

PROJECT DESCRIPTION

Grantee: Hampton Roads Sanitation District (HRSD)

Grant: #440-S-12-07 (HRSD-VIP NRI Project)

Hampton Roads Sanitation District (HRSD) owns and operates the Virginia Initiative Plant (VIP), which provides secondary treatment (activated sludge) with biological nutrient removal at a design capacity of 40 MGD. The existing treatment process is designed to provide biological phosphorus removal and seasonal nitrification and denitrification. Wastewater treatment processes include influent screening and pumping, vortex grit collection, primary clarification, secondary treatment consisting of the VIP 3-stage nutrient removal process, and chemical disinfection. Solids handling processes consist of centrifuge dewatering (primary and waste activated sludge), incineration, and a Nitrification Enhancement Facility (NEF). The NEF is a side-stream, activated sludge process which treats incinerator scrubber blow-down compounds that are nitrification inhibitors. This stream is then combined with the dewatering centrate and recycled to the main treatment process. Discharge is to the Elizabeth River near its confluence with the James River.

HRSD has a combined “bubble” wasteload allocation for nitrogen and phosphorus for their treatment plants discharging within the James River watershed. Due to a reduced nitrogen wasteload allocation established in Virginia’s Phase 1 Watershed Implementation Plan (WIP) for the Chesapeake Bay’s total maximum daily load (TMDL) for nutrients, additional nitrogen removal from these plants must be in place by January 1, 2017. Upgrading the VIP to an enhanced nutrient removal (ENR) level is a major element in HRSD’s overall strategy to meet this goal and improve local water quality.

Under a plan referenced as “Virginia Initiative Plant Nutrient Reduction Improvements” (VIP NRI), HRSD outlines the specifics of its objective to provide additional nitrogen removal capabilities while maintaining biological phosphorus removal. Facilities will be designed to achieve annual average effluent concentrations of 5 mg/l total nitrogen (TN) and 1 mg/l total phosphorus (TP). This will be accomplished by converting the existing VIP 3-stage nutrient removal process to a 5-stage process (the VIP process plus a 2nd anoxic zone and reaeration zone) by adding additional biological reactor volume and secondary clarification capacity to support year-round nitrification and additional denitrification. The proposed configuration is designed to support two operating modes, a normal flow mode providing 5-stage biological nutrient removal and a wet weather mode comprised of the 3-stage VIP process in parallel with a conventional activated sludge treatment process. This flexible capability will be enabled by the construction of a new 4 MG Versatile Bioreactor (VBR) and Secondary Clarifier #6. These units will work in series with the VIP reactors to enhance nutrient removal during normal flow conditions and then transition to separate operation parallel to the VIP reactors during high flow events.

An additional key objective of the NRI project is to increase the peak hydraulic capacity of the plant from 80 MGD to 100 MGD. This is an integral part of the project and several improvements to various areas of the facility are planned.

Major components included in the project are outlined below:

- Preliminary Treatment Facility (PTF) to include influent screening, screenings handling, wet well, and influent pumping with a 100 mgd capacity.
- A 2 million gallon flow equalization (EQ) tank to allow time for plant staff to transition between normal and wet weather operating modes during storm events that produce flows above 70-80 mgd.
- An equalization tank diversion structure to divert screened raw wastewater influent to the EQ tank.

- A 4 million gallon versatile bioreactor (VBR) and new Secondary Clarifier No. 6 to convert the existing VIP biological nutrient removal process to a 5-stage enhanced nutrient removal process during normal flow conditions. The VBR will operate as a conventional secondary activated sludge process during high flow events.
- A new Supplemental Carbon Storage and Feed Facility.
- New nitrate and anaerobic recycle (NRCY and ARCY, respectively) pumps. There will be 5 each rated at 10 mgd, four operating and one standby.
- A new Chlorine Contact Channel (CCC) and other disinfection facility improvements to provide additional conveyance, flow measurement, and disinfection capacity for wet weather flows that exceed the hydraulic capacity of the secondary clarifier effluent channel, chlorine contact tanks, and Parshall flume.
- A Primary Solids Holding Tank (PSHT), converted from an unused WAS storage tank, to provide improved handling of wet weather solids loads to the primary clarifiers and to function as a fermenter to produce volatile fatty acids (VFAs). These will be used as a carbon source for biological phosphorus removal or denitrification processes.
- Odor control facilities including an 8300 cfm bioscrubber to treat odorous air from the plant influent structures and new PTF, and a 15,000 cfm activated carbon scrubber for the EQ Tank.
- Electrical system improvements, including new electrical gear to support new process facilities, replacement of existing 13.2kV and 480V switchgear at the end of its useful life, and replacement of the existing standby generators.
- Additions to the existing Distributed Control System to monitor and control new unit processes.
- New yard piping, including a raw influent wastewater line from the proposed PTF to the new EQ Tank Diversion Structure, piping to accommodate inflow/outflow at the new EQ Tank, and piping to convey mixed liquor from the new VBR to the secondary clarifiers.
- Site improvements including access roads and stormwater management systems to support the planned NRI facilities.