Camping in Comfort

Suspended growth tertiary treatment systems enable a Virginia state park to expand its visitor facilities

By Scottie Dayton

In 1971, 17-mile-long Lake Anna was created to serve as a water coolant for Virginia Power's nuclear plant. The surrounding 2,058 acres in Spotsylvania were known as Gold Hill and contained the defunct Goodwin Gold Mine. The Virginia Division of Parks joined the two properties and established Lake Anna State Park in 1983. Today, private cottages surround the lake, which is a popular summer vacation spot.

Accommodating more than 200,000 visitors annually placed a premium on the park's overnight facilities, and in 2004 construction began on 47 new campsites for recreational vehicles, two comfort stations, bathhouse, RV dump station, well house, and a laundry and linen storage facility.

Design of the multiple onsite system fell to Claire Smith, P.E., of Hankins and Anderson Consulting Engineers in Richmond, Va. "The site required low-pressure distribution," she says.

"The density of campsites left no room for sleeved pipe, which is a smaller pressure distribution pipe inserted into a larger drainage pipe within a gravel bed. I also was concerned that heavy equipment would compact the sand and jeopardize the system's performance."

Contractor Bucky Carroll of the Stamie E. Lyttle Co. in Richmond recommended lightweight chambers that didn't need gravel and significantly reduced man-hours. Many of the new facilities were operational in time for the 2005 summer season.

Site conditions

Lake Anna and tributaries have 250 miles of shoreline. The terrain is moderate with mixed hardwoods and pine forests. Soils are red clay, red silty clay loam with mottles, silt loam and brown loam. The percolation rate is 90 minutes per inch. Distance to groundwater is greater than six feet. No wells or springs are present. Most onsite systems for new construction are conventional septic systems.

The final trench with Quick4 Equalizer 36 chambers is backfilled after installation.

System components

Smith designed the system to handle 6,900 gpd. Its major components are:

Well House #1

- 1,000-gallon septic tank (all tanks and pump stations by Clear Flow Co., Waynesboro, Va.)
- One distribution box
- 900-square foot drainfield

Well House #2 — Pump Station

- Two 1,600-gallon septic tanks
- Whitewater DF50 ATU from Delta Environmental Products. Each unit has a high water float and alarm panel.
- 2,500-gallon pump station
- 620 feet of 6-inch force main (all lines spaced 6 feet on center)
- 54 trenches, 45 by 2 feet
- All pumps from Commonwealth Engineering, Burlington, Mass.
- 4,860-square feet of low pressure drainfield using Quick4 EQ36 chambers from Infiltrator Systems Inc.

System Profile

Location:	Spotsylvania, Va.
Facility Served:	Lake Anna State Park
Installer:	Bucky Carroll, Stamie E. Lyttle Co., Richmond, Va.
Site conditions:	Soils of red clay, red silty clay loam with mottles, silt loam and brown loam. Percolation rate 90 mpi; distance to groundwater greater than six feet.
Major components:	Whitewater ATUs from Delta Environmental Products Inc., Denham Springa, La.; 2,200 chambers from Infiltrator Systems Inc., Old Saybrook, Conn.
Hydraulic capacity:	6,900 gpd

RV Comfort Station

- Two 1,600-gallon septic tanks
- Whitewater DF150 ATU
- 2,500-gallon pump station
- 1,600-feet of 6-inch force main
- 40 trenches, 50 by 2 feet
- 4,000-square feet of low-pressure drainfield with EQ36 chambers

Comfort Station B

- Two 1,600-gallon septic tanks
- Two Whitewater DF100 ATUs
- 2,500-gallon pump station
- 340 feet of 6-inch force main
- 54 trenches, 45 by 2 feet
- 4,860-square feet of low-pressure drainfield with EQ36 chambers

Linen Storage and Laundry

- 2,500-gallon septic tank
- 2,000-gallon pump station
- 320-feet of 2-inch force main
- One stilling basin
- Two distribution boxes
- 450-feet of 4-inch TiteLine (14 lines 100 by 3 feet)
- 4,020-square feet of drainfield with 400 Quick4 standard chambers.

System operation

Gray water from the laundry enters the septic tank, then is dispersed from the pump station at an average rate of 1,200 gpd and a peak flow of 6.3 gpm. Sewage from the RV dump station flows from the septic tanks through the ATU, and is dispersed from the pump station at an average of 1,500 gpd and a peak flow of 3.9 gpm. Comfort station B and Well House #2 have average and peak flows of 1,350 gpd and 3.5 gpm.

The low-pressure lines provide five feet of head at the end to move liquid to the drainfield, but the laundry uses gravity feed and distribution boxes. From the pump stations, water travels through two 6-inch pipes to the header, through a 6- by 1 1/4-inch tee, then to 1-inch PVC pipes on top of the chambers. Holes drilled every four feet in the pipe and chambers disperse the effluent evenly.

Whitewater ATUs use the activated sludge and extended aeration methods of biological waste reduction. A conical clarifier is supported inside the main mixing tank. The space between them is the aeration zone where multiple PVC air-drop lines inject compressed air. Wastewater enters the mixing tank and is oxygenated for 24 hours. This process produces the minimum of sludge and can handle widely varying hydraulic and biological flows. The mixed liquid then enters the clarifier from the bottom.

Inside the settling chamber, sludge residues sink and re-enter the clarifier for additional processing. The clear treated water is hydraulically displaced upward and discharged to the drainfield. The sludge must be periodically removed from the units.

Installation

Carroll began installing the system in the winter of 2004. Inclement weather created unanticipated delays, but much of the work was finished in time for the heavy camping season. Carroll was scheduled to complete the project by the end of 2005.

Maintenance

The Virginia Park Service has maintenance contracts with various specialty equipment providers. ■

Above, 1,800 EQ36 chambers are installed in two-foot-wide trenches in the second section of the drainfield. At the left, two 6-inch lines carry effluent to the header line. Off the header line, the effluent travels through a tee, then to a distribution pipeline at the tops of the chambers.