



CITY OF
PORTLAND, OREGON

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TO: Erik Sten, Commissioner
Michael Rosenberger, Director, Bureau of Water Works

FROM: Barbara Clark, City Auditor *BC*

SUBJECT: Review of Brentwood Water Main Construction Project

To help the City Council, Water Bureau, and other interested parties assess the Bureau's performance on a pilot project to bid and install water mains, we conducted a review of the Brentwood Mains Construction Project. The Water Bureau traditionally contracts for main installation when the estimated cost of a project exceeds \$50,000. The Brentwood project was the first experiment to allow the Bureau to compete against private contractors for the right to do work traditionally contracted out. The Bureau's cost estimate was the lowest of six bids received from private firms and it was awarded the "contract" to replace over 16,950 feet of old 2 inch steel pipe with 4, 6, and 8 inch ductile iron water mains.

Scope and Methodology

One objective of our review was to assess the accuracy and reliability of reported project costs. We obtained and tested source documents supporting project costs, interviewed the project engineer, construction foreman, and Bureau accounting staff, and made other tests and analysis to ensure that all costs were included in the final accounting.

Another objective was to verify that the construction methods and practices used by the Bureau's construction crews and materials used were installed as specified in the contract. To assist us in this effort, we hired KPFF Consulting Engineers to perform site visits to evaluate construction work and report their findings.

In conducting our review, we followed the General Standards of Government Auditing Standards, 1994 Revision.

Contract Price

As shown below, the original contract was for \$511,746; however, change orders and quantity adjustments increased it to \$549,770.

Contractors are required to submit change orders if any adjustments to the contract price are desired. Three City-approved change orders totaling \$53,235 increased the contract price from \$511,746 to \$564,981. These change orders were required primarily because the Associated General Contractors (AGC)-initiated Temporary Restraining Order caused a 28-day delay in the construction start date. This delay required the Bureau to follow (rather than precede) the Bureau of Environmental Services sewer construction work. As a result, the Bureau had to pave entire streets rather than only construction trenches as originally planned. Adjustments to the final quantities required and used totaled \$15,211 which reduced the final contract price from \$564,981 to \$549,770.

Original Contract Price	\$511,746
Change Order 1 - Change paving from a trench patch to leveling course	(757)
Change Order 2 - Change paving from trench patches to leveling course	42,936
Change Order 3 - Additional work caused by following BES crews	<u>11,056</u>
Subtotal	564,981
Quantity adjustments	<u>(15,211)</u>
Final Adjusted Contract Price	<u>\$549,770</u>

Project Costs

The Water Bureau accounts for all costs of water main construction projects. However, the majority of these projects require expenditures in areas not considered the responsibility of a construction contractor. For example, project design and engineering, street opening permits, materials testing, construction inspection, and other costs are typically incurred and accounted for by the Bureau but are not considered the responsibility of a contractor. Therefore, in determining the costs incurred by the Bureau as a construction contractor, these other "non-contractor" costs need to be deducted to arrive at what would typically be the "contractor's" costs of construction.

The Bureau's final accounting for the Brentwood Project is summarized below.

Total Project Cost to the Bureau	\$694,237
Less: Engineering and other "non-contractor" costs	(73,052)
Less: Additional compensation, move in and out, and materials costs resulting from a 30-day delay caused by an AGC-initiated Temporary Restraining Order	<u>(7,831)</u>
Total "Contractor" Cost	\$613,354
Final Adjusted Contract Price	<u>549,770</u>
Total "Contractor" Cost Over Final Adjusted Contract Price	<u>\$ 63,584</u>

Cost Overruns

As shown above, the Bureau incurred cost overruns totaling \$63,584 in the following areas.

Cost Overruns/(Savings) Incurred:	
Personnel	\$27,979
Equipment	11,684
Materials (including gravel)	31,803
Paving	<u>(7,882)</u>
Net Cost Overrun	<u>\$63,584</u>

The Bureau could not explain all of the reasons for the overruns. It could be because the Bureau did not submit all of the change orders necessary. Or it could be that the Bureau was too optimistic when it estimated costs. The Bureau did report that one of the causes for the overrun in materials was because the Bureau's cost estimators were inexperienced and unfamiliar with soil conditions at the site and with gravel pricing methods. To ensure that the Bureau's project estimators did not have an unfair advantage over private contractors, they were denied access to the project's more experienced design engineers and could not discuss such things as soil conditions with them.

In addition, an incorrect conversion factor was used to convert tons to cubic yards which resulted in underestimating the quantity of gravel required. The Bureau's estimators also mistook a price quote from the gravel backfill supplier as a price per cubic yard rather than per ton. These errors cost the Bureau more than \$11,000 in additional gravel.

It should be noted that any overruns incurred by a private contractor would have to be absorbed by the contractor from his profits. Because the City is a non-profit entity, there were no profits built into the Bureau's cost estimate. Any overruns are absorbed by the Bureau's rate payers.

Construction Assessment

KPFF Consulting Engineers were hired to confirm whether the project was constructed in accordance with the contract plans and specifications. They determined that the City's construction crews encountered changed conditions and additional costs due to conflicts caused by concurrently constructed Mid-County sewer projects in the area. Their report indicated that these conflicts appeared to be predominantly a direct result of delays at the onset of construction due to the AGC restraining order and poor soil conditions which caused some caving in of the pipe trench. KPFF did report that there did not appear to be a discrepancy or a deficiency in the general or supplemental project specifications which would have been responsible for the additional costs incurred. KPFF went on to say that the change orders appeared to reflect actual conditions encountered and were not unusual for the type of work and coordination effort required for the project. The full report of KPFF is attached for your reference.

Conclusions

Our review determined that the Bureau's accounting for contract price adjustments and project costs was complete and materially accurate.

It is not possible to conclude that the City would have paid less to have the mains replaced by the next lowest bidder. While the Bureau's original estimate was lower than the next lowest bidder, quantity adjustments and change orders added another \$38,024 to the original contract price. In comparing the Bureau to the next lowest bidder, we do not know what the magnitude of the next lowest bidder's change orders (if any) would have been. Nor do we know whether any savings in materials quantities would be passed on to the City as a reduction of the contract price. As a result, it is not possible to determine whether the Bureau's total "Contractor" cost was more or less than the next lowest bidder's final cost would have been.

While this project did not appear to be successful from a cost standpoint, work was performed in a professional manner consistent with preset specifications. The lessons learned by the Bureau should be applied to future projects and efforts to perform construction in-house. Given experienced estimators using the same methodology for calculating costs, and absent disruptive legal action, it is entirely possible that the Bureau could successfully compete with the private sector.



Construction Overview of Brentwood Water Main Project

***City of Portland
Office of the City Auditor***

Introduction

KPFF Consulting Engineers, which has been under contract to BWW for the Mains Maintenance program, provided design services for the SE Brentwood District main improvements. Services included plan and profile design of mains within streets qualified for improvements within the Bureau of Transportation Engineering's (BTE) "Cheap and Skinny" streets, plan design on those streets not identified in the BTE program and the project specifications which were developed to the then current BWW and City of Portland standards.

In an on-going effort to provide a "least cost to the public agency", the project specifications included a "Notice Of Possible Construction By The City" statement. This statement identified the Brentwood project as a project which was to be bid by City forces. As responsive low bidder, the City would award itself the contract for these improvements.

The City was low apparent and responsive bidder on the SE Brentwood mains and did award itself the construction contract. This however was met with stiff opposition from the Associated General Contractors (AGC). In response to the City awarding itself the Brentwood project, the AGC filed for and received at the beginning of February, 1996, a temporary restraining order preventing the City from constructing the Brentwood mains project. In April of 1996 the restraining order was overturned and the City was allowed to commence work on this project.

Scope Of Work

In response to the concerns cited by the AGC, The City of Portland, Office of City Audits contracted with KPFF Consulting Engineers to provide limited construction observation services and evaluation service for the construction of the SE Brentwood mains. The scope of services identified to be provided by KPFF were as follows:

1. Review the project specifications; familiarization with the planned Bureau construction and inspection.
2. Perform a weekly inspection of the work site and the construction and inspection performance.
3. Review of inspection reports, materials submittals and change order requests and documents.
4. Preparation of a report at the completion of the construction project providing an opinion on how well the project conformed to the specifications as appropriately amended.
5. Provide testimony and reports as may be requested by the City in response to legal action over this project.

Background

The City of Portland Bureau of Water Works (BWW) owns and operates an extensive water system serving the Portland Metropolitan area. This system, with primary sources located at the Bull Run watershed and the east and west wellfields, consists of several million gallons of storage capacity on the east and west sides of the Willamette River, pump stations to assist in the supply and distribution of water throughout the reservoir network and several hundred miles of supply and distribution mains providing service to industrial, commercial and residential users alike.

The Water Bureau's network is generally broken down into two components, supply and distribution.

Supply

The supply components of the system, including the Bull Run watershed and the groundwater wells, are those which are directly responsible for providing water to an extensive reservoir network distributed throughout the Portland Metropolitan area. An additional supply main provides water to Washington County through an agreement with the Tualatin Valley Water District (TVWD). Supply mains generally range in size from 12" to 48" and are either ductile iron or steel pipe. The reservoirs, generally constructed of steel or concrete, range in size from 50,000 to 75 million gallons. Reservoirs have been placed at relatively high points and will provide water to either reservoirs located at lower elevations or to directly to the distribution network.

Distribution

The distribution component consists of several hundred miles of 4" to 12" pipe. The pipe materials generally consist of ductile or cast iron. This extensive distribution network provides direct service to the industrial, commercial and residential customers of the metro area.

To meet the ever evolving water demands of the Portland metro area, BWW has developed the Capital Improvement Program (CIP). The CIP, funded by the rate payers in the metro area, is responsible for funding supply and distribution network expansions and upgrades. The Mains Maintenance Program, funded within the CIP, is responsible for the maintenance and upgrades of BWW's distribution network to current design standards. Work within this program includes the replacement of undersized mains, installation of new mains in newly developed areas and maintenance of the existing distribution system. The purpose of the maintenance improvements is to increase fire flows to current standards, improve the level of service to the rate payers and provide long-term build-out of an area while providing an anticipated design life 100 years.

The SE Brentwood District, identified within the Mains Maintenance Program, included the replacement of approximately 17,000-lineal feet of undersized and outdated 2-inch steel mains with 4-inch, 6-inch and 8-inch ductile iron mains. Improvements also included the addition of several fire hydrants to meet current BWW design standards and to improve fire flows within the project area.

Evaluation

As agreed to in KPFF's contract with the City's Auditor's office, KPFF performed observation services for the SE Brentwood project. An evaluation of tasks as outlined in the scope of services is as follows:

Design Services

- **Review the project specifications; familiarization with the planned Bureau construction and inspection.**

Specifications:

KPFF performed design services for this project including:

- Development of the project plans.
- Development of the specifications. The project specifications contained standard City of Portland legal and procedural documents including, but not limited to, "Notice To Contractors", "Bid Bond", "MBE/WBE participation", "Prevailing Wage Rates", and the "Proposal" form. In addition to the standard City forms the legal documents contained a "Notice Of Possible Construction By The City" indicating to prospective bidders that the Brentwood project was a project to be performed by it's own forces.

KPFF also prepared the bid quantity tabulation form for the Brentwood project. Quantities calculated are based on design distances measured and quantities calculated based on designed profile depths and existing elevations surveyed. The quantities do not reflect changed conditions such as trench cave-in and changes in alignment due to conflicts with newly installed utilities not identified on the plans.

In addition to the legal and procedural documents, KPFF prepared the special specifications including general and supplemental conditions for this project. Per KPFF's previous experience with mains maintenance projects, each construction project requires both standard and supplemental specifications which address consideration to local conditions such as, but not limited to:

- Traffic
- Erosion Control
- Noise Abatement; and
- Coordination with other construction activities which may be going on in the project area. These conditions clearly identify a contractor's roles and responsibilities and provides the framework for identifying changed conditions which may provide the contractor an opportunity to request additional and in some cases a reduction in compensation.

Additional Costs:

In reviewing the specifications and the construction related documentation, the City crews encountered changed (additional costs) conditions due to conflicts with the concurrently constructed Mid-County sewer projects in the area. These conflicts appeared to be predominately a direct result of delays at the onset of construction due to the temporary restraining order and poor soil conditions which caused some caving in of the pipe trench. There did not appear to be a discrepancy or a deficiency in the general or supplemental project specifications which would have been responsible for the additional costs.

Construction Observation

- **Perform a weekly inspection of the work site and the construction and inspection performance.**

KPFF performed weekly site visits with the intent to observe the construction activity as it related to the project specifications and to industry standards for water main installations. The construction as observed conformed to both guidelines with the following noted exceptions:

- KPFF observed minor trench cave-in on several of the project's streets. The native materials appeared to be predominately sandy silts with an abundance of cobbles. The larger cobbles often presented problems during excavation causing some trench cave-in and over-excavation. In addition, minor conflicts with storm drainage laterals due to changed field conditions caused minor adjustments in pipe grade.
- KPFF also noted a revision to BWW's standard practice of providing an asphaltic base lift after the trench has been adequately compacted and compaction tested. Several of the streets were backfilled with a leveling course to finish grade and not paved with a base lift. These streets were in poor existing condition or poor condition due to all the construction activity occurring in them and were identified, as a result of on-going coordination with Mid-County's contractor, to receive an overlay as part of the Mid-County sewer work. The specifications allow for changes in quantities and scope of work due to field conditions not identified in the plans and specifications. Per conversations with BWW staff and field observations, these changes were made to reduce redundant activities between BWW and Mid-County contractor's and potentially save the City some money.

- **Review of inspection reports, materials submittals and change order requests and documents.**

KPFF reviewed samples of inspection reports, change order request and associated construction documentation. However, material submittals were not available to be reviewed by KPFF because the materials used for this project were inspected, approved by BWW inspectors and provided directly to the BWW construction crew.

Change Orders:

Per conversations with BWW staff and KPFF's review of the change order requests for the Brentwood project, changes which resulted due to field conditions were identified and requested within the allowances of the project specifications.

- As previously indicated, changes to the original plans were performed as a result of on-going coordination with the Mid-County work and with the intent to provide the least cost to the City of Portland.
- Increases in tonnage paving were offset by reductions in sawcutting and trench patching identified in the proposal form.
- All three change orders appear to reflect actual conditions encountered and are not unusual for the type of work and coordination effort required for the Brentwood project.

Inspection Reports:

The Inspection Reports typically contain an inventory of construction staff on-site, location of work, construction activity performed and unusual conditions encountered. While evaluation of BWW inspection reports did not result in the identification of any concerns or deficiencies, several reports did indicate marginal soil conditions or minor conflicts with installed storm and sanitary sewer components which had an impact on final excavation and trench backfill quantities.

Findings And Conclusions

Based on the field observations performed and the documentation reviewed by KPFF, the construction of the SE Brentwood mains appeared to conform to City of Portland's and BWW standard and supplemental construction specifications. The installation work, including coordination with Mid-County's sewer contractor, appeared to proceed extremely well.

From a purely construction perspective, we recommend the City continue to have the opportunity to bid it's own work. However, to improve it's relationship with and mitigate concerns from the Associated General Contractor's (AGC) office the City may wish to consider the following:

- Are the estimating and bidding practices consistent with local and industry standards? Does BWW estimating reflect true cost to perform a particular task or is it the City's cost to perform that task?
- Does the City, which is under contract to several pipe suppliers, pay the same price for a unit of pipe that a contractor bidding the work is going to have to pay?
- The WBE/MBE participation program has a built in cost which contractor's have to reflect in their unit prices. Does the City incur a similar cost, or does the City possibly avoid this issue by indicating that it's hiring practice conforms to the program?

KPFF strongly recommends that the City continue to work with the AGC's office. Concerns could be mitigated and the bidding environment could remain what it was always intended to be: fair and equitable while providing a quality product at the least cost for the owner.

