for the use of design-build delivery for water and wastewater infrastructure projects is a positive one, with the total project spending set to grow from some $7.7 billion in 2017 to $9 billion in 2021, thus significantly reversing the downward trend since the beginning of the Great Recession in 2008.

Potential capital outlay for the use of design-build delivery is expected to rise from approximately 9% to 11% of total project spending through 2021 with a possible upside of 16% year-over-year growth projected.

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Potential capital outlay for the use of design-build delivery is expected to rise from approximately 9% to 11% of total project spending through 2021 with a possible upside of 16% year-over-year growth projected.
The market for all water and wastewater capital and operating services is highly dynamic; and is particularly so as the industry begins to make what is believed to be the third major transition since modern water and sanitation services began in America. These scenarios have evolved as the process of sewering municipalities and towns occurred throughout the U.S. from the 1800s to mid-1900s and the delivery of a centralized treatment of water and wastewater became widespread. Industry dynamics further escalated following enactment and funding of the Clean Water Act in 1972 into the 2000s. Now in 2017, we believe that the industry is poised with a series of new conditions, together with new legislation, that are highly favorable for employing the use of design-build delivery—and further departs from the “business as usual” previous practices. The following drive this transition:

- By heavily investing in the removal of the easy pollutants, unit costs for the next increment of pollution removal will be significantly higher than historical costs.
- Many communities, especially those with extensive fixed water and sewer infrastructure and declining populations, have reached limits of most reasonable definitions of affordability and will need to examine more efficient options to use for the future.
- Remaining clean water needs are principally focused around wet weather controls like storm water control and combined sewer overflow reduction; and where solutions are area-based they often require very expensive disturbance of existing urban development.
- Growth-related water needs are concentrated in a handful of states with significant supply-demand imbalances, which drives up the cost of new supply and expands markets for water reuse at costs equivalent or lower than nearly all other alternatives.
- Fundamentally, there is relatively little water quality gain associated with future capital investments, either measured against historical costs per unit removed or against the cost of managing other sources of pollution in typical watersheds, which is causing water and wastewater utilities to seek “one-water” solutions and partnerships with others within their watersheds.

All of the above scenarios have created what industry leaders have termed the “Utility of the Future,” where these forces combine to drive the need for more innovation and collaborative methods of project delivery, with a focus on management of valuable resources as opposed to management of waste.

Within this third wave of transition in the U.S. water and wastewater sector—and because of more complex problems and strained public budgets—a demand for innovation and a new willingness to collaborate has emerged. **As a result, current market conditions appear to favor a growing use of design-build project delivery for the foreseeable future.**

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WDBC MEMBER COMPANIES

WDBC is comprised of 11 member firms representing over 60% of the design-build firms on the ENR Top 100 List delivering water infrastructure projects. Membership comprises any private sector company engaged in integrated design and construction services or in construction management at-risk (CMAR) as a prime contractor or under a risk-sharing arrangement with a partner; and which has in-depth, in-house comprehensive engineering capabilities to design and build public and investor-owned rate regulated utility water or wastewater treatment facilities in North America.

WDBC ADVISOR GROUP

WDBC Advisor Group consists of 16 firms providing products and services and are currently working or desiring to work with engineering companies in some capacity in the water design-build sector.
MISSION
Advancing design-build delivery methods to transform the water industry—through collaborative thought leadership and education, supported by research.

MISSION
DBIA promotes the value of design-build project delivery and teaches the effective integration of design and construction services to ensure success for owners and design and construction practitioners.

DBIA and Water Design-Build Council Strategic Alliance
With the mutual goal of creating a platform for successful capital project delivery in the water and wastewater sector, DBIA and the Water Design-Build Council (WDBC) have formed a strategic alliance. Through closely aligned and collaborative efforts, DBIA and WDBC leaders are committed to providing timely and relevant resources to meet the needs of water and wastewater sector owners and practitioners. Both organizations understand the challenges and importance of providing essential resources to support the economic and societal needs of our nation’s water infrastructure. Combining the strengths of each will leverage both DBIA’s and WDBC’s achievements to date and further both organization’s ongoing commitment to develop, promote, and implement best practices specifically tailored for water/wastewater sector collaborative project delivery.