

September 22, 2006



Mr. Peter Letourneau
King County Department of Natural Resources
201 S. Jackson Street
BWO-NR-0100
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Subject: Brightwater Treatment Plant: Audit of WTD's Management of Treatment Plant Engineering Services Contract Amendments

Dear Pete:

Introduction

In accordance with Task 400 Work Order No. 11, we have reviewed the following documents related to the audit of Treatment Plant Engineering Services contract amendments:

- *Proposed Final Report – Wastewater Treatment Division's Management of Brightwater Treatment Plant Engineering Services Contract Amendments* as transmitted by letter from the Auditor dated July 18, 2006. (Audit Report),
- King County Executive's response to the Performance Audit dated August 8, 2006.
- A more detailed response from the Executive dated August 17, 2006.

The Audit Report evaluates two aspects of the Brightwater Treatment Plant design:

- How well did WTD manage contract amendments for the Brightwater Treatment Plant design engineering services?
- Were the lump sum contract for the treatment plant final design and the General Contractor/Construction Manager (GC/CM) preconstruction services cost effective?

The Audit Report reached two principal findings:

Finding #1: *Management of the Brightwater Treatment Plant Contract Amendments was Not Consistent with County Policies or Industry Best Practices for Effectively Controlling Costs.*

Finding #2: *The Contracting Methods Selected for the Brightwater Treatment Plant Final Design Services Contributed to Higher Design Costs.*

The Audit Report also makes a number of recommendations related to each of the two findings. Some of these recommendations are directed to WTD practices; others are directed to overall Executive Branch procurement policies and practices. The Executive has responded in detail to the Audit Report's findings and recommendations.





Our review of the documents related to the Audit Report focused on addressing the following issues:

- Are the design costs for the Brightwater Treatment Plant higher than would typically be expected for this type of project?
- Were there some inherent characteristics in how the treatment plant project (design and construction) was contractually structured that led to higher than expected design costs?
- Does the OMC have additional comments on the Auditor's findings and recommendations on WTD's Compliance with the County's Standards and Procedures?

The following provides a discussion of these issues.

Issue #1: Are the design costs for the Brightwater Treatment higher than would typically be expected for this type of project?

Audit Report:

Underlying the two findings in the Audit Report is the auditor's conclusion that the total cost of professional engineering contract services for the treatment plant design is higher than industry averages. The auditor based this conclusion on several calculations:

- *"Brightwater design costs exceeded the initial contract amount for professional design services by approximately \$13.4 million (32.3 percent)*
- *"... the cost of professional engineering contract services for the treatment plant design was 17 percent of the estimated treatment plant construction cost. This percentage exceeded the 6 to 12 percent industry average for professional contract services for wastewater treatment plants. The design cost as a percentage of construction cost ratio is a common method used in the construction industry to measure project cost performance."* The auditor cited a 1982 Architect/Engineering Cost Survey conducted by the Milwaukee Metropolitan Sewerage District (Milwaukee Survey Report) which was referenced in the *Brightwater Project Overview Report* (R.W. Beck, June 2005) as the basis for the "6 to 12 percent industry average.

WTD Responses:

In its responses to the Audit Report, WTD states that they believe that the auditor should have used total treatment plant program cost rather than construction cost in calculating these percentages, and that, if the auditor had done so, the design cost percentage would have been 9.2%, which WTD concluded was "within the 6-12% range".



Discussion and Oversight Consultant Comments

In our opinion, neither WTD nor the auditor made a true “apples to apples” comparison with the percentages from the Milwaukee Survey Report. (The reasons for this are detailed in the footnote¹, below.) However, these methodological issues can obscure what we believe to be two important points related to the treatment plant design costs and “industry standards”:

- First, because delivery of large capital projects has become increasingly complex (due to factors such as siting, permitting, public involvement), there is no currently recognized “industry standard” for the cost of overall engineering services. The American Society of Civil Engineers (ASCE) cost curves (Manual 45) cited in the Milwaukee Survey Report were developed in the 1970s; the Milwaukee survey was conducted in the early 1980s. Thus, the information contained in the Milwaukee Survey Report is between 25 and 35 years old and should not be used as an “industry standard.” (The Milwaukee Survey Report also specifically stated that the cost information was to be used as “a baseline for determination of the reasonableness of design proposals. The survey data and curves do not result in “absolute” ranges or ceilings for design costs.”) In fact, the most current edition of the ASCE Manual 45 states:

“The percentage of construction cost method is seldom used now. Because of increasing complexity and large variation in tasks for projects, the percent of construction cost fee curves no longer have a direct correlation to the required engineering fees for specific projects.”

- In preparing the *Brightwater Project Overview Report*, we concluded that a more reasonable assessment could be made by looking at projects of comparable size and complexity. Based on those comparisons, we concluded that Allied Costs for the Brightwater Treatment Plant (not the Conveyance Projects) were indeed high.

¹ The Milwaukee Survey Report asked survey participants to provide data for their projects’ construction cost and for design services. The percentage was calculated on the basis of design services vs. construction cost. Thus WTD’s use of “total program cost” rather than construction cost was incorrect for comparison purposes, and WTD’s calculated percentage was lower than it should have been. (The confusion may have arisen because Milwaukee Metropolitan Sewerage District ultimately changed their practice and used total program cost; but they changed the percentage range used as well.)

The Milwaukee Survey Report did not compare “*professional engineering contract services*” to construction cost as did the auditor. Rather, the Milwaukee Survey Report compared design costs to construction costs. The Report included the following items in design costs: preliminary engineering (planning and assisting the client in procuring field investigations, client conferences, preparation of preliminary engineering studies and designs, preliminary layouts, sketches, outline specifications and reports, preliminary cost estimates) and design (client conferences, planning and assisting the client in procuring field information necessary for design, furnishing engineering data for permits, preparation of detailed contract drawings, specifications, and estimates.) In our opinion, some of the “*professional engineering contract services*” for the Brightwater Treatment Plant were beyond the scope of design costs as defined in the Milwaukee Survey Report.

The Milwaukee Survey Report presented cost information on the basis of cost curves. Most surveyed projects fell within the cited six to 12 percent range for design as a percent of construction; however, in general, the larger projects had a lower percent design cost, presumably reflecting some economies of scale.



(Allied Costs include both budgeted engineering services and staff effort.) Since the Overview Report was prepared, significant additional engineering effort has been expended on value engineering the treatment plant 60 percent design. This also increased the cost of engineering services relative to construction but, more importantly, reduced expected construction costs.

Issue #2: Were there some inherent characteristics in how the treatment plant project (design and construction) was contractually structured that led to increases in design costs?

Audit Report

The Audit Report states that WTD agreed to use lump sum contracting for final design (as opposed to the County's more common practice of using cost plus fixed fee contracting) because the scope of final design services seemed well defined. The auditor concluded that the lump sum contracting for final design services and duplicative consulting efforts contributed to higher than expected design costs.

"The lump sum contracting method for the final design services did not contain standard provisions to control project costs, which contributed to a 60 percent design that exceeded the estimated treatment plant construction budget. The use of multiple consulting firms with duplicative responsibilities also led to higher design costs."

"The absence of a "design to construction budget" provision in the lump sum contract contributed to a 60 percent estimate that significantly exceeded the estimated construction budget...Because the lump sum contract did not contain requirements for the design consultant to develop construction cost estimates during the final design phase, and did not contain a design to construction budget provision, the county rather than the consultant absorbed the additional costs of the excess and redesign efforts."

In addition:

"Another concern regarding the 30% design was the extent to which the construction cost estimates were based on allowances rather than more definitive elements. R.W. Beck...reported to the County Council that 56 percent of the cost estimates completed at the 30 percent design milestone were based on allowances. R.W. Beck was concerned about the reliability of the construction cost estimate developed at the 30 percent design because of the dependence on allowances for a substantial portion of the estimate. The dependence on allowances also implies that decisions were not reached on major systems to generate a sufficiently defined schematic design."



The auditor made two recommendations based on these conclusions:

- “Design to construction budget” and “stop work” provisions should be included in future professional engineering services contracts to avoid unnecessary design costs. (Auditor Recommendation #5)
- The Phase IV construction engineering services contract and the GC/CM construction contract should contain distinct and clearly defined roles and responsibilities which do not overlap with the roles and responsibilities of CDM. (Auditor Recommendation #6)

The Audit Report also drew conclusions related to WTD’s decision to use GC/CM contracting for the Treatment Plant:

“WTD’s selection of the GC/CM approach and the Hoffman Company was advantageous in improving the quality and the construction cost for the treatment plant. However, WTD may not have maximized the full benefits of the GC/CM approach during the early implementation of the preconstruction services contract that could have helped reduce costly redesigns of the treatment plant”

The auditor made the following recommendation with respect to GC/CM contracting:

- The Procurement and Contract Services Section, with input based on lessons learned from WTD, should develop guidelines for the use of GC/CM contracting methods. (Auditor Recommendation #7.)

WTD Responses:

Overall WTD disagrees with the auditor’s finding that the contracting methods selected for the Brightwater Treatment Plant final design contributed to higher design costs. WTD states that it believes that the increase in project costs were primarily driven by record commodity price inflation as well as other external factors such as permitting, and that the expenditures in redesign were prudent given the construction cost savings that resulted. WTD further states that while there may be lessons learned, use of GC/CM and lump sum contracting methods are “both appropriate for this project and provide project benefits.”

With respect to the auditor’s recommendation that “design to construction budget” and “stop work” provisions be included in future contracts, WTD states that they “should be evaluated but not mandated.”

WTD cites a number of efforts that it has undertaken to address concerns about duplicative efforts between consultants. In addition, WTD states that it has concluded that, in the future, estimating services should remain with the designer to help strengthen designer responsibility for cost control.



With respect to the benefits of involving the GC/CM contractor earlier in the design effort as was recommended by the auditor, WTD concludes “it is highly speculative to conclude that earlier involvement would have reduced costly redesigns. The primary driver behind the need to redesign the project was significant increases in construction materials costs.”

Discussion and Oversight Consultant Comments

Overall, we agree with the auditor’s conclusion that certain early decisions related to contracting for engineering services may have contributed to higher than expected design costs. While WTD correctly notes that higher than anticipated commodity price escalation was a major driver of increased construction costs (which led to the need for value engineering efforts), we believe different engineering contracting methods may have realized and “corrected for” these trends earlier and/or more efficiently. Specifically, in the *Project Overview Report*, we raised the following concerns:

- **Cost Estimating Responsibility.** Initially, the County elected to have independent cost estimates developed by URS instead of, rather than in addition to, the designer. We concluded that “...this approach may distance the designers from the cost ramifications of their design choices.”
- **Use of Allowances in Cost Estimates.** While use of allowances is common in early estimates of project costs, we did raise concerns about the number of allowances in the 30% estimate for the treatment plant. However, our concern was centered on the question of whether or not WTD’s assumed contingencies were adequate (WTD’s budget had a \$52 million contingency; we had estimated that the contingency should be closer to \$97 million).
- **Lump Sum Contracting for Final Design.** We concluded that this method “...provides little to no incentive for the designer to slow down the design effort to consider changes or to revise the design concept to cut construction costs.”

WTD states that it has determined that some cost estimating responsibility should remain with the designer on future projects although independent estimating may also be prudent depending on project circumstances. We agree with this determination.

The auditor also recommended that “design to construction budget” and “stop work” provisions” should be included in future contracts; WTD agrees that they should be considered but not mandated. With respect to these provisions, we note the following:

- “Stop work” provisions for designers are generally being resisted in the industry unless accompanied by provisions for reimbursement of engineering mobilization and demobilization costs. In fact, there is a growing trend in the industry toward simultaneous owner and designer QA/QC reviews of design packages. This simultaneous review (as with lump sum contracting), is intended to shorten the duration of time required for design. Where the design is routine and straightforward, lump sum contracting and simultaneous reviews may contribute to



overall efficiency. However, on complex projects with a significant political dimension (i.e. difficult siting, permitting, public involvement), these approaches can raise the risk and costs of redesign.

- “Design to construction budget” provisions may mean different things to different people. At the very least, we believe that contract provisions should give the designer an incentive to provide feedback to the owner on the cost implications of both the designer’s recommendations and of the requirements for the project that are being placed by the owner. One end of the spectrum could be achieved by requiring that the designer develop frequent cost estimates and that they notify the owner if certain thresholds are exceeded. The other end of the spectrum would require the designer to redesign at its own cost if construction costs exceeded budget. We agree with WTD that a specific approach should not be mandated and that individual project circumstances should be considered in determining the best method for a given project.

We agree that WTD has taken a number of steps to address concerns regarding duplicative efforts between engineering contractors. These efforts should continue as recommended by the auditor.

We also agree with the auditor’s recommendation that the Procurement and Contract Services Section should take advantage of the “lessons learned” to develop guidelines for the use of GC/CM contracting. Another important issue to note with respect to GC/CM contracting is that, under this contracting method, minimizing design costs is not considered a goal in and of itself. Rather, the goal is to increase the certainty of construction cost estimates developed during the design, which more effectively allows the owner to consider design changes that will result in more efficient and cost effective construction.

Issue No. 3: Does the OMC have additional comments on the Auditor’s findings and recommendation on WTD’s Compliance with the County’s Standards and Procedures?

Audit Report

Overall, the auditor concluded that:

“WTD’s management of the final design contract amendments and associated change notices were not consistent with select county-wide policies, internal WTD procedures or industry practices.”

The auditor also made the following observations:

- WTD initiated additional design work without approved contract amendments
- WTD did not always obtain the additional reviews and authorizations required by County policies and procedures based on the value of the amendment amount (i.e. director approval required for amendments over \$25,000; department director review



if amendments total more than 10% of the original contract value; project control officer review for amendments over \$150,000.

- WTD performed critical cost reviews in lieu of developing independent estimates or several amendments.
- WTD project documentation regarding amendment negotiations and supporting analysis was not kept up to date.
- WTD did not request procurement waivers for work changes beyond the contract scope of work.

Based on these observations, the auditor made the following recommendations:

- WTD should conform its practices to established County policies and procedures (Auditor Recommendations #1-3).
- The Procurement and Contract Services Section should assess current county policies in relation to unique large-scale capital projects to ensure their reasonableness and to promote consistent compliance by county agencies. Particular attention should be given to adequate delegation of approval authority.

WTD Responses:

Overall, WTD acknowledges that management of contract amendments needs to be improved to ensure compliance with County policies and procedures. WTD notes that in some circumstances, the appropriate response to the auditor's findings should be to change County policy to provide more flexibility, rather than to change WTD practice. For example, WTD performed critical cost reviews in lieu of independent estimates. While this conflicts with current policy, the auditor also acknowledges that *documented* critical cost reviews are an acceptable foundation for negotiating competitive contracts or amendments.

Discussion and OMC Comments

While we are not in a position to comment on WTD's procedural compliance, we note the following with respect to the auditor's findings, conclusions and recommendations:

- We concur with the auditor's recommendation that policies and procedures be reviewed with respect to how well suited they are to large, complex capital projects. The auditor specifically recommends that the delegation of approval authority for design changes be considered in order to balance the need to keep projects of this type moving forward and the need for cost accountability. We would expand this recommendation to include a review of delegation of approval authority during construction.



- The auditor notes that, in a number of cases, WTD pre-authorized work prior to having completed a signed amendment. Whether or not this actually led to increased design costs is likely a function of how well the scope of work was defined when the pre-authorization occurred

Conclusions

Overall, the auditor found that design costs for the Brightwater Treatment Plant were higher than expected and that this was caused by:

- Inconsistent adherence to County policies and procedures;
- Contracting methods used for engineering services specifically in the final design phase; and
- Costly re-designs associated with value engineering efforts.

We agree with the auditor's finding that the design costs are high but the causes of this are complex. Both the auditor and WTD acknowledge that siting, permitting, and mitigation requirements have contributed to higher design costs.

While improvements can clearly be made by WTD with respect to complying with County procurement practices and policies, it is not clear to us that such compliance would have significantly reduced design costs.

However, certain contracting decisions made early on in the final design phase may have contributed somewhat to higher design costs. These include:

- The lump sum contracting for final design, which created incentives for the designer to finish the design as quickly as possible.
- Omitting the responsibility for cost estimating from the designer's scope. As a result, the designer was well into the next phase of design before obtaining cost information on the previous phase.

Had commodity price escalation been within expected ranges, these two decisions may not have had a significant influence on the design costs. However, when coupled with rapidly escalating construction commodity prices, these design contracting decisions provided inadequate opportunities for cost information to be fed back to the designer in a manner that would have allowed adjustments to the design to have made on a more timely and ongoing basis.

However, once WTD realized the extent of the potential increase in construction cost (i.e. once the GC/CM had completed its construction cost estimate for the 60% design), WTD initiated an extensive value engineering effort on the 60 percent design. This effort added substantially to the design cost (by about \$5.5 million) and extended the design schedule (but not to the overall project construction schedule since site preparation work was allowed to proceed).

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Nonetheless, in our opinion, it was the right management decision to make in that it resulted in the identification of potential construction cost reductions of \$86 million. In the end, it is construction, not design costs, that will be the greatest determinant of whether or not the overall Brightwater Project meets its budget objectives.

We appreciate the opportunity to offer our comments on the Brightwater Conveyance projects. Please contact me if you have any questions, or require additional information.

Very truly yours,

R. W. BECK, INC.

A handwritten signature in black ink, appearing to read 'R. J. Bingham'. The signature is written in a cursive style and is positioned above a horizontal line that extends across the page.

Robert J. Bingham
Project Manager

RJB/sjp/ato