

Pipeline

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What You Need To Know About BNR

Wastewater systems in the Chesapeake Bay watershed are faced with increased treatment standards. Biological Nutrient Removal (BNR) is now the focus of regulators in order to achieve the goals of the Chesapeake Bay Tributary Strategy. Compliance will come at a very high price. Costs are expected in the billions for capital construction and operating expenses.

The PA Department of Environmental Resources has imposed maximum annual BNR load limits based on total nitrogen (6 mg/l) and total phosphorous (0.8 mg/l) at average plant design flow. Over 180 plants in the Bay tributary must comply within the next 5 to 6 years.

HOW WE CAN HELP

GD&F is a leader in nutrient removal design. We have the project experience and technical expertise for large and small BNR treatment systems. Our team of process engineers and scientists are at the forefront of biological nutrient removal (BNR) planning strategies and design.

Technical Expertise

GD&F is known throughout the industry for its innovative and technically creative plant designs. **Jim Butler, Jim Balliet, Mark Glenn and Travis Long** – well known industry specialists – are part of GD&F's staff of process design engineers and scientists with over 100 years of collective experience in system planning and design. Also, their in-depth, hands-on experience in wastewater characterization, plant operations and process optimization ensure the plant operates as it was designed to.

Project Experience

GD&F has planned and designed the full range of BNR treatment systems. These include plants varying in size



Osceola Mills 0.4 mgd ICEAS facility (decanter mechanism).

from 0.25 to 30 mgd. GD&F designed the BNR modifications to the Altoona Westerly plant (24 mgd) using the Modified Ludzack-Ettinger (MLE) system. The recently completed Saxton Borough Municipal Authority and ORD (Osceola Mills) Sewer Authority plants successfully employed an intermittent cycle extended aeration system (ICEAS)— a variation of the sequencing batch reactor (SBR) process—to achieve nutrient reduction. The Portage Area Sewer Authority plant expansion (6.0 mgd) also uses the ICEAS system. The proposed Karthaus-Burnside wastewater plant (0.115 mgd) uses an adapted extended aeration process with a staged anoxic zone.

Total Daily Maximum Loads (TMDL) And Enhanced Nutrient Removal (ENR)

Although the current PADEP strategy uses the “cap load” method (annual loading limits) USEPA Region III is considering TMDL limits for even higher levels of total

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nitrogen and phosphorous control, or Enhanced Nutrient Removal (ENR). Designers must consider processes that are adaptable to future TMDL limits and compatible with ENR. For instance, GD&F is designing the Altoona Easterly plant with a Stage 5-Bardenpho process and ENR membrane bioreactors and effluent filtration for a possible TMDL limit on the Little Juniata River.

Wastewater Characterization

GD&F applies a system-specific solution to BNR control and avoids the package or one-size-fits-all approach. A key to effective process selection is defining influent quality throughout the full range of wastewater flow. Water quality kinetic parameters are often enhanced by specialized tests such as the high F:M analysis. Proper design criteria is essential for the proper design of reactor basins, aeration/mixing facilities, return sludge pumping and final clarification.

Handling High Flow

Many plants experience high wet weather flows from excessive inflow-infiltration and combined sewers. The integrity of the BNR process must be preserved to prevent solids washout and maintain nitrate return, SRT and F:M ratio. GD&F has designed step feed facilities to bypass the BNR reactors for chemically enhanced sedimentation at the final clarifiers while still meeting suspended limits.

Computer Modeling

While there is no substitute for design experience and judgment, powerful computation tools are available to supplement the design process. For instance, BioWin® software is finding acceptance in the design community for modeling dynamic conditions such as temperature, diurnal flow/quality, process kinetics and seasonal flow variation. GD&F personnel have applied BioWin in all BNR planning and design projects as a check on process design assumptions and determining annual loads for permit “cap load” conditions.

Control And Instrumentation

At many plants, biological nutrient removal is a radical operating departure from a typical secondary treatment process. BNR demands a stable and predictable process which can only be achieved by precise operational control. The acquisition of process input/outputs, acquired in real



Saxton 0.6 mgd ICEAS facility (fill cycle).

time, assists operating personnel in these efforts. GD&F has designed supervisory control systems (SCADA) to provide this information. GD&F personnel, under the direction of **Andy Johnson**, have designed hundreds of similar applications.

Nutrient Credits

The nutrient credit market is an option for some systems. Compliance with cap load limits can be achieved by purchasing credits under Pennvest’s nutrient trading project with the Chicago Climate Exchange. GD&F recommended that the Clearfield Municipal Authority purchase credits as an interim compliance solution for its 4.5 mgd plant.

Function And Cost Control

All the technical knowledge and expertise is for naught unless the project works as designed. The project must also be affordable, both now and in the future. This is where the GD&F experience factor comes through.

It is our depth of knowledge in planning and design, project management, operator needs and the appropriate use of new technology that makes the difference. From the use of the best nutrient removal technology to the maximum reuse of existing facilities, cost-effectiveness and functionality are our primary objectives.

GD&F OFFERS COMPLETE BNR PROJECT ENGINEERING SERVICES

from preliminary planning to startup, commissioning and beyond. Our personalized approach to your system needs and those that operate it have been our hallmark for over 55 years. Let GD&F assist you in developing a nutrient removal strategy for your treatment plant.