
**WASTEWATER TREATMENT EVALUATION
BENEZETTE TOWNSHIP STP
PART II – HIGH TOURIST SEASON
BENEZETTE TOWNSHIP, ELK COUNTY, PA
NPDES #PA0263711**



Bureau of Clean Water

December 2016

Executive Summary:

High tourist season in Benzette Township, Elk County, typically brings slug loads of motor home and travel trailer septage into the wastewater treatment system. These slug loads of high strength, septic organic waste overwhelm the facility's treatment capacity and cause prolonged periods of effluent violations.

In the autumn of 2016, DEP's WWTAP staff returned their instrumentation to Benzette in order to assess the effect of high loading on what is usually an underloaded facility. (Underloading and other issues were discussed in a previous report.) Installation of the WTE equipment was delayed until after the first major slug load had occurred. Plant operators Wes Lape and Perry Hretzik had stated that the facility was producing clean effluent prior to the weekend of September 17, 2016, when the first major overload appeared on Sunday afternoon and evening. The operators alleged that, during this time, approximately forty caravan trailers had discharged septage at the dumping station in Benzett Campground.

Over the course of the next week, slug loads continued. Operators reported that the campground had not been the only site; other septage discharge was alleged to be done by system users at their sewer cleanout stubs on their respective properties. Apparently, some cabin owners sublet portions of their property for use by travel trailers, including access to the sewer lateral by way of the exterior clean-out stub.

Despite recommendations for controlling both the slug loads and their effect on the operation of the facility, the operators and the facility owners initially balked at the financial costs of intervention. Attempts to control the damaging effects focused chiefly on sequestration of the waste into the idle A-side treatment train, where it was not aerated, and repeated disposals into an already-overloaded reed bed, where the septage was essentially untreated. Following repeated discussions with regional DEP staff and with the facility owners, Perry Hretzik received permission to import live biomass from the Jay Township STP in an attempt to control the facility. Notwithstanding aeration problems already cited in the first study (Spring 2016,) the facility limped along until the high tourist season ended.

At the time, no sanctions were placed on the sources of the slug loads, pending review of the sewer ordinance by the township solicitor.

Based on observations by DEP staff and the data collected during September and October 2016, the following recommendations are amended to the original study:

- The facility owner should vigorously reassess the assignment of EDU to commercial facilities, especially the campground, and enforce prohibitions of discharges in excess of those assignments, up to and including surcharges, fines, and prohibition of motor home and travel trailer septage.
- The facility owner should enforce a ban on any property owners from connecting or allowing the connection of motor homes or travel trailers to the existing sewer system through existing residential lateral cleanouts.

- The operators should attend training on troubleshooting and remedying activated sludge systems.
- The facility owners should have their engineer conduct an evaluation of the existing facility's shortcomings, especially to the ongoing aeration insufficiency that prevents adequate treatment of ammonia waste, and they need to evaluate the facility's incapability to meet its denitrification requirements, as cited in the earlier study, and recommend solutions.
- The facility owners should revisit their practice of servicing and maintaining customers' grinder pump stations at no cost to homeowners in perpetuity, requiring instead that the burden of caring for and replacing the grinder pumps be borne by the homeowners/system users.
- The facility owners should establish and maintain both a sewer contingency fund and a maintenance fund for the treatment facility, so that adequate funding will be available for operating and maintaining their investment.

Wastewater Treatment Evaluation, September - October 2016:

Benezette Township, Elk County, owns and operates a 40,000 gallon per day (gpd) package wastewater treatment facility consisting primarily of Purestream EA activated sludge treatment units that were modified for biological nitrogen reduction. The treatment facility and its collection system were constructed between 2011 and 2013, funded chiefly through the United States Department of Agriculture (USDA) Rural Development which oversaw the development of engineering plans created by Northwest Engineering, Tidioute, PA, which has since been acquired by Stiffler McGraw Engineers. Since its commissioning in 2013, various operational difficulties had come to the attention of the Pennsylvania Department of Environmental Protection (PA DEP,) and violations of the facility's effluent discharge (NPDES) permit have aroused interest of US Environmental Protection Agency, Region III. A Wastewater Treatment Evaluation study was conducted by PA DEP's wastewater technical assistance program (WWTAP) during the early spring months of 2016 to evaluate operational conditions. Problems and operational difficulties found at that time were discussed in a report, "Wastewater Treatment Site Evaluation, Benezette Township STP, June 2016."

During the evaluation, the plant operators said that the high tourist season—September and October—typically confront them with the opposite of the underloading problems they were confronting during the early Spring months. The evaluator agreed to return in the Fall to characterize operational conditions in order to provide a more complete understanding of the problems and issues facing Benezette Township's treatment facility.

The chief findings of the initial study were that the facility is chronically underloaded for most of the year, resulting in inability of the operators to maintain a healthy biomass needed to treat the available waste. The evaluator recommended that supplemental carbon in the form of food-manufacturing waste should be used to supplement the waste stream during these lean times. The report also noted that the treatment process itself had been designed for biological nutrient removal of nitrogen waste, ammonium and nitrate, but insufficient organic loading and insufficient aeration, combined with solids management and process control problems, meant that very little nitrification of ammonia to nitrate was actually taking place and that nitrate was never being produced to yield denitrification products. The report also recommended that the treatment trains be evaluated for improvements to aeration in order to provide for basic nitrification.

During the late summer and early autumn, short-term, explosive population growth results in excessive organic loading for about six to eight weeks of the year. The evaluator discovered that, during the interim from Spring to Autumn, no significant changes had been made to the physical plant; therefore, aeration, solids management, and process control problems encountered during the low-loading evaluation remained to exacerbate lack of nitrification during the high-loading season.

The second evaluation examined the adverse impacts of excessive organic loading. These problems were mainly attributable to septage slug loads and organic overloads occurring on a weekly basis in the collection system. Slug loading is the direct result of

unregulated travel trailer and motorhome owners' septage dumping into the collection system, whether at a dumping station located in one of the village's two main camp grounds, or into the residential grinder pump stations at residences where the owners allegedly rent camper space on their land. In either case, the discharges through these individual system users far exceed the amount of effluent domestic units (EDU) designated and paid for.

There are three principal actions the Township may take for mitigating high loading at the treatment facility during peak tourist season:

- The campground dumping stations should at least be limited by their owners to paying guests only, no longer open to anyone passing through with a full tank and a few dollars to pay for the privilege; it is up to the campground owners to come up with a working enforcement system for their patrons;
- The Township has the right to enforce prohibition of the dumping of trailer and motorhome septage at these campgrounds or at sewer line cleanouts at private cabins. They may require the installation of holding tanks at the campgrounds, where private haulers would be responsible for removing septage wastes. This may require the Township to develop and enforce rigorous local limits on the quantity of septage, if not a total ban, permitted into the collection system at the parks or by sewer customers allowing the dumping of septage into their residential sewer cleanouts.
- The facility operators should operate both treatment trains during high tourist season. They should adjust the level controls in the surge tank to provide storage capacity and attenuation of high organic loading, insofar as it is possible to do so. Alternatively, the Township may wish to expand the surge tank or replace it in order to attenuate the flow of wastewater into its treatment process or contract hauling of excess wastewater to other treatment facilities where capacity is available.

The Township may wish to direct its engineers to examine ways to retrofit the existing BESST system to meet the challenges posed by both chronic underloading during the off-season and excessive loading during the short tourist high-season, providing that septage dumping is banned or heavily regulated.

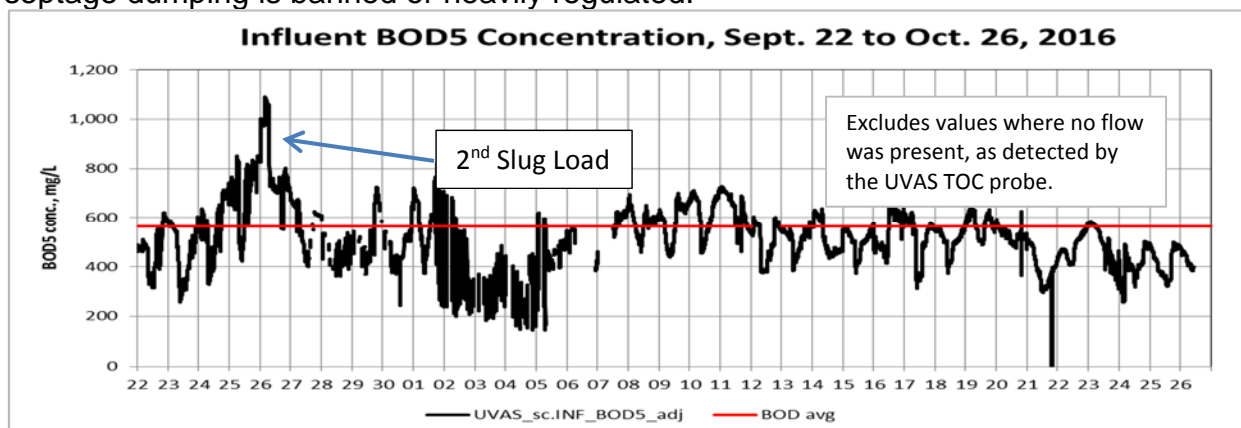


Figure 1: High Tourist Season Influent BOD₅ Concentrations at Benezette Twp STP. In the chart, one sees that the average BOD₅ had been 565 mg/L, compared to a design average concentration of 400 mg/L.

When the evaluator arrived on site September 20, 2016, he found the operators already working in crisis mode to stem the effects of a large slug load that passed into the plant on the preceding weekend. Unfortunately, the operators were unprepared for the surge in organic loading: the surge tank level appeared to be unchanged for the routine operation earlier that year; that is, its level was near a minimum, with the lift pumps cycling on and off. No effort had been made to decrease the pumping cycle to allow the surge tank to function as designed, to attenuate loading by holding a greater capacity and slowly feed into the plant.

Instead, the operators attempted to sequester high-strength waste into the A-side treatment train, which had been idle, half-empty, and unaerated. They wasted much of the damaged biomass and some of the raw wastewater to the existing reed bed that was not large enough for this sustained amount of loading. The diminished biosolids in B-side treatment were unable to thrive under conditions of low dissolved oxygen and repeated slug loads, and biosolids remained over wasted at about 500 mg/L through the remainder of September. The operators and owners initially resisted the evaluator’s recommendation to transfer in biomass from another treatment plant to stabilize the facility, but eventually, this expense was permitted by the facility owners.

The evaluator suggested that A-side be put into service, and aeration was restarted. Also, some of the biomass seed sludge was placed in A-side to stabilize the wastewater that had been stored there. The recommendation was to run both treatment trains throughout the remainder of the high-tourist season.

Despite proactive efforts, the facility did not approach stability until late October.

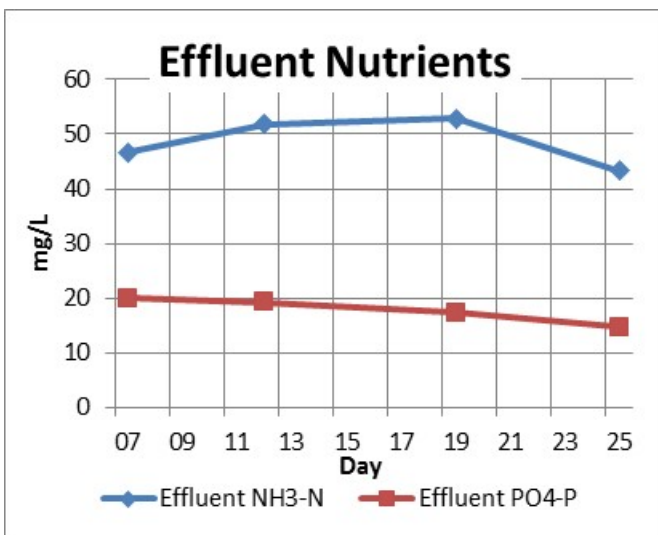


Figure 2: Effluent NH3-N & TP

Dissolved oxygen levels in the oxic zones remained well-below the recommended minima of 1.0 to 1.5 mg/L, and Oxidation / Reduction Potential in the oxic zone remained in the “anoxic” zone, while in the denitrification (anoxic mixing) zones, the ORP remained in the “anaerobic” zone (instead of “anoxic.”) The consequence of this is that the high-strength organic waste remained relatively untreated; the ammonia-nitrogen spiked as high as 70 mg/L in the disinfection tank, with effluent ammonia-nitrogen grab test results in the high forties and low fifties.

Effluent phosphorus grab-tested in the mid-to-upper teens. What chlorine was available for disinfection was rapidly consumed by settled solids and by nitrites. Effluent at Outfall 001 had a distinctive brown, cloudy appearance and smelled strongly of ammonia and organic acids.

During the evaluation, the regional inspector reiterated the evaluator’s request that the outfall pipe be clearly designated as non-potable discharge. The plume was clearly visible along the bank of the receiving stream, approximately one hundred feet below the outfall. This condition persisted throughout the evaluation.



Plant operators continued to conduct the routine effluent testing during the evaluation, and they employed an electronic total suspended solids probe to monitor the biomass concentrations in the various tanks. During October, the biomass concentration built steadily as a result of restrained sludge wasting and concurrent seeding from the Jay Township plant.

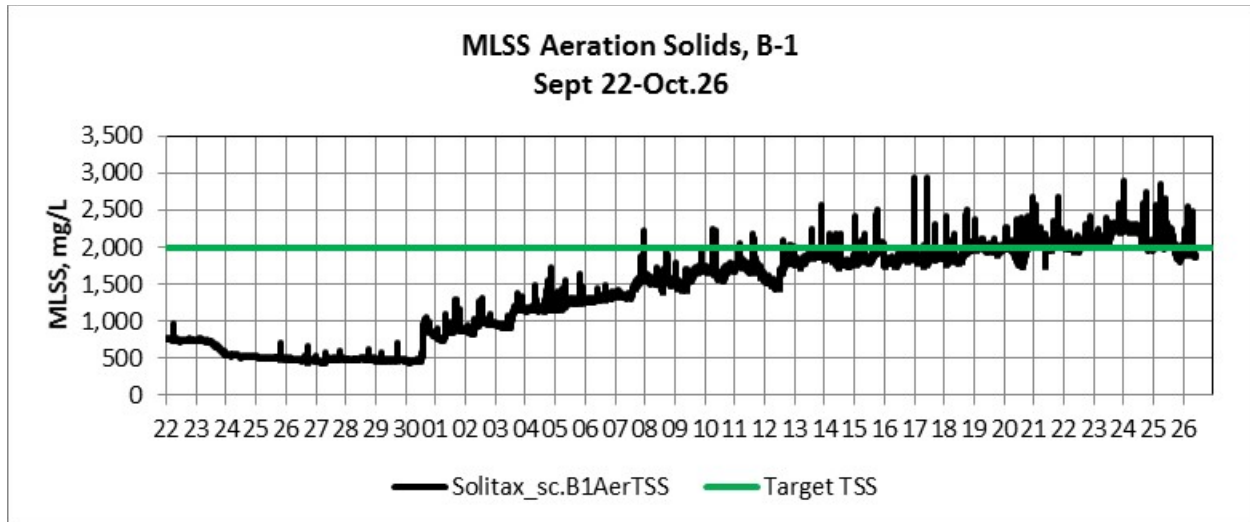


Figure 3: High Tourist Season Influent BOD5 Loading at Benezette Twp STP, with loading limits shown for 1 train (solid red line,) and for both trains in service (dotted red line.)

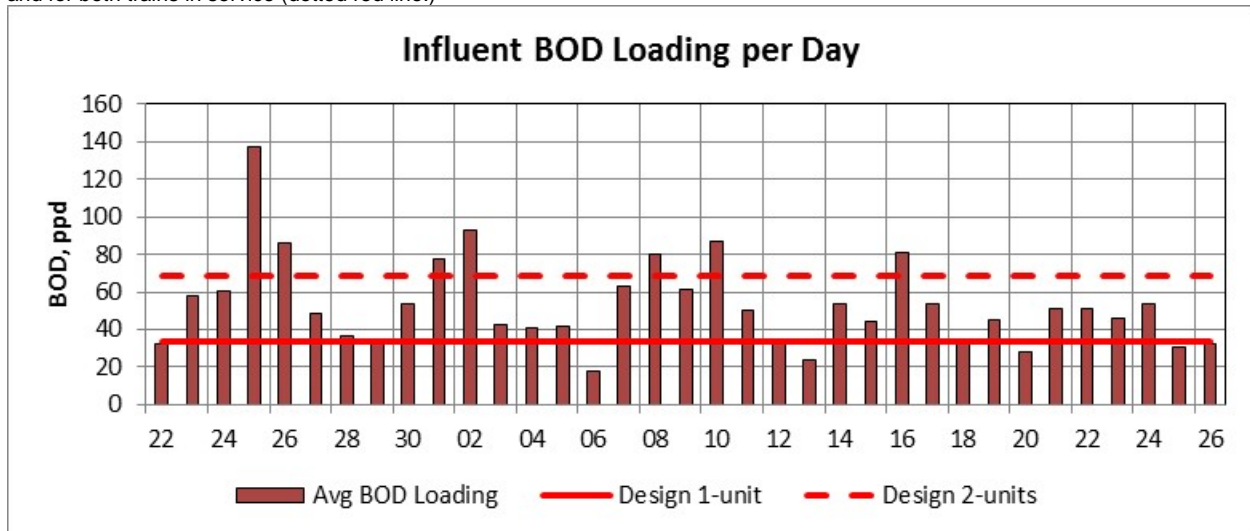


Figure 4: High Tourist Season Influent BOD5 Loading at Benezette Twp STP, with loading limits shown for 1 train (solid red line,) and for both trains in service (dotted red line.)

The preceding chart depicts the organic loading to the facility between Sept. 22 and Oct. 26, 2017. The organic loading limit for the facility is 68 lb. BOD₅/day, and if one train is in service (approx. 50% of aeration capacity,) this limit is halved to 34 lb./day. For many days of the evaluation, the operators were using only one train for treatment and employing the other as an extended holding tank for septage. As seen in the chart, where only one train was in service, the facility experienced sustained organic overload, and this chart does not display data for the initial slug load which occurred around Sunday, September 18. Perry Hretzik set aside a sample of raw influent from that date, and its chemical oxygen demand (COD) tested at 3,100 mg/L. (If, according to Mecal + Eddy, BOD₅ is 50% of COD, then the concentration of the slug load sample would have been 1,550 mg.BOD₅/L.¹

Based on data from the Hach UVAS probe, the average and maximum daily BOD₅ concentrations were plotted in the graph shown below:

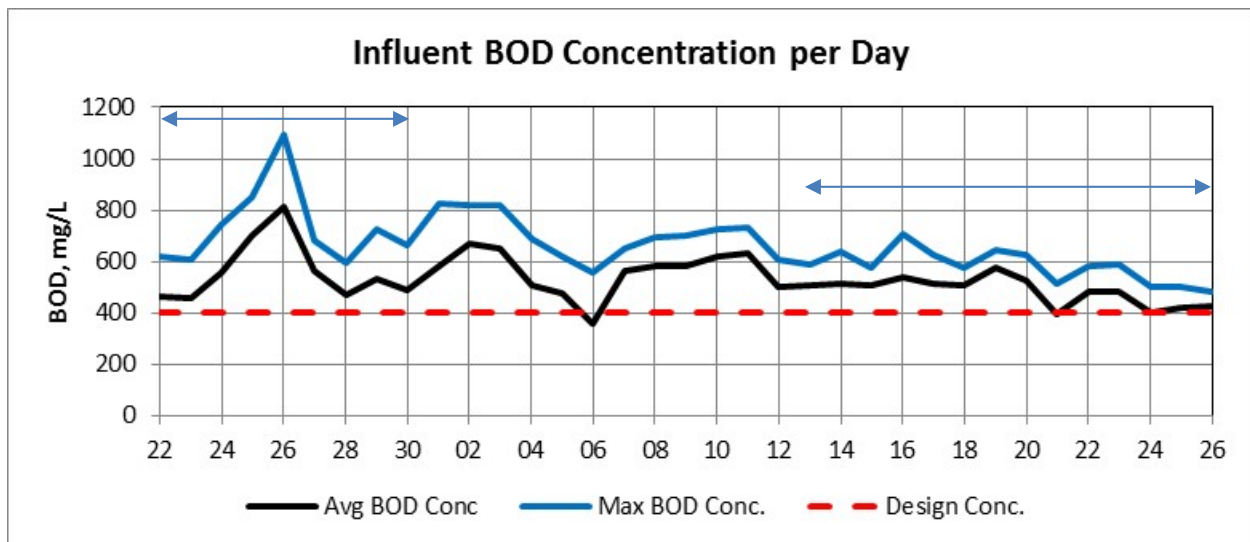


Figure 5: High Tourist Season Influent BOD₅ concentration at Benezette Twp STP, showing the original design BOD₅ concentration as a dotted red line.

In the chart above, where the average BOD₅ had been 565 mg/L, compared to a design average concentration of 400 mg/L. Note for the period from Sept. 22 –Sept. 30, the average BOD₅ concentration was about 660 mg/L, where maximum daily average peaked at 820 mg/L during the final weekend of September, tapering to average concentration of c. 480 mg/L for the last two weeks during the evaluation (Oct. 13-26.) The instantaneous maximum concentration was 1,093 mg/L and occurred on Monday, Sept. 26, 2016, representing the high volume of dumping of caravan and RV waste tanks. This peak follows on a slug load reported by the operators during the previous weekend of Sept. 18, which is alleged to have been equal or higher. (That observation

¹ The raw wastewater organic loading was measured by a UV organics probe placed at the influent splitter box. This probe was calibrated against laboratory COD concentrations, where BOD₅ is typically 50% of COD for domestic wastewater (Wastewater Engineering, Treatment, Disposal, and Reuse, 3rd Ed., Metcalf + Eddy.) Metrics where no flow was occurring were removed from the data set.

predates the placement of the instrumentation, so no data other than a COD test had been obtained.)

Subsequent effects upon the wastewater treatment system and its operation were, without a doubt, calamitous. For this BNR package plant, the sustained slug loads nullified every consideration that had gone into facility design. Dissolved oxygen concentrations in the oxic zones dropped below 0.5 mg/L and remained there for much of October. Recovery of DO levels began around October 21 as the facility became stable.

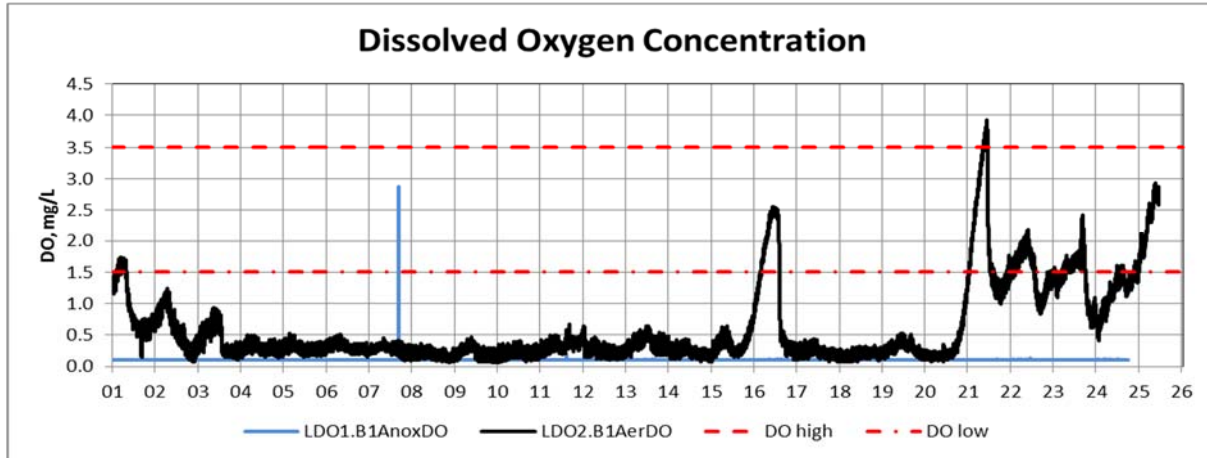


Figure 6: DO graph showing insufficient aeration until late October.

Oxidation / Reduction Potential, a measurement of the conditions likely to favor denitrification in anoxic treatment zones where both recycled nitrate and a carbon source are present, remained within the anaerobic range for much of the same period:

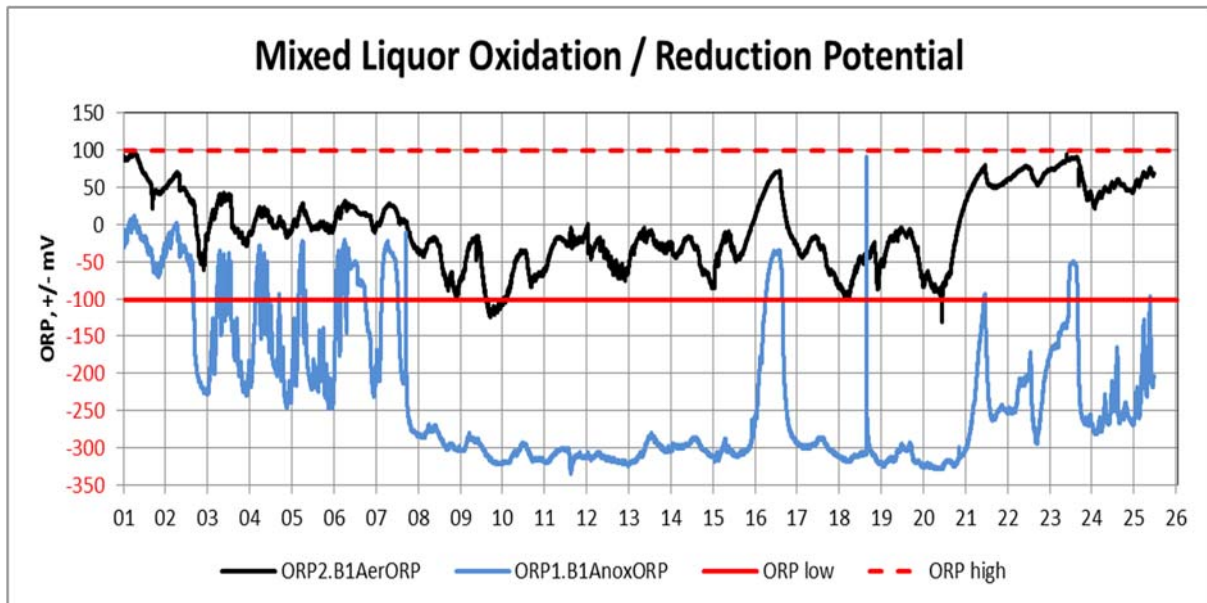


Figure 7: ORP chart for October, showing that Oxidation zone ORP was insufficient for nitrification, while Anoxic zone ORP remained largely within the anaerobic zone. This is further proof that the aeration system, as presently configured, has been insufficient.

Ammonium and Nitrate probes were located in the disinfection tank. Despite the presence of calcium hypochlorite tablets, ammonia registered as high as 70 mg/L in this tank. Nitrate concentration was low not because of working denitrification but because ammonium remained untreated:

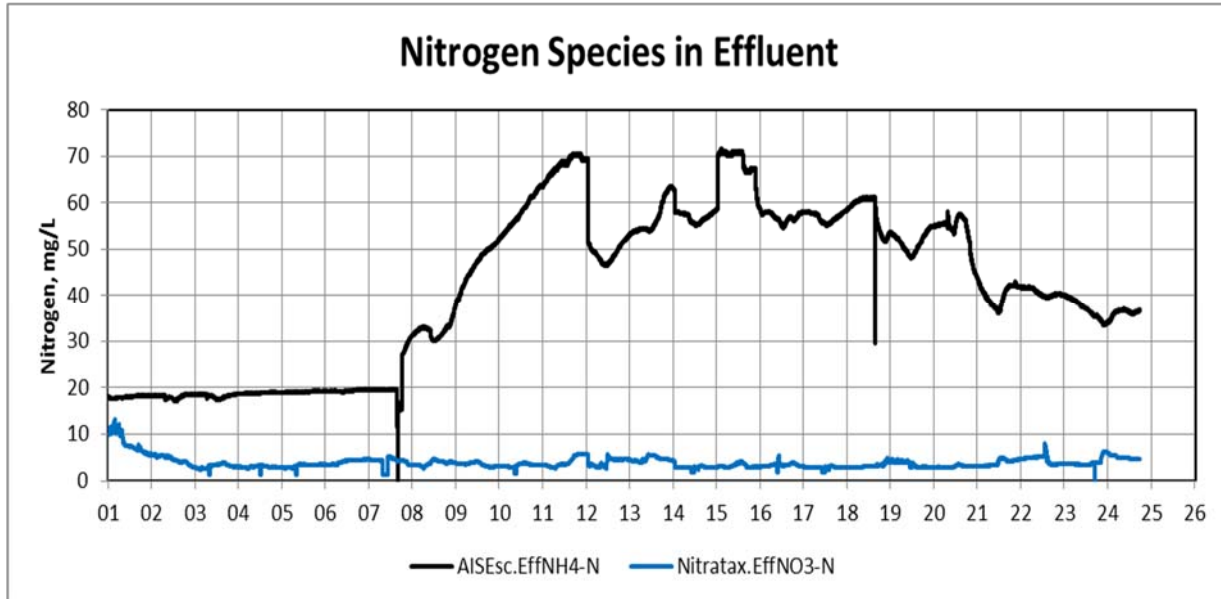


Figure 8: Ammonium and Nitrate concentrations in the Disinfection Tank (Effluent balance tank) showed that ammonia predominated for much of the month, and denitrification will not occur where there is no nitrification to begin with.

The evaluation concluded on October 26, at which time problems at the facility appeared to be moderating somewhat in the presence of seed sludge and as the high tourist season tapered into the traditional hunting season.

Maintenance of Facility

Due to ongoing budget constraints and associated limitations on contracted labor costs at the facility, maintenance continues to be reactive rather than preventive. Although both owner and operator understand the pressing need to preserve and repair finishes on the major components of the system, little or no actual effort has been expended. The typical workday appears to leave time only for the required compliance testing and whatever reactive operational efforts are required that day, including sludge wasting and transfer, addition of defoaming agents, checking solids.

Because there were no spare parts for grinder pump stations in the collection system, the onsite pump station for the reed bed drainage was rendered only manually operational after its float-control switch was removed and reinstalled at the Visitor Center. The pump was restored to full operation later in the month when a replacement part arrived. In an ideal world, there would have been sufficient spare parts in reserve to prevent this occurrence, which, technically, could have been considered a violation of the NPDES Permit.

Generally, spare parts and replacement motors/pumps/blowers are purchased on an *ad hoc* basis, where overnight or 2-day delivery has been sufficient for getting supplies

from market to application. However, an oft-repeated lament by the operators and the owners of the facility was that there are insufficient funds available for purchase of spare parts. It is highly recommended that the facility owners set aside funding for maintenance and contingencies. A well-organized treatment facility typically maintains a supply of routinely-needed spare parts. Yet "if wishes were horses, beggars would ride."

During a discussion of the availability of spare parts, the operators informed the evaluator that Township was absorbing all of the replacement costs for the grinder pump stations installed at customer connections throughout the collection system. They alleged that the Township retained ownership of the equipment and therefore all of the maintenance burden. Elsewhere, maintenance and replacement costs for similar pumps are borne by their users, not by the system owner. At the least, such costs ought to be shared.

The oil spill observed during the spring months has been cleaned up, and the waste oil storage has been moved under roof in one of the township sheds.

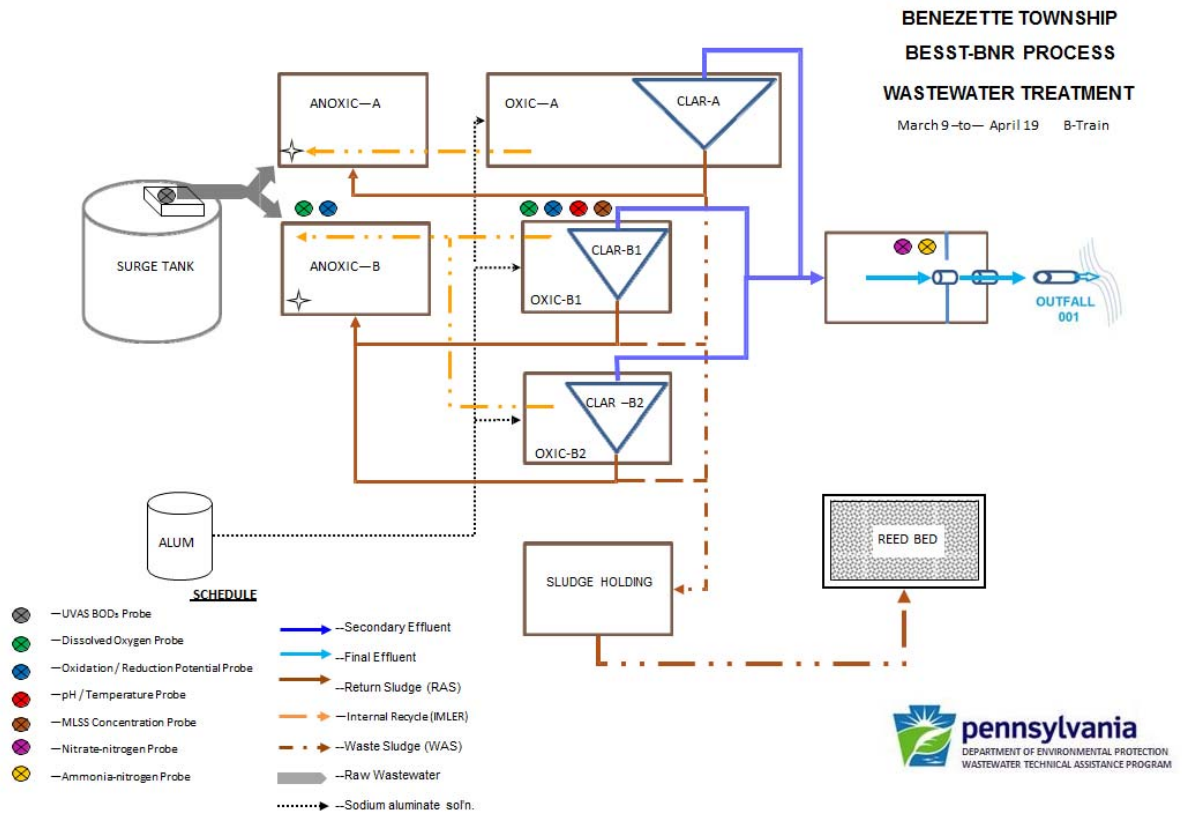
During the evaluation, it appeared that a large quantity of oil-based paint had been illicitly dumped into the sewer, finding its way into the surge tank.

Replacement of the wooden boards at the clean-out entry for the reed bed as stopped the leaching of water from within the reed bed to the ground outside.

The yard lights are still not operational.

Attachment I

Plant Schematic: The following diagram depicts the treatment process at Benzette. (excerpted from earlier report.)



Attachment 2

Photographs of Benezette Overload/Slug Load Conditions, Fall Tourist Peak



Photo: Grey Water of Clarifier Effluent



Photo: Surge Tank—Septage and Low Level



Dead, Grey Biomass in Anoxic Zone



Sequestered Biosolids in A-Side



Oil & Grease accumulation in Surge Tank



Brown effluent / Sulfonator



High Organic Load Foaming



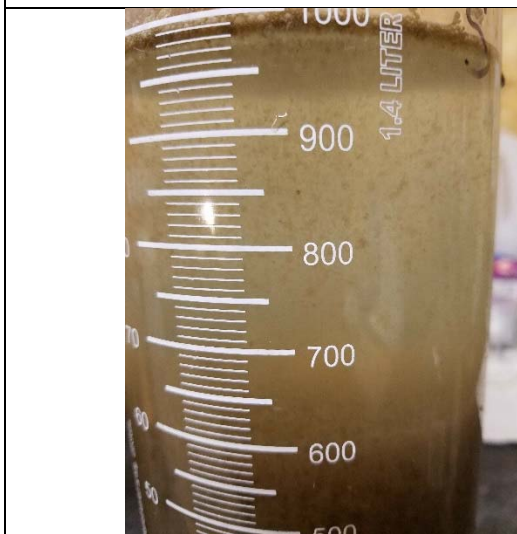
MLSS Carryover in Clarifier Trough



Unlabeled Outfall Pipe / Grey Discharge



Grey Plume Downstream of Outfall



Impaired Settleability



Alleged Paint Dumping (balled oil paint in corner)



Benezett Campground (4 EDU Assigned)



Unregulated / Misregulated Trailer Dump Site (Campground)



Probe Assembly at B-Side



UVAS Placement at Inflow Splitter



A-Side Under Aeration



Existing Single Reed Bed