

KING COUNTY'S PROJECT DELIVERY APPROACH FOR THE BRIGHTWATER PROJECT

Calvin Locke

King County, Wash., Wastewater Treatment Division

William W. Edgerton

MWH Jacobs Associates Joint Venture

INTRODUCTION

King County, Washington operates a regions wastewater treatment system that provides treatment to 18 cities and 16 sewer districts in the greater Seattle metropolitan area. The system serves 1.4 million people and currently includes two regional treatment plants.

In 1999, a long-range planning study identified the need for a third regional treatment plant, now known as Brightwater.

Prior to this project, the county has almost exclusively used the traditional design-bid-build delivery process for its capital projects. However, with the adoption of the RWSP, the county began to study the potential application of innovative project delivery methods.

This paper looks at the project delivery methods used for the Brightwater project, based on the specific needs of this large, complex, and multi-faceted project.

THE KING COUNTY WASTEWATER TREATMENT SYSTEM

In 1958, voters approved the formation of a regional agency called the Municipality of Metropolitan Seattle, or Metro, to build and operate a regional wastewater collection and treatment system. Prior to the formation of Metro, there were no regional wastewater treatment facilities and pollution of Lake Washington and Puget Sound from untreated sewage was a concern for many residents. In 1994, King County merged with Metro.

The county's 1,087 square kilometer (420 square miles) wastewater service area covers most of urban King County and extends into portions of two neighboring counties. The system includes two regional treatment plants, a local plant, 61 pump and regulator stations, and 571 kilometers (355 miles) of conveyance pipeline which convey wastewater from local districts to the treatment plants.

As with other areas, the greater Seattle/King County region has seen rapid population growth. The RWSP estimates that the current system would soon reach capacity, and called for the construction of a new third regional treatment plant, called Brightwater, to be operational by 2010.

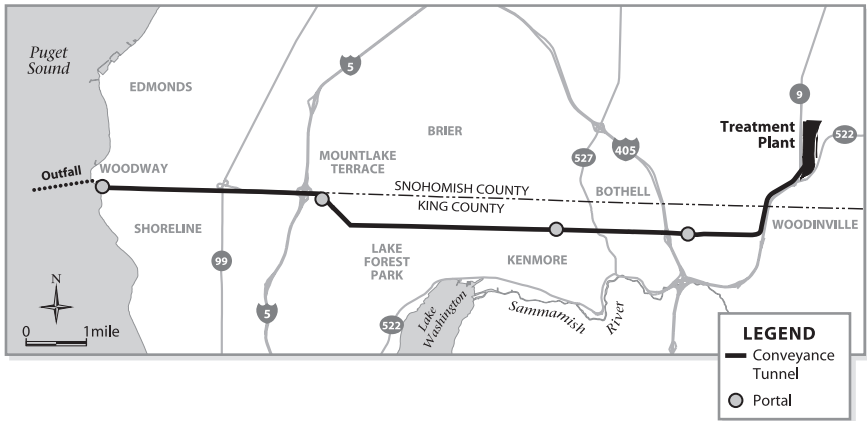


Figure 1. Brightwater Project, including treatment plant, conveyance system, and marine outfall

THE BRIGHTWATER PROJECT

With the adoption of the RWSP, the county began the siting and environmental review process for the Brightwater project. The project includes a treatment plant with initial capacity of 136 million liters per day (36 million gallons per day), expanding to 204 million liters per day (54 million gallons per day) in 2040; approximately 21 kilometers (13 miles) of conveyance tunnels; and a marine outfall in Puget Sound (See Figure 1). The estimated cost of the project is \$1.5 billion (2004 dollars).

PROJECT DELIVERY—LOOKING AT NEW METHODS

King County has experience in successfully implementing major capital projects. For example, in the mid-1980s the county constructed the Downtown Seattle Transit Project, an underground transit tunnel running under the city center; in the early 1990s the county successfully expanded the West Point Treatment Plant. Both of these projects were approximately \$500 million. They were completed on time and within budget using a single design consultant and a traditional design-bid-build contracting method.

As part of implementing the RWSP, the county completed a study of alternative project delivery methods. The study identified project delivery methods for particular projects and recommended that the county consider these methods.

The county did this study, in part, because changes in state law now allow using alternative project delivery methods; prior to this, only design-bid-build methods could be used. The county, along with many other public agencies, were also aware that “doing business” is much different now than in the early days of the Metro system. Privatization is happening across the county and public agencies are looking at project delivery methods used by private industry for ways to be more efficient. It is more complicated to staff up and hire the necessary consultants and contractors. Many large public works projects have been over budget and behind schedule.

Using the project delivery study as a guide, the county began its project delivery analysis early in its planning for Brightwater. A number of factors were considered as part of this analysis:

- Some of the techniques, such as design-build, would require a different form of contracting with the design firm.
- State and county restrictions on procurement require legislative approval if certain alternate contracting methods are used. This can add several months to the process.
- The project delivery method determines what type and how many staff are required and the extent of county involvement in the design process, both of which need to be known early in the project.

No project of the magnitude had been done by the county. In addition to its size and cost, other aspects of the project would have to be considered when looking at new project delivery methods:

- The project would be on an aggressive schedule, allocating only about 10 years for completion. This would include an extensive 4-year siting and environmental review process, in addition to project design and construction. During this time, multiple treatment plant sites, conveyance routes, and marine outfall zones would be evaluated before selection of the final system.
- Because of the lengthy siting process, and the fact that the scope of the project would not be well defined until the site selection was made, it was thought that it would be challenging to hire one large design team at the start of the project.
- Due to the listing of chinook salmon as an endangered species under the federal Endangered Species Act (ESA), there would be heightened scrutiny and permitting requirements by federal and state agencies, as well as by local tribal governments with fishing rights in Puget Sound and Lake Washington.
- The conveyance system would likely pass through multiple jurisdictions, potentially complicating the permitting process.
- The project would require expertise in many specialized disciplines, including oceanography, marine construction, public involvement, land acquisition, permitting, environmental review, deep tunneling technology, geotechnical studies, wastewater treatment and odor control processes.

BRIGHTWATER PROJECT DELIVERY

All of these factors determined the contracting strategy that was used by King County for the Brightwater project. The county developed a basic framework of separating the treatment plant design from the conveyance design. Using this as a basis, decisions on the types and numbers of contracts (see Table 1) were made as the project progressed and as better information became available. The following sections describes the major contract packages.

Phase One: Predesign, Siting, Environmental Review, and Scientific Studies

At the beginning of the siting process, over 100 sites were identified as possible locations for a treatment plant. Following this, a series of siting evaluations narrowed the number of sites being considered. During this time seven possible outfall locations and up to ten conveyance alternatives (both surface and below ground) were looked at. These alternatives were narrowed to two treatment plants, and conveyance and marine outfall options that were evaluated during the environmental review process. After issuance of the final environmental report, a plant site, outfall zone and conveyance route were selected.

Table 1. Summary of Brightwater Project delivery contracts

Contract Title	Approx. Contract Amount (\$ million in 2004 dollars)	Contract Start (actual or expected)
DESIGN		
Siting and Environmental Review	\$12.1	Early 2000
Marine Outfall Siting	\$3.0	Early 2000
Art Program	\$4.3	Early 2000
Oceanography	\$1.3	Mid 2000
Program Management Services	\$11.0	Mid 2001
Treatment Plant Design	\$41.6	Mid 2002
Architecture and Site Design	\$4.4	Late 2002
Conveyance Predesign	\$11.2	Late 2002
Geotechnical Services	\$16.8	Late 2002
Conveyance Final Design	\$24.0	Mid 2004
CONSTRUCTION		
Conveyance Construction Management	\$30.0	Mid 2005
Treatment Plant Construction Management	\$12.0	Late 2005
Treatment Plant (GC/CM)	\$311.0	Mid 2006
East Tunnel Contract	\$170.0	Mid 2005
Central Tunnel Contract	\$173.0	Early 2006
West Tunnel Contract	\$84.0	Mid 2006
Influent Pump Station	\$49.0	Mid 2006
Marine Outfall	\$20.0	Mid 2007
Conveyance Facilities (will be more than one contract)	\$24.0	Mid 2006

The engineering predesign work and scientific studies done during this phase of the project were integral to the selection process, and had to provide enough information to make siting decisions and to support the environmental analysis. This phase of the project also included a public outreach program that was be inclusive of citizens, environmental groups, tribal and local governments, and state and federal permitting agencies. This phase included the follow contract packages:

Siting and Environmental Review. This was a multidisciplinary team which developed an overall siting process and criteria that would be applied in subsequent rounds to narrow the number of sites being considered. The contract included consultants with expertise in facility siting, environmental review, land acquisition, landscape architecture, and public involvement. Part of this contract included conceptual site designs so that local communities could better understand the project, and so that visual impacts could be evaluated.

Treatment Plant Predesign. This team developed the plant layout and facility needs that could then be applied to the siting and environmental review processes and also serve as a basis for final design. This work supported the development of siting criteria used to evaluate and narrow the sites being considered. Predesign was started

before the final site was selected. This allowed the county to get an early start on the design process.

Conveyance Predesign. Along with the treatment plant siting, it was necessary to develop the potential conveyance systems and routes and to provide analysis of these alternatives. This contract provided engineering analysis during the siting process, support for environmental review, predesign engineering for the selected conveyance alignment and marine outfall, public involvement staff, and the development of a preliminary conveyance permitting and acquisition plan.

Marine Outfall and Oceanography Studies. The county studied a number of outfall locations in order to find a suitable marine outfall. This included studying circulation and dispersion patterns, bathymetry, nearshore habitat mapping, seafloor geology, and shoreline use and risk assessment.

Program Management Services. As part of implementing the RWSP, this contract included development of a management program for all wastewater division projects scheduled to come on line by 2010–2016. Specific to Brightwater, the contract includes cost estimating and scheduling services in support of the environmental review process, and constructability review of the project during the predesign phase. One of the reasons for having this work done under one contract instead of including it within the scopes of the individual design contracts was so that cost and schedule estimates could be performed consistently for the entire project.

Architecture and Site Design. Recognizing the importance of a common architectural theme to gain community support, the county executed a separate contract to provide system-wide architectural services to support the design work being done under other contracts. This included predesign drawings, and preliminary conceptual drawings to support permit applications. The contract allows for future amendment to cover all remaining phases of the work, including architectural related construction management support during construction.

Public Art. King County has a program where 1% of project costs are reserved for public art projects. The county's art program is working with the other design teams to integrate public art into the overall project. This will include selecting artists for the project and administering the artists' contracts.

Geotechnical Services. Because of the potential multiple design contracts for conveyance, the county wanted to have one geotechnical services contract that would provide consistent information for project design and construction. King County had successfully used this concept previously on the Denny Way CSO project. (As it turned out, there is only one final conveyance design contract.) The geotechnical contract involves a two-phased boring program, including Phase 1 and Phase 2 Environmental Site Assessments, preparation of technical memorandums to the designer, a geotechnical data report, and geotechnical baseline report.

Phase Two: Treatment Plant and Conveyance System Final Design

With the completion of the siting process—and the selection of a treatment plant site, conveyance route, and outfall location—final design of the system could proceed. This was carried forward under two contracts: one for treatment plant final design, which was done as a continuation of the predesign contract, and another for conveyance final design. These contracts also included continued support for land acquisition, permitting and public involvement. Other contracts that were implemented during predesign continued, including: geotechnical investigations; architecture, design and public art programs, which could now move from conceptual to final plans; and program management which provided final cost estimates and value engineering to reduce costs.

An important consideration during predesign was to look at the type, number, and scope of the construction contracts that would be used. This, in turn, would influence the packaging of the final design contracts. As discussed in the next section, conveyance construction would be divided into a number of separate contracts, whereas the treatment plant construction would be covered under one General Contractor/Construction Management (GC/CM) contract.

Deciding on multiple conveyance construction contracts meant that the county had options on how it could package the conveyance final design contracting. The county could use a single final design contract, which had the advantages of overall design coordination and possible savings from economies of scale by having similar specifications and design for all of the conveyance construction contracts. Or they could have multiple design contracts, which could benefit from competition between designers and the fact that each of the tunnel segments had unique features that could be better addressed by multiple contracts.

In the end the decision to use one conveyance final design contract was largely based on scheduling: there was not time enough to go through the multiple procurement cycles necessary to solicit more than one designer and still meet the 2010 startup date.

Phase Three: Construction Delivery

Early on in the project, alternative construction contracting methods were considered for both treatment plant and conveyance construction, including the following:

- **Design-bid-build:** one advantage is the county's proven track record of successful project using this method.
- **Design-build:** Though it is used for some projects, this method was not considered a viable option for conveyance. The county looked to recent problems that Sound Transit (a regional transit agency) had with proposals that exceeded their budget and with information from other design-build case studies. It was concluded that most problems on tunneling projects resulted from differing site conditions and that the design-build method did not have any advantage over design-bid-build in addressing this problem.
- **General Contractor/Construction Manager (GC/CM):** the typical benefit from this method is the coordination of multiple subcontractors and associated contract interfaces. However, Washington state statutes limit the GC/CM to self performing a maximum of 30% of the work. This was an option for the treatment plant, but for conveyance the tunnel excavation and lining would be such a significant part of the work that the county wanted the prime to perform the work and not act as a broker for a series of subcontractors.
- **The "Portland Method"** is a modified form of GC/CM, a cost-reimbursable/ fixed fee approach that has been used by the City of Portland on tunneling projects. It provides that more of the work can be self-performed, but in Washington state this would require state legislative approval, which could lead to uncertainty and schedule delays.

After considering these various methods, the county decided on the following construction delivery methods:

Conveyance Construction Contracts. The county decided to use the Design-Bid-Build delivery method for conveyance and IPS construction. GC/CM and the Portland Method were not used, primarily due to limits on self-performance, possible schedule disruption, and cost considerations. Along with selecting the contract method, an

analysis of alternative contracting packaging was completed, which indicated that three tunnel construction packages would be the optimum number to attract qualified firms, and provide sufficient economic competition. Conveyance construction packages are expected to include:

- **Conveyance Tunneling** will include three major tunnel contracts (known as the West, Central, and East tunnels). The decision to separate the work into these contracts was based on the goal of keeping the tunnel contracts below \$300 million to encourage competition, avoiding having more than one contractor at the site at one time, and the ability to meet the project schedule. The first contract is scheduled to go out to bid in mid-2005, with the others to follow at six month intervals. Subsequent contracts will include facilities at several of the portal sites, including final site work, restoration, odor control facilities, and landscaping.
- **Influent Pump Station (IPS)** will be located at a portal that will serve as both a mining and receiving portal for two of the tunneling contracts. With three separate contractors operating from this site at various times, the interfaces need to be carefully managed. The design process has been challenging with one firm performing the tunnel design and another firm performing the pump station design, both on the same site. The bid advertisement for the IPS is scheduled for late 2006.

Marine Outfall. Because there are alternate methods for constructing the mile-long marine outfall, the county is considering a Design-Build contract for this work. This is in part based on the county's experience on previous outfall projects where the contractor had proposed modifications to the design that were beneficial to the project. There is adequate time in the schedule for this process, which requires approval from the King County Council. The solicitation for this contract is schedule for 2006.

Treatment Plant Construction Contract. On past King County projects, treatment plants were built with multiple prime contracts, and the County assumed the risk of the contract interfaces. This proved to be a source of dispute, and as an alternative approach, the county decided to engage the services of a General Contractor/Construction Manager (GC/CM) to coordinate the various subcontracts and contract interfaces. The GC/CM firm was hired prior to the 30% level of design and was scoped to provide contractor input on constructability issues.

Construction Management Contracts. As of the date of this writing, there are two future consulting contracts yet to be executed. The conveyance system construction management contract will include resident engineering, inspection, and project control services for the three tunnel and facilities contracts that make up the conveyance system. The treatment plant construction management contract will include similar services for the GC/CM contract. By ordinance, King County must hire construction management firms on projects in excess of \$10 million. Furthermore, to avoid conflicts of interest, the county has a practice of not allowing any of the firms that participated in the design to be on the construction management contracts. These contracts are expected to be executed in 2005.

Insurance Contracts. King County has purchased Errors & Omissions (E&O) insurance coverage for the design consultants. The advantage is cost savings due to buying one large policy and minimizing the problem of trying to sort out responsibility if problems occur involving multiple design firms. One of the problems with owner-provided E&O insurance is that many of the smaller firms cannot cover the deductible on their own. To address this, the prime design firms are covering the deductible.

King County is also in the process of obtaining an Owner Controlled Insurance Program (OCIP) for the construction contracts, to take advantage of cost savings that

may accrue as a result of having a single source for general liability and builders' risk insurance. There are other advantages of OCIP such as having higher limits of coverage, uniformity and adequacy of coverage for all contractors and subcontractors, some of whom may not be able to purchase the amount of coverage on their own and uniformity of handling claims. The county has engaged the services of a broker to place this insurance for the construction contractors. Workers' compensation is not included in this OCIP coverage, since Washington is a monopoly state for workers' compensation coverage.

SUMMARY

Project delivery on major capital projects can be complex and every project is unique. The key factors that led to the contracting strategy on Brightwater included the size and complexity of the project, the tight schedule (which included lengthy siting, public involvement, and environmental review processes), the advantages and limitations of different delivery methods (including state and county procurement laws), and the different types of work involved. Based on these factors, the county selected to have separate contracts for the treatment plant, conveyance, and marine outfall during the pre-design and design phases; one GC/CM contract for treatment plant construction; separate contracts for the conveyance tunnel construction, facilities, influent pump station; and a design-build contract for the marine outfall.

Lessons Learned:

- Start early in the project to determine the best contract delivery strategy.
- Be willing to be innovative, while at the same time relying on what you know works best for your agency.
- Always keep the project schedule in the forefront and remember to consider how alternate delivery methods will affect this, especially if they require changes in statutes or too much disruption to the organization.