

DCWASA's Project Delivery Approach for the Washington DC CSO Program

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ABSTRACT: To comply with the National CSO Policy, DCWASA completed a Long-Term Control Plan in 2002 and entered into a consent-decree agreement with the United States and DC government, establishing an implementation schedule for a number of projects to control CSOs into the Anacostia River. Several of these projects are tunnels. Previously, DCWASA used the traditional design-bid-build delivery process for capital projects. Now it is studying alternative project delivery methods to ensure contractor interest in individual projects. This paper summarizes contract packaging approach, anticipated project delivery methods, and risk allocation techniques that will be used for the DCWASA CSO program.

BACKGROUND

The District of Columbia Water and Sewer Authority (DCWASA) is a multijurisdictional regional utility that provides drinking water distribution and wastewater collection and treatment to more than 500,000 residential, commercial, and governmental customers in the District of Columbia, and also collects and treats wastewater for 1.6 million customers in Montgomery and Prince George's counties in Maryland and Fairfax and Loudoun counties in Virginia. DCWASA operates the Blue Plains Advanced Wastewater Treatment Plant (Blue Plains), the largest advanced wastewater treatment plant in the world, which covers 150 acres and has a dry-weather flow capacity of 370 million gallons per day (MGD) and a peak pumping capacity of 1.076 billion gallons per day. To collect this wastewater, DCWASA operates 1,800 miles of sanitary and combined sewers, 22 flow-metering stations, 9 off-site wastewater pumping stations, and 16 stormwater pumping stations within the District. Some of this construction dates back to the early 1800s. As shown in Figure 1, separate sanitary and storm sewers serve approximately two-thirds of the District area; the remaining one-third is served by combined sewer systems. The combined systems discharge an estimated 2 billion gallons of combined sewage into local waterways annually. The Anacostia River receives most of this, roughly 1.3 billion gallons, the Potomac River almost 640 million gallons, and Rock Creek averages 50 million gallons.

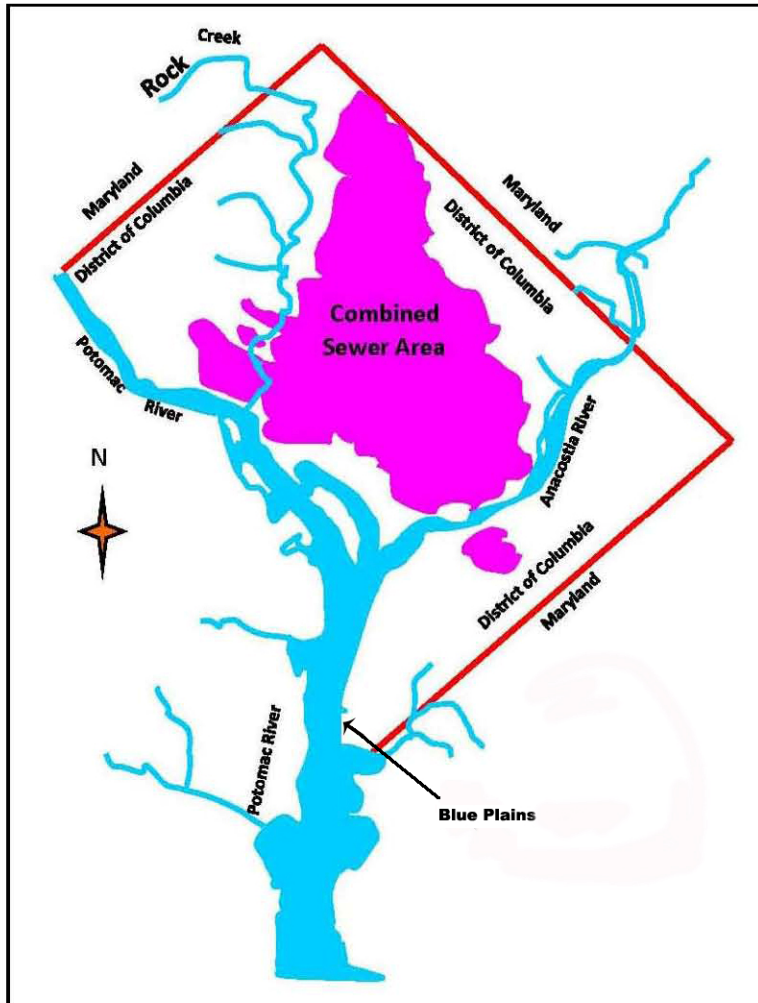


Figure 1. Metropolitan DC area served by separate sanitary/story and CSO systems

Section 402(q) of the Clean Water Act enacted in 2001 (P.L. 106-554) requires communities with combined sewer systems to prepare long-term plans for control of combined sewer overflows (CSOs). DCWASA began CSO control planning in the late 1990s and finalized a Long Term Control Plan (LTCP) in July 2002. This LTCP includes a system of tunnels for the Anacostia River, Rock Creek, and the Potomac River (Figure 2), which will capture combined sewer flow for treatment at Blue Plains.

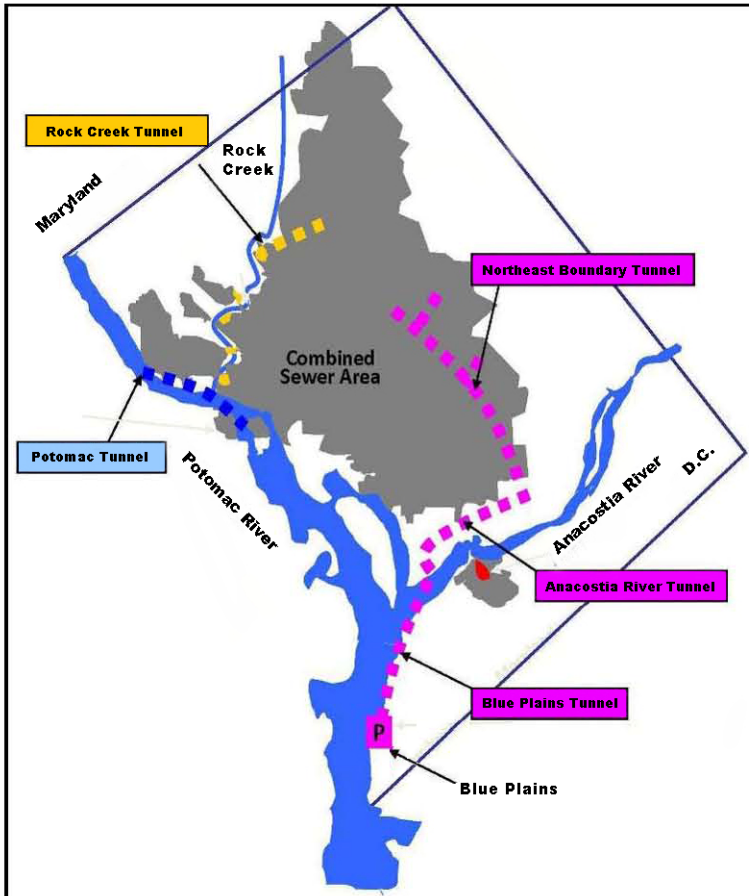


Figure 2. LTCP tunnel system

The schedule for completing the LTCP is included in a federal court consent decree among the United States, the District Government, and DCWASA. Scheduled for completion in 2025, the LTCP will play a significant role in restoring DC waterways. As part of this ambitious plan, the Anacostia River Projects (ARP) will reduce the overflows and improve water quality of the Potomac and Anacostia rivers. The project includes \$2.2 billion for construction of deep tunnels, diversion structures, and a pumping station to divert, store, and convey combined sewer overflows to Blue Plains, reducing sewage overflows to the Anacostia River by 98 percent. These projects are the highest priority in the court-ordered schedule, and the portion of the LTCP for the Anacostia River projects, from Blue Plains to just south of RFK Stadium, must be in operation by March 23, 2018.

The Blue Plains Tunnel (Figure 3) is the first tunnel project in this program. This tunnel will launch from the Blue Plains Advanced Wastewater Treatment Plant, run approximately 18.2–36.5 m (60–120 ft) deep under the eastern shore of the Potomac and Anacostia rivers, and traverse north to the retrieval shaft near the new Nationals’ Baseball Park. The ground is primarily clay, silt, and sand. The tunnel will be constructed using an earth pressure balance machine. It will be supported using a single pass precast segmental liner with a finished inside diameter of 7 m (23 ft).



Figure 3. Blue Plains Tunnel Alignment

Five deep, large-diameter shafts will be built along the alignment to service tunneling operations and provide space for future permanent facilities to be constructed under separate contracts. Shaft construction techniques being considered include slurry wall and ground freezing. It will be up to the contractor to select the best method for the anticipated ground conditions and physical constraints at each shaft site. Shafts will be constructed to accommodate installation of a final liner meeting minimum geometric requirements. Shaft final liner diameters will range from 15.2 to 30.5 m (50 to 110 ft). When complete, these shafts will function as hydraulic facilities, and will include a pumping station, a grit and screening facility, drop shafts, and an overflow shaft.

This tunnel project involves multiple challenges, including varied soil conditions, potentially contaminated high groundwater, tunneling under the Potomac and Anacostia rivers, and controlling/mitigating movements of existing facilities and utilities during excavation and tunneling. Existing site constraints need to be addressed above and below ground. The alignment runs under U.S. and District of Columbia government property, and it is critical that the design team work closely with various government agencies and private developers to coordinate staging and mitigate the negative impacts of construction to the surrounding communities.

CONTRACT PACKAGING

In order to meet the consent decree dates, the LTCP was further developed and a facility plan prepared. The facility plan established a detailed implementation schedule, which divided the overall Anacostia River Program into a series of contract packages, with the underlying objective being to achieve the best value for DCWASA, using the philosophy that the best bid prices can be obtained through enhancing economic competition by ensuring the maximum number of qualified bidders for each contract package. Packages were designed to be large enough that well-qualified and experienced contractors would be encouraged to bid, and small enough that they would not be overly restrictive (due to bonding, insurance, management of subcontractors, etc.). The dividing line between “large enough” and “small enough” in monetary terms is highly variable, and depends on the type of work and industry practices for bonding and sharing financial risk. To the extent possible, contracts were also structured to match market conditions and the availability of labor and equipment at the time of bidding.

The determination of contract packaging on the ARP applied these principles in the following manner:

- 1 *Type of work*: Establishing separate contract packages for (1) tunnels, which would likely be constructed by national and/or international tunneling firms; and (2) surface diversion facilities, which would be constructed by local sewer contractors familiar with local practices.
- 2 *Contract Value*: Limiting the total size of the contract so that it would not exceed the anticipated bonding limits of qualified firms. Based on the most recent bidding results in the underground industry, tunnel contracts in the range of \$300 million seem to strike a good balance of qualifying without restricting.
- 3 *Geographical*: Minimizing the contract interface between adjacent contractors.

In addition to these factors, the contract packaging strategy considered DCWASA’s policy of meeting EPA’s fair share objectives for MBE/WBE participation. The resulting contract packaging approach is shown in Figure 4.

Contract Divisions: Anacostia River Projects

Division	Description
A	Blue Plains Tunnel
B	CSO 013/014 Diversion Sewer
C	CSO 019 Overflow & Diversion Facilities
D	Bolling AFB Overflow & Diversions
E	CSO 015, 016 and 017 Diversion Sewer
F	CSO 018 Diversion Sewer
G	CSO 005/007 Diversion Sewer
H	Anacostia River Tunnel
I	Main Pumping Station Diversion Facilities
J	Northeast Boundary Tunnel
K	Northeast Boundary Branch Tunnels
L	Northeast Boundary Area Diversion Sewers
M	Mt Olivet Road Diversion Sewer
W	Blue Plains Tunnel Site Preparation
Y	Tunnel Dewatering Pumping Station and Enhanced Clarification Facility
Z	Replace Poplar Point Pumping Station

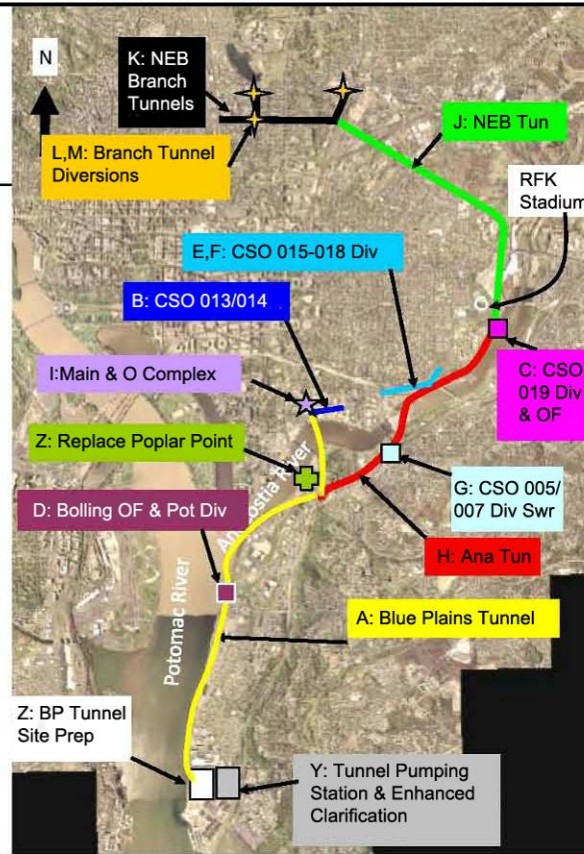


Figure 4. Contract packaging approach for Anacostia River Projects

In summary, this plan includes four deep, large-diameter, soft ground tunnels with a combined total length of 20.6 km (12.8 mi). The four main tunneling contracts are the Blue Plains Tunnel, the Anacostia River Tunnel, the Northeast Boundary Tunnel, and the Northeast Boundary Branch Tunnels. In addition to the four tunnel contracts, there are seven separate surface diversion structure contracts, two overflow structure contracts, two pumping station contracts, and one demolition/site preparation contract—for a total of sixteen separate contracts. The schedule for these contracts is shown in Figure 5.

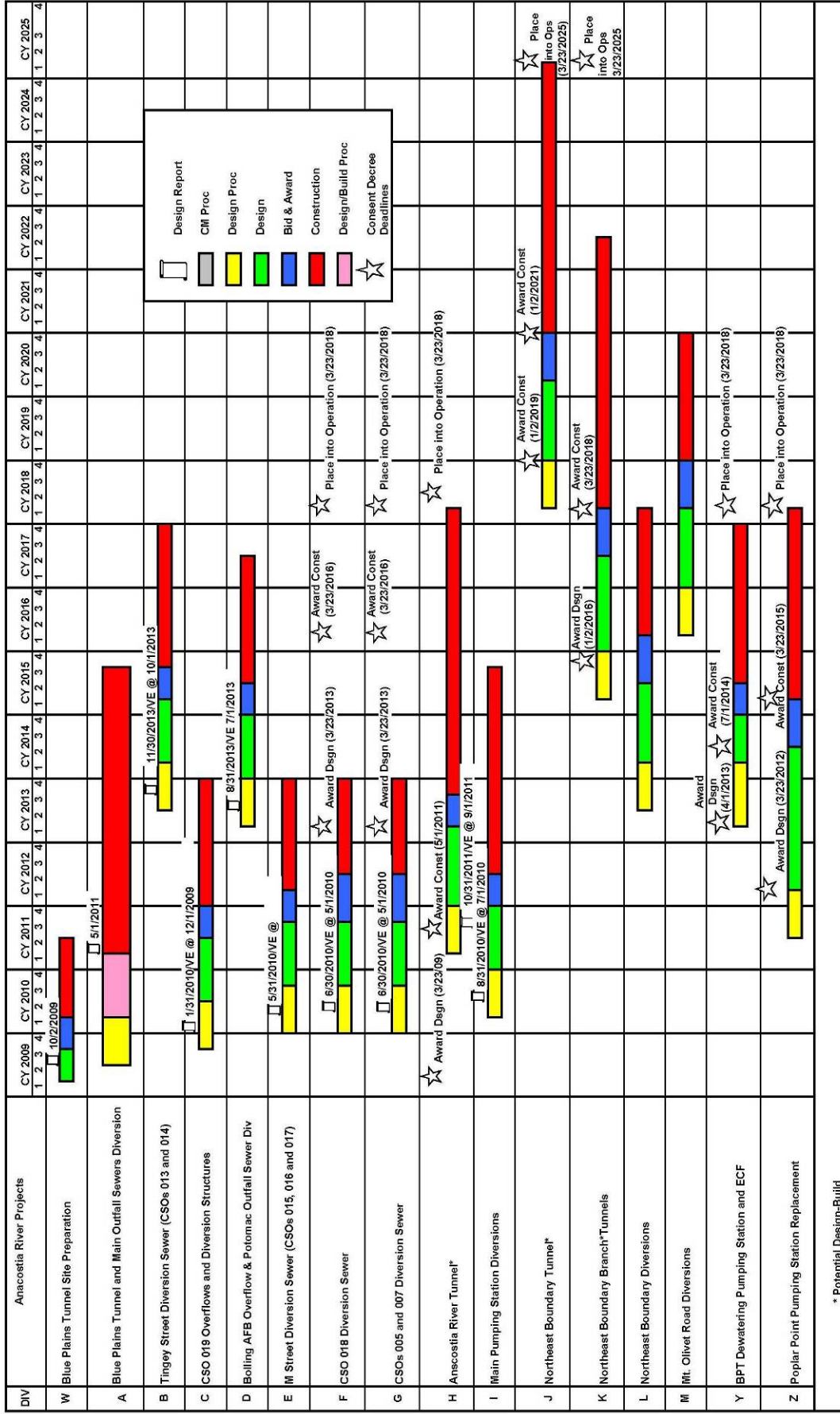


Figure 5. DC WASA LTCP Master Schedule

* Potential Design-Build

PROJECT DELIVERY METHODS

DCWASA considered two basic approaches for project delivery methods for contracts related to the tunnels and near-surface structures:

- 1 *Design-Bid-Build (DBB)*, which has been DCWASA's traditional method for project delivery, and
- 2 *Early Contractor Involvement (ECI)*, an "umbrella term" that can include various methods associated with design-build (DB), construction manager at risk (CMAR), cost reimbursement fixed fee (CRRF), and public-private partnership (PPP).

DBB: A Traditional Approach Considered

Advantages

DCWASA found several advantages to the traditional DBB approach. It has a long history of use, the terms and conditions are well defined and understood, the legal aspects are well established, and the lowest price can be obtained through competitive bidding. In addition, this approach can also contain ECI-like aspects (i.e., some degree of collaboration) through informal contractor discussions prior to bid, and it gives the owner the maximum control over the design.

Disadvantages

For the owner, there are a number of disadvantages to the DBB approach. The owner has multiple contacts to manage (architect/engineer [A/E], contractor, construction manager [CM]); the contractor considers the owner's design to be warranted and is entitled to base its bid on "best" assumptions; and there are uncertainties as to what the "lowest responsive bid" includes. In addition, given the nature of the roles and responsibilities, the relationships among the parties tend to be adversarial as opposed to collaborative. There is a proclivity for cost growth through design changes needed to resolve errors and omissions, which can result in claims and litigation; there are difficulties in obtaining the combination of best value, quality, and lowest price; and changes can result in extended schedule. Also, although the owner does have maximum control over design, it should be kept in mind that it does not necessarily have maximum control over the budget.

ECI: An "Umbrella" Alternative Approach Considered

Advantages

The ECI "umbrella" approach provides the flexibility to obtain the desired "end of the day" results. The schedule can be shorter than DBB, and can provide reliability and predictability. There is the opportunity to maintain the competitive lowest price feature of the DBB. There are opportunities to reduce uncertainties for all parties: owner, engineer, contractor, sureties, and third parties; decisions don't have to be made in a vacuum, given the collaborative atmosphere; the approach promotes equitable risk sharing and risk management; and there are opportunities to obtain risk sharing and risk management input from all parties. The ECI approach recognizes that design and construction is an integrated process, so it provides a forum to capture creativity, innovations, and preferences from the engineering and contracting communities—there are opportunities to obtain construction expertise before the design is complete, and the contractor "buys-in" to the design solution. In addition, this approach offers settings to obtain the best quality and value, and the owner can obtain single-source accountability.

Disadvantages

However, when considering this approach, there are some things to be aware of. ECI umbrella options are not well proven. The owner relinquishes some control over value, quality, function, and other objectives; and the owner depends on "qualitative" information in selecting the parties (e.g., prices are often absent in the criteria used to select a team under various ECI umbrella methods). Finally, this approach requires the owner to maintain transparency throughout the process.

Traditional and Alternative Approaches

In July 2009, DCWASA established new procurement regulations that provide for the use of both the traditional DBB approach and the various alternative project delivery options included under the ECI umbrella. Specific delivery methods considered for application on the Anacostia River Program included the following.

Traditional Design-Bid-Build (DBB)

An A/E firm would be engaged to prepare final contract documents for competitive public bidding. A CM would then conduct a constructability review prior to bidding, and that firm would monitor the construction. Depending on the complexity of the project, an expert panel or project review board (PRB) might provide an independent review of the design process.

Design-Build (DB)

Using this model preliminary plans would be prepared, and up to three DB teams would be short-listed by qualifications. The short-listed teams would be asked to submit technical/price proposals based on proposal and contract requirements issued in a Request for Proposal (RFP) document. During preparation of the technical/price proposal, proprietary meetings would be held with the short-listed teams to achieve the Early Contractor Involvement. The final selection would be based upon a combination of price and technical factors. Subsequent to the final selection, the unsuccessful teams would be compensated with a stipend for submission of responsive technical/price proposals.

Construction Management At-Risk (CMAR)

An A/E firm and a CM firm would be engaged to provide design and construction monitoring services. A solicitation for qualifications would then be issued to CMAR teams or firms. Short-listed firms would submit technical proposals that would contain information on the team, preconstruction deliverables, the construction process, ability to self perform, a plan for MBE/WBE utilization, development of a Guaranteed Maximum Price (GMP), and a cost proposal for overhead, profit, staff cost, sharing savings, and other cost-related items other than construction-specific costs.

The CMAR team would be selected based on a “best value” scoring system, whereupon an A/E agreement would be executed with the selected CMAR team to provide preconstruction services. The CMAR team would then participate in the development of the project design, typically entering the process at 30 to 50% design. At some point in the design (e.g., 80 to 90%), the CMAR team would submit a GMP that would be either accepted or rejected. If accepted, a construction Notice to Proceed (NTP) would be issued. If rejected, the owner would be free to use the information obtained in the preconstruction phase and seek competitive bids, or select another CMAR team.

Determining Project Delivery Systems

During a six-month period beginning in December 2008, DCWASA investigated which project delivery system would be most likely to result in a successful project, considering the technical features of the project, an internal evaluation of agency characteristics, and how the expected bidders would be likely to react to the various delivery systems. This investigation began with a two-day workshop, and concluded with an all-day presentation to the General Manager, with recommendations for which delivery system to use on which contracts.

During the internal and external evaluation the following conclusions and criteria were reached:

- 1 Early Contractor Involvement during design completion would significantly improve the chances of success.
- 2 A competitive procurement process was necessary to ensure the support of DCWASA staff and its Board of Directors.
- 3 Whatever delivery system was used had to encourage contractor participation by addressing concerns related to risk allocation and procurement confidentiality.
- 4 The proposed process had to have been used successfully in other jurisdictions.

Comparing the various delivery systems considered against these criteria resulted in the following recommendations.

Tunnel projects

For the tunnel projects, and in particular for the Blue Plains Tunnel, the design-build (DB) process was determined to be the best approach. The most efficient way to involve the contractor and designer together in addressing design decisions is for the designer to have a contract with the contractor. This would also minimize DCWASA's design risk. In addition, the DB procurement process can use a combination of price and technical factors, with a defined evaluation system for the more subjective elements, thereby retaining the competitive nature of the procurement process. Also, during the proprietary meetings, the contractor's concerns about risk allocation could be addressed, and changes made in the solicitation document if warranted. A communication protocol could be established that would satisfy any lingering contractor anxiety related to the confidentiality of information exchanged during these meetings. This DB process has been used successfully on other tunneling projects, and the contractors expected to be interested in this project are familiar with it.

The success of the design-build process used on the Blue Plains Tunnel will be evaluated before its use is recommended for the follow-on tunnel contracts. The master schedule has sufficient time for this evaluation to be completed.

Near-surface projects

For near-surface projects, the design-bid-build (DBB) process was determined to be the best approach. DCWASA could control the design process through separate procurement of AE firms, which was thought beneficial for near-surface structures. In addition, contractor input on constructability need not be integral with the final design, and thus can be provided during the bidding period. The DBB procurement process selects the lowest responsive, responsible bidder. The apparent low bidder is determined through public opening. Contractors who would be interested in the near-surface structures would, for the most part, be local and familiar with the risk allocation philosophy contained in standard DCWASA construction contracts. DCWASA typically uses the DBB procurement process for all construction contracts.

RISK MANAGEMENT

DCWASA recognizes that it faces a number of challenges, both technical and commercial, in order to achieve a cost-effective project within the time period required to meet the consent-decree date. To address these challenges, DCWASA is committed to using a balanced and fair contracting approach that appropriately allocates risk among the parties. In furtherance of this goal, the agency is seeking to modify certain contracting practices by implementing commercially viable risk management provisions.

The DCWASA legal department is currently modifying existing contract language to be more appropriate for underground projects and to incorporate this risk management policy. At the time of this writing, a draft of the revised General Conditions is not yet available, but it is expected that contract terms will include the following.

Geotechnical Baseline Report (GBR). A draft GBR will be provided to the short-listed firms to use in the preparation of their proposals. This GBR will establish baselines for ground parameters, based on the investigations completed. As part of the proposal process, each bidder will interpret the various baselines expressed in this draft GBR, and consider those baselines in the development of its design and construction approaches. At the proposer's request, the GBR could be modified to incorporate additional agreed-upon geotechnical risk allocation measures, and in such a case, a revised GBR would be issued by addendum to all bidders.

Liquidated Damages. Project completion time is an important factor in achieving project success. DCWASA intends to incorporate liquidated damage provisions for substantial completion, as well as interim milestones that would allow follow-on contractors access to certain work sites. At present, there have been no decisions made on either the use of incentive provisions for finishing early, or on instituting a project cap on the amount of liquidated damages that could be assessed.

Performance and Payment Bonds. Because the largest contract is expected to be in the \$300 million range, it is expected that contractors and sureties will be able to comply with DCWASA standard performance and payment bonds in the amount of 100% of the contract price.

Retention Practices. DCWASA's retention practice is to withhold 10% until the contract is 50% complete and then, given satisfactory progress, not subject further pay applications to any withholding, thus leaving a retention balance of 5% at project completion.

Payment Provisions. Recognizing that tunnel construction contracts impose special financial burdens on the contractor, DCWASA expects to include a provision allowing payment for materials stored off-site that would apply to precast concrete segments. In addition to the standard mobilization provisions, there may be another provision that would allow progress payments for engineering, fabrication, and delivery of the tunnel boring machine (TBM). Because most permanent materials are expected to be purchased relatively early in the contract term, it is not expected that a cost escalation provision for commodities will be included.

Partnering. There will be a partnering provision allowing for quarterly meetings, similar to those found on most underground projects.

Dispute Resolution Board. DCWASA anticipates having a three-person dispute resolution board to make recommendations on disputes. Details of the specification and the dispute resolution process are not yet final.

Hazardous Materials. Excavation at some shaft sites may encounter contaminated and/or hazardous materials. DCWASA is in the process of undertaking environmental investigations to identify both the quantity and quality of any such material. If, based upon these investigations, some of this material is expected, then a unit price will be included in the bidding schedule that will allow separate payment for hauling and disposing of such material at a licensed landfill.

Escrow Bid Documents. The contract documents will require that detailed bidding preparation documents be provided and held in escrow for use in future change negotiations.

Owner Controlled Insurance Program (OCIP). DCWASA has used a Rolling OCIP for years on its projects. It is expected that such an OCIP will be in place on the Blue Plains Tunnel project, although the details of what coverages will and will not be included are still being negotiated with the carriers.

SUMMARY AND CONCLUSIONS

The DCWASA CSO program is a large system with a number of underground structures that is just beginning the detailed design and construction phase. The contract packaging established using the criteria discussed herein has resulted in 16 separate contracts, 4 of which are tunnel contracts. The delivery methods to be used are a combination of design-build and design-bid-build, with the first tunnel contract, for the Blue Plains Tunnel, to be issued as a design-build. Risk allocation provisions intended to create a balanced and fair contract that allocates risk reasonably among the parties is in the process of being developed. It is anticipated that the success of this CSO program will be determined in part by the results of these contract decisions.