



## Water

### Drinking Water

**Client**  
City of Chesapeake

**Location**  
Chesapeake, VA, USA

## Northwest River Water Treatment Plant

### Project Highlights

- Complex river water treatment upgrade
- Sophisticated membrane processes allow maximum flexibility for treating variable water sources
- Award winning design
- Completed full-scale plant designs, design implementation, and construction management

### Project Description

For several years the City of Chesapeake, Virginia considered alternatives for upgrading the 38,000 m<sup>3</sup>/d Northwest River Water Treatment Plant.



The city selected CH2M HILL to design upgrades to the existing conventional treatment processes—rapid mix, flocculation, sedimentation, and high-rate filtration—and to design a new membrane treatment facility with 45,500 m<sup>3</sup>/d total capacity. The raw water is highly colored river water with characteristics that include high concentrations of total organic carbon (TOC) and manganese, low alkalinity, and low pH. Saltwater intrusion into the river and a need to comply with future regulations restricting disinfection byproducts (DBPs) were the two main drivers behind the upgrade. The membrane treatment facility designed by CH2M HILL satisfies both of these water quality goals.

The new membrane treatment facility is designed to treat conventionally filtered surface water or brackish water from deep wells.

In 1993 and 1994, CH2M HILL conducted a membrane pilot test program to help determine the most feasible approach to removing DBP precursors and protect against saltwater intrusion. The pilot programs confirmed the feasibility of upgrading the Northwest River plant. The proposed design for the upgrade included separate facilities for membrane treatment of filtered water from the river and of brackish water from deep wells.

The design, which resulted in one of the most sophisticated water treatment plants in the United States, includes conventional and membrane processes that allow maximum flexibility for treating the variable water sources. Four process trains of cellulose acetate membranes effectively handle saltwater intrusion into the river. Two separate trains of fully aromatic polyamide membranes treat the brackish groundwater from the production wells. Under the worst-case operating scenario, all membrane trains operate on flow from the river, and all wells are in service. Under typical (non-brackish) conditions, only one or two membrane trains operate, saving energy costs.

One of the most complex aspects of the upgraded plant operation was the need to regularly verify that water quality parameters are met. These include water quality requirements mandated for potable water, water quality requirements imposed by the treatment processes at the plant (such as pre-



treatment requirements for the membranes), and water quality requirements associated with sidestream discharges (as mandated in discharge permits).

CH2M HILL designed the system so that a computerized distribution system monitors water quality and control functions, as well as flow matching and pressure control functions. CH2M HILL instrumentation and control staff provided complete startup and testing services for the entire plant, including the SCADA system and functional integration with the membrane control systems and data reporting computer systems.

The plant has been in full operation since 1999 and received the Consulting Engineers Council of Virginia Engineering Excellence Award for the year 2000.