



Water Wastewater

Client

Loudoun County Sanitation
Authority

Location

Loudoun County, Virginia, USA

Broad Run Water Reclamation Facility

Project Highlights

- Preliminary Design
- Membrane Bioreactor (MBR) Technology
- Activated Carbon
- Pilot Testing of Innovative Processes

Project Description



Loudoun County Sanitation Authority (LCSA) provides public water and wastewater services to unincorporated areas of Loudoun County. The eastern part of the county, located near Dulles International Airport, is served by the Blue Plains Wastewater Treatment Plant (WWTP). However, the amount of flow that can be treated at Blue Plains is limited by agreement. Therefore, a new wastewater treatment facility is needed for Loudoun County. The new facility, to be called the Broad Run Water Reclamation Facility (WRF), will provide primary, secondary, and advanced treatment, followed by disinfection and discharge of the effluent into Broad Run, a tributary of the Potomac River.

The new facility will be designed to meet some of the most stringent wastewater treatment standards in the United States. Effluent limits of 1 mg/L for TSS, 10 mg/L for COD, 3 to 8 mg/L for total nitrogen, 0.1 mg/L for total phosphorus, and less than 2 cfu/100 mL for total coliforms are anticipated. Due to the stringent effluent limitations, particularly the COD and TSS limits, advanced waste treatment (AWT) is required. An MBR will be used for the secondary process followed by granular-activated carbon (GAC) for the removal of residual organic compounds.

CH2M HILL provided the following preliminary design and pilot services for the Broad Run WRF:

- Performed an environmental evaluation of the site, including a wetlands-delineation study and an archaeological study
- Assisted with the selection of the discharge location on Broad Run
- Developed a unique process involving the use of MBR technology to meet the effluent requirements of the Broad Run WRF
- Completed a pilot testing program to verify that the combination of an MBR with activated carbon will meet anticipated discharge limits and achieve objectives for biological nutrient removal

Monetary and non-monetary evaluations were conducted to compare MBR technology to conventional AWT processes. The evaluations' conclusions indicated that MBRs were much less expensive than conventional AWT processes such as high-lime treatment, and were cost competitive with conventional AWT processes such as multi-point alum addition.



The results of the pilot program showed that GAC was more cost effective than powdered-activated carbon (PAC) for the removal of residual organic compounds from the MBR effluent.

A number of unique benefits of MBRs were identified in the Preliminary Design Study and Pilot Program, including reduced site requirements, a reduced number of liquid and solids processes, and the inclusion of a positive pathogen barrier. The pathogen barrier was viewed as particularly important for this application, since the discharge location is 10 miles above a major water intake. Additionally, effluent from the Broad Run WRF will be of exceptional quality.

The first portion of the Preliminary Design Study addressed the issue of choosing a discharge location for the proposed facility. LCSA and its stakeholders used decision analysis processes to complete this task. To provide guidance for the decision making process, the following priorities were identified for maximization:

- Public health
- Stream water quality
- Public acceptance
- Investment value for LCSA
- "Permitability"

The discharge location on Broad Run is 10 miles upstream of a water intake on the Potomac River that serves a large population in the Washington metropolitan area. Consequently, special emphasis has been placed on the public health, stream water quality, and public acceptance factors associated with this project.

LCSA invited elected officials, regulatory officials from the Virginia Department of Environmental Quality and the Virginia Department of Health, and other interested stakeholders to informational sessions and tours of the pilot facilities throughout the course of the pilot program. Two full-color "Community Update" brochures were also produced and provided to interested stakeholders.

The LCSA Pilot Testing Program was the first demonstration of a five-stage BNR process coupled with MBR technology. It was also the first demonstration of one MBR followed by a second MBR that utilized PAC. The performance of the PAC reactor was compared to that of conventional GAC reactor for the removal of residual organic compounds from MBR effluent. The program successfully demonstrated the technical feasibility and cost-effectiveness of using an MBR with a BNR process and GAC to produce a high quality effluent.

Following the pilot testing, revised construction and operating costs were evaluated. The Pilot Program was successful in determining that MBR and GAC will provide a cost-effective process solution for the Broad Run WRF.