Preliminary Analysis of Nitrogen Reduction Performance of COG Region Wastewater Facilities
COG staff update 9/10/2021

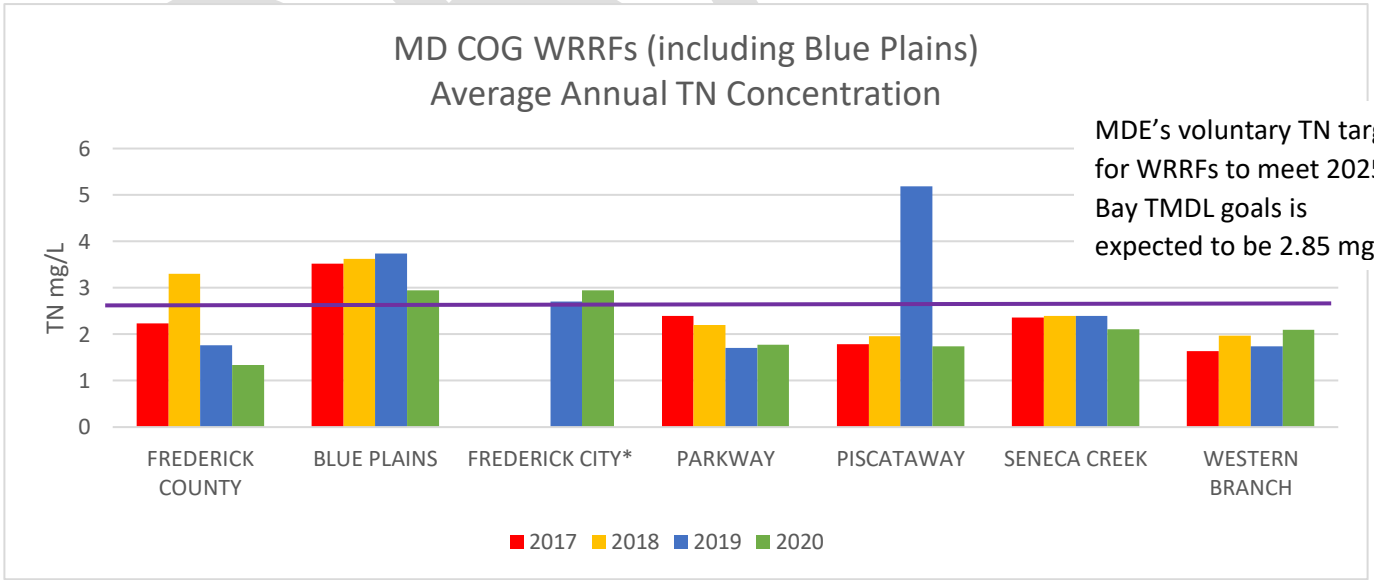
There is renewed interest in how much nitrogen reduction can be achieved by area wastewater resource recovery facilities (WRRFs), particularly in Maryland, as the Bay TMDL's 2025 deadline for achieving nutrient and sediment reductions consistent with water quality goals draws nearer.

COG staff analyzed area WRRF total nitrogen (TN) discharge concentrations by downloading values for flow and discharge loads from the Wastewater Data Report in CAST, which is the Chesapeake Bay Program's interface for watershed model loads and the accounting framework for the TMDL (CAST - Public Reports (chesapeakebay.net).

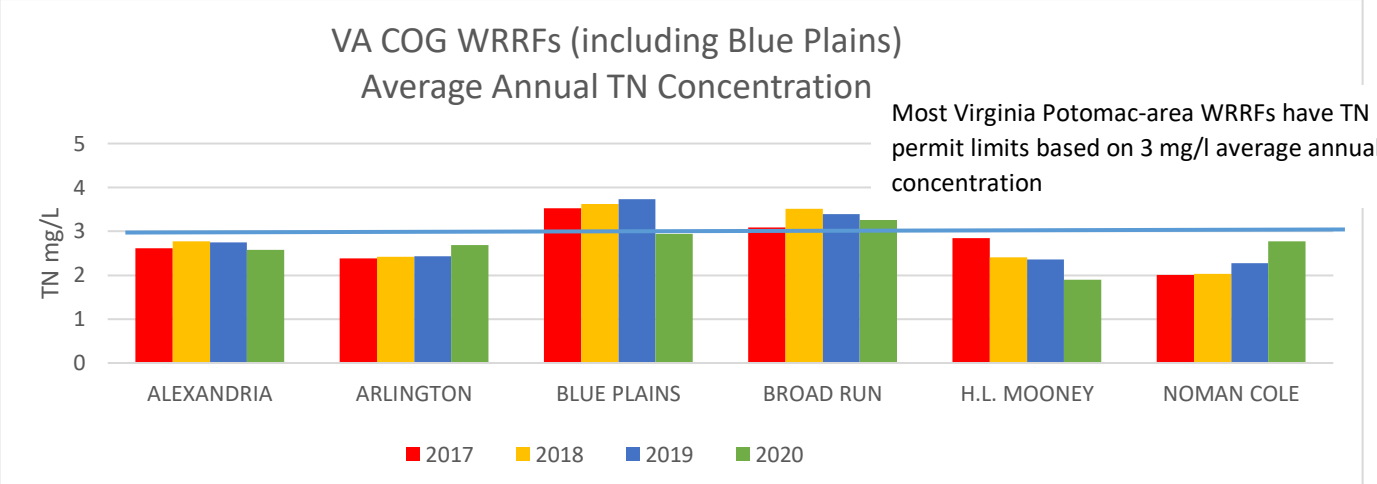
Note: these CAST values do not precisely match the actual data from the plants' discharge monitoring reports (DMRs). There are a few significant discrepancies that COG staff hopes to investigate and resolve. However, the data appears accurate enough to draw some general conclusions about nitrogen reduction performance in the COG region.

Maryland situation

Wastewater load targets under Maryland's WIP 3, developed in 2018 and issued in 2019, were based on a statewide average TN concentration of 3.25 mg/l. To meet a requirement to include the impact of climate change on Bay water quality, Maryland is adjusting its WIP to achieve an additional TN reduction of 1.142 million pounds. Although not yet official policy, MDE officials have indicated that its new wastewater performance goal for 2025 is likely to be a statewide average concentration of 2.85 mg/l. Since implementing enhanced nutrient removal practices, COG-area WRRFs in Maryland mostly achieve an average annual TN concentrations between 2 and 3 mg/l. Permit limits are generally based on 4 mg/l, so the current performance significantly below this level is driven by state cost-share incentives and a desire to optimize environmental progress. TN reduction performance also is improved by the fact that most plants operate well below their design capacities.



* Frederick City fully implemented ENR in 2019



Virginia situation

Virginia WRRFs in the COG region are operating in the same range as Maryland plants. However, the drivers are somewhat different. Most of the large Potomac area plants have TN permit limits based in part on 3 mg/L (Broad Run's is based on 4 mg/l.) Performance below 3 mg/l at these Virginia facilities is driven largely by the need to maintain a cushion below permit limits based on 3 mg/l. There are no cost-share incentives for performance and at this point very little value in nitrogen credits in the Potomac basin under Virginia's Nutrient Credit Exchange Program.

Blue Plains situation

DC Water's permit for the discharge (Outfall 002) from wastewater processing is a pound-based limit for total nitrogen: 4,370,078 pounds/year. Because actual flows vary from year to year, this total pound limit represents various levels of TN reduction performance. For an average flow of 309 million gallons per day (mgd), for instance, Blue Plains could meet the limit with a performance at or below 4.65 mg/l. At design flow capacity of 370 mgd, meeting the limit would require a performance at or below 3.88 mg/l. Meeting the District of Columbia's Phase 3 WIP does not require performance below these levels.

Long-term considerations

It is important to note that almost all regional WRRFs are currently operating around the limit of technology for nitrogen removal, with limited variation based on influent flows, inputs of chemicals and energy, and varying levels of plant capacity. Both the Maryland and Virginia approaches to meeting their 2025 nutrient reduction targets under the Bay TMDL depend on wastewater performance that is considerably better than what it takes to meet the plants' individual allocations established in the 2010 Bay TMDL (typically based on design flow x 3-4 mg/l).

In a sense, the states are using better-than-required wastewater performance to make up for lower-than-anticipated nutrient reduction progress by the other major source sectors: agriculture and urban stormwater. However, part of this performance is based on the plants' ability to use constructed capacity in excess of current flows to drive greater TN reductions. This constructed capacity above current flows will be needed to support planned future growth and to connect existing on-site systems where feasible. As a result, we can expect

increased loads from treating and discharging more flow and from declining performance levels as actual flows approach the plants' design capacity flows.

This excess removal by wastewater cannot be counted on indefinitely. Unless further TN load reductions occur in the agricultural and urban stormwater sectors post 2025, these likely increases in wastewater TN discharge in the future would eventually result in violation of the Bay TMDL's cap provisions.