Brightwater Treatment Plant

Project Location and Facility Capacity

King County, Washington; 51 mgd peak month flow

Project Highlights

- Site selection, environmental impact statement (EIS), facilities planning, design, and construction support performed by a CH2M HILL-led team, with Brown and Caldwell, Mithun, and 16 other subconsultants
- Split-flow membrane bioreactor (MBR) process improves effluent quality and reduces plant footprint compared to conventional secondary treatment
- CH2M HILL produced extensive, complex deliverables, including siting strategy documents, facilities plan report and supporting technical memoranda, public involvement materials, permitting submittals, and design documents

Project Description

For the past 12 years, a CH2M HILL-led team has worked with King County to deliver Brightwater, a new US$488 million wastewater treatment and reclamation facility that serves the northern portion of the County's wastewater service area. Brightwater was placed in operation in September 2011.

Brightwater is the hub of a new $1.85 billion regional wastewater system that includes an off-site influent pump station, 12 miles of tunnels and conveyance pipelines, a marine outfall in Puget Sound, and a reclaimed water distribution network. The 120-acre Brightwater Treatment Plant site, reclaimed from automobile wrecking yards and other uses, has been transformed into a park-like setting, with streams, wetlands, trails, overlook structures, and an environmental education/community facility, the Brightwater Center.

The four–phase Brightwater project included (1) performing studies and public outreach assistance for siting the new plant, (2) selecting the plant site and preparing an EIS, (3) designing the treatment plant, and (4) providing comprehensive engineering services during construction and commissioning.

Odor Control: Key to Public Support

King County assured the surrounding community that Brightwater would have no odors—ever. To meet this challenge, process facilities are totally enclosed and ventilated to multiple-stage odor control systems. Foul air treatment includes bioscrubbers which serve as roughing filters and reduce chemical consumption in subsequent treatment stages. The odor control approach was instrumental to plant siting. Its successful operation—producing no detectable odors at the property line—has been critical to achieving community acceptance.

Scope of Services	
✓	Siting Studies and EIS
✓	Large Wastewater Facility Planning and Design
✓	Liquids Treatment and Solids Handling Processes
✓	Odor Control
✓	Class A Reclaimed Water Production
✓	Energy and Residuals Recovery
✓	Sustainability Features and Public Amenities
✓	Mitigation Wetlands and Habitat Enhancement
✓	Architecture and Landscape
✓	Geotechnical Engineering
✓	Public Involvement and Community Outreach
✓	Cost Estimating Support
✓	Permitting
✓	Services during Construction (SDC)
Design Fee	$47 million
Construction Cost	$488 million, composed of: - Liquids Contract, $314 million - Solids Contract, $174 million
Start Date/End Date	May 2002/June 2007 (Design) June 2006/June 2013 (Construction)
Reference	Stan Hummel, P.E. Project Representative 206.263.9457 stan.hummel@kingcounty.gov
Key CH2M HILL Staff	
Pat Burke Rick Smith John Spencer	Project Manager, 2006-present Project Manager, 2003-2005 Siting and EIS Project Manager
Doug Berschauer	Deputy Project Manager
Tina Hastings	Project Engineer and SDC Lead
John Rogers	Permitting and Stormwater
Glen Daigger, Bruce Johnson	Treatment Process Technology Evaluation
Jay Witherspoon, Scott Cowden	Odor Control Design and Air Permit Support
Bryan Youker	MBR Design
Dave Kelly, Steve Bakken	Instrumentation and Control Systems

Design Delivery

Pre-design tasks included screening and selecting technologies for liquids, solids, and odor control; conducting pilot studies; authoring a facilities plan for the Brightwater system; developing treatment plant layouts; and preparing schematic design drawings of the new facility.

The CH2M HILL team then developed construction documents consisting of over 5,000 drawings and supporting specifications, organized into multiple contract packages. Drawings were prepared using three-dimensional (3D) modeling software that provided detailed, graphical images of process facilities. The design team made extensive use of 3D visualization tools to enable County staff to optimize facility layouts for function and maintenance. The 3D model files were provided to the construction contractors to aid in planning and execution of their work.

MBR Process Reduces Pollutant Discharge

Brightwater uses an innovative split-flow process wherein 98 percent of the annual flow is routed through the MBR for advanced treatment, while infrequent peak wet weather flows receive chemically enhanced primary clarification (CEPC). The MBR and CEPC effluents are blended prior to discharge to meet the requirements of the NPDES Permit. The split-flow MBR was chosen over conventional activated sludge, high purity oxygen, and biological aerated filtration following evaluation of cost, engineering, operability/maintainability, stakeholder interests and environmental considerations. The split flow MBR offers improved effluent quality and reduced footprint at equal or less cost than competing processes. A portion of the MBR effluent is directed to reuse as Class A reclaimed water.


Brightwater MBR

Solids Handling: Designed for Future Flexibility

Solids handling facilities include gravity belt thickening of raw solids, mesophilic anaerobic digestion in modified silo digesters, and centrifuge dewatering. Solids storage is provided to equalize the feed to the digestion process, and to allow intermittent operation of dewatering equipment. The digesters are constructed with post-tensioned walls to minimize construction costs and are configured to facilitate future conversion to a thermophilic process. All solids processing facilities, including the biosolids truck loading bay, are fully enclosed, with foul air conveyed to the odor control facilities.

Site Design Minimizes Ecological Footprint

Brightwater includes constructed wetlands and wildlife habitat that mitigate project impacts. Open space and fish-rearing habitat have been enhanced by reconstructing degraded streams that had been routed through culverts. Paving has been minimized, reducing runoff. Stormwater management includes detention, sedimentation, and polishing through constructed wetlands. These enhancements improve water quality in nearby Little Bear Creek.

Community Amenities

The site provides community amenities including the Brightwater Center, walking paths, public art, interpretive signage, and native-based landscaping.

The Brightwater Center was developed by the CH2M HILL team working in concert with the County and a task force of local educators. The facility includes public meeting space, areas for exhibits and interpretive displays, and teaching/laboratory rooms. The Brightwater Center has been recognized as LEED® Platinum by the U.S. Green Building Council.

Resource Recovery/Reuse

Class A reclaimed water is produced at Brightwater with an initial capacity of 7 mgd. Space is reserved on-site for facilities that will increase reclaimed water production to 21 mgd.

Reclaimed water is used on site for irrigation, toilet and urinal flushing, and other activities that do not require potable water. Reclaimed water is distributed off site for use at other King County facilities and a golf course. Biosolids from the treatment plant are digested and dewatered for beneficial use, primarily through agricultural application.

Renewable Energy/Energy Conservation

The Brightwater design incorporates innovative features that will conserve energy and reduce life-cycle costs. The liquids process design includes chemically enhanced primary clarification, which can be used to optimize primary treatment performance and reduce peak aeration demands. Secondary treatment uses direct drive turbo blowers that provide energy savings while reducing the blower room footprint.

The Brightwater design includes an Energy Technology Demonstration Facility (ETDF), which will be used to test new means of generating electrical power and other forms of energy. If construction funding is approved, the ETDF would consist of 11 test beds, with provisions for supply of digester gas, natural gas, and reclaimed water. Electrical energy generated at the facility would be fed into the plant electrical system, offsetting a portion of the electrical load. Heat produced by the pilot installations would be fed into the plant hot water system, offsetting a portion of the plant heating demand.


Brightwater ETDF

Project Metrics

Parameter	Value	Comments
Consultant Contract Number	E13035E	Liquids Construction Contract No.: C38138C-535 Solids Construction Contract No.: C00168C07
Original Fee	$12 million	Original scope/fee was for facilities planning and preliminary design
Total Design Fee	$47 million	Original contract was amended to include final design, permit support, construction contract packaging, and detailed EIC design
SDC Fee	$18 million	Contract was amended to add comprehensive services during construction, commissioning support, and record drawings preparation
Construction Cost Estimate	$559 million	General contractor/construction manager's guaranteed maximum price for treatment plant, including bid alternates
Bid Cost	$467 million	Total bid cost for Liquids and Solids contracts
Total Construction Cost	$488 million	As-constructed cost for Liquids and Solids contracts
Project Start Date	May 2002	Inception of design
Construction Substantial Completion	January 2011 (planned) August 2011 (actual)	Construction substantial completion was extended due to delays in construction of the Brightwater Conveyance System, East Tunnel Contract
Plant Start Date	September 2011	

Project Awards

2005

American Society of Landscape Architects, Award of Honor, Brightwater System Siting Project

2009

American Institute of Architects, Seattle, Regional Top 10 Green Award

2011

King County Legacy in Sustainable Development – Brightwater Treatment Plant Environmental Education and Community Center
Northwest Construction Consumer Council, Green Project of the Year

2012

Environmental Business Journal, Project Merit Award

American Academy of Environmental Engineers (AAEE), Excellence in Environmental Engineering, 2012 Honor Award

American Council of Engineering Companies (ACEC), Washington Section, 2012 Engineering Excellence Gold Award

American Council of Engineering Companies, 2012 Engineering Excellence, National Recognition Award

American Institute of Architects, Washington Council, 2012 Citation Award for Excellence in Civic Design

Global Water Awards, 2012 Reuse Project of the Year

Engineering News Record, Best Project, Northwest Region

American Society of Civil Engineers, Seattle Section, Outstanding Civil Engineering Achievement Award

2013

American Society of Civil Engineers, 2013 Outstanding Civil Engineering Achievement Competition Finalist

Association of General Contractors, Build Washington Awards, Project of the Year, Heavy/Industrial Category