Authors

John R. Hollenbeck, P.E.[1], is the Nacimiento Project Manager within the Public Works Department of San Luis Obispo County, California. He is the full-time manager of the project through the design, bidding and construction phases. Mr. Hollenbeck has been engaged in the evaluation, design, and construction management for hydraulic structures since graduating from Kansas State University with a B.S. and a M.S. degree in Civil Engineering in 1984 and 1986, respectively.

Thomas C. Trott, P.E.[2], is the Nacimiento Project Engineer within the Public Works Department of San Luis Obispo County, California. He works full-time to assist the management of the Nacimiento Water Project through its design, bidding and construction phases. Mr. Trott received his B.S. degree in Civil Engineering in 2003 from California Polytechnic State University, San Luis Obispo. He has experience in design and construction of a variety of facilities including roadways, sewer systems, storm water systems and water supply systems.

Paul R. Kneitz, P.E.[3], is an Associate Vice President and Senior Project Manager with Black & Veatch Corporation in Walnut Creek, California. He specializes in managing large water resources projects principally involving raw water and treated water conveyance and water treatment. For the Nacimiento Water Project, he is serving as Deputy Project Manager and Chief Engineer during the design, bidding and construction phases. Mr. Kneitz graduated from the University of California, Berkeley with a B.S. degree in Civil Engineering and an M.S. degree in Structural Engineering in 1976 and 1977, respectively.

Carolyn K. Berg, E.I.T., is the Nacimiento Project Engineer within the Public Works Department of San Luis Obispo County, California. She works full time assisting with the overall management of the Nacimiento Water Project through its design, bidding and construction phases. Ms. Berg graduated from California Polytechnic State University, San Luis Obispo with her B.S. degree in Civil Engineering in 2008. Her experience lies in design, construction, and management of water filtration and water supply systems, specifically in developing communities, and her course work emphasized geotechnical studies.

[1] in Kansas and California
[2] in California
[3] in California

BIDDING STRATEGIES HELP MANAGE CONSTRUCTION BUDGETS: A CASE HISTORY OF THE NACIMIENTO WATER PROJECT

John R. Hollenbeck, P.E.[1], M. ASCE, Thomas C. Trott, P.E.[2], M. ASCE
Paul R. Kneitz, P.E.[3], Carolyn K. Berg, E.I.T.[4], AM. ASCE

ABSTRACT

Management of a project's construction budget cannot be limited to managing the content of its design; consideration must be given to the project's bidding process. Taking a strategic approach to a project's bidding process can significantly increase the success of the management of the project's construction budget. Case history of the bidding of the Nacimiento Water Project proves this point.

The Nacimiento Water Project (Project) consists of a sloping multi-port intake facility and pump station, two intermediate pump stations, three storage tanks, control center, and approximately 45 miles of transmission pipeline ranging in diameter from 36-inches to 12-inches, with the goal of delivering 15,750 acre-feet of raw water to communities spread across the County of San Luis Obispo, California. The Project is owned and managed by the San Luis Obispo County Flood Control and Water Conservation District (District) and began its design phase in 2004. In 2007, the engineer's estimate predicted a construction value of $140.5-million; however, bids for the Project, opened in the fall of 2007, resulted in a construction value of $123.8-million. To date, the Project's construction is within budget.

This paper discusses the District's bidding of the Project. Specifically, the paper addresses how the District's implementation of bidding strategies such as division of project into contracts, bid timing, contractor outreach, contractor pre-qualification, bid packaging, and bid advertising improved the management of the Project's construction budget and positioned the Project to obtain favorable bids, quality contractors, and a stable budget throughout construction.

[1], [2], [4],San Luis Obispo County Flood Control and Water Conservation District, County Government Center-Room 207, San Luis Obispo CA, 93408,
[1] jhollenbeck@co.slo.ca.us, [2] ttrot@co.slo.ca.us, [4] cberg@co.slo.ca.us
[3] Black & Veatch Corporation, 2999 Oak Road, Suite 490, Walnut Creek, CA 94597, KneitzPR@bv.com

BIDDING STRATEGIES HELP MANAGE CONSTRUCTION BUDGETS: A CASE HISTORY OF THE NACIMIENTO WATER PROJECT

John R. Hollenbeck, P.E., Thomas C. Trott, P.E.,
Paul R. Kneitz, P.E., and Carolyn K. Berg, E.I.T.

PROJECT BACKGROUND

District's Water Rights

In 1959, the District entered into an agreement with Monterey County Flood Control and Water Conservation District (now Monterey County Water Resources Agency) to secure rights to 17,500 acre-feet of water per year from Nacimiento Reservoir. Nacimiento Reservoir is located entirely within San Luis Obispo County, California (County), and was built by Monterey County Flood Control and Water Conservation District, who continues to control reservoir ownership and operations. The reservoir has a storage capacity of 377,900 acre-feet and serves the purpose of abating seawater intrusion in the groundwater aquifers of the Salinas River Valley.

After a severe drought stressed the County's primary water supply (mainly groundwater) in the late 1980's, the District decided to take a close look at the feasibility of distributing Nacimiento water within the County as a supplemental water supply. The results pointed to Nacimiento water as the next affordable water resource for the County.

Nacimiento Water Project

The District's Board of Supervisors approved the Project's Final Environmental Impact Report (EIR) in January 2004, allowing District staff to move forward with the Project. The Project is a raw water transmission facility designed to deliver 15,750 acre-feet of water per year from Nacimiento Reservoir to various communities within the County. It generally consists of a multi-port intake structure, three pump stations, three storage tanks, 45 miles of pipeline, four turnouts, a control center, and a Supervisory Control and Data Acquisition (SCADA) and Project control system. The Project budget is $176-million, including design, construction, construction management, environmental permitting, and right-of-way. Five participants – City of Paso Robles, Templeton Community Services District, Atascadero Mutual Water Company, City of San Luis Obispo, and San Luis Obispo County Service Area 10-A – have executed an agreement with the District to obtain water rights and to fund the Project. All agencies are collectively referred to as Participants.

PROJECT BUDGET

Budget Limitations

All infrastructure projects have budget limitations. They usually result from both the amount of demand for the infrastructure the project will provide and the financial

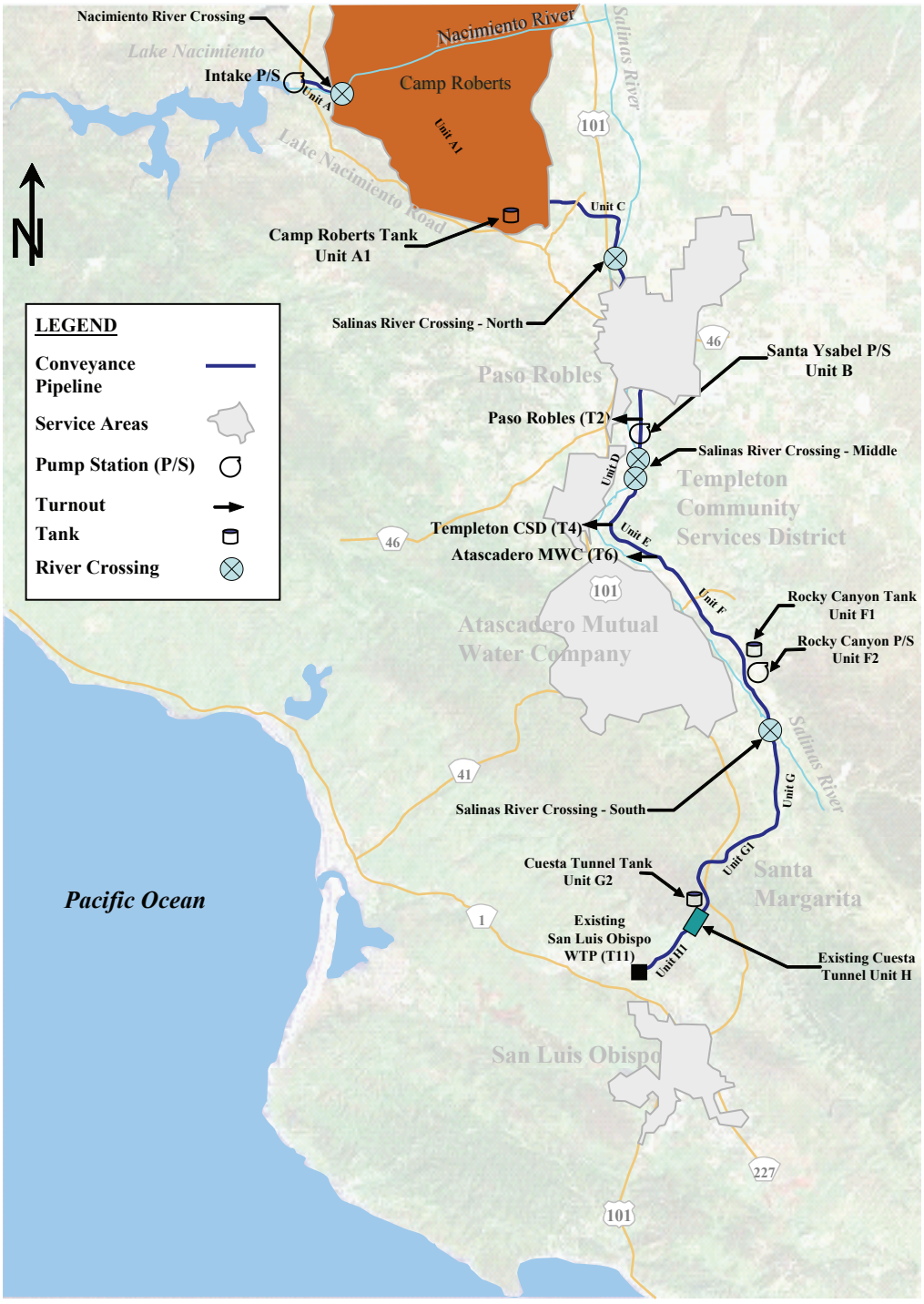

Figure 1. Nacimiento Water Project, San Luis Obispo County, California

capacity of the project's owner. This Project did not offer a high level of either attribute. Although the County's primary water sources experienced stress, the need for supplemental water had not yet become dire; and the County's small communities understood that the Project's cost would likely be greater than any single infrastructure project ever undertaken by the County. The combination of these two factors produced a Project environment that demanded the financial cooperation of multiple communities and the guarantee of a reasonable Project cost. If the District could not produce these, the Project would not be constructed.

The preliminary estimated Project budget was $150-million (excluding finance costs) when the District presented the Project to the County's communities. All communities evaluated the Project seriously, realizing that the need for supplemental water loomed in the near future; however, none of them could afford to bind themselves to a Project that had the potential to increase much greater than the presented price. As a result, the District placed an opt-out period in the Participants water delivery entitlement contracts. The opt-out period provided each Participant the option to back out of their contract within 30 days after 30 percent of the estimated construction value had been bid. In other words, if the Project bid too high, the Participants could back out and the Project would not move forward. Thus, the success of the Project became dependent on the District's management of the Project's budget.

To move the Project forward successfully, the District needed to identify the Participants' "threshold of financial pain." Said another way, the District understood that the details of designing, permitting, managing, and constructing a project of this magnitude could not be pinpointed nor guaranteed by a preliminary cost estimate and it needed to know the upper limits of Project cost that could occur without the Participants deciding to opt-out of their water delivery entitlement contracts. Discussion with the Participants led the District to believe that the Participants' "threshold of financial pain" had a rough upper limit of $200-million (see Figure 2). As long as the District kept the Project's budget within these limits, the Project could move forward to completion.

The Project's budget is comprised of costs attributable to five main components: preliminary engineering, environmental, design, right-of-way, and construction. Although these budget components were originally valued at $150-million in the preliminary budget, the early stages of the Projects' design phase indicated a likelihood that the Project, if designed and built according to the EIR, would cost much more than originally estimated. This caused the District to believe that, unless they implemented a variety of budget management strategies, the budget would likely exceed the $200-million threshold.

The District chose to focus its budget management efforts on managing construction costs. Construction had the highest cost and was the most fluid of the five budget components; thus,

Figure 2. Threshold of Financial Pain

the District reasoned that strategic decisions made in the Project's design and bidding phases would significantly impact construction costs and, thus, create the greatest impact on the overall budget. Strategies to manage the other four budget components were also put in place, but, since these components possessed a more fixed nature and a lesser value than construction costs, the strategies could not create the same magnitude of impact on the overall budget.

Managing the Budget with Smart Design

The District concentrated on smart design as its main strategy to cut construction costs, recognizing that the extra expense of generating innovative design ideas becomes negligible when compared to the construction savings realized by implementing the ideas. Tens of millions of dollars were shaved off the cost of construction by continually evaluating the Project's design and conducting a value engineering session at the 30 percent design submittal.

Despite these savings, the Project's budget continued to hover uncomfortably close to the $200-million mark. Near the end of the design phase, an estimate of construction costs (Engineer's Estimate), completed by the design engineer and confirmed by the construction management consultant, contributed to an overall Project budget estimate of $190-million (see Table 1). This estimate confirmed the need for the implementation of another budget management strategy that possessed the potential to significantly impact construction costs.

Managing the Budget with Bidding Strategies

Acknowledging that it would need more than smart design to keep the Project budget below the Participants' "threshold of financial pain," the District searched for another way to significantly impact construction costs. It deemed that the second most effective way to cut construction costs was to implement bidding strategies. With the Project's budget estimate at $190-million, the Project's success hinged on the ability of these bidding strategies to significantly impact construction costs.

BIDDING STRATEGIES

Theory

Each bidding strategy focused on obtaining favorable bids and limiting

Table 1. Project Budget Estimate – Design Phase Conclusion (Pre-Bid)

Project Components	Estimated Cost
Preliminary Engineering	$2.2 Million
Environmental	$8.1 Million
Design	$12.3 Million
Right-of-Way	$3.2 Million
Construction[1]	$164 Million
Total	**$190 Million**

[1] Engineer's Estimate ($140.5-million) + Other Construction-related costs ($23.5-million)

future construction costs. The District upheld four main theoretical principles to achieve these results:

1. Increases in the number of bidders results in increases in competition among bidders.
2. Increases in competition among bidders results in decreases in bid prices.
3. Quality contractors make few costly construction mistakes, resulting in low overall construction costs.
4. Contractual documents with clear conditions and shared risk reduce bid contingencies, resulting in low bid prices.

Division of Project into Contracts

Few contractors possess the financial capacity to undertake a Project with an estimated $140.5-million construction value; thus, the District divided the Project into five smaller contracts to avoid limiting the Project's potential pool of bidders. The five contracts are:

- Contract 1 – Intake
- Contract 2 – Facilities
- Contract 3 – Pipeline North (22 miles)
- Contract 4 – Pipeline Central (11 miles)
- Contract 5 – Pipeline South (12 miles)

The District divided the Project based on monetary value and type of work required for each bid package. The Intake work in Contract 1 required a general contractor with specialty experience in performing and managing microtunneling, marine work, and shaft excavation. The Facilities work in Contract 2 required a general contractor with specialty experience in performing and managing the construction and development of storage tanks, pump stations, and SCADA systems. Recognizing that few pipeline contractors possess the experience to successfully perform or manage these types of work, the District separated the Intake and Facilities work from the pipeline work. This ensured that pipeline contractors would not be discouraged from bidding the Project (increasing bidding competition) and not encouraged to bid work that their experience did not support (increasing contractor quality). Likewise, the District separated the Intake work from the Facilities work to

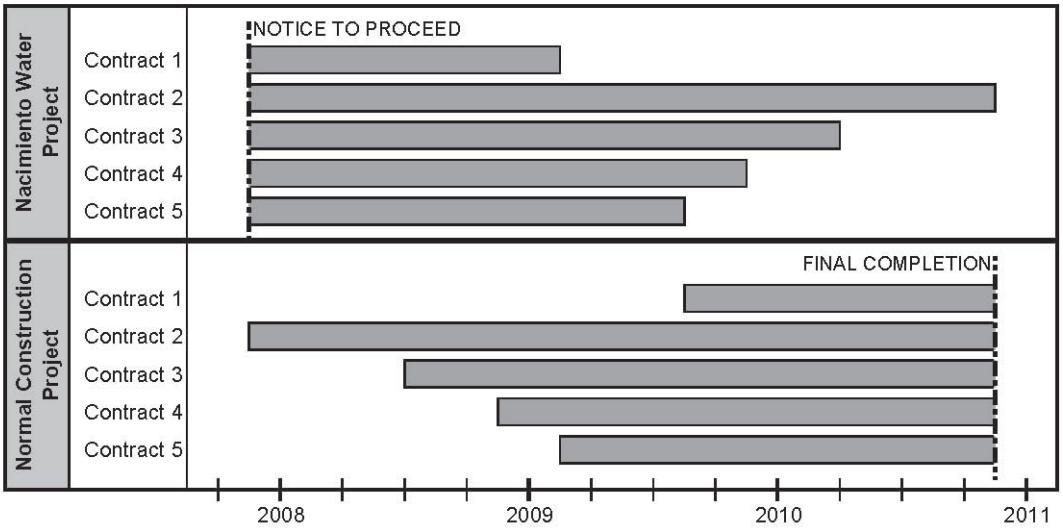

Figure 3. Bid Scheduling – Project vs. Normal

encourage bidding participation from experienced facilities contractors who did not possess experience in pipeline or intake construction. The Project's pipeline work was divided into Contracts 3, 4, and 5 so that the monetary value of each Contract would not be too great to deter small pipeline contractors and, yet, would still entice large pipeline contractors by presenting them the opportunity to win all three Contracts.

Bid Timing

Most projects with multiple contracts set bid opening dates based upon the timing required to issue notices to proceed that will allow all contracts to finish at a given time. The Distict had to rethink this type of bid scheduling in order to satisfy the opt-out clause in the Project's water delivery entitlement contracts. Since the opt-out required at least 30 percent of the estimated construction value to be bid before the opt-out period could pass, the District devised a plan to bid all contracts at the same time. This meant that all construction contracts would receive a notice to proceed at the same time and finish at different times. Figure 3 illustrates this phenomenon.

The District scheduled the opening of bids for all Contracts within the period of one month, allowing the District to strategically sequence and offset each Contract's bid opening date to obtain the best results. Bids for the Intake contract, Contract 1, opened first since it contained specialty work from contractors who could possibly choose to bid the other Contracts if awarded Contract 1. The pipeline contracts, Contracts 3, 4, 5, bids opened next, with one-week spacing between each. The strategy behind this sequencing predicted that a large construction company would bid aggressively to win Contract 3, the largest pipeline contract, giving them an advantage in the following two bid openings, since their mobilization costs would already be covered in the Contract 3 bid. The pipeline Contracts bid sequencing also created a bidding atmosphere where contractors who

were unsuccessful on previous pipeline contracts would bid more aggressively on remaining contracts. Contract 2, Facilities, was bid last, creating an opportunity for experienced facilities contractors who bid unsuccessfully on the Intake and pipelines Contracts to bid aggressively for the Facilities work. Overall, the sequencing elevated bidder competition and helped the District achieve low bid prices.

Since Project bid openings all occurred within the same month, the District benefitted from a consistent financial atmosphere in the construction industry. At the time of Project bidding, the construction industry experienced a reduction in work due to a lull in residential development. Project bid results reflected the hunger for work that the contractors experienced. Although an owner does not have the luxury of predicting the future or drastically rescheduling his project's bids, the District understood it would greatly benefit by working throughout the design phase to generate an educated prediction of the financial environment that Project's bids would experience. The information produced by this effort aided the District in determining the type and quantity of bidding strategies it needed to establish to attain success.

Contractor Outreach

In order to maximize the number of contractors bidding on the Project, the District had to maximize Project awareness amongst the contractor population. To do this, the District carried out a contractor outreach strategy during the design phase. The District, first, developed a list of general contractors located within the western United States who had performed work similar to that required by the Project. Each contractor on the list was then contacted and informed of the Project to determine contractor interest.

The District then devised a plan to conduct three contractor workshops to build and maintain contractor interest. All contractors that expressed interest in the Project received invitations to attend the workshop and the District made workshop participation available via the internet to maximize contractor attendance. The first workshop was held at the time of the 90 percent design submittal and provided contractors with an overview of key Project components. The second workshop took place during the development of the front-end specifications and discussed the contract terms that would be best suitable for the contractor and the District. The third workshop occurred approximately one month in advance of bid advertisement and presented the details of the Project's bidding phase. Each workshop lasted 90 minutes, including time for contractor questions and answers. The workshops provided contractors with an opportunity to give input on the Project prior to completion of its design and specifications. This early partnership demonstrated the good faith of the District and helped the District adjust the Project's design and specifications to obtain favorable bids.

Contractor Pre-Qualification

The District recognized that an average

general contractor did not have the experience to successfully perform some of the unique portions of the Project. Specifically, it was crucial to the Project that a highly qualified contractor performed the horizontal directional drilling (HDD) required for river crossings in Contracts 3 and 4 and the Intake's marine, microtunneling, and shaft excavation work in Contract 1. All subcontractors bidding the HDD work were subjected to a pre-qualification process that judged their previous HDD experience as well as their performance on HDD projects. All general contractors desiring to bid the Intake work had to engage in a pre-qualification process that required contractors to possess a high level of experience in self-performing and managing shaft excavation, microtunneling, and marine work. Contractor performance on other similar projects was also evaluated. The District developed the pre-qualification statement, uniform system of rating, and the appeal process from templates developed by the California Department of Industrial Relations.

The District received seven pre-qualification submittals from subcontractors desiring to bid the HDD work, six of which were deemed responsive. Eight general contractors submitted pre-qualification packages to bid the Intake work, seven of which were deemed responsive. While contractor pre-qualification guaranteed that the District would obtain a qualified Intake contractor, it also limited the number of bidders that could bid on Contract 1. Only three of the seven pre-qualified contractors bid on Contract 1, creating a low level of competition among bidders; however, the District deemed this as an acceptable risk based on the potential of extreme impacts to construction cost that could occur as a result of obtaining an unqualified contractor.

Assembling Bid Packages

In an effort to reduce unnecessary contingencies from bids, the District dedicated a significant amount of time during the design phase to assemble clear, consistent, and fair bid packages. With the contractual front-end specifications as the main focus, the District aimed to present a Project-specific contract, written to equitably share risk with contractors in areas where most owners shed risk onto the contractor. For example, the District took ownership of the risk of differing site conditions, offered a value engineering incentive to share the savings of contractor cost-reduction proposals, and provided allowances for utility conflicts and hazardous materials. The District also involved the Project's construction management team in the review process to make sure that the front-end specifications had clear and practical procedures and requirements, including change order procedures, contractor obligations, and payment procedures. As a result, the District presented a contractor-friendly bid package to contractors that helped avoid large bid contingencies.

Advertising for Bids

The call for Project bids went out on May 22, 2007, for Contracts 1, 3, 4, and 5 and on June 12, 2007, for Contract 2.

Contract	Bid Opening Date	No. of Bidders	Low Bid ($)	High Bid ($)
1	7/16/07	3	$20.8 Million	$29.4 Million
3	7/19/07	9	$38.4 Million	$51.3 Million
4	7/26/07	9	$22.7 Million	$29.3 Million
5	8/2/07	7	$16.3 Million	$24.0 Million
2	8/16/07	4	$25.6 Million	$32.3 Million

Table 2. Project Bid Opening Results

Recognizing the need to keep contractors apprised of their competition and of any contract revisions, the District utilized a professional reprographics company to organize the bidding process. This company efficiently reproduced and delivered bid packages, made daily updates to the plan holders list, and distributed all addenda. The District also developed a website for bidders to submit bidding questions. Both answers to questions, updated twice weekly, and the plan holders list, updated daily, were posted for contractors on the website. As bid opening dates approached, the District contacted interested contractors that had not purchased bid packages. The combination of these bid advertising strategies created a smooth bidding process that encouraged contractors to bid and increased bidding competition amongst contractors.

BID RESULTS

Bid Turn-Out

The District opened bids for the five Project contracts over a one-month period. The first bid opening revealed that less than half of the seven general contractors prequalified to bid Contract 1 (Intake) chose to pursue the Project. This low turnout is likely attributable to the complexity of the work (many prequalified contractors chose to bid the work as subcontractors instead of general contractors) and the fact that another comparable project opened bids during the same week as Contract 1. The three subsequent bid openings for the pipeline contracts, Contracts 3, 4, 5, produced a large number of bidders and highly competitive bids. Contract 2 (Facilities), the final bid opened, attracted a common number of bidders and fairly competitive bids. Table 2 summarizes the bid opening schedule as well as the bid results.

Bid Prices vs. Engineer's Estimate

Overall, Project bidding resulted in a construction value 12 percent ($16.7-million) lower than the Engineer's Estimate. Figure 3 illustrates a comparison of individual and total contract bid prices to their respective values taken from the Engineer's Estimate.

Only Contract 1 resulted in a bid price higher than expected, with a low bid 59 percent ($7.7-million) higher than the Engineer's Estimate. The District believes this large price differential is a

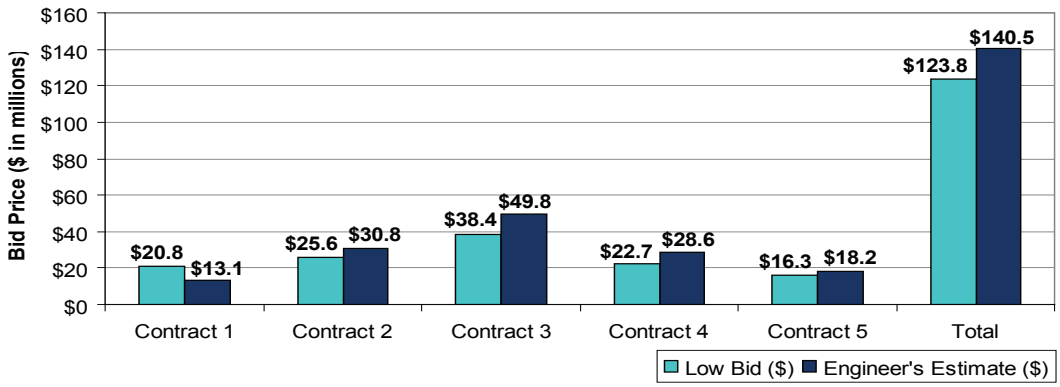

Figure 3. Bid Prices vs. Engineer's Estimate

product of two main bidding conditions. First, the Contract only yielded three bidders, reducing bidding competition levels below District expectations. The second condition had to do with the Project specifications regarding lake levels. The District understood, prior to bidding, that lake levels would affect contract pricing because Contract 1 required substantial marine work; however, it did not understand the financial weight the lake levels carried. Project specifications called contractors to assume maximum lake levels during construction, even though lake levels were anticipated to be at least 50-feet lower. The District later discovered that this was a costly risk for the contractor to bear since increasing depth of marine work substantially increases labor costs. Should the District have borne the risk, Contract 1 would likely have achieved a much lower bid price.

The following three contracts for pipeline work, Contracts 3, 4, and 5, resulted in bid prices much lower than the Engineer's Estimate. Respectively, each contract's bid price came in below the Engineer's Estimate by margins of 23 percent ($11.4-million), 21 percent ($5.9-million), and 11 percent ($1.9-million). All these contracts attracted large numbers of bidders, which likely had the greatest impact on bid prices.

Contract 2 resulted in a bid price 17 percent ($5.2-million) lower than the Engineer's Estimate. Although the Contract did not attract a large number of bidders, bidder competition levels remained high because contractors who had bid unsuccessfully on the four previous contracts made extra efforts to attain the work.

Opt-Out Success

Although the estimated total Project cost at the end of the design phase neared the $200-million mark, bidding strategies implemented by the District led the way to opt-out success. The district's bidding strategies, along with a favorable financial bidding environment, produced construction bids that totaled $123.8 million instead of the $140.5 million set forth in the Engineer's Estimate. This savings lowered the overall estimated Project budget to $176-million, resulting in opt-out success. The Project

continues to remain within this budget midway through the construction phase.

LESSONS LEARNED

Over the course of the Project's design and bidding phases, the District learned the following lessons about using bidding strategies to manage construction costs:

- The implementation of bidding strategies can have the same magnitude of impact on the overall budget of a project as smart design.
- Development and implementation of bidding strategies need to begin near the onset of the project's design phase.
- Wherever possible, the owner should structure the contractual front-end specifications so that the risk of changed conditions is owned by the owner or shared with the Contractor.
- The owner should analyze the financial state of the construction industry to develop the most effective bidding strategies.
- Obtaining quality contractors is just as important as obtaining favorable bids.

NOTES