WASTEWATER PLANT PERFORMANCE EVALUATION

November 24, 2009, through January 19, 2010

Union Township, Lebanon County, Authority
Lickdale Sewage Treatment Facility

NPDES #PA0083607

Bureau of Water Standards & Facility Regulation
POTW Optimization Program

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

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Disclaimers:
The mention of a particular brand of equipment is in no way an endorsement for any specific company. The Department urges the permittee to research available products and select those which are the most applicable for its situation.

The goal of the Department's Wastewater Optimization Program is to improve water quality at drinking water intakes by optimizing upstream wastewater plant effluent quality. This often times involves permittees achieving effluent quality above and beyond any permit requirements.

1 Wastewater Plant Performance Evaluation

From mid-November, 2009, through mid-January, 2010, DEP staff conducted a wastewater plant performance evaluation (WPPE) of the Union Township, Lebanon County, Authority's Lickdale "Dutchland"-package wastewater treatment plant, 0.10 MGD, on the recommendation of inspectors in the department's South Central Regional Office and with the permission of the facility's contract operator, Walton Environmental Services, LP, of Kennett Square, PA. This report summarizes the findings of the evaluation.

The WPPE Program is funded under an Environmental Protection Agency (EPA) grant for studying the effect of process optimization on the reduction of dangerous waterborne pathogens found at drinking water facilities within a ten-mile distance downstream from municipal wastewater plant discharges. The nearest water intake is on the Swatara Creek, approximately one mile downstream from the discharge of the Lickdale plant. DEP staff employed continuous-recording nutrient and water chemistry probes and a portable wastewater laboratory to effect process optimization, following an initial evaluation of candidate facilities.

The WPPE program focuses on each treatment process in order to produce the best water quality possible. Optimization often requires setting voluntary goals for each treatment process which are better than the minimum permit requirements. For example, although there may be no requirement to maintain low phosphorus loading to the receiving stream during the winter months, the facility may voluntarily set a limit and strive to meet it through continued treatment, while carefully recording and reporting progress.

Operators should see their job not as "running a sewage treatment plant" but "manufacturing a high quality effluent and/or high-quality biosolids" for further utilization. It's a mindset that is adopted and cultivated through ongoing self-improvement and continuing education.

DEP installed both the continuously monitoring digital probes and a portable wastewater laboratory during the fourth week of November and began automatically collecting data recorded at fifteen-minute intervals, downloading probe data onto a notebook computer set up in the facility's blower building/motor control center, where a small laboratory bench had been available for sample packaging and spot-testing. In addition, DEP staff conducted a variety of process monitoring tests when on-site. This data generally confirmed the data already being recorded by plant staff in their process monitoring activities, and DE{ staff also obtained aqueous samples from different sampling points in the treatment process on a weekly basis, delivering the samples to PA-DEP's

Bureau of Laboratories facility in Harrisburg for supplemental routine analysis and to calibrate the digital instruments. Generally, DEP staff attended the site two or three days per week during the WPPE. Specific sampling required under the terms of the study grant was undertaken, where 10-liter samples of final effluent, background receiving stream, and impacted surface waters downstream were analyzed using EPA Method 1623 for waterborne pathogens *Cryptosporidium* oocyst and *Giardia lamblia* cyst, two species of particularly noxious drinking water pathogens which must be removed by downstream potable water filtration facilities.

DEP staff completed on-site activities on January 19, 2010, and the last of the laboratory reporting was completed by June. The WPPE examined the site history, its operations and operations data for the previous year, and looked for operations issues that might be improved in order to increase the water quality for downstream users. Findings and recommendations are summarized in this section, below.

1.1 Operational Strengths

The following items are Operational Strengths that were identified during the WPPE. These include strengths of both the operators and the facility itself.

- Process control tests were generally within acceptable ranges of operation. The biomass is in good health, although it may be trending to the endogenous side of the chart.
- Contract operators spend up to a half day at the plant, checking various treatment parameters in addition to those daily checks (TRC, flow) required by the permit. Much of the contractors' time is spent checking or adding chemicals to the system, including lime or coagulant aids.
- Township Maintenance Staff are tasked to perform preventative maintenance activities, servicing plant motors and performing general site care and services.
- Plant security is good, with the perimeter secured by standard wire fence with locked gates. The control building remains locked when unattended. Grates over most processes assure staff and visitor safety in the areas of ground-level tanks, wet wells, and the pumping station. The dry well pumping station is properly equipped with safety devices assuring proper ventilation and security.
- The township has updated Act 537 Plan and has made an effort to assure the sewage treatment plant is adequate for the anticipated growth and development of the collections system. It must be noted that the Lickdale plant was slated for replacement with a larger capacity sequencing batch reactor (SBR) facility prior to the economic crash in 2008 that ended most immediate development plans for Union Township. In the long term, the

new facility will be built, but its construction is heavily dependent on an improving economy and is thus not likely in the immediate future.

1.2 Focus Points for Improvement:

The following items have been identified as focus points to assist in optimization efforts, and they are ranked “High,” “Medium,” and “Low” in terms of their importance to optimized functioning of the treatment facility. Focus points include both operational tactics and physical plant issues that can or do impact optimization efforts. These items generally demand more of the operator’s attention and therefore require more of the operator’s time to perform. The benefits are expected to be favorable by improving the plants discharge quality and thereby improving downstream water quality. The priority levels are defined as follows:

1.2.1 High

Major impact on plant performance on a repetitive basis and/or has been associated with a regulatory violation:

- The facility continues to report occasional excursions of its permit limits, most recently November 2010. These excursions may be attributed to capacity and technology issues with the existing package plant. Plans exist for replacement of the 0.1 MGD Dutchland package plant with a 0.3 MGD biological nutrient removal (BNR) sequencing batch reactor (SBR) facility, but development and financing had been postponed due to the soft economy and related lack of new development in Union Township. Flows at the plant during the WPPE did not exceed 0.090 MGD, so the proposed ADF of 0.30 MGD hasn’t been necessary yet, but The Authority’s first priority should be securing funding in order to build the planned replacement facility. Union Township should consult with their engineer to develop a strategy to reduce ongoing permit excursions through temporary operational and physical improvements.
- Dutchland process tanks have accumulated shredded rags and detritus which inhibit correct lift pump operation and befoul instrumentation. These tanks must be removed from service at least once per year for cleaning, inspection, and maintenance, and the Authority needs to support this schedule with a budget that allows for proper maintenance and replacement of worn machinery or components, insisting that the tanks be cleared of debris. Any improvement to treatment, dissolved oxygen transfer, or pump maintenance cycle time as a result of this work should be documented.

Figure 1.1: Moss growing on a process pipe: How long does moss take to accumulate?

- Staffing by part-time contract operators is usually adequate when the facility is operating within its limits; however, there are times when the facility is temperamental and requires much more attention than can be scheduled by staff who must work with other facilities during the same work day. Seasonal changes in Pennsylvania often adversely affect facility performance, requiring more time of the operators to adjust many parameters from "spring/summer" to "fall/winter" conditions. The Authority should designate a full-time operator who is certified for both the wastewater treatment plant and the collections system. They certainly can continue to employ the contractor and contract operators, but they should budget more time for these operators to remain on site to monitor and correct operations when necessary.[1] If the new plant is built, it will require the services of a full-time operator.[2]
- Efforts to control total nitrogen in the effluent in the existing package plant, using an "on/off" aeration scheme, were not possible due to the need to separate the air lift pumps from the subsurface aerators. Another proposed method, converting one or two of six aeration tanks per train to anoxic reactors, required the use of two subsurface mixers and two submersible pumps, neither of which were available during the WPPE. It may have been possible to promote denitrification through some additional plumbing changes, but the budget did not permit this, and in the long term, it would not have been practical in light of the existing proposal to upgrade the facility to a 0.30 MGD BNR/SBR. Union Township should consult with their engineer to develop a strategy to meet the nutrient removal requirements through operational and physical improvements to the system.

1.2.2 Medium

Minimal impact on plant performance on a repetitive basis;

- Township or Authority staff, in charge of mechanical equipment maintenance, should assure that adequate reserve equipment is on hand so as to avoid lengthy delays in replacing or repairing damaged equipment. In particular, the second of two PD blowers was out of service for the entire duration of the WPPE

[1] The Department has no issue with the use of contract operators, provided they are certified to operate the facilities they work with. One important issue to consider when reviewing qualifications and bid packages, though, is that the contractor proposal regarding time and labor at the facility realistically account for periods where additional operational time is needed. Time/Labor Charges comprise a large part of the bid for an operations contract. The bids should be reviewed by a qualified person such as the facility's consulting engineer to determine if time/labor bid is adequate.

[2] It should be noted that many small municipalities employ a certified operator who may be assigned other duties in the municipality, unrelated to the operation and maintenance of wastewater plants. This is acceptable, so long as the operator's first priority remains operating the facility. The point is that the operator has to be available to make process control decisions and remain within range of the plant to assure that operational adjustments do not jeopardize effluent quality.

because a motor had been removed for rebuilding on the day DEP set up its equipment, November 24. That blower was not in service on January 19, the day the WPPE ended. This unconscionable delay prevented contract operators from

- assuring adequate dissolved oxygen levels in the aeration facility during times of peak loading and oxygen demand.
  While it is possible to back-feed air from the digester blower to the treatment units, the digester blowers do not have the capacity to maintain proper aeration. Motor or blower rebuilds should be completed within ten work days or sooner.

Figure: Disassembled blower system

- Laboratory equipment is obsolete or unavailable for proper battery of process monitoring and control testing. Contract operators had a portable TRC analyzer, phosphate colorimeter, a DO probe available for daily process checks, and a Settleability cylinder; however, they did not appear to be using a complete set of basic wastewater lab tools in order to fully assess the condition of the biomass as recommended by sources such as Activated Sludge, 1st Edition, MOP-9 WPCF and similar publications. Although DEP made this equipment available to the contract operators, there is no evidence that it was used by them, and no questions were asked about process monitoring during the on-site activities.[3] Generally, the operators arrived on site, manually wasted sludge, checked chemical pumps or added lime, conducted TRC tests and spot-DO readings, and then moved on to the next site. Process monitoring tests appeared to be cursory or not important. Attachment E includes a list of laboratory equipment provided for the WPPE. Attachment K lists a schedule of tests for facilities with flow capacity under 1.0 MGD, with a recommendation to conduct more than the minimum, and a brief explanation of particular tests and references.
- A temporary power line supplying power from the pole outside the facility perimeter fence to the meter for the plant was installed after a failure of the underground line. This was to be a temporary measure lasting “a few weeks” but it remained this way for the duration of the WPPE. This is considered a hazard, and the contract operator should have more forcefully urged the plant owner to remedy this in a much shorter time

[3] Most times, DEP and Operator staffs were unable to coordinate their schedules so as to be at the plant at the same time. Typically, the contract operators were working a circuit, and their schedule at Lickdale was variably dependent on their activities at other job sites. DEP staff made an effort to communicate the results of PM/PC tests they performed, but the facility log book rarely reflected acknowledgement of the documentation left for the operators.

frame than two months. It is possible that the expense of excavating the main line had been a dilatory factor in the failure to quickly replace this, but combined with the continued unavailability of a backup blower for the aeration process during the WPPE, it appeared that no one considered issues like this to be important., and that speaks to an overall impression of benign neglect.

Figure: Temporary main power line from transformer on pole.

- Variability of the dissolved oxygen swings at the plant affect the health of the biomass and its ability to settle well in the clarifiers. This problem can be mitigated by employing a feedback loop including digital DO probes in the aeration tanks and variable speed drives on the blower motors, provided that both blowers are simultaneously in service. As seen in the histogram to the right, dissolved oxygen readings varied widely, from next to zero mg/L at times of high loading to 9.5 mg/L when loading or flow was diminished. Low DO in an aeration tank promotes the development of filamentous organisms that hinder Settleability in clarifiers. Excessively high DO may represent over-aeration that causes floc-shear that results in solids loss at the clarifiers. High DO is also indicative of wasted energy, because biomass requires DO no higher than 4.0 mg/L to thrive.

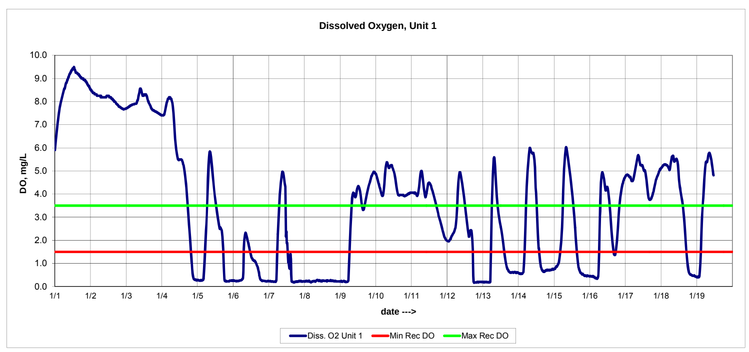


Figure: DO histogram showing highs and lows

- The effluent composite sampler should be maintained in good working order and used for obtaining flow-proportional effluent samples for composite testing. If it is not possible to connect this

Figure: Sample compositor in sad shape.

sampler to the facility flow meter, then a timed-interval bulk sampling may be an acceptable substitute; however, there is some diminishment in the precision of the sample. Inspection of the effluent sampler showed pink algae growing in the sampling tube. The presence of such algae may interfere with the quality of the sample obtained for compliance testing. The tube should be cleaned or replaced.

- Sludge production estimates in Attachment M were calculated using historical data from DMR reports and engineering data from the Part II NPDES Permit Application. According to the calculations, it appears that the amount of sludge hauled from the facility outpaces the theoretical sludge production by 140%. Theoretical sludge production is calculated based on measured flow and the results of bi-monthly BOD and TSS testing, using standard engineering factors accounting for type of treatment and length of digestion. Since the sludge hauler bases its billing on volume and percent solids of the material being hauled, these data are likely to be highly reliable. Consistency of the plant loading data suggests that it is also reliable, but the sample interval of twice per month may not be sufficient to effectively characterize the actual loading. Facility operators may be missing instances of slug loads from industrial and commercial users. More frequent sampling of the raw wastewater for BOD and TSS may be required to effectively characterize plant loading. In addition, the township should develop a profile of its collection system that includes loadings based on actual testing of commercial and industrial wastes (or requiring that commercial and industrial users perform such testing in order to meet minimum requirements for an industrial pretreatment program.)

1.2.3 Low

Minimal impact on plant performance on a rare basis or has the potential to impact plant performance:

- The facility had in reserve some pails of bioaugmentation material; however, it did not appear to have been employed in a while. Adding bugs to the biomass helps maintain the system at the top of the natural growth curve, and it should be done regularly following a review of process monitoring tests that include the Oxygen Uptake Rate test and microscopic examination. Many guide books on Activated Sludge include charts demonstrating qualities of a well-conditioned biomass.
- Develop charts for flow rates through air lift pumps, based on the effects of adjusting flow through the existing valves. (E.G.: Chart flow rate for each eighth or quarter turn of the valve, timing the flow rate using the old bucket and stop-watch method. In the absence of electronic flow metering for return and waste sludge flows, at least this is something.) Get into the practice of measuring waste flows so as to prevent over-wasting, and keep

good records of the presumed flow rates so that a solids inventory can be developed and maintained.

- Consider adding facilities that ease the process of adding sodium aluminate to the biomass to reduce lower back strain and repetitive motion injuries to operations staff. Since this particular activity is frequent, and because there is no "counter-level" workspace for opening bags and slaking chemical into the mixed liquor, it may be helpful to purchase or build a table or bin for this purpose, so that the material can be handled more efficiently and without potential for harm. If the practice is to be continued in an upgraded facility, it will be cheaper in the long run to provide for bulk storage and automated transfer of sodium aluminate.
- Sludge transfer should take place in a manner that assures material spilled onto the ground can be quickly cleaned and properly disposed of. A dedicated sludge loading station with storm drains returning to the head of the plant would be ideal.

1.3 WPPE Rating:

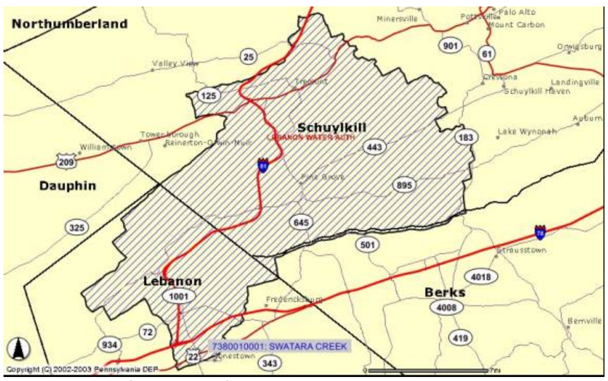
Background of the rating system for WPPE is described in Attachment A. As a result of our evaluation and our on-site interaction with the plant operators, we have assigned a facility rating of **Needs Improvement**, because although the plant met its permit requirements for pollutants and reported no excursions during the WPPE, it continues to experience compliance issues, as evidenced in a total solids and phosphorus effluent violation in November 2010. Other factors are that the Dutchland plant is functionally obsolete: Process monitoring tests showed that the facility doesn't attenuate slug loads and, while the plant was designed for 100,000 gpd and 208.5 ppd BOD, it appears to operating at its limits with flow and loading of half that amount (44,000 gpd and 100.2 ppd.) It is doubtful that the facility can meet its nutrient reduction requirements under the Chesapeake Bay Tributary Initiative, and operating the plant in a manner which ensures effluent quality is highly labor-intensive in a way that does not assure the best use of operator time and Authority resources. A connection ban may be required of the collection system until the facility is upgraded to handle anticipated peak flow and loading.

1.4 Re-evaluation:

Presently, there are no plans to re-evaluate the facility for the WPPE Program, although we anticipate that re-evaluations may become part of the program if it matures. However, we would like to revisit the facility within three-year's time to see if changes were made as a result of this evaluation, if optimization strategy had been adopted, and if the facility status changed.◘

2 Downstream Water Treatment

The nearest potable drinking water source is 4.3 stream miles downstream of Lickdale's outfall, at a secondary 2.0 MGD intake for the Lebanon Water Authority's water filtration plant in PWSID #7380010. This drinking water facility obtains the 5.0 MGD of its source water from the fairly isolated Siegrist Reservoir located in Schuylkill County, but it also has a secondary intake located on the Swatara Creek adjacent to the village of Jonestown, in Lebanon County. For the purposes of the WPPE, discussion of downstream water treatment is confined to this secondary water source, as it is most directly downstream of the Lickdale outfall on a tributary of the Swatara Creek.



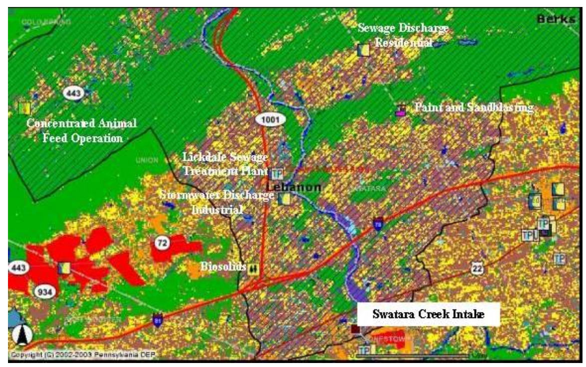


Table 2.2: Swatara Creek Watershed located in Lebanon and Schuylkill counties.

Swatara Creek has a mostly rural, 192 square mile watershed in Lebanon and Schuylkill counties. The watershed is 71% wooded and 25% agriculture. Potential pollution threats include nutrient contamination and silt accumulation associated with agricultural activities and concentrated livestock feeding operations (CAFO,) metals and acidity due to abandoned mine drainage, and other pollutants associated with major highways and related infrastructure (gas/repair stations), sewage treatment plants, and industrial discharges. The raw water quality on Swatara Creek is variable, with raw water turbidity usually 3-6 NTU but up to 100 NTU after a rain event. Raw water pH is around 6.6-6.8.

Figure 2.3: Swatara Creek water intake beside impoundment, located in Jonestown, PA.

2.1 FPPE Review—

The Lebanon Water Authority facility employs conventional filtration. Raw water turbidity levels entering the plant are relatively stable and usually range from 0.95 to 5.5 NTU with occasional spikes above 50 NTU. Historical data for the past year indicates that the maximum daily filtered water turbidity remained below the optimization goal of 0.1 NTU 96% of the year. The filtered water turbidity was below 0.1 NTU and the particle counts were below 25 throughout the entire on-site evaluation. Laboratory staff found acceptable reduction of *Giardia*-sized and *Cryptosporidium*-sized particles in a microscopic particulate sample (MPA).

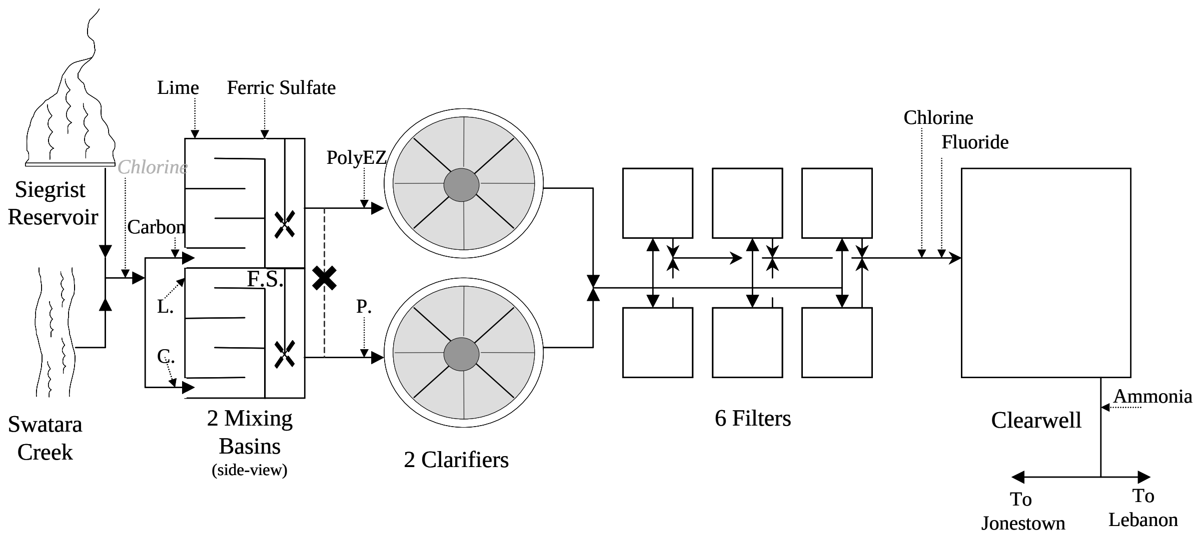


Figure 2.3: Flow Schematic for Lebanon City Water Filtration Plant

2.1.1 Facility Information

The list below relates some detail about water production at the Lebanon Water Authority. The most recent FPPE report from 2003 states that the facility's water production is "**commendable**" for its ability to remove water pathogens and its owner and staff commitment to water quality, as evidenced by water test results that were better than most filtration plants of its type and by the pro-active response of owners and staff to recommendations made in previous evaluations.

Plant Production

- Current daily production: 7.2 MGD (5000 gpm)
- Time of operation: 24 hours/day, 7 days/week
- Permitted/design capacity: 10 MGD (6944 gpm)
- Allocations Permit: Total 11 MGD with 1.84 MGD bypass.
  Siegrist Reservoir 8 MGD with 1.37 MGD bypass.
  Swatara Creek 8 MGD with 18.4 MGD bypass.
- Pumps: 4 vertical turbine raw water pumps at the Swatara intake (4, 5, 5.5 & 6 MGD)
  4 vertical turbine high service finished water pumps (4, 6, 8 & 8 MGD)
  2 vertical turbine backwash water pumps (Both 3 MGD)

2.2 Water Chemistry—

The water plant uses the following chemical additives in its treatment process:

Chemical Treatment
- Coagulation: Ferric Sulfate
- pH adjustment: Lime
- Disinfection: Gas Chlorine, Ammonia
- Corrosion Control:
- Other: PolyEZ, Powdered Activated Carbon, Fluoride

The WPPE evaluation at the Lickdale wastewater plant did not review finished water from the downstream water filtration plant, but focused only on raw water quality from the secondary water source.

During the WPPE, DEP staff at Lickdale included analysis of the Swatara Creek source water as "impacted" downstream samples. The table below lists test results for general water chemistry and nutrients. Initial sampling was performed on Forge Creek, 500 meters downstream of the plant outfall, prior to the confluence of the two creeks; thereafter, the downstream sampling location was relocated nearer to the secondary raw water intake for the Lebanon Water Authority, on Swatara Creek. The dilution effects of the larger creek were immediately apparent, such that must downstream impacts of the Lickdale effluent were negligible. Nutrients in the source water were well-under the MCL.

Sample	183	186	194	202	211	220	229	238				
Date	10/20/09	12/01/09	12/08/09	12/14/09	12/21/10	12/28/10	01/05/10	1/12/10				
Time	14:40	14:43	15:45	14:35	11:13	15:05	14:25	10:06				
Locus	DWS	DWS	DWS	DWS	DWS	DWS	DWS	DWS				
AccNo.	200903666	200904127	200904193	200904284	200904372	200904404	201000018	20100074	Average	Max	Min	Std. Dev.
BOD	0.70	0.50	1.00	0.30	0.50	1.10	0.90	0.50	0.69	1.10	0.30	0.29
pH	7.9	7.3	7.2	7.2	7.3	7.3	7.4	7.3	7.36	7.90	7.20	0.23
ALK.	85.8	13.6	15.8	16.2	15.6	16	20.4	17.6	25.13	85.80	13.60	24.59
TDS					76	90	96	108	92.50	108.00	76.00	13.30
TSS	<5	<5	<5	5	<5	5	<5	<5	5.00	5.00	5.00	0.00
VSS	<5	<5	<5	<5	<5	8	<5	8	8.00	8.00	8.00	0.00
NH3-N	0.02	<0.02	0.03	0.05	0.03	0.03	<0.02	0.02	0.03	0.05	0.02	0.01
NO2-N	<0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.01	0.00
NO3-N	2.92	0.95	1.26	1.37	1.16	1.69	1.18	1.02	1.44	2.92	0.95	0.64
TKN	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	n/a	n/a	n/a	n/a
Phos	0.032	<0.01	0.016	0.031	0.019	0.02	0.013	0.017	0.02	0.03	0.01	0.01
Chloride	28.80	8.50	9.70	15.10	12.90	16.70	16.50	14.6	15.35	28.80	8.50	6.21
Bio#	200901288	200901386	200914109	200901427	200901448	200901454	201000007	201000019	Average	Max	Min	Std. Dev.
TC	1,000	300	200	20,000	200	300	200	200	481	20,000	200	6,955
FC	280	20	160	630	20	60	<20	100	95	630	20	218

Table 2.1: Downstream (Impacted) Water Samples showing dilution effect on Lickdale effluent.

2.3 Waterborne Pathogen Discussion—

During the WPPE, DEP staff sampled two downstream locations: Forge Creek approximately 500 meters downstream of the wastewater plant outfall, and Swatara Creek at the secondary source intake of Lebanon Water Authority. The test results, seen below, were markedly different. A third, final Method 1623 test was not performed, in the interest of cost, because optimization efforts at Lickdale were negligible.

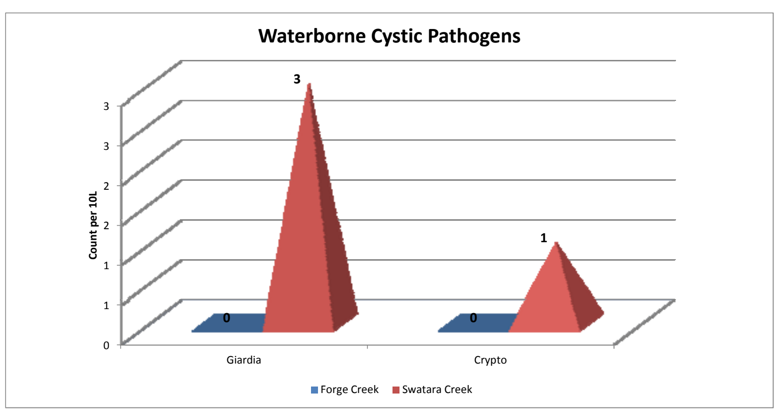


Figure: Comparison of Forge and Swatara Creeks, Me1623 pathogens.

Forge Creek, which has a relatively low flow an much smaller watershed compared to the much larger Swatara Creek, contained no *Cryptosporidium* oocyst or *Giardia lamblia* cyst downstream of the wastewater plant outfall in late October. In contrast, a January sample of the Swatara Creek at the water intake in Jonestown showed three *Giardia* and one *Cryptosporidium* per 10 liters. The table below shows the results of all testing.

Sample	Date	Effluent		Upstream		Downstream	
		Giardia	Crypto	Giardia	Crypto	Giardia	Crypto
Forge Creek	10/20/2009	21	0	0	0	0	0
Swatara Creek	12/28/2009	151	4	1	2	3	1

Table 2-1: Method 1623 Pathogen Test Results, count per 10 Liter sample.

These data, taken in their entirety, infer that the impact of the Lickdale plant's effluent on stream conditions appears to be negligible. The Swatara Creek watershed, which is mostly agricultural or forested, produces a greater risk of waterborne pathogens than does its smaller tributary. Note that a 1-log increase in Giardia coming from the Lickdale plant may have contributed to a negligible increase of Giardia downstream on the Swatara, but it is more likely that the pathogen concentration downstream is more affected by the greater volume of water coming from the northern reaches of the watershed. From a statistical standpoint, these numbers show no correlation between treatment plant effluent and downstream water quality, insofar as water pathogens are concerned. It may not be possible at all to relate waterborne pathogens to sewer plant effluent.◘

Attachments

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Attachment N—Chesapeake Nutrient Reporting Worksheet.......................N-1

Attachment A—Program Description

Description and Goals:

As part of an EPA-sponsored grant, the DEP has created a Wastewater Optimization Program to enhance surface water quality by improving sewage treatment plant performance beyond that expected by existing limits of the plants' National Pollutant Discharge Elimination System (NPDES) Permits.

The goal of this program is to encourage wastewater treatment facilities to voluntarily produce higher-quality effluent than mandated by the limits set in their NPDES permits and to optimize treatment in such a way that reduces contaminants and pathogens in surface waters that are consumed for drinking water following filtration at facilities downstream.

The initial focus will be to work with wastewater treatment facilities within ten miles upstream of these drinking water filter plant intakes. DEP will conduct Wastewater Plant Performance Evaluations (WPPEs) to assist municipal wastewater systems in optimizing their wastewater treatment plant processes as part of the Wastewater Optimization Program. Each evaluation is expected to last up to 2 months.

Process Optimization:

- Purpose of Optimization: Set production goals as if running the process were an industry that makes a product: clean water and biomass.
- Goal-Setting: Voluntary meeting of limits that are better than the minimum required limits in the permit in order to reduce pathogen, nutrient, and emerging contaminant loadings to downstream drinking water facility intakes.
- Action Items: Break down optimization tasks into various activities or adjustments that should be done to improve routine operation.

This new program is modeled after DEP's Filter Plant Performance Evaluations (FPPEs) conducted at Drinking Water facilities.

This program is not part of the Field Operations, Monitoring and Compliance Section. Sample collection methods utilized during this evaluation generally do not conform with 40 CFR Part 136, therefore the data collected will not be used, and in some cases is not permitted to be used for determining compliance with a facility's effluent limits established in its NPDES permit.

Wastewater Plant Performance Evaluation:

- Department staff will consult with the plant operators to explain the program, the goals, the equipment used, and the expectations for participation.

- Upon arrival at the wastewater plant, Department staff will set up equipment, including meters capable of continuous, in-line monitoring for pH, Oxidation-Reduction Potential, Ammonia, Nitrates, Dissolved Oxygen, and other parameters.
- The Department will utilize the equipment to gather data on system performance, show the operator how to gather similar data, and explain the value of gathering the data. We'll also explain how operators could choose to modify their treatment processes based on interpretation of the data collected.
- Although the Department may show operators how to achieve effective process control by using these process monitoring tools, the operators will continue to make all process control decisions, in conformance to their licensing requirements, and retain responsibility for those changes.
- The Department will also lend the facility additional laboratory equipment which will remain on site during the WPPE to assist in data collection and interpretation.
- During this time, the operator may need to spend more time performing routine testing at the treatment plant than was done previously. This will allow correlations to be made between process modifications and the process response.
- One major goal of the program is to provide the operator with the process monitoring knowledge and experience necessary to gather useful data and utilize it to make beneficial changes in the treatment process and the receiving stream long after the Department and its equipment have been removed.
- There is no charge for the Department's review of the treatment process, setup of all equipment, the process control monitoring that will take place, lending meters to the plant during the WPPE, data collection and explanation of potential effects that process modifications can have on the treatment process.
- The municipality will be responsible for providing laboratory bench space and 120 VAC power for the instrumentation. Any costs associated with process modifications (such as equipment upgrades, chemical purchases, etc.) that the municipality deems appropriate and beneficial as a result of the WPPE remain the responsibility of the municipality. The municipality reserves the right to cease participation in the WPPE at any time.
- Following the equipment set-up, the Department will observe the facilities and review operational practices, treatment processes, chemical treatment, operational data currently collected, and overall system performance.
- During the evaluation, the Department will review monitoring records, laboratory sheets, operations log sheets, and any drawings and specifications for the treatment facility. Also of interest is data currently

collected and how it is utilized for daily process modifications. This information is usually available from existing reports.

Program evaluation team will consist of 1 to 2 people: Wastewater Optimization Program Specialists, PA licensed as a wastewater plant operators with operations and compliance assistance experience.

Potential Benefits:

- Use of online process control monitoring equipment during the WPPE, use of hand held meters and portable lab equipment during the WPPE, and furthering the operators' knowledge of process control strategies and monitoring techniques,
- Producing a cleaner effluent discharge which minimizes impacts to the environment and downstream water users, and possible identification of process modifications that could result in real cost savings.
- Where the optimization goals may be more stringent than current requirements of your NPDES permit, they are completely voluntary. The WPPE objective is to optimize wastewater treatment plant performance in order to enhance surface water quality, minimizing the effects of pathogen and nutrient loading to downstream drinking water plant intakes.
- Furthermore, pursuit of a good rating in the WPPE program may place the wastewater system in a better position to meet more stringent regulatory requirements in the future, should they occur. For example, regulatory changes over the last ten years have reduced the final effluent Total Chlorine Residual limits requiring dechlorination or optimization of treatment processes to reduce the levels of chlorine added to the process for disinfection. Facilities who have voluntarily maintained lower residuals than listed in their permit have found it easier to comply with the updated regulations.

Potential Obstructions to Success

Many factors may present obstructions to a successful plant optimization. Some of these are listed below:

- Inadequate use or interpretation of regular process monitoring test results
- Inadequate funding of facility operating expenses, including staff training, chemical and energy usage, equipment maintenance
- Miscommunication as to program goals and methodologies
- Obsolete, inadequate, or out-dated treatment equipment and methods

Attachment B—WPPE Team

WPPE Team

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Kennett Square, PA 19348

Andy Rettew, Contract Operator
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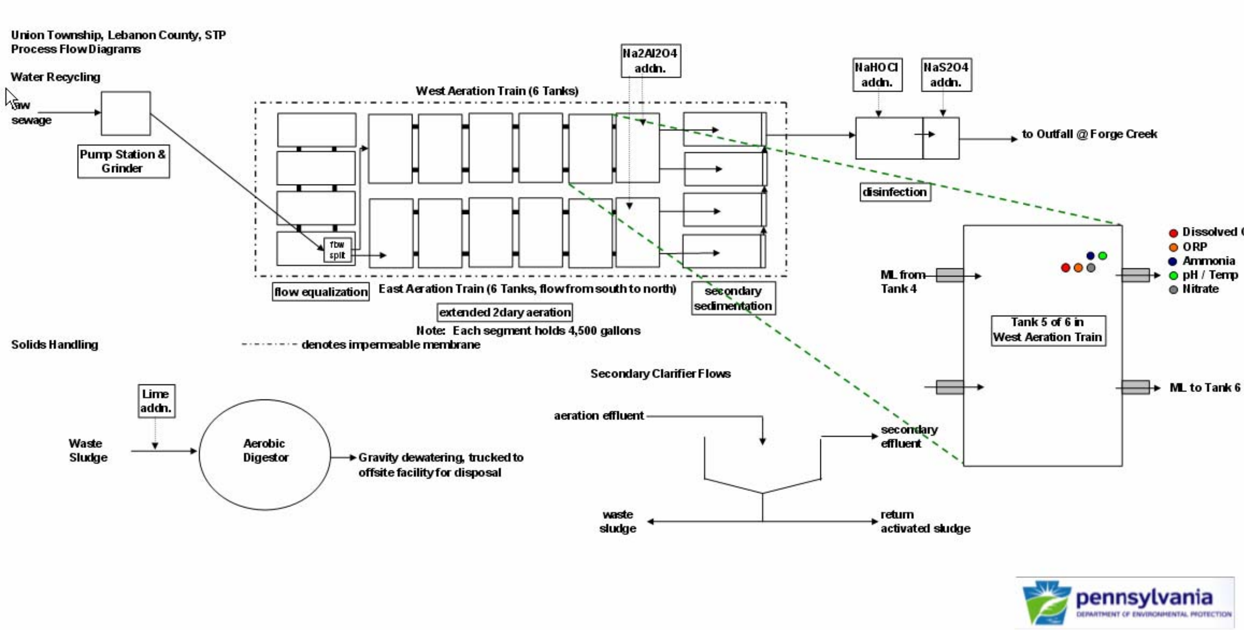
Attachment C—Plant Description and Treatment Schematic



Notes:

- The facility is a package plant composed of pre-cast concrete vaults assembled in an impermeable membrane.
- Design ADF = 0.10 MGD; MaxMoFlow = 0.1 MGD, also.
- Four vaults comprise Equalization Holding, for 27,600 gallons.
- Submersible pumps drive wastewater flow from pumping station wet well to inflow splitter box, where flow distributes to two trains of six vaults each.
- Each vault has a capacity of 6,900 gal. Each train: 41,400 gal.; both 82.8 kgal.
- Sodium aluminate is used to assist sludge settling.
- Aeration is provided by one of two positive displacement blowers.
- Return and Waste Sludge flows are driven by air-lift pumps.
- Each train has 2 clarifier vaults, interconnected, 6,900 gal. each, for 13.8 kgal.
- Return sludge from clarifiers re-enters aeration train at tanks one and two.
- Waste sludge is sequestered in the original unitized package plant, which has been gutted and retrofit as a single 35,000 gal. unit.
- Phosphorus is removed using liquid alum (Delpar 2000, includes polymers.)
- Effluent is disinfected using Sodium hypochlorite and detained prior to dechlorination using Sodium bisulfite.
- Plant outfall 001 is external to a site perimeter fence, a sidewall incursion that enters the east side Forge Creek.
- Lebanon City Authority has a 2 MGD water intake 4.3 stream-miles downstream from Union Twp. Outfall 001, behind a low-head dam on Swatara Creek. Lebanon City receives main flow of 5 MGD from reservoir in protected watershed.

Attachment D—On-site Process Monitoring and Control

At the time of the deployment, we noted that the main power to the facility was out of service, and a temporary power line was snaked across the ground from the pole outside the perimeter fence. In addition, one of the two main blower motors for the plant was out of service, and township personnel came to remove both it and the PD blower for repair and rebuilding. This latter event played a significant role in our being unable to achieve better dissolved oxygen concentrations in the mixed liquor.

The Union Township, Lebanon County, Municipal Authority owns and operates a small-flow extended aeration package wastewater treatment plant servicing the Village of Lickdale in Union Township, Lebanon County and the businesses immediately nearby in the township. The facility is currently rated for 0.10 MGD flow and 208.5 lb/day BOD but has had most of its 400 effluent domestic units (EDU) connected or reserved according to the Municipal Wasteload Management Report. Present use averages 0.044 MGD flow and 100 lb/day BOD, but the facility has experienced many permit excursions over the years and has difficulty maintaining steady-state biomass conditions.

Figure D-1: Lickdale WWTP (center) on Forge Creek (along northeast ramp of

Lickdale discharges to Forge Creek, a small tributary of the Swatara Creek that supplies a downstream impoundment used by the Lebanon City Water Authority as a secondary source for its filtration plant serving connections in and around the county seat. Forge Creek is listed as a warm-water fishery having a watershed area of about 1.84 square miles, with a confluence at river mile 43.15 of Swatara Creek. It is listed as being impaired by "agriculture/flow alterations" and "agriculture/siltation" in the 2007 Lebanon County Conservation Plan. Swatara Creek itself drains a 549 square-mile watershed covering three counties. It flows to the Susquehanna River just south of Middletown Borough in Dauphin County. Flow subsequently enters the Chesapeake Bay. Total maximum daily load (TMDL) issues regarding the Upper Swatara Creek watershed include acid-mine drainage and metals.

An engineering study recommended upgrading capacity to 0.30 MGD by replacing the existing Dutchland package plant with sequencing batch reactor (SBR) technology with improved disinfection and nutrient control as part of a strategy that would accommodate growth in Union Township. Financing issues combined with a severe downturn in the economy to render the project unfeasible; however, the Authority still has to deal with capacity issues as well as the imminent publication of effluent nutrient limits pursuant to the Chesapeake Bay Tributary Initiative. This treatment facility had been previously owned by the North Lebanon Sewer Authority which operates a wastewater treatment plant in Jonestown near the intersection of Swatara Creek with Jonestown Road, the "original" U.S. Rte. 22 through Lebanon County. It had been built as a 0.035 MGD industrial wastewater treatment plant for the surrounding commerce park, with the original package plant now used as a 35 kgal. Aerobic digester. The collection system has two pumping stations, one on-site; other, in the industrial park west of the I-81 interchange. The station within the treatment plant's perimeter fence serves village of Lickdale, local restaurants and hotels, a recently-built truck stop, and the Tyco electronics plant nearby, north on PA-72

Performance Evaluation:

In late November 2009, DEP staff Bob DiGilarmo and Marc Neville of the Filter Plants Program arrived on site and set up equipment for continuous monitoring of various qualities of the mixed liquor in one of the two unitized treatment tanks. Probes were placed in the Tank 5 of Unit 2 Aeration Train and included the materials listed in Attachment E. Because the facility is composed of ground-level vaults covered with aluminum grates, there were no traditional railings for mounting the probe carriers, so DEP staff fabricated probe mounts using PVC pipe. The data generated by those probes is provided on an accompanying CD-rom disk and also graphically represented in Attachment G.

A portable wastewater lab was established inside the blower building that also contains a small laboratory bench, disinfection equipment, chemical storage, and the motor control center. This lab equipment was lent to the facility's operators for their use during the on-site activities period and was also used by DEP staff to calibrate the on-line probes and supplement data to characterize the facility's operations and efficiency. Examples of bench testing data are included in Attachment I, with the remainder of this data on the CD-rom disk.

Four standard sample points are established for the overall WPPE program: Raw Wastewater (INF) as it enters the facility for treatment, Final Effluent (EFF) as discharged to the plant outfall, Background Receiving Stream (UPS), and Impacted Receiving Stream (DWS.) Additional internal sampling points included Mixed Liquor from the two treatment trains, the Return/Waste Sludge from the clarifier floor, and the Clarifier Supernatant, taken prior to disinfection. Test data from these sampling points provided a baseline operational diagnosis and then also assessed any improvements due to minor process changes and adjustments. Test data for samples analyzed at the DEP Bureau of Laboratories is presented in tabular and graphic forms in Attachments J and K.

On-Site Experiences:

DEP staff conducted a weekly assessment of the operation using routine process monitoring tests. An example worksheet is depicted in Attachment I, showing the results of Settleability, OUR, %Solids by Volume, and colorimetric nutrient tests for a 3 representative days, November 13, December 16, and December 28.

Process Monitoring & Control Tests:

The Lickdale facility is a small discharger and contracts with an environmental laboratory for most of its analyses. The contract operator's staff obtains samples in vendor-provided, preserved jars, and the laboratory conducts the tests. This approach is taken by many small treatment plants in light of the costs associated with certifying and maintaining an on-site lab. One of the purposes of the WPPE program, though, is to reacquaint plant operators with the need for routine process monitoring and control tests. For that reason, DEP lends client facilities sufficient lab equipment to conduct qualitative and some quantitative tests of the relative condition of the treatment system, the raw wastewater strength, and the effluent quality. A listing of this equipment follows in Attachment E. Graphs of the Hach Continuous Monitoring data are exhibited in Attachment G, while test results for samples analyzed at DEP's Bureau of Labs in Harrisburg are tabulated in Attachment J, followed by graphical representations of those test results. In the following paragraphs, a short discussion of the minimum recommended process monitoring testing is provided. Attachment K summarizes the minimum tests required for facilities discharging under 1.0 MGD. Our recommendation tends to favor more frequent sampling and analyses than listed in the table there, because the facility is difficult to manage when plant upsets occur.

A full set of process monitoring tests may take three to four hours for one person to complete, record, and interpret. As a rule, with facilities under 1 MGD flow, most process monitoring tests such as SOUR, Settleability, and Solids-by-volume can be done twice per week while maintaining a margin of safety; however, composite raw wastewater should be tested for COD on a daily basis. This is important in determining if slug loading or illegal dumping is taking place. Such loading can easily kill off the biomass. If the facility is not attended long enough on weekends and holidays, the wastewater samples can be preserved using H_2SO_4 and refrigerated until the next time the operator can run the test.

At the beginning of the WPPE, the biomass tended to have a higher concentration and was in an endogenous phase of growth, as seen by the relatively flat Settleability chart and low oxygen uptake rates. Over the course of the study, we observed incidents of over-wasting one of the aeration trains, followed by a period where no wasting occurred while a digester pump was out of service. The second set of bench tests showed solids concentrations more uniform, but with lower OUR and even more endogenous behavior. Toward the end of December, the solids mass was lower, and Settleability was better, with consistency of OURs at or near 12 mg. O_2/hr.

Process monitoring tests over the course of the WPPE showed that the system is receiving 50% its hydraulic and 25% its organic loading, but more consistency is needed in setting waste rates, regulating dissolved oxygen, and seeding. Food to Mass ratio is too low for existing biomass under aeration, causing biomass to be over-oxidized and endogenous. Were loading to approach the actual design values, the facility may require much more attention to the details of operating it efficiently in order to avoid plant upsets and low-quality effluent.

On-site Process Test Results:

A variety of analyses conducted during the WPPE were used to characterize the facility. A sample bench sheet with actual process monitoring results is found as Attachment I, followed by example graphs for the bench tests.

Some values that stand out in the routine analyses follow:

Mixed Liquor Suspended Solids for Aeration Train 1 averaged 2,900 mg/L with a maximum of 3,560 mg/L, ± 530 mg/L. The average ratio of volatile to total solids was 76%, ± 3%, which would indicate "older" sludge conditions under normal circumstances.[4] Aeration Train 2 similarly averaged 2,850 mg/L ± 750 mg/L, but trended younger at 80% VSS/TSS, with considerably different settling characteristics. The operator noted that it is easy to accidentally "over waste" the train, because the use of unmetered air lift pumps is imprecise at best. Microscopic exam usually showed a variety of microlife, indicating that the facility is operating under generally good conditions.

Return and waste sludge concentrations tended to hold in the 998 to 3,960 mg/L range.[5] As a rule, return sludge concentration should be two to three times the concentration of the biomass in the aeration tanks. This is difficult to maintain at Lickdale, most likely because the air-lift pump technology does not afford the level of fine-tuning that is found in plants employing more modern equipment. RAS

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[4] Young sludge/Old Sludge: These terms are generalizations used to characterize biomass conditions. In young sludge, free swimming flagellates and ciliates tend to dominate, and the bacteria are in the log phase of growth and reproduction. High-rate plants tend to operate better under these conditions, but conventional or extended aeration usually run better when the biomass is at the top of the growth curve or in the endogenous stage of growth, "old sludge" conditions. Ratios for endogenous stage would be closer to 70% to 75% VSS of TSS. For reactors operating in the low 80% range, one would expect to see high F/M ratio, high respiration rate, and low MCRT. The opposite is true for facilities operating in the 70% VSS/TSS range.

[5] Thus, one would expect to see RAS solids at about 7,000 to 10,000 mg/L; acceptable values for winter that would not work during summer, because odor would invariably follow. At Lickdale, the RAS solids in AT1 were under 2,000 mg/L on 3 of 7 occasions, indicating there had been no blanket retention in the clarifier for this train.

concentrations could be maintained at higher values, but operators would be required to spend more time adjusting the pumps and monitoring concentrations. In addition, the clarifiers would be at greater risk of bulking or solids washout if sludge concentrated there too long.

As regards the raw wastewater, the average influent BOD grab samples taken from the Influent splitter box between 11 AM and 2 PM was 389 mg/L, +/- 73 mg/L. The average loading, based on measured effluent flow, was 137 lb/day +/- 56 lb/day. BOD to COD ratio varied widely among the samples, averaging 106% but as low as 70% and as high as 165 % on occasion. This variability would make it difficult for operators to reliably substitute COD testing for BOD testing when determining feed rates for raw wastewater. Despite this, we continue to maintain that the COD test can be a practical indicator of relative wastewater strength, and it is useful because of its 2-hour digestion time as opposed to a 5-day incubation period for the BOD test. Viewing these data, we would suggest that operators using the COD test perform more frequent comparison testing using the BOD test, at least once per week, in order to obtain a rolling average to use on the daily COD results. A COD test of a composite sample every day the plant is manned would give operators a better handle on the true loading to the facility. The operators should also occasionally conduct hourly sampling in order to characterize slug loads or variations of wastewater strength. Doing so is necessary for achieving peak performance from the facility.

Waste nutrient values averaged 87.3 mg/L for Total Nitrogen and 10.9 mg/L for Total Phosphorus, with ammonia-nitrogen averaging 70.8 mg/L and Total Kjeldahl nitrogen, a measure of ammonia and organic nitrogen, averaging 87.2 mg/L. Intermediate forms of oxidized nitrogen, of course, were non-detectable. Alkalinity averaged 326 mg/L, an pH was consistent at 7.6 s.u. Total Suspended Solids averaged 410 mg/L, with loadings averaging 139 ppd. Two-thirds of our samples fell within a +/- 58 pound range.

Effluent water chemistry during the WPPE generally confirmed historical data reported in the facility's compliance testing and reporting, based on environmental laboratory results and the DMR record. Effluent suspended solids and volatile suspended solids were mostly undetectable, to a limit of 5 mg/L. Loadings, consequently, were under an average 2.3 lb/day. CBOD values averaged 3.1 mg/L +/- 1.9, with loading averaging 1.07 lb/day +/- 0.71 lb/day. As expected, with colder weather, the treatment efficiency lapsed somewhat, with higher loadings occurring in January, at 2.17 lb/day, than in December, where the samples averaged 0.75 lb/day.

Effluent alkalinity averaged 140 mg/L, and pH averaged 7.8. Total nitrogen averaged 41.9 mg/L, composed mostly of nitrate-nitrogen, which averaged 39.6

mg/L, and total phosphorus averaged 0.41 mg/L, with a maximum concentration of 1.08 mg/L. These nutrient values are important, because the facility would have to maintain concentrations of 18.0 mg/L and 2.0 mg/L for TN and TP, respectively, at 0.10 MGD in order to maintain compliance with proposed annualized Chesapeake loading limits of 5,479 lb. of TN and 612 lb. of TP.[6]

Fecal Coliform test results had a geometric mean of 37 cfu/100 ml. during the WPPE, with a maximum reported value of 120, not bad for non-bathing season quantities.

Lickdale employs NaHOCl "bleach" solution as a disinfectant, followed by dechlorination using $Na_2S_2O_3$ solution added to the final chamber of the effluent discharge tank. Total chlorine residual for the month averaged 0.03 mg/L +/- 0.04 mg/L. The facility's historical record shows that TRC levels rarely exceeded this range, although a maximum of 0.5 mg/L was reported. The existing chlorine contact volume and holding time is sufficient for killing the Fecal Coliforms.[7] The dechlorination chemical is protective of the receiving stream.

During late summer of 2009, the WPPE program was tasked to begin monitoring receiving streams and plant effluent for chlorides, as this pollutant is a rising concern in states that employ halides to depress freezing temperature of water on highways. The maximum concentration limit (MCL) for chlorides in drinking water is 250 mg/L, the point at which water acquires a "salty" taste. In samples of the Lickdale effluent, the chloride content once exceeded 2000 mg/L, averaging 432 mg/L. By way of comparison, the Forge Creek background sample averaged 22 mg/L and the impacted sample, taken 200 meters downstream of the outfall, averaged 28 mg/L. Downstream Swatara Creek chloride values were even lower, averaging 13.4 mg/L. This relative lack of environmental impact with regard to the treated effluent in early winter supports suspicions that chlorides in surface waters are more of a road maintenance winter materials issue than a wastewater treatment one.

[6] Based on data developed during the WPPE, the nutrient loadings were 454 lb. TN and 4 lb. TP in December, and 619 lb. and 5 lb., respectively, in January. Extrapolating this to a 12-month period, the annualized load would have been out on TN, requiring the facility to purchase nutrient credits from another user in the watershed. (There is currently no market for this.) Alternatively, the facility would be required to implement biological nutrient removal (BNR,) which could be quite costly.

[7] Apart from samples sent to BOL, we did not independently test for TRC during the WPPE using the Hach field kits, relying instead on the equipment of and test results generated by the plant operators who performed their tests in accordance with permit requirements and manufacturer instructions.

Photos of Biomass observed during Microscopic Exam:

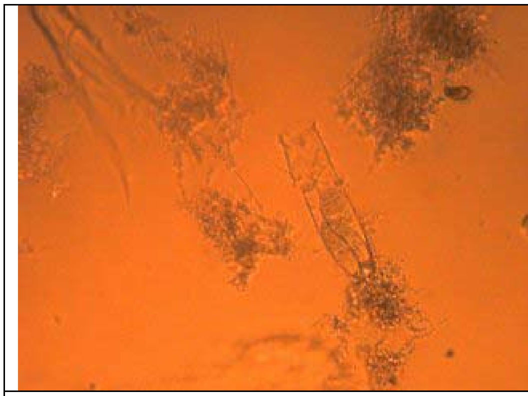
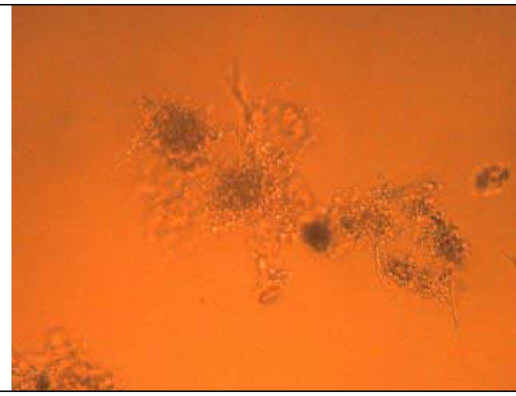
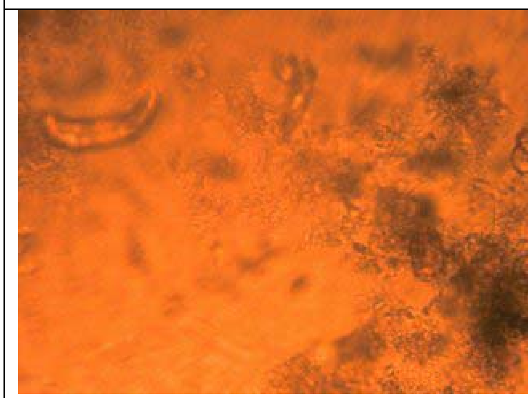
		

Figure D-2		**Figure D-3**
		Biomass showed a prevalence of rotifers with some nematodes and few stalked ciliates. Where stalks were observed, they tended to be deheaded. These "old sludge" conditions are expected in extended aeration plants but may also be seen in facilities where there is too much biomass or not enough food sources.
Figure D-4		

Attachment E—Equipment Deployed

DEP staff visited the site on November 24, 2009, and the following day to set up equipment. Marc Neville and Bob DiGilarmo fabricated probe mounts because the Lickdale plant had no railings to which the probes are usually mounted. Equipment was staged at Tank 5 of treatment train 2, using electricity tapped from the blower building's convenience circuits. The laboratory equipment had to be set up on a separate table because space for working was limited.

Digital, Continuously Monitoring Probes:

1 – Laptop computer with signal converter
1 – SC1000 SCADA Base Unit
1 – LDO probe
1 – pH probe
1 – ORP probe
1 – NH_4D probe w/Cleaning System
1 – Nitratax probes
1 – Solitax probes

Laboratory Equipment On-loan:

1 – Hach HQ40d handheld pH and LDO meter
1 – LBOD probe
1 – DR2800 spectrophotometer
1 – Wastewater Field Test Kit
1 – Raven centrifuge with 6 sample tubes
1 – Raven Core Taker sampler
3 – Raven settleometers
1 – COD Heater Block
1 – Microscope with electronic photographic/video capability
1—Collapsible bench-top table

Attachment F—Equipment Placement Photos

Figure F-1: Probe mount stands fabricated from Schedule 40 PVC pipe.

Figure F-2: Probes affixed to mounting poles (top to bottom: DO, NO3, ORP, pH/Temp.

Figure F-3: Air compressor (center) for Ammonia probe cleaning system, on mounts.

Figure F-4: Ammonia probe being calibrated overnight using standard solution.

Figure F-5: Hach SC-1000 Module with Digital Display, mounted on railing near west aeration train.

Figure F-6: Sensor Probes set up in Tank 6 of west aeration train.

Figure F-7: DEP Field Laboratory set up in Control Building.

Figure F-8: Close-in view of recording notebook displaying continuous digital monitoring.

Attachment G—Data Charts

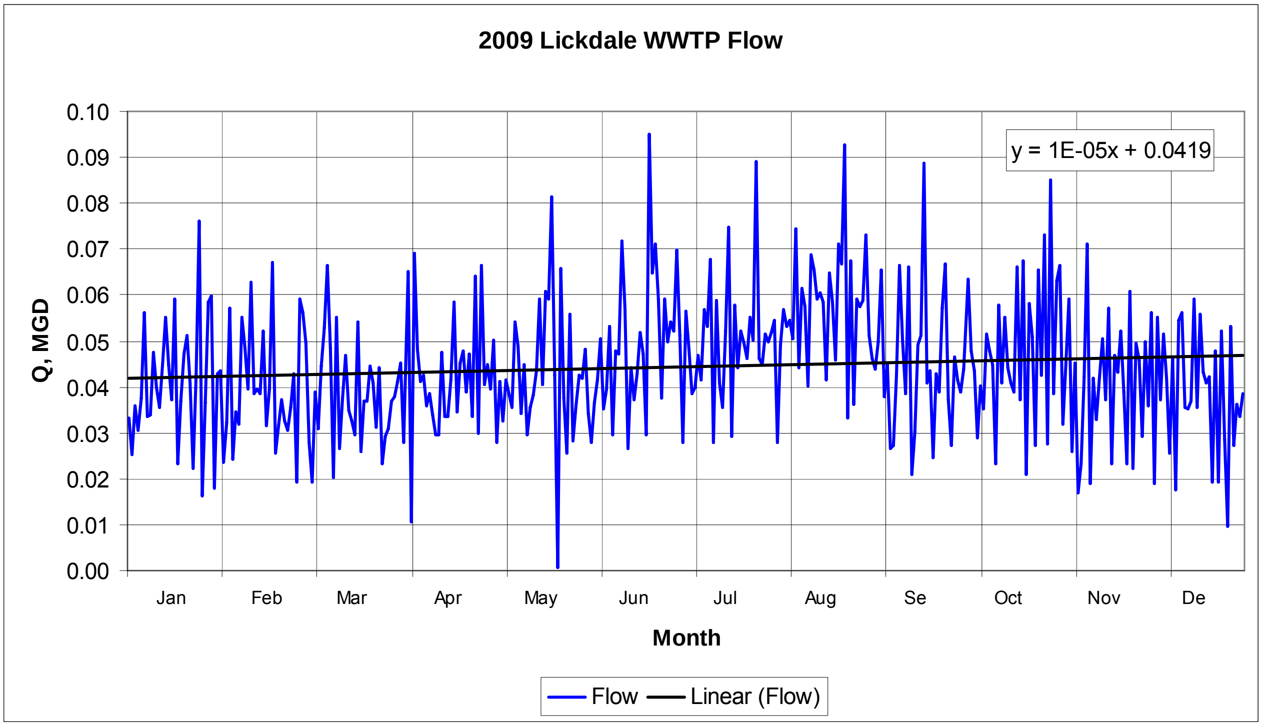


Figure G-1: 2009 Average Daily Flow, Lickdale WWTP

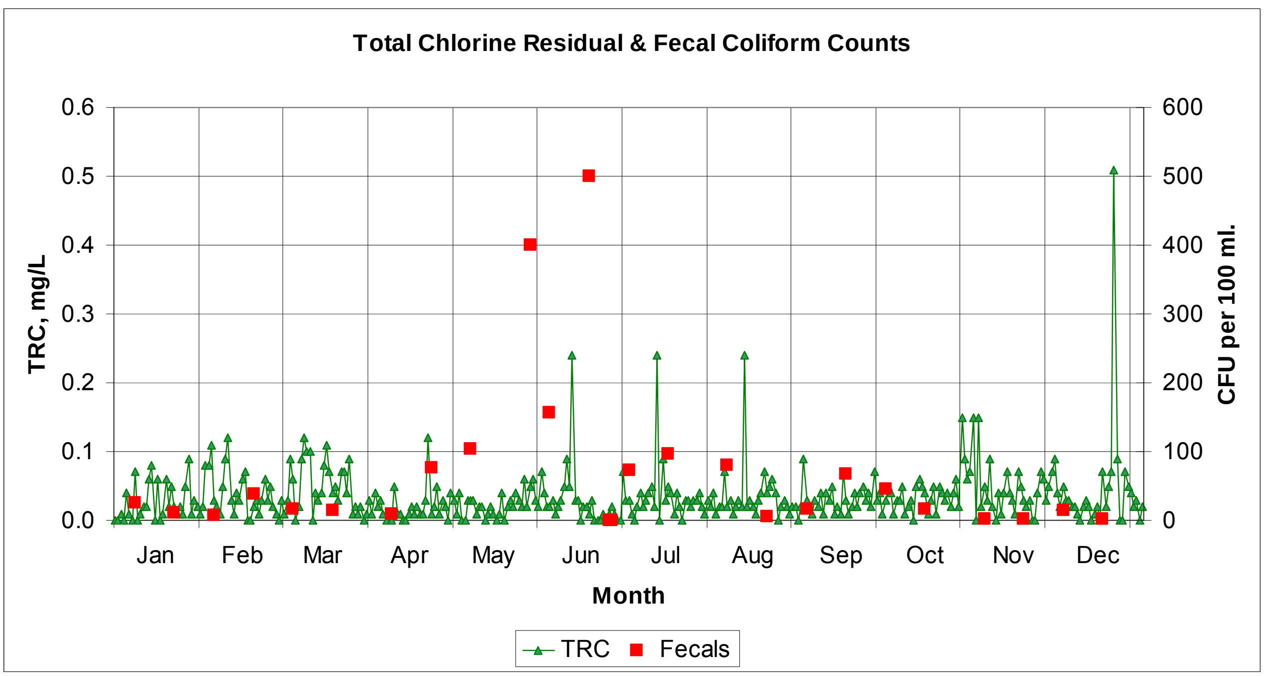


Figure G-2: 2009 TRC & FC Counts, Lickdale WWTP

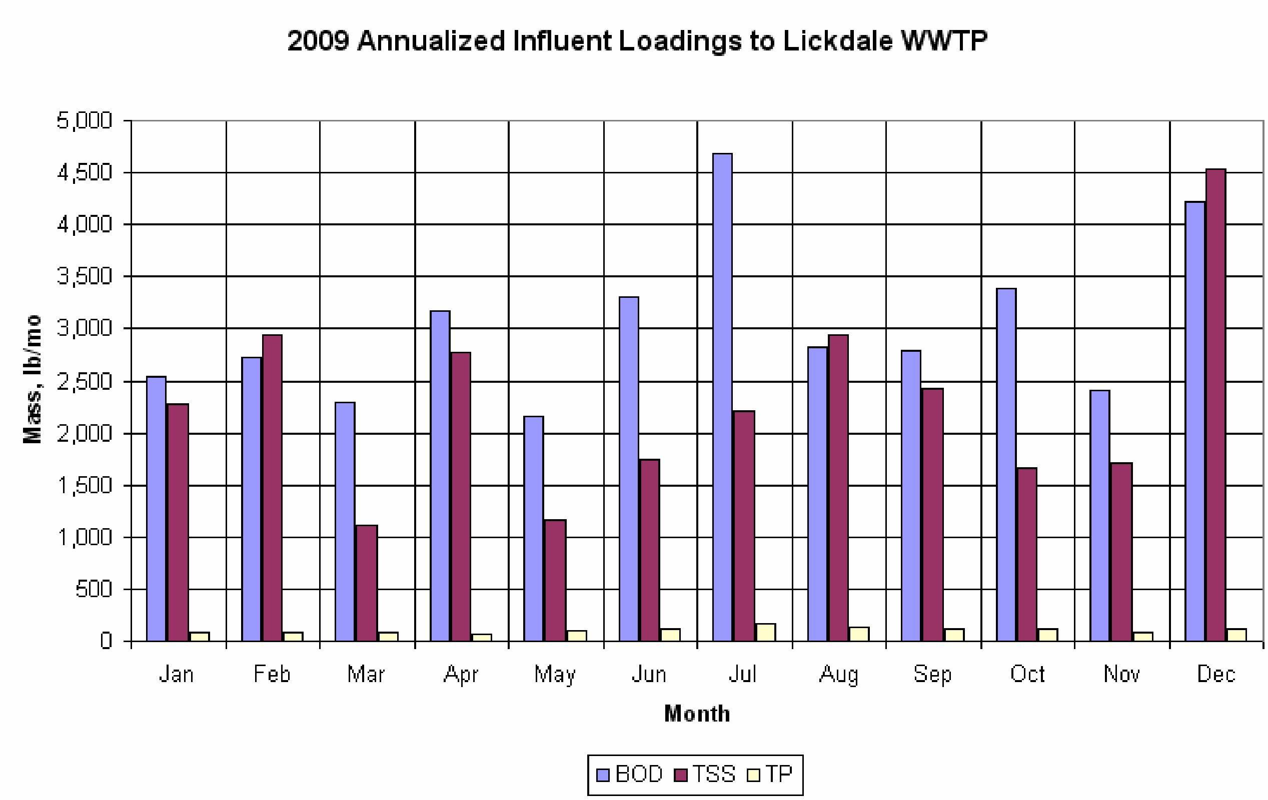


Figure G-3: Influent Wastewater Mass Loadings, Lickdale, 2009

2009 Annualized Influent Loadings to Lickdale WWTP

Month	BOD5 Avg ppd	BOD5 ppd/mo	TSS Avg ppd	TSS ppd/mo	TP Avg ppd	TP ppd/mo	ALK Avg ppd	ALK ppd/mo
Jan	81.7	2,534	73.3	2,272	2.4	75	64.6	2,002
Feb	97.5	2,730	104.8	2,934	2.9	80	69.7	1,953
Mar	74.1	2,298	35.9	1,114	2.7	83	77.6	2,407
Apr	105.7	3,172	92.4	2,772	2.5	74	90.0	2,700
May	69.4	2,153	37.4	1,161	3.4	104	120.1	3,724
Jun	110.4	3,313	58.4	1,752	4.0	120	109.7	3,290
Jul	151.2	4,688	71.3	2,210	5.6	173	150.1	4,653
Aug	91.3	2,830	94.7	2,937	4.2	130	103.0	3,193
Sep	92.7	2,782	80.8	2,424	3.8	113	122.3	3,670
Oct	109.4	3,391	53.4	1,654	3.6	111	140.1	4,345
Nov	80.6	2,417	57.0	1,710	2.8	84	93.0	2,791
Dec	136.1	4,218	146.2	4,533	3.9	122	118.3	3,666
Total Mass		36,526		27,471		1,269		38,393
AvgMoMass	100.0		75.5		3.5		104.9	
MaxMonth	151.2	4,688	146.2	4,533	5.6	173	150.1	4,653
MinMonth	69.4	2,153	35.9	1,114	2.4	74	64.6	1,953

Table G-1: Influent Wastewater Mass Loadings, Lickdale, 2009

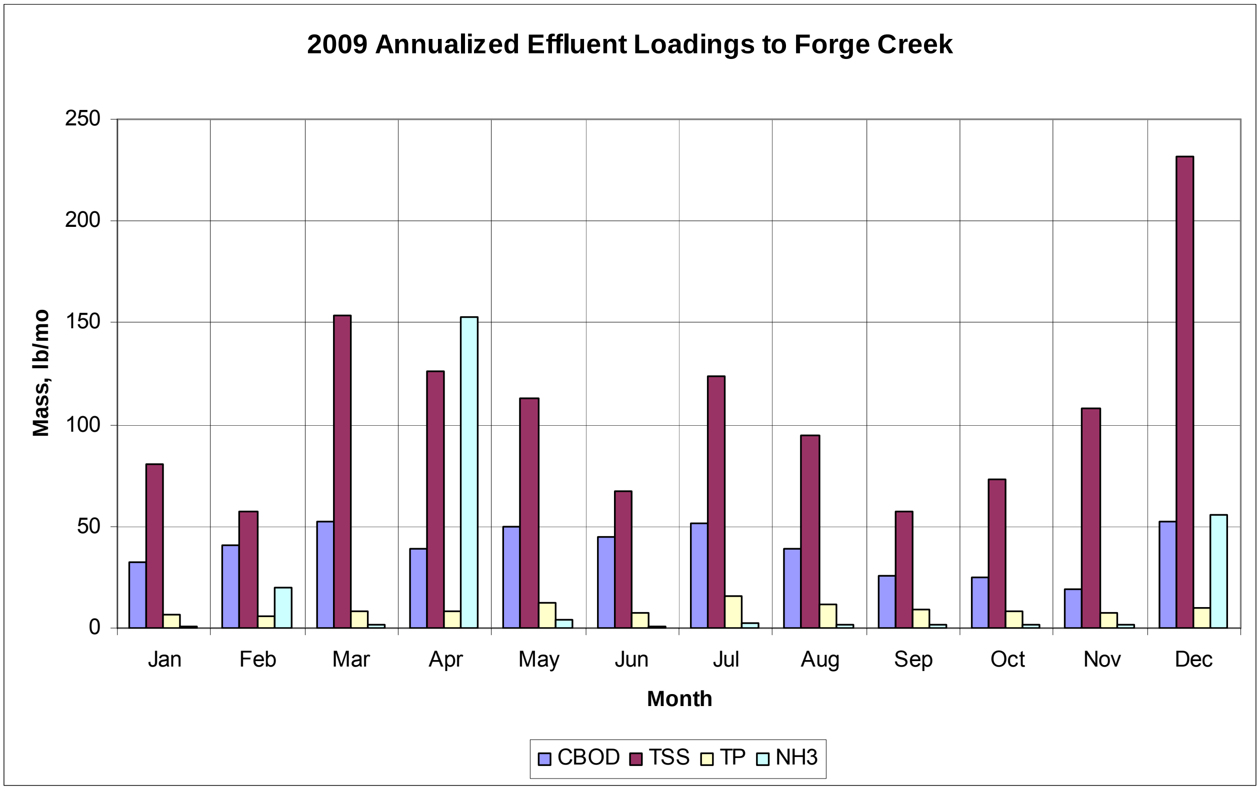


Figure G-4: Effluent Mass Loadings, Lickdale, 2009

2009 Annualized Effluent Loadings to Forge Creek

Month	CBOD Avg ppd	CBOD ppd/mo	TSS Avg ppd	TSS ppd/mo	TP Avg ppd	TP ppd/mo	NH3 Avg ppd	NH3 ppd/mo
Jan	1.0	32.2	2.6	80.5	0.2	6.4	0.0	0.8
Feb	1.5	40.6	2.1	57.4	0.2	5.4	0.7	20.3
Mar	1.7	52.7	5.0	153.5	0.3	8.2	0.0	1.5
Apr	1.3	39.0	4.2	126.0	0.3	8.7	5.1	152.7
May	1.6	49.6	3.7	113.2	0.4	12.6	0.1	4.3
Jun	1.5	45.0	2.3	67.5	0.3	7.7	0.0	1.2
Jul	1.7	51.2	4.0	124.0	0.5	15.7	0.1	2.1
Aug	1.3	38.8	3.1	94.6	0.4	11.8	0.0	1.2
Sep	0.9	25.5	1.9	57.0	0.3	8.8	0.1	2.0
Oct	0.8	24.8	2.4	72.9	0.3	8.3	0.0	1.4
Nov	0.6	19.4	3.6	108.0	0.3	7.6	0.0	1.5
Dec	1.7	52.4	7.5	231.7	0.3	10.4	1.8	55.4
Total Mass		471		1,286		112		244
AvgMoMass	1.3		3.5		0.3		0.7	
MaxMonth	1.7	52.7	7.5	231.7	0.5	15.7	5.1	152.7
MinMonth	0.6	19.4	1.9	57.0	0.2	5.4	0.0	0.8

Table G-2: Effluent Mass Loadings

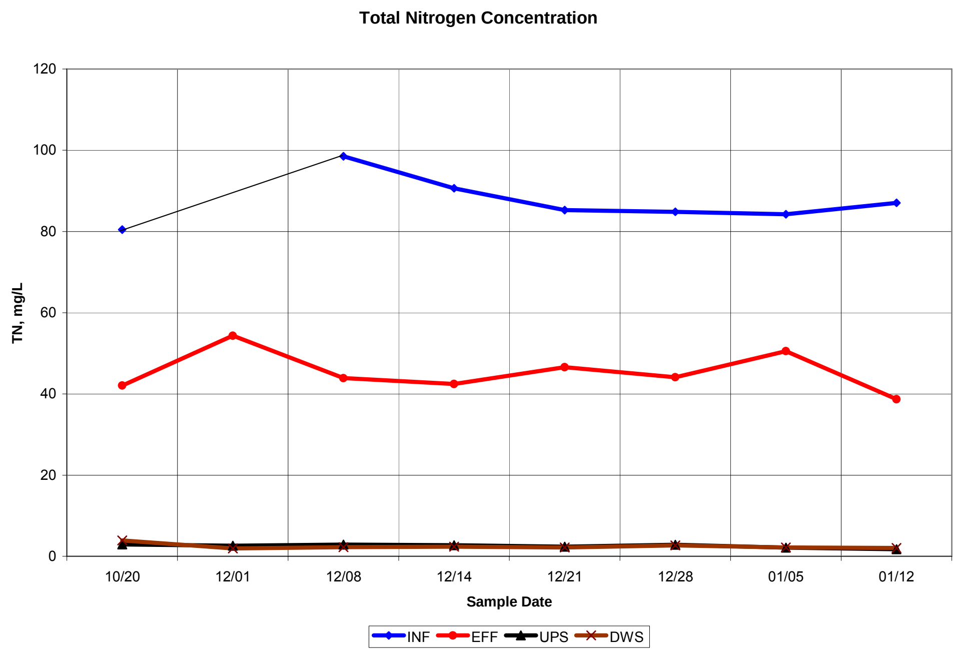


Figure G-5: Total Nitrogen Concentration in BOL Samples, Lickdale, Fall/Winter 2009

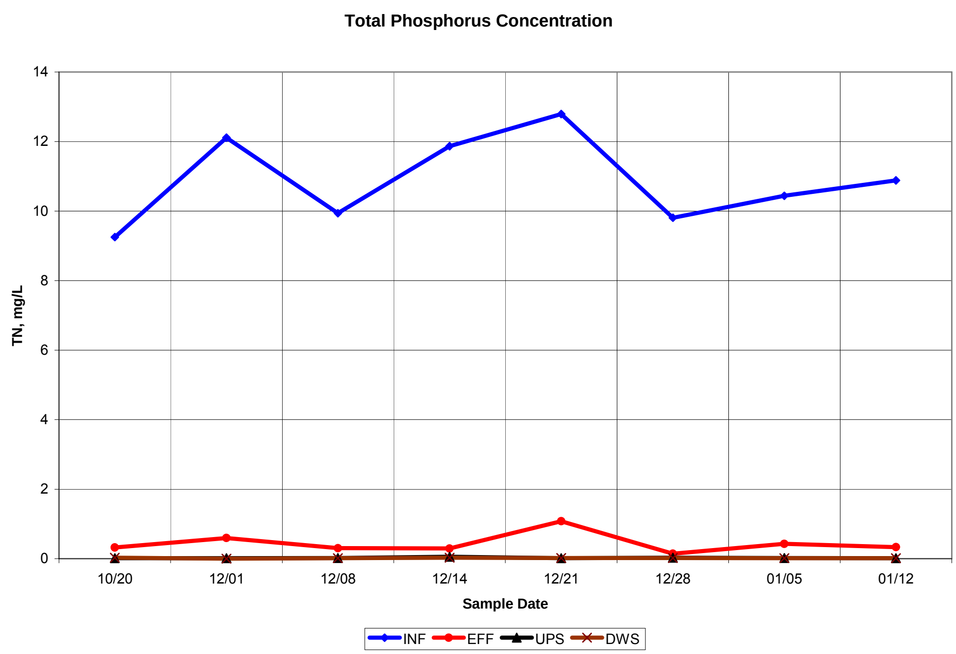


Figure G-6: Total Phosphorus Concentration in BOL Samples, Lickdale, Fall/Winter 2009

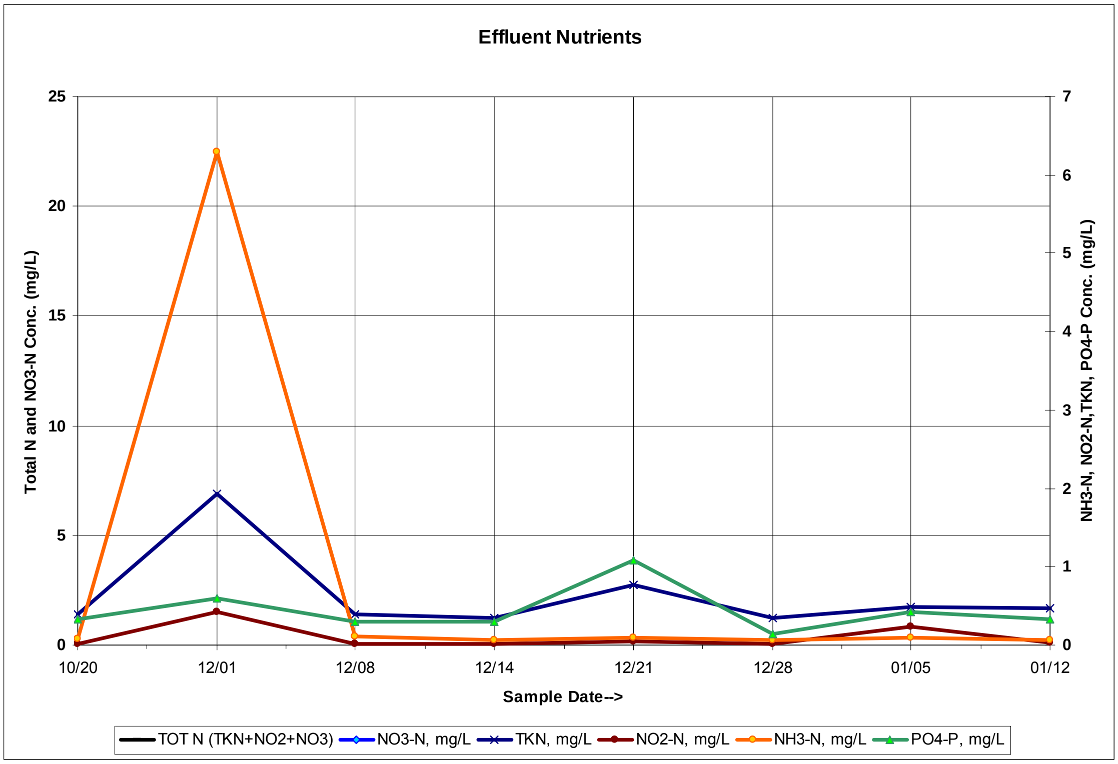


Figure G-7: Example slug load effect on plant dynamic, Dec. 11, 2009

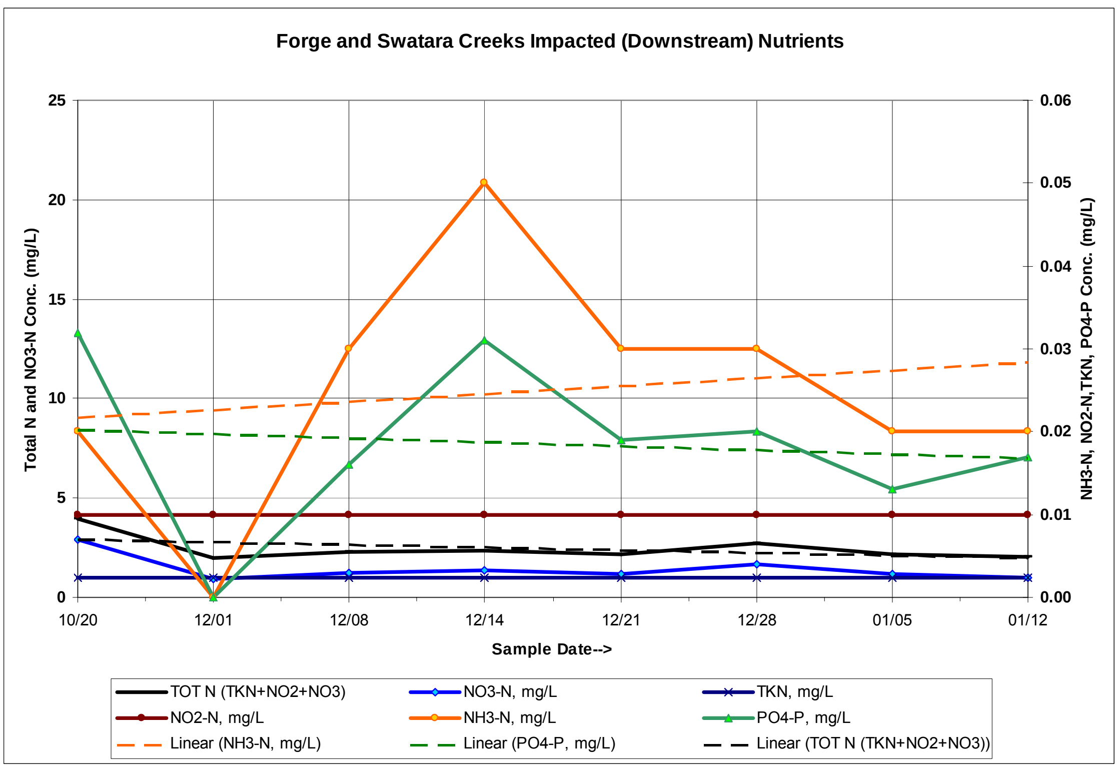


Figure G-8: Example slug load effect on plant dynamic, Dec. 11, 2009.

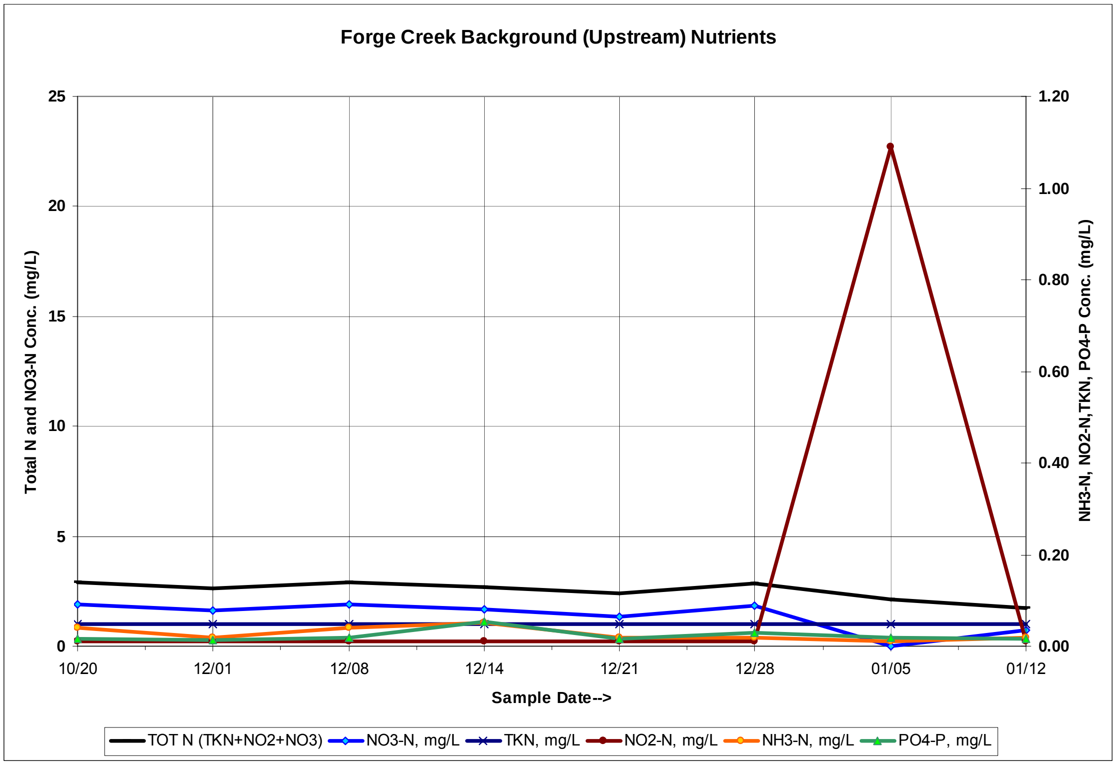


Figure G-9: Example slug load effect on plant dynamic, Dec. 11, 2009

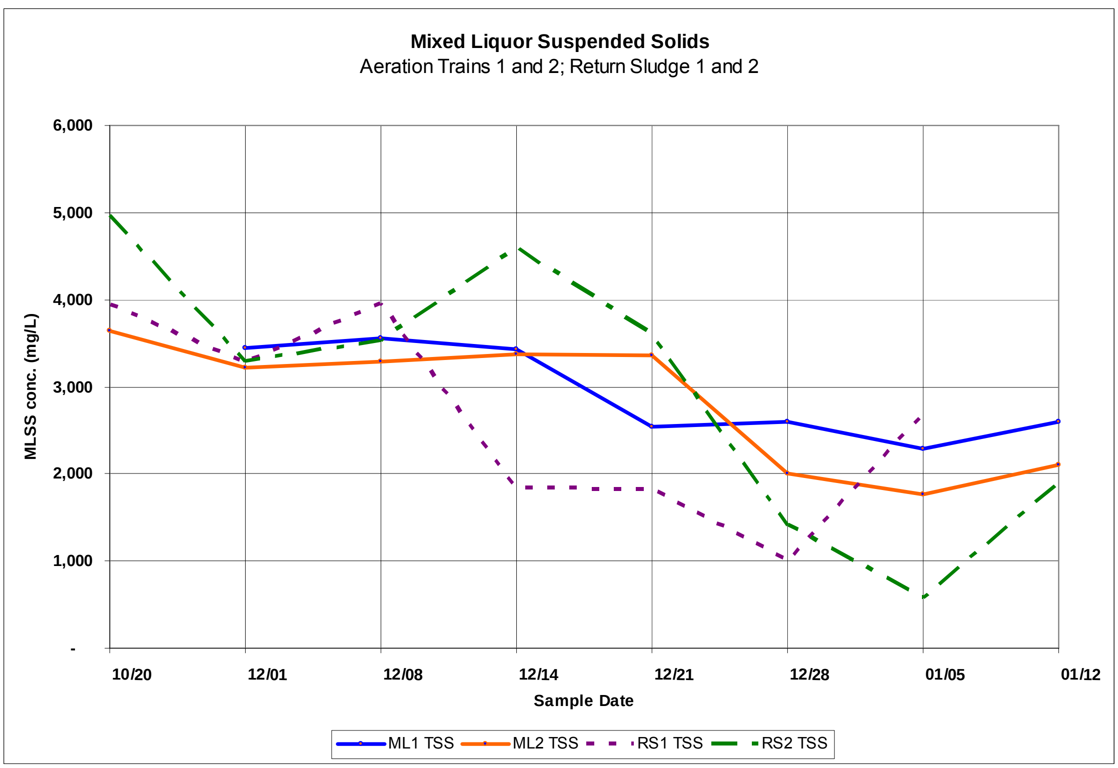


Figure G-10: Example slug load effect on plant dynamic, Dec. 11, 2009.

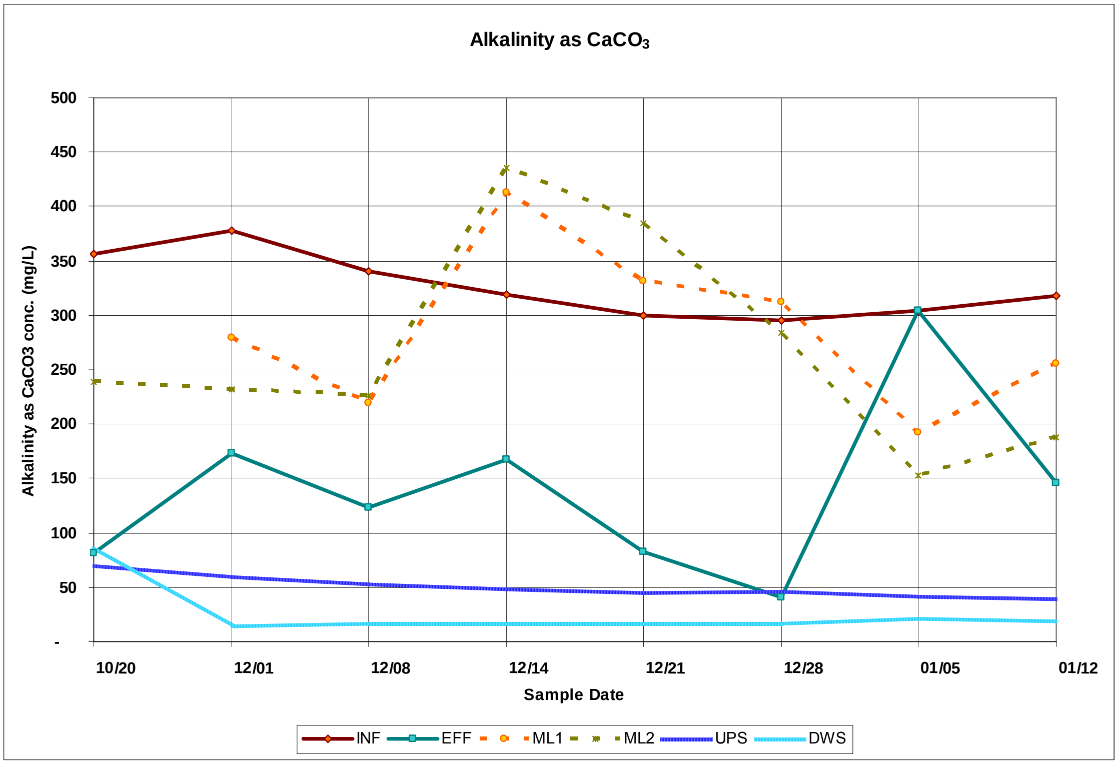


Figure G-11:

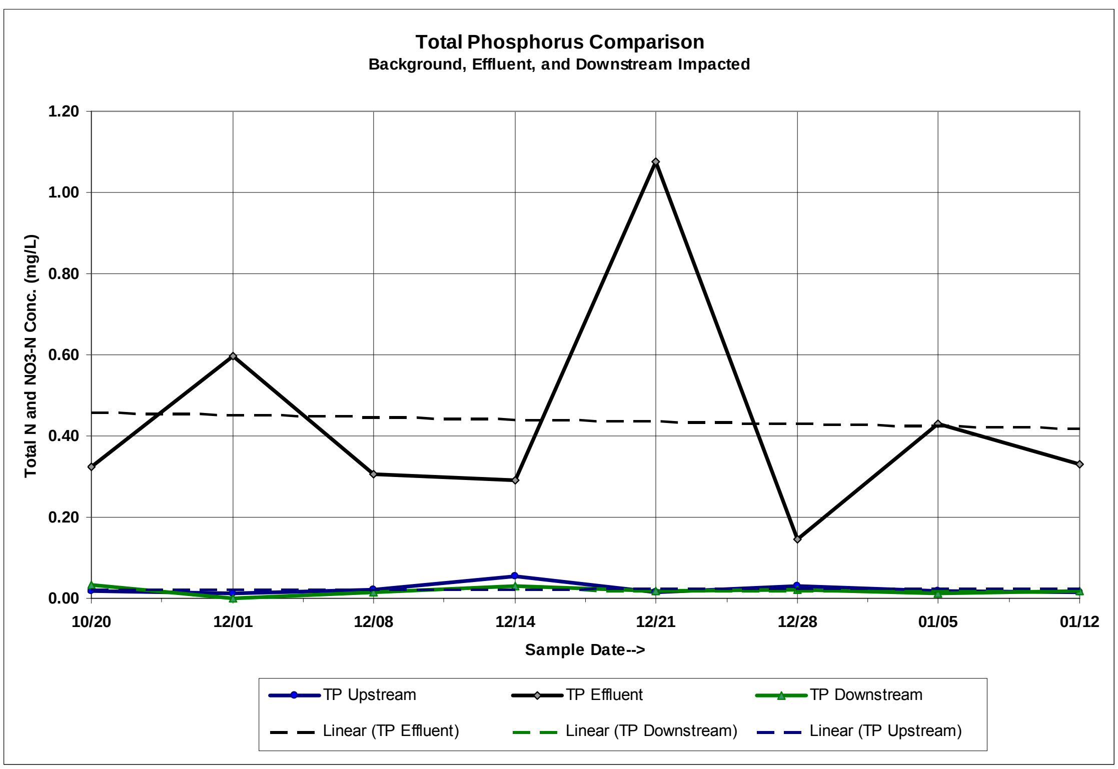


Figure G-12:

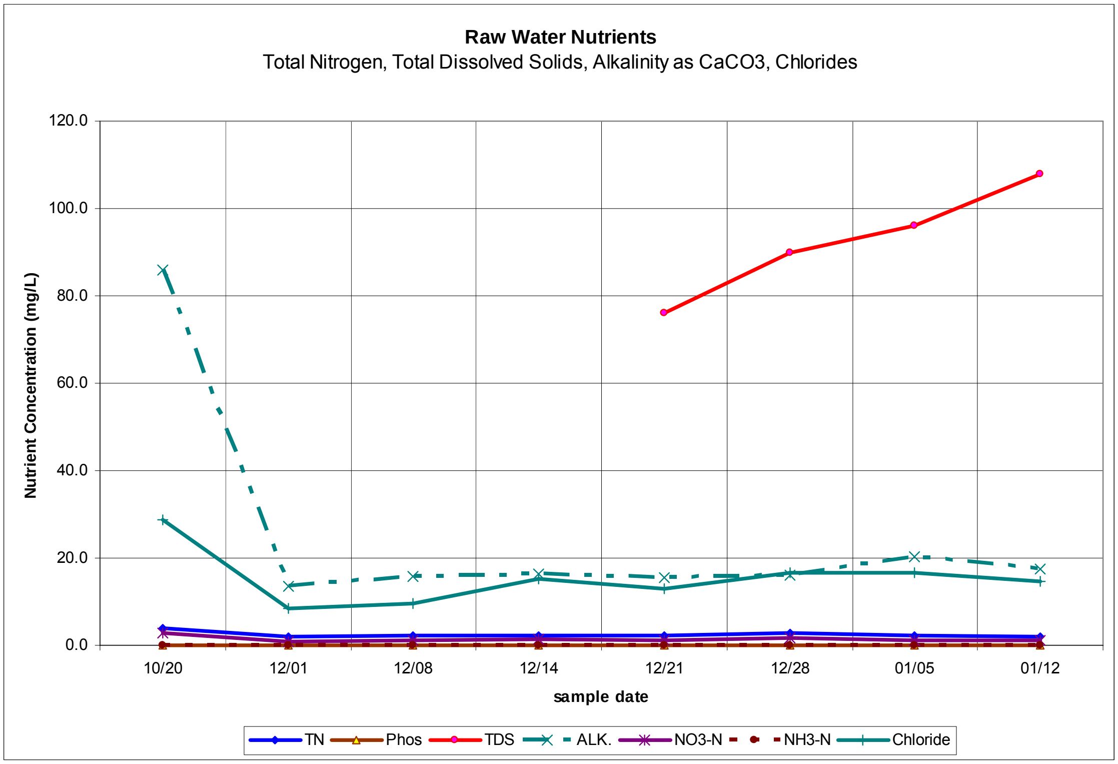


Figure G-13:

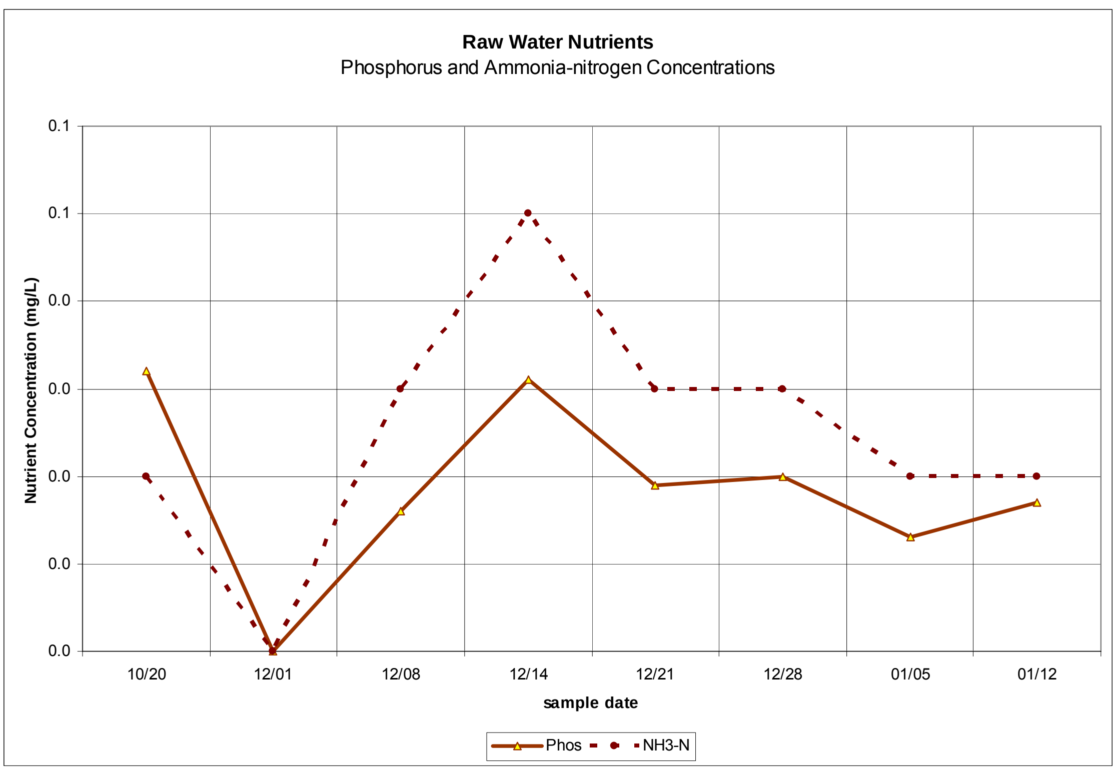


Figure G-14:

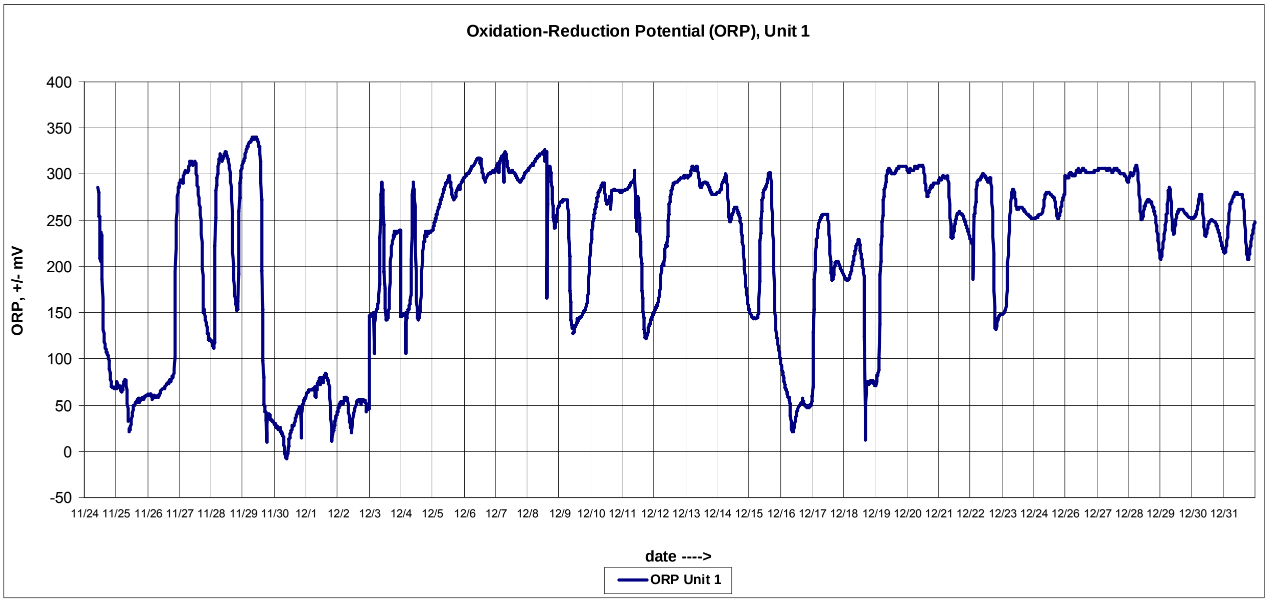


Figure G-15: Month-long histogram of ORP measurements by Hach system: Lickdale WWTP Aeration Train 2: Note that Nitrification occurs at ranges above c. 150 mV. Denitrification under anoxic conditions, in the presence of both a carbon source and a nitrate source, will occur below 150 mV to -150 mV. Anaerobic and septic conditions occur below -150 mV, when Sulphur from proteins is used as a proton sink, creating H2S with its characteristic "rotten egg" malodor.

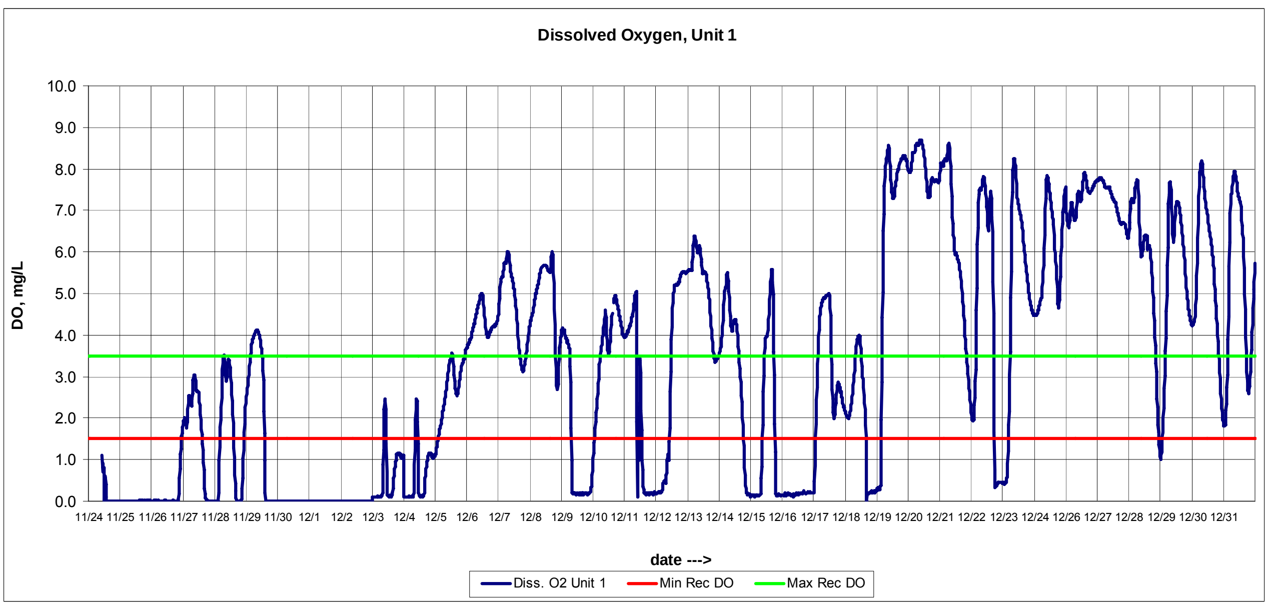


Figure G-16: Month-long histogram of Dissolved Oxygen in Aeration Train 2, Lickdale WWTP: Note that "ideal" operating range is delineated by the lines at 1.5 and 3.5 mg/L. (Some texts cite 2 and 4 mg/L.) Below 1.5 mg/L, anoxic conditions encourage the growth of filamentous organisms and increase the probability of bulking in clarifiers. Above 3.5 mg/L, there is an increase of floc-shearing, with resultant ashing of solids in clarifiers, and waste of energy, as DO levels above 3.5 are not necessary to treat wastewater.

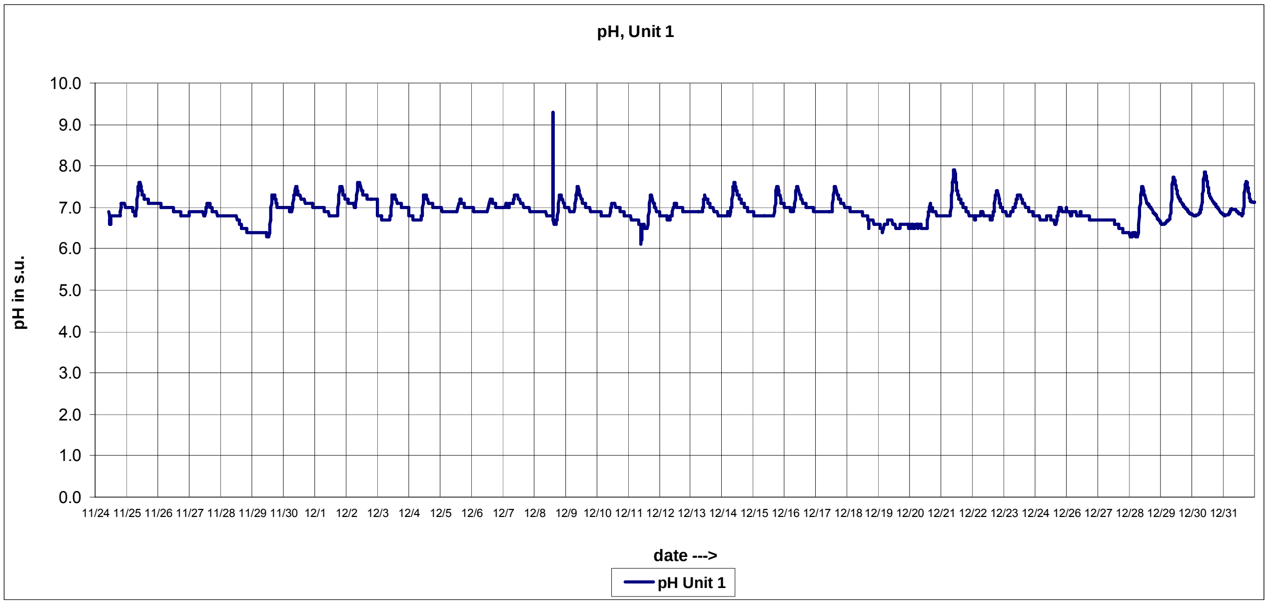


Figure G-17: December 2009 pH Histogram, Lickdale WWTP: This graph shows the pH changes that occurred almost daily as a result of lime addition and its buffering effect on the mixed liquor. One pH spike to above 9.3 is seen on 12/8, perhaps representing an industrial or commercial slug load. Dissolved oxygen and ORP both fell off rapidly in the hours following this pH spike, and nitrate formation dropped off almost to zero, indicating the whatever entered the plant had a deleterious effect on the biomass and stopped nitrification for several hours afterward.

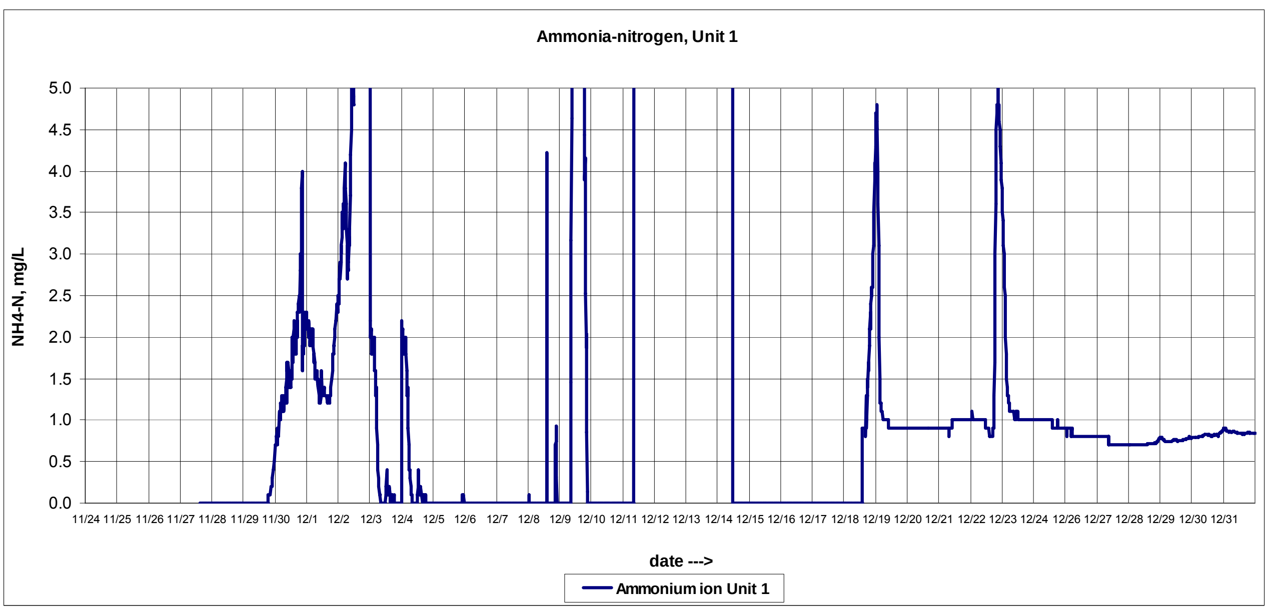


Figure G-18: Narrow-range histogram showing Ammonia-nitrogen in Lickdale WWTP, December 2009.

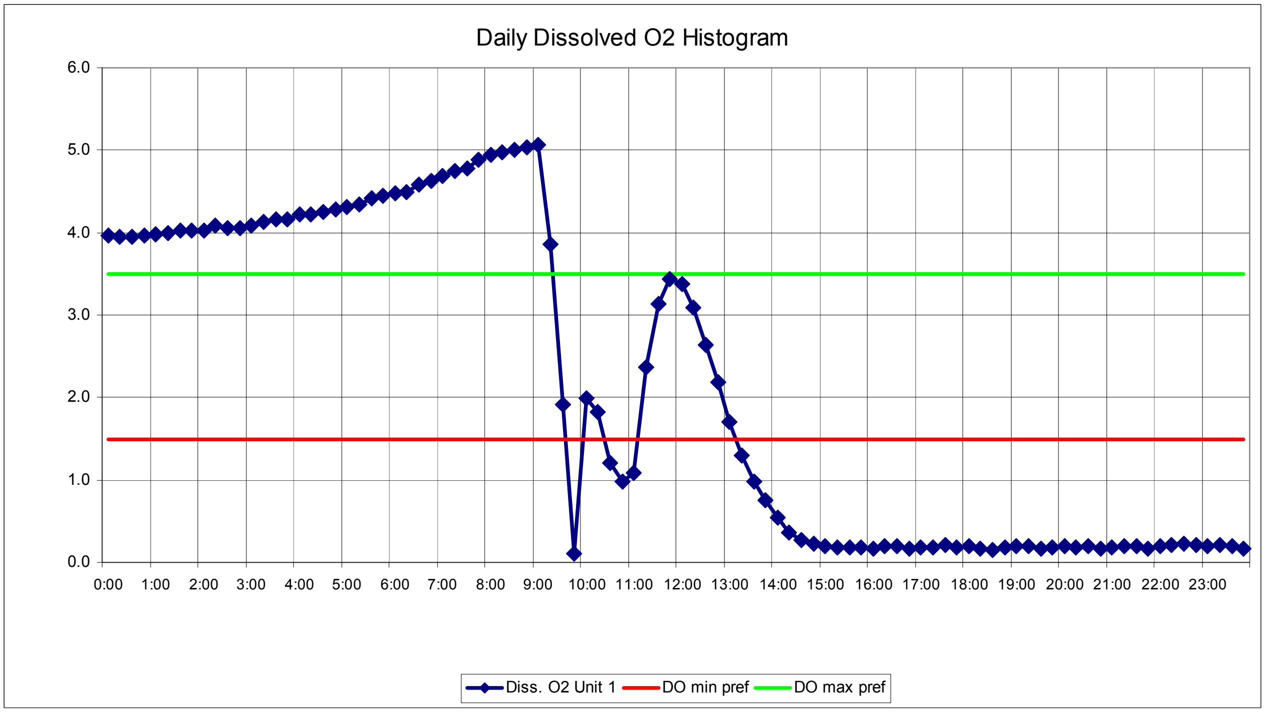


Figure G-19: Example slug load effect on plant dynamic, Dec. 11, 2009. This histogram and those that follow are examples of the daily continuous monitoring features offered by the digital probes. In particular, these histograms point to a sudden change in the character of the waste entering the facility on December 11, where a slug load caused rapid decline of DO and ORP and a corresponding loss of nitrification in response to the suppression of DO. It was not possible to characterize the waste load without a composite sampler running 24-7; however, these graphs suggest that the operators should increase their surveillance of the facility's loading and collection system in order to characterize the waste and, perhaps, set industrial pre-treatment requirements on offending users.

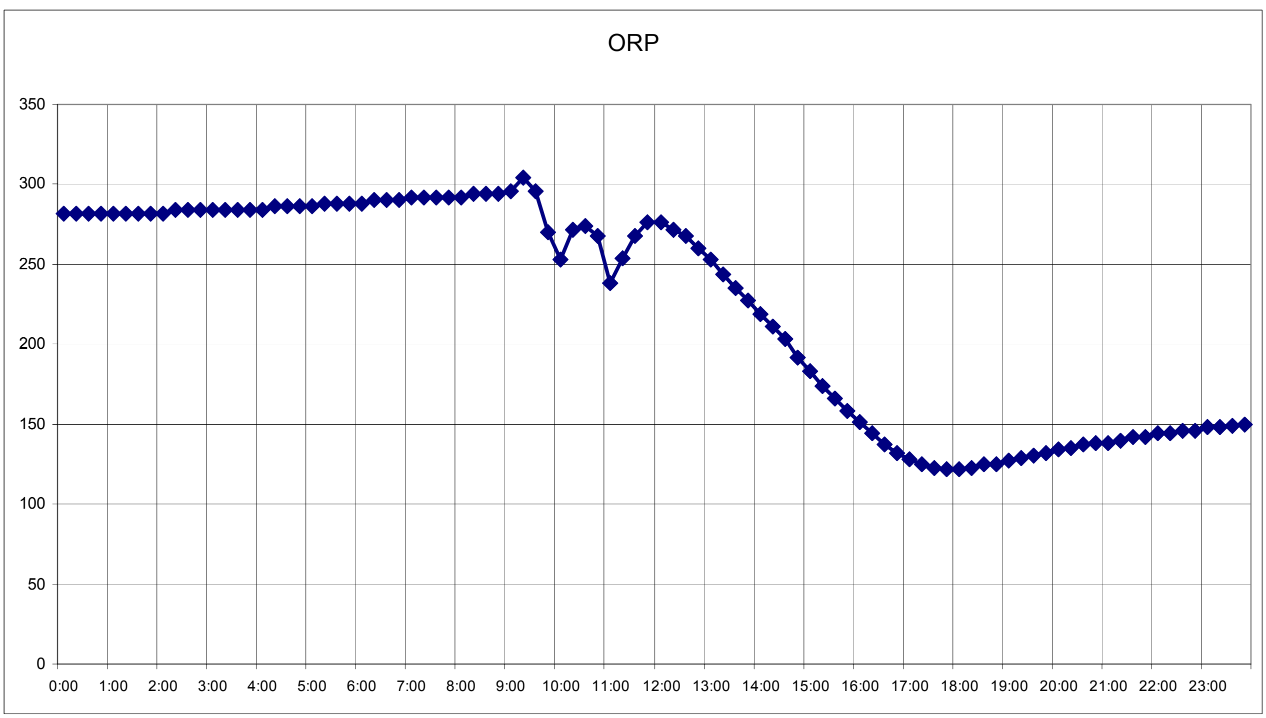


Figure G-20: Example slug load effect on plant dynamic, Dec. 11, 2009: OUR dropped with DO loss

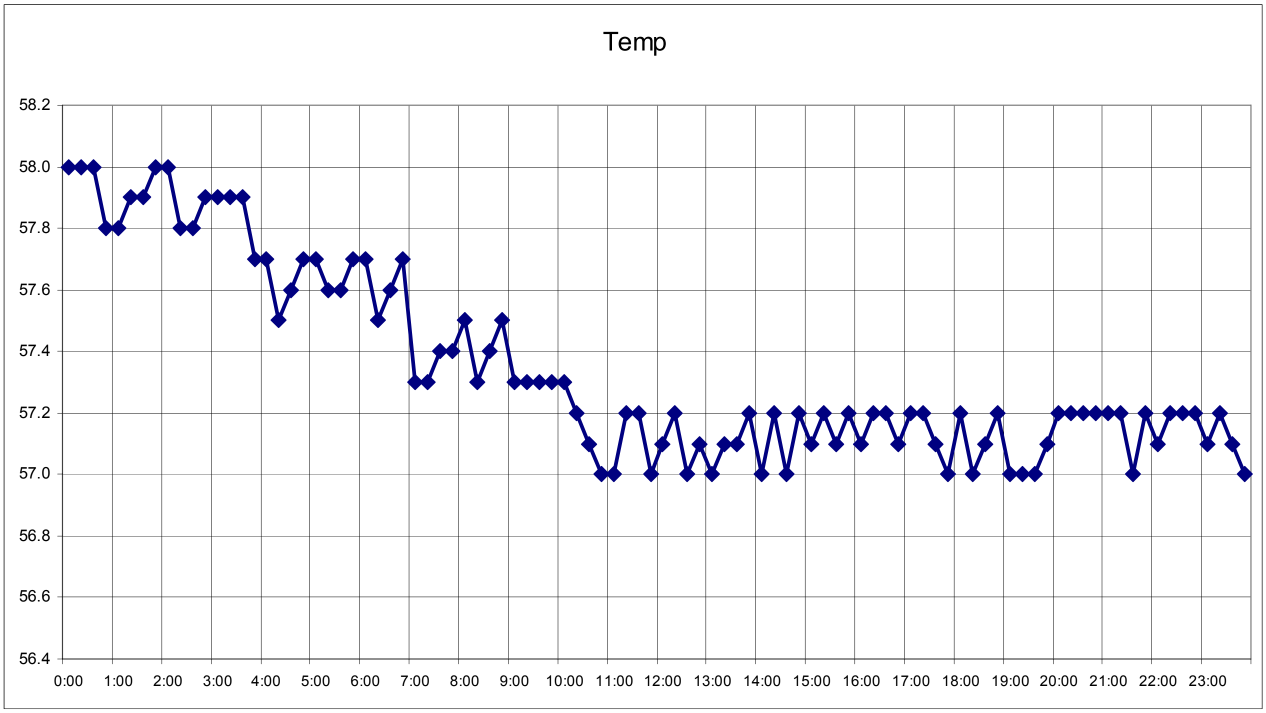


Figure G-21: Example slug load effect on plant dynamic, Dec. 11, 2009

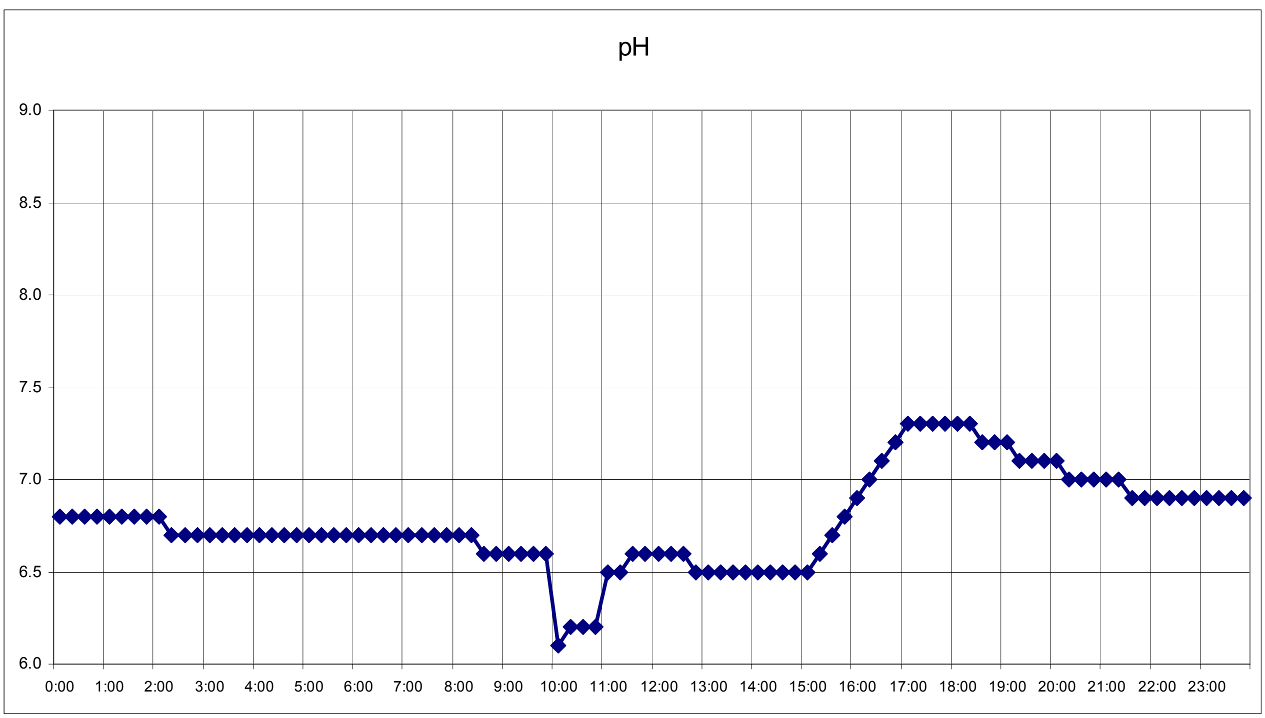


Figure G-22: Example slug load effect on plant dynamic, Dec. 11, 2009: pH drop at 10 AM suggested a slug load.

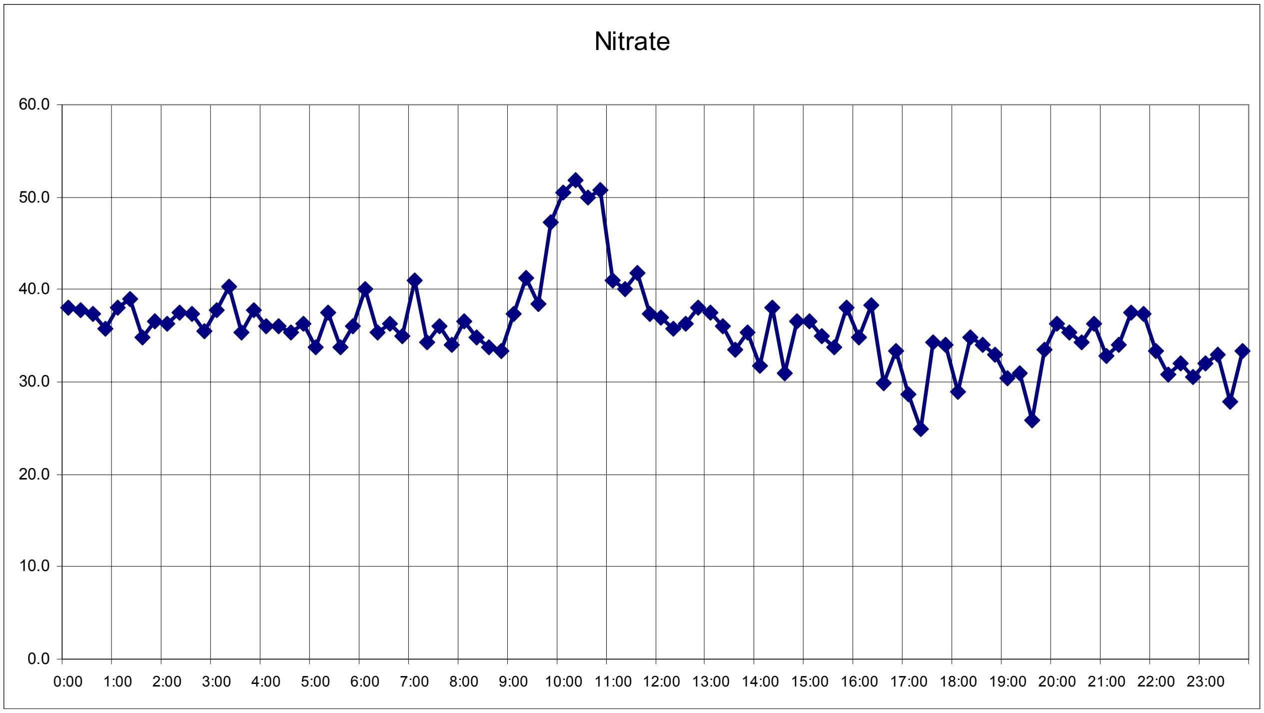


Figure G-23: Example slug load effect on plant dynamic, Dec. 11, 2009: More nitrate could have been in the waste stream.

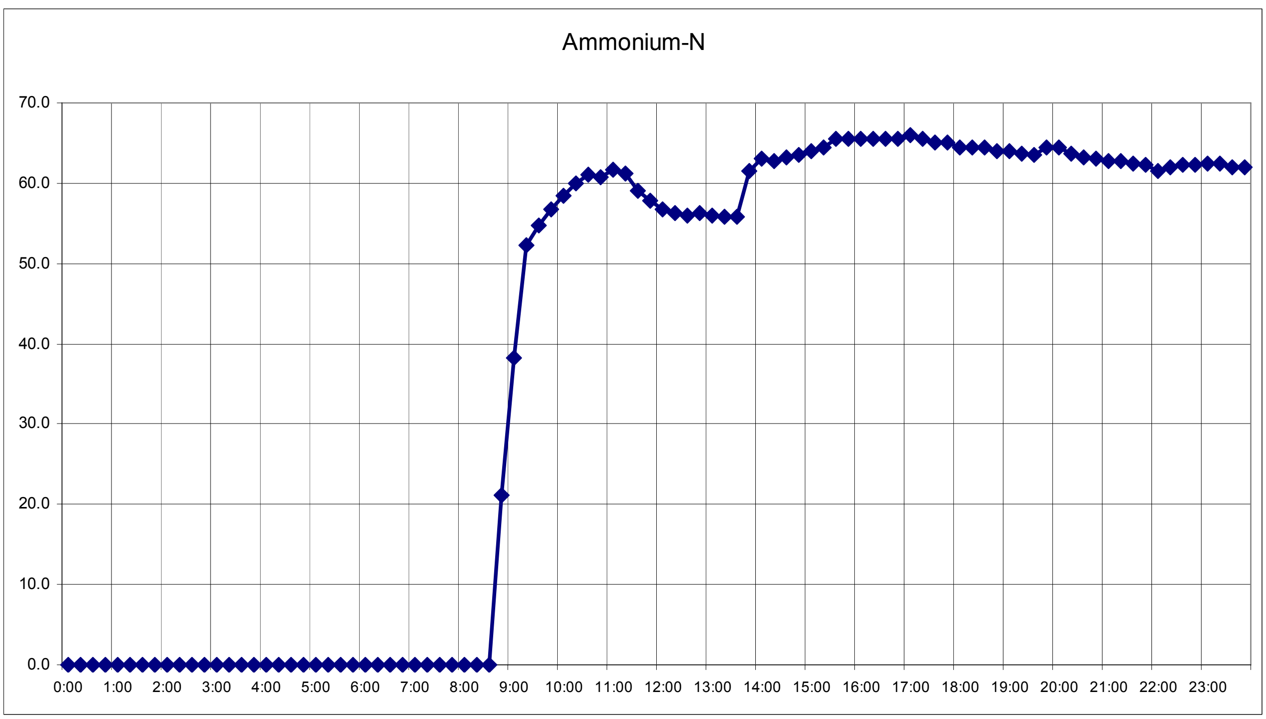


Figure G-24: Example slug load effect on plant dynamic, Dec. 11, 2009: NH3-N rose rapidly following loss of nitrification.

Attachment H—Pathogen Test Results (Method 1623)

Because process modifications were not possible to do without the financial participation of the owner's representative, and due to the lack of a second blower for the duration of on-site activities, only two Method 1623 assessments were performed.[8] The first, in October 2009, assessed downstream conditions on Forge Creek, approximately 120 meters upstream of its confluence with Swatara Creek. The second assessment sampled downstream conditions at or near the Swatara impoundment for the City of Lebanon's auxiliary water source.

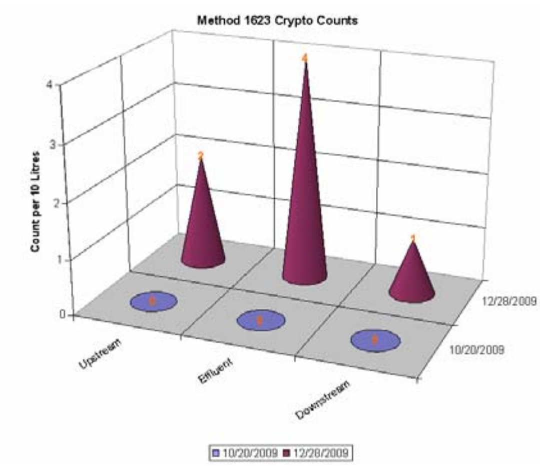


Figure H-1: *Cryptosporidium* oocyst counts

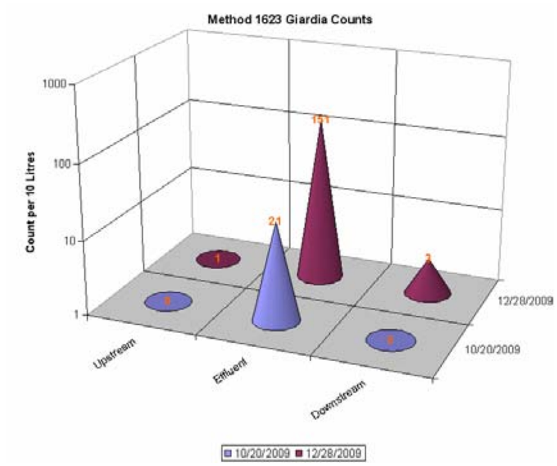


Figure H-2: *Giardia lamblia* cyst counts

DWS Sample	Date	Upstream		Effluent		Downstream	
		Giardia	Crypto	Giardia	Crypto	Giardia	Crypto
Forge Creek	10/20/2009	0	0	21	0	0	0
Swatara Creek	12/28/2009	1	2	151	4	3	1

Table H-1: Method 1623 Pathogen Test Results: Upstream samples both Forge Creek; Downstream as indicated.

[8] A third assessment would have been done if we had been able to experiment with process optimization using on/off aeration to promote denitrification.

Attachment I—Example Process Monitoring Sheets

Example WPPE Daily / Weekly Bench Data

Following are examples of the Example Bench Test Reports for Daily or Weekly Process Monitoring tests. The testing conducted while on-site during the WPPE consisted of three basic activated sludge test protocols, plus any other testing that was specific to the contact-stabilization mode of wastewater treatment.

11/13/2009

Union Township, Lebanon County, Authority STP Process Monitoring Data for
Friday, November 13, 2009

Raw WW	1338	mg/L COD	366	lb/day	BOD5 Analog = (grab, no dil.)	1793	mg/L	=	490 lb/day
Flow at no	0.0328	MGD							

Settleability:

	Unit 1	Unit 2
0	1000	1000
5	500	970
10	380	910
15	320	860
20	290	800
25	270	750
30	250	710
	245	690
40	240	670
	230	610
50	220	550
	220	515
60	220	480

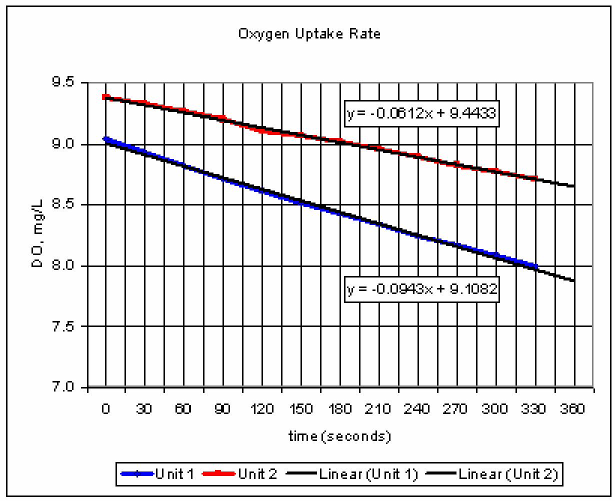
OUR

time	Unit 1 reading	Unit 2 reading
0	9.05	9.38
30	8.94	9.33
60	8.82	9.27
90	8.71	9.20
120	8.62	9.11
150	8.52	9.07
180	8.43	9.02
210	8.34	8.96
240	8.25	8.90
270	8.17	8.83
300	8.09	8.77
330	8.00	8.71
360		

		Unit 1	Unit 2
Manual	Slope	0.192	0.122
	OUR	11.52	7.32
Calculated using slope:			
	Slope2	0.0943	0.0612
	OUR	11.316	7.344

pH checks

INF	AT1	1RAS	
	7.3		
	AT2	**2 RAS**	**EFF**
	7.4		7.7



Parameter	Unit 1		Unit 2		Effluent	Digester
DO	5.97		6.9		9.49	0.3
pH	7.3		7.4		7.7	
Temp	17.8		18.7		16.4	14.2
SSV-30	250		710			
MLSS	3,444		3,220			
SVI	73		220			

Centrifuge solids by volume

INF	AT1		RAS1	AT2	2RAS	EFF
-	2.8		1.0	4.5	5.5	-

Settled Sludge Concentration

time	Unit 1	Unit 2
0	2.8	4.5
5	5.5	4.6
10	7.2	4.9
15	8.6	5.2
20	9.5	5.6
25	10.2	6.0
30	11.0	6.3
	11.2	6.5
40	11.5	6.7
	12.0	7.4
50	12.5	8.2
	12.5	8.7
60	12.5	9.4

Unit 1 Process Nutrients:		Dilution	Tube	Under/Ove	Unit 2 Process Nutrients:		Dilution	Tube	Under/Ove
TP	mg/L P	No dilution	HR	-	TP	mg/L P	No dilution	HR	-
NH3-N	mg/L N	No dilution	LR	-	NH3-N	mg/L N	No dilution	LR	-
NO3-N	mg/L N	No dilution	HR		NO3-N	mg/L N	No dilution	LR	-

Influent Nutrients:		Dilution	Tube	Under/Ove	Effluent Nutrients:		Dilution	Tube	Under/Ove
TP	mg/L P	No dilution	HR	-	TP	mg/L P	No dilution	HR	-
NH3-N	mg/L N	No dilution	ULR	-	NH3-N	mg/L N	No dilution	ULR	-
NO3-N	mg/L N	No dilution	LR		NO3-N	mg/L N	No dilution	LR	

Notes: Aeration Train 1 appears to have been overwasted, with low solids and more vigorous, young sludge activity in OUR. Note solids spins roughly half of AT2 side. Also, final settleability is higher, more evidence of young-sludge conditions. Recommend holding off on wasting this side for the next 2 days. DO levels high: maybe not enough food right now: only one blower in service.

Figure I-1: Example Daily Bench Sheet, Lickdale WWTP, 11/13/2009.

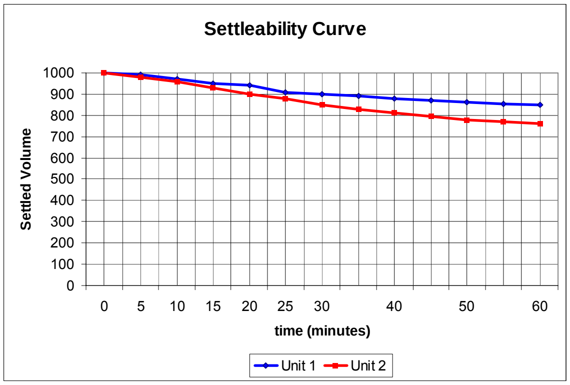


Figure I-2: Settleability Curve 11/13/2009

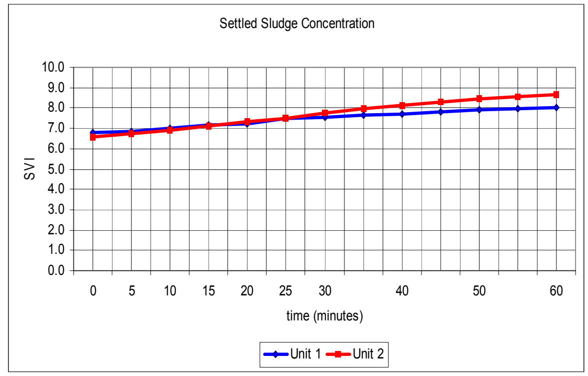


Figure I-3: Settled Sludge Concentration, 11/13/09

12/16/2009

Union Township, Lebanon County, Authority STP Process Monitoring Data for Wednesday, December 16, 2009

grab, no dil.
Raw WW 384 mg/L COD 114 lb/day BOD5 Analog = 372 mg/L = 111 lb/day
Flow: 0.036 MGD

Settleability:

	Unit 1	Unit 2
0	1000	1000
5	990	980
10	970	960
15	950	930
20	940	900
25	910	880
30	900	850
	890	830
40	880	810
	870	795
50	860	780
	855	770
60	850	760

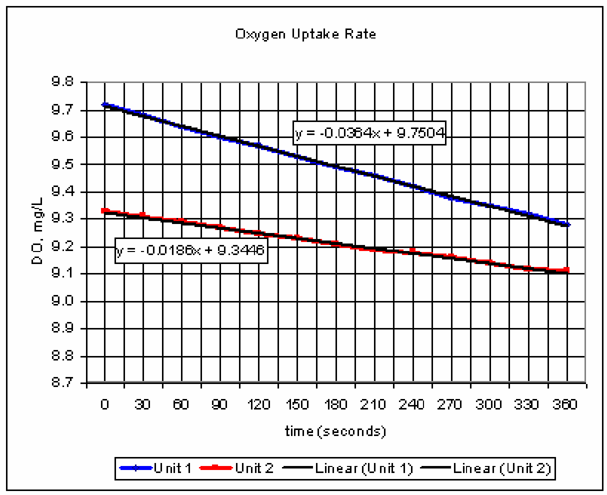
-21.84

OUR

time	Unit 1 reading	Unit 2 reading
0	9.72	9.33
30	9.68	9.31
60	9.64	9.29
90	9.60	9.27
120	9.57	9.25
150	9.53	9.23
180	9.49	9.21
210	9.46	9.19
240	9.42	9.18
270	9.38	9.16
300	9.35	9.14
330	9.32	9.12
360	9.28	9.11
Manual Slope	0.074	0.038
OUR	4.44	2.28
Calculated using slope:		
Slope2	0.0372	0.0186
OUR	4.464	2.232

pH checks

INF	AT1	1RAS
8.4	7.3	
	AT2	**2 RAS**	**EFF**
	7.2		7.3



Parameter	Unit 1		Unit 2		Effluent	Digester
DO	0.17		0.22		9.4	
pH	7.3		7.2		7.3	
Temp	14.6		14.5		14.4	
SSV-30	900		850			
MLSS	3,500		3,400			
SVI	257		250			

Centrifuge solids by volume

INF	AT1		RAS1	AT2		2RAS	EFF
-	6.8		7.0	6.6		7.2	

Settled Sludge Concentration

time	Unit 1	Unit 2
0	6.8	6.6
5	6.9	6.7
10	7.0	6.9
15	7.2	7.1
20	7.2	7.3
25	7.5	7.5
30	7.6	7.8
	7.6	8.0
40	7.7	8.1
	7.8	8.3
50	7.9	8.5
	8.0	8.6
60	8.0	8.7

Unit 1 Process Nutrients:			Dilution	Tube	Under/Ove
TP	6.342	mg/L P	No dilution	HR	-
NH3-N	0.7	mg/L N	No dilution	LR	-
NO3-N	46.3	mg/L N	No dilution	HR	-

Unit 2 Process Nutrients:			Dilution	Tube	Under/Ove
TP		mg/L P	No dilution	HR	-
NH3-N		mg/L N	No dilution	LR	-
NO3-N		mg/L N	No dilution	LR	-

Influent Nutrients:			Dilution	Tube	Under/Ove
TP	11.21	mg/L P	No dilution	HR	-
NH3-N	0.06	mg/L N	No dilution	ULR	-
NO3-N	34.7	mg/L N	No dilution	LR	-

Effluent Nutrients:			Dilution	Tube	Under/Ove
TP	0.28	mg/L P	No dilution	HR	-
NH3-N	0.06	mg/L N	No dilution	ULR	-
NO3-N	34.7	mg/L N	No dilution	LR	-

Notes: No wasting during the period because the wasting pump is down. Log notes digester is being decanted. Settleability is lousy right now, probably because solids are high, bulky.

Blue numbers are entered
Red numbers are calculated

Figure I-1: Example Daily Bench Sheet, Lickdale WWTP, 12/16/2009.

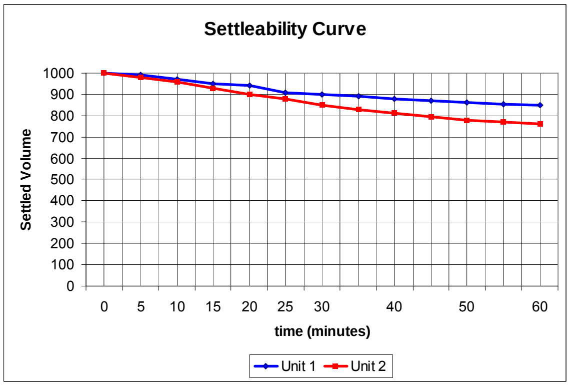


Figure I-2: Settleability Curve 12/16/2009

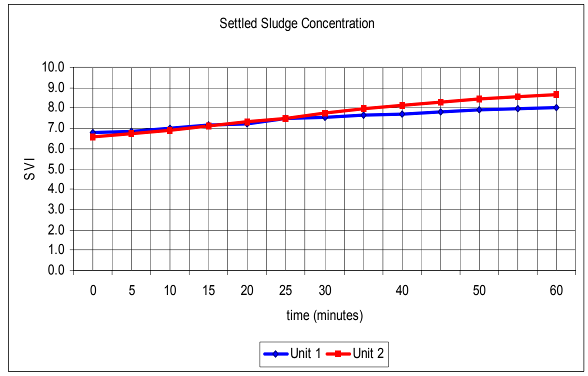


Figure I-3: Settled Sludge Concentration, 12/16/09

12/28/2009

Union Township, Lebanon County, Authority STP Process Monitoring Data for grab, no dil.
Monday, December 28, 2009

Raw WW 565 mg/L COD 129 lb/day BOD5 Analog = 548 mg/L = 125 lb

Flow: 0.0274 MGD

Settleability:

	Unit 1	Unit 2
0	1000	1000
5	910	720
10	660	500
15	620	460
20	530	400
25	490	370
30	440	330
	410	315
40	380	300
	365	285
50	350	270
	345	265
60	340	260

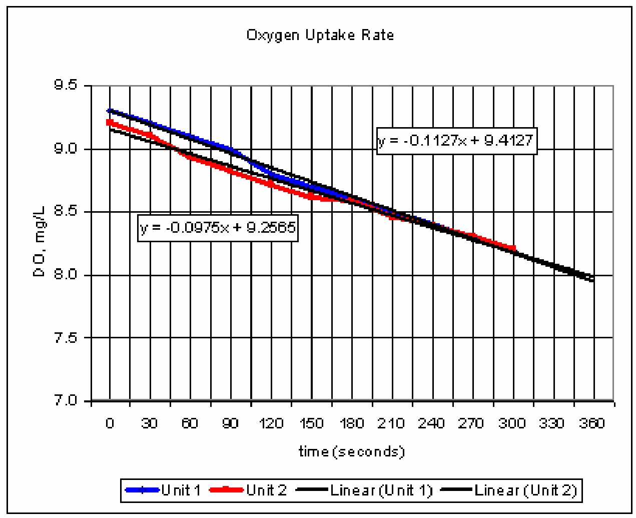
OUR

time	Unit 1 reading	Unit 2 reading
0	9.30	9.21
30	9.20	9.11
60	9.10	8.94
90	9.00	8.83
120	8.80	8.72
150	8.70	8.62
180	8.60	8.59
210	8.50	8.46
240	8.40	8.39
270	8.30	8.31
300	8.20	8.21
330		
360		

		Unit 1	Unit 2
Manual	Slope	0.22	0.2
	OUR	13.2	12
	Calculated using slope:		
	Slope2	0.1127	0.0975
	OUR	13.524	11.7

pH checks

INF	AT1	1RAS	
7.5	7.4		
	7.6		7.3



Parameter	Unit 1		Unit 2		Effluent	Digester
DO	6.4		7.2		9.35	
pH	7.4		7.6		7.3	
Temp						
SSV-30	440		330			
MLSS	2,598		2,008			
SVI	169		164			

Centrifuge solids by volume

INF	AT1		RAS1	AT2	2RAS	EFF
0.2	3.10		2.35	2.6	1.92	

Settled Sludge Concentration

time	Unit 1	Unit 2
0	3.1	2.6
5	3.4	3.6
10	4.7	5.2
15	5.0	5.7
20	5.8	6.5
25	6.3	7.0
30	7.0	7.9
	7.6	8.3
40	8.2	8.7
	8.5	9.1
50	8.9	9.6
	9.0	9.8
60	9.1	10.0

Unit 1 Process Nutrients:			Dilution	Tube	Under/Over
TP	4.6	mg/L P	No dilution	HR	-
NH3-N	0.31	mg/L N	No dilution	LR	-
NO3-N	35.7	mg/L N	No dilution	HR	-

Unit 2 Process Nutrients:			Dilution	Tube	Under/Over
TP		mg/L P	No dilution	HR	fail
NH3-N	0.604	mg/L N	No dilution	LR	-
NO3-N	42.7	mg/L N	No dilution	LR	-

Influent Nutrients:			Dilution	Tube	Under/Over
TP	9.81	mg/L P	No dilution	HR	-
NH3-N	58	mg/L N	No dilution	ULR	-
NO3-N	0	mg/L N	No dilution	LR	-

Effluent Nutrients:			Dilution	Tube	Under/Over
TP	0.16	mg/L P	No dilution	HR	-
NH3-N	0.06	mg/L N	No dilution	ULR	-
NO3-N	43.2	mg/L N	No dilution	LR	-

Notes:

Blue numbers are entered
Red numbers are calculated

Figure I-1: Example Daily Bench Sheet, Lickdale WWTP, 12/28/2009.

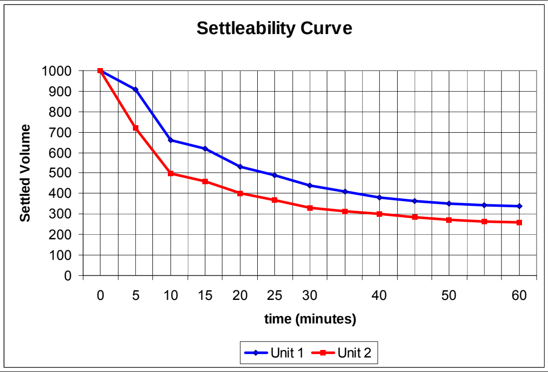
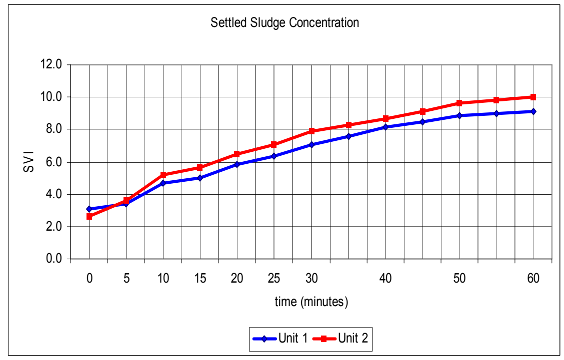
	

Figure I-2: Settleability Curve 12/28/2009	**Figure I**-3: Settled Sludge Concentration, 12/28/09

Attachment J—Tables of Sample Data from Bureau of Labs Testing

Union Township, Lebanon County, Authority: October 2009 through January 2010:

Sample	178	183	181	198	208	217	226	236				
Date	10/20/09	12/01/09	12/08/09	12/14/09	12/21/10	12/28/10	01/06/10	1/12/10				
Time	11:30	11:10	10:38	11:46	08:60	12:30	0.42361111	10:52				
Locus	INF	INF	INF	INF	INF	INF	INF	INF				
Acc No.	I2009036667	I2009041268	I2009041832	I2009042846	I2009043724	I2009044043	I2010000178	I2010000746	Average	Max	Min	Std. Dev.
BOD	264.00	490.00	327.00	386.00	388.00	462.00	386.00	413.00	388.1	490.0	264.0	72.8
COD	336.8	704.0	327.6	424.2	289.7	344.7	474.2	260.7	386.1	704.0	260.7	143.0
pH	7.7	7.7	7.6	7.8	7.8	7.6	7.7	7.7	7.8	7.7	7.6	0.1
ALK.	366.8	377.4	340.2	318.8	289.8	286.8	304.8	317.8	326.3	377.4	286.8	29.2
TDS						470	472	660	600.7	660.0	470.0	61.4
TSS	112	468	364	640	666	444	408	400	409.8	666.0	112.0	187.6
VSS						414	342	338	364.7	414.0	338.0	42.8
%Volatile						93%	84%	86%	0.9	0.9	0.8	0.1
NH3-N	81.1		73.79	68.79	67.26	68.78	66.65	69.30	70.8	81.1	68.8	10.0
NO2-N	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01				
NO3-N	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04	<0.04				
TKN	80.39	n/t	98.49	80.68	86.2	84.8	84.19	87.02	87.2	98.6	80.4	6.8
Phos	9.261	12.109	9.94	11.867	12.782	9.81	10.438	10.884	10.9	12.8	9.3	1.3
Chloride	96.2	93.6	86.6	108.9	96.3	181.8	113.8	169.9	118.1	181.8	86.6	38.9

Sample	179	184	182	200	209	218	227	236				
Date	10/20/09	12/01/09	12/08/09	12/14/09	12/21/10	12/28/10	01/06/10	1/12/10				
Time	11:42	12:00	0	11:56	08:68	11:40	10:20	11:40				
Locus	EFF	EFF	EFF	EFF	EFF	EFF	EFF	EFF				
Acc No.	I2009036668	I2009041270	I2009041833	I2009042848	I2009043726	I2009044044	I2010000179	I2010000747	Average	Max	Min	Std. Dev.
CBOD	1.30	2.00	1.90	2.10	6.30	1.80	6.00	4.70	3.1	6.3	1.3	1.9
pH	7.9	7.8	7.8	7.9	7.6	7.6	7.7	7.9	7.8	7.9	7.6	0.2
ALK.	81.2	172.8	123.8	167	83	40.2	304.8	146.6	139.8	304.8	40.2	80.9
TDS				762	738	760	824	848	784.4	848.0	738.0	48.6
TSS	6	<6	<6	<6	28	<6	8	6	11.0	28.0	6.0	10.1
VSS	10	<6	<6	<6	8	<6	14	12	11.0	14.0	8.0	2.6
%Volatile					31%							
NH3-N	0.08	6.30	0.11	0.06	0.09	0.07	0.1	0.06	0.9	6.3	0.1	2.2
NO2-N	0.02	0.42	0.01	0.02	0.04	0.01	0.23	0.03	0.1	0.4	0.0	0.1
NO3-N	40.62	47.04	42.47	41.18	43.78	42.88	48.69	36.98	42.9	48.6	37.0	3.7
TKN	1.4	6.89	1.4	1.24	2.77	1.21	1.73	1.69	2.3	6.9	1.2	1.9
Phos	0.324	0.698	0.306	0.281	1.077	0.144	0.430	0.331	0.4	1.1	0.1	0.3
Chloride	109.3	130.9	2,069.3	144.7	167.7	246.8	171.3	424.7	431.8	2069.3	109.3	669.3
Bio#	B2009012891	B20090136869	B20090141211	B20090142774	B200901448	B200906222-	B2010000083	B2010000203	Average	Max	Min	Std. Dev.
Loc.	EFF	EFF	EFF	EFF	EFF	EFF	EFF	EFF	GeoMean			
TC	780	100	300	200	1,300	100	1,700	600	397			
FC	40	<10	<20	40	120	40	110	20	61			

Sample	182	186	193	201	210	219	228	237				
Date	10/20/09	12/01/09	12/08/09	12/14/09	12/21/10	12/28/10	01/06/10	1/12/10				
Time	13:10	12:20	11:00	11:60	10:10	12:00	0.43263889	11:58				
Locus	UPS	UPS	UPS	UPS	UPS	UPS	UPS	UPS				
Acc No.	I2009036680	I2009041271	I2009041834	I2009042847	I2009043728	I2009044046	I2010000180	I2010000748	Average	Max	Min	Std. Dev.
BOD	0.70	0.60	0.80	0.70	1.20	0.90	1.10	0.70	0.83	1.20	0.60	0.23
pH	7.9	7.8	7.7	7.6	7.8	7.7	7.7	7.9	7.78	7.90	7.60	0.11
ALK.	69.4	68.8	62.4	47.4	44.2	46.8	40.2	38.2	49.66	69.40	38.20	10.36
TDS					144	166	160	138	149.60	166.00	138.00	12.04
TSS	<6	<6	<6	6	<6	<6	<6	<6				
VSS	26	<6	<6	<6	<6	6	8	6	11.60	26.00	6.00	8.71
NH3-N	0.04	<0.02	0.04	0.06	<0.02	<0.02	0.01	<0.02	0.04	0.06	0.01	0.02
NO2-N	<0.01	0.01	0.01	0.01	<0.01	<0.01	1.09	0.01	0.23	1.09	0.01	0.48
NO3-N	1.92	1.61	1.90	1.7	1.37	1.84	<0.02	0.72	1.68	1.92	0.72	0.43
TKN	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00				
Phos	0.017	0.013	0.020	0.064	0.016	0.030	0.018	0.016	0.02	0.06	0.01	0.01
Chloride	17.9	16.1	14.0	22.6	26.3	31.2	27.3	20.4	21.86	31.20	14.00	6.12
Bio#	B2009012884	B2009013867	B2009014108	B2009014268	B200901447	B200901464	B2010000076	B2010000186	GeoMean	Max	Min	Std. Dev.
Loc.	UPS	UPS	UPS	UPS	UPS	UPS	UPS	UPS				
TC	700	300	300	8,000	800	600	300	400	642	8,000	300	2,684
FC	360	200	220	600	80	100	120	28	161	600	28	187

Sample	183	188	194	202	211	220	229	238				
Date	10/20/09	12/01/09	12/08/09	12/14/09	12/21/10	12/28/10	01/06/10	1/12/10				
Time	14:40	14:43	16:46	14:36	11:18	16:06	14:26	10:08				
Locus	DWS	DWS	DWS	DWS	DWS	DWS	DWS	DWS				
Acc No.	I2009036682	I2009041272	I2009041836	I2009042848	I2009043727	I2009044048	I2010000181	I2010000749	Average	Max	Min	Std. Dev.
BOD	0.70	0.60	1.00	0.30	0.60	1.10	0.90	0.60	0.69	1.10	0.30	0.29
pH	7.9	7.3	7.2	7.2	7.3	7.3	7.4	7.3	7.36	7.90	7.20	0.23
ALK.	86.8	13.6	16.8	18.2	16.6	18	20.4	17.6	26.13	86.80	13.60	24.69
TDS					78	80	86	108	82.60	108.00	76.00	13.30
TSS	<6	<6	<6	6	<6	6	<6	<6	6.00	6.00	6.00	0.00
VSS	<6	<6	<6	<6	<6	8	<6	8	8.00	8.00	8.00	0.00
NH3-N	0.02	<0.02	0.03	0.06	0.03	0.03	<0.02	0.02	0.03	0.06	0.02	0.01
NO2-N	<0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.01	0.01	0.00
NO3-N	2.92	0.96	1.28	1.37	1.16	1.69	1.18	1.02	1.44	2.92	0.96	0.64
TKN	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00				
Phos	0.032	<0.01	0.018	0.031	0.019	0.02	0.018	0.017	0.02	0.03	0.01	0.01
Chloride	28.80	8.60	9.70	16.10	12.90	16.70	16.60	14.6	16.36	28.80	8.60	6.21
Bio#	B2009012886	B2009013868	B2009014109	B2009014270	B200901448	B200901464	B2010000077	B2010000188	GeoMean	Max	Min	Std. Dev.
Loc.	DWS	DWS	DWS	DWS	DWS	DWS	DWS	DWS				
TC	1,000	300	200	20,000	200	300	200	200	481	20,000	200	6,966
FC	280	20	160	630	20	60	<20	100	86	630	20	218

Table J-1: Influent, Effluent, Background, & Impacted Sample Results, items in red denote below detection limit results.

Union Township, Lebanon County, Authority: October 2009 through January 2010:

Sample		187	196	203	212	221	230	243				
Date		12/01/09	12/08/09	12/14/09	12/21/10	12/28/10	01/06/10	1/12/10				
Time		11:23	0	12:16	10:28	12:53	10:30	12:37				
Locus		ML1	ML1	ML1	ML1	ML1	ML1	ML1				
Acc No.		I2008041273	I20080 41936	I2008042848	I20080 43728	I2 008044047	I20 10000 182	I20 100 00754	Average	Max	Min	Std. Dev.
pH		7.2	7.1	7.4	7.4	7.4	7.2	7.2	7.3	7.4	7.1	0.1
ALK.		278	220	413	331.6	312.8	191.8	256.2	286.2	413.0	191.8	74.3
TSS		3,444	3,584	3,436	2,536	2,698	2,280	2,594	2923.1	3584.0	2280.0	533.8
VSS		2,486	2,602	2,612	1,864	1,984	1,760	2,124	2200.3	2612.0	1760.0	386.8
%Volatile		72%	73%	76%	73%	76%	76%	82%	0.8	0.8	0.7	0.0
NH3-N			0.40	0.43	0.64	0.31	0.28	0.29	0.4	0.6	0.3	0.1
NO2-N		0.42	0.08	0.11	0.48	0.26	2.01	0.18	0.6	2.0	0.1	0.7
NO3-N		34.76	37.59	32.41	40.65	36.7	38.68	23.38	34.6	40.7	23.4	5.6
Chloride			128.60	166.00	186.40	180.10	180.00	214.4	177.6	214.4	128.6	28.5

Sample		188	196	204	213	223	231	240				
Date		12/01/09	12/08/09	12/14/09	12/21/10	12/28/10	01/06/10	1/12/10				
Time		11:28	11:38	12:21	10:34	12:58	10:40	12:48				
Locus		RS1	RS1	RS1	RS1	RS1	RS1	RS1				
Acc No.		I2008041275	I20080 41937	I2008042860	I20080 43729	I2 008044049	I20 10000 183	I20 100 00761	Average	Max	Min	Std. Dev.
TSS		3,940	3,272	3,958	1,840	1,820	998	2,700	2,647	3,958	998	1,143
VSS		3,224	2,468	2,928	1,368	1,414	804	1,822	2,001	3,224	804	893
%Volatile		82%	75%	74%	74%	78%	81%	67%	76%	82%	67%	5%

Sample	181	189	197	205	214	222	232	241				
Date	10/20/09	12/01/09	12/08/09	12/14/09	12/21/10	12/28/10	01/06/10	1/12/10				
Time	12:56	11:24	11:45	12:19	10:42	12:48	10:28	12:41				
Locus	ML2	ML2	ML2	ML2	ML2	ML2	ML2	ML2				
Acc No.	I2008038660	I2008041274	I20080 41938	I2008042861	I20080 43730	I2 008044048	I20 10000 184	I20 100 00762	Average	Max	Min	Std. Dev.
pH	7.2	7.1	7.1	7.4	7.4	7.6	7.2	7.1	7.3	7.6	7.1	0.2
ALK.	238.8	231.6	226.2	436.8	384.6	284	162.4	187.6	267.8	436.8	162.4	96.9
TSS	3,844	3,220	3,288	3,376	3,368	2,008	1,770	2,100	2,847	3,844	1,770	760
VSS	2,608	2,388	2,780	2,916	2,608	1,618	1,438	1,768	2,263	2,916	1,438	565
%Volatile	68%	74%	85%	86%	77%	81%	81%	84%	80%	86%	68%	6%
NH3-N	0.38	0.27	0.32	0.28	0.37	0.23	0.26	0.34	0.31	0.38	0.23	0.06
NO2-N	0.06	0.09	0.08	0.16	0.46	0.04	1.98	0.22	0.39	1.98	0.04	0.66
NO3-N	26.89	42.91	26.69	28.36	31	37.84	41.04	30.97	32.81	42.91	26.69	6.83
Chloride	106.6	137.6	128.2	173.9	176.8	191.4	183.5	240.2	164.83	240.20	106.60	41.61

Sample	180	190	198	206	215	224	233	242				
Date	10/20/09	12/01/09	12/08/09	12/14/09	12/21/10	12/28/10	01/06/10	1/12/10				
Time	12:50	11:20	11:33	12:24	10:48	13:04	10:44	12:46				
Locus	RS2	RS2	RS2	RS2	RS2	RS2	RS2	RS2				
Acc No.	I2008038659	I2008041276	I20080 41939	I2008042862	I20080 43731	I2 008044050	I20 10000 186	I20 100 00763	Average	Max	Min	Std. Dev.
TSS	4,970	3,296	3,632	4,600	3,596	1,418	578	1,806	2,987	4,970	578	1,546
VSS	3,008	2,420	2,960	3,640	2,784	1,134	444	1,488	2,222	3,640	444	1,087
%Volatile	61%	73%	81%	79%	77%	80%	77%	78%	76%	81%	61%	7%

Sample	207	216	225	234	239				
Date	12/14/09	12/21/10	12/28/10	01/06/10	1/12/10				
Time	12:30	10:50	13:06	10:36	12:50				
Locus	CL1	CL1	CL1	CL1	CL1				
Acc No.	I20080 42863	2008043732	2008044051	2010000188	I20 10000760	Average	Max	Min	Std. Dev.
BOD	1.4	2.80	2.20	4.40	4.30	3.02	4.40	1.40	1.31
pH	7.8	8	7.9	7.2	7.4	7.66	8.00	7.20	0.34
ALK.	293	227	177.2	94.4	141.6	186.64	293.00	94.40	76.76
TDS	864	900	858	780	834	846.80	900.00	780.00	44.38
TSS	<5	7	<5	8	7	7.33	8.00	7.00	0.58
VSS	<5	<5	6	12	8	8.67	12.00	6.00	3.06
NH3-N	<0.02	0.03	0.03	0.03	0.02	0.03	0.03	0.02	0.01
NO2-N	0.01	0.01	0.01	0.02	0.01	0.01	0.02	0.01	0.00
NO3-N	38.53	48.65	44.96	48.66	38.75	43.11	48.66	38.53	5.10
TKN	1.41	2.06	1.49	1.48	1.72	1.63	2.06	1.41	0.27
Phos	0.64	0.494	0.266	0.392	0.267	0.39	0.64	0.27	0.13
Chloride	138	148.6	189.8	183.2	216.5	171.18	216.50	138.00	31.89
Bio #		B2008014276	2008014484						
Loc.		CL1	CL1			Geo Mean	Max	Min	Std. Dev.
TC		6000	140,000			28,983	140,000	6,000	84,762
FC		760	11,000			2,872	11,000	760	7,248

Sample	245
Date	1/12/10
Time	12:58
Locus	CL2
Acc No.	I2010000767
BOD	3.90
pH	7.3
ALK.	106.2
TDS	834
TSS	8
VSS	<5
NH3-N	<0.02
NO2-N	0.01
NO3-N	39.87
TKN	1.82
Phos	0.267
Chloride	240.4

Sample	244
Date	1/12/10
Time	12:53
Locus	MS1
Acc No.	I2010000766
BOD	
pH	
ALK.	
TDS	
TSS	
VSS	
NH3-N	<0.02
NO2-N	0.04
NO3-N	38.98
TKN	1.47
Phos	0.223
Chloride	
TN	39.77

Sample	246
Date	1/12/10
Time	12:54
Locus	MS2
Acc No.	I2010000768
BOD	
pH	
ALK.	
TDS	
TSS	
VSS	
NH3-N	<0.02
NO2-N	0.04
NO3-N	39.38
TKN	1.34
Phos	0.342
Chloride	
TN	42.62

Table J-2: Aeration Tank Mixed Liquor, Clarifier Supernate Sample Results

Attachment K—Recommended Process Control Tests, Observations, Calculations

Operator Sample collection guidelines Plant Flow: Less than 1.0 MGD

Sample Parameter	Sample Location	Sample Type	3/Week	1/Week	2/Month
Raw Influent *					
BOD5 and TSS	Influent	Grab			x
Alkalinity	Influent	Grab			x
COD	Influent	Grab			x
NH3-N	Influent	Grab			x
pH	Influent	Grab		x	
Flow	As permitted	Totalizer	Daily		
* Frequency of sampling may need to be increased or decreased depending on plant size or conditions					
Aeration Basin					
MLSS / MLVSS	Aeration Tank	Grab			x
Centrifuge Testing	Aeration Tank	Grab		x	
Dissolved Oxygen	Aeration Tank	In Situ		x	
Settleability (SV30)	Aeration Tank	Grab	x		
pH	Aeration Tank	Grab		x	
Microscopic Evaluation	Aeration Tank	Grab			x
Return Activated Sludge, SS	RAS line	Grab			x
Computation of SVI, F/M, sludge age, and/or MCRT	-	-	As data collected		
Secondary Clarifier					
Sludge blanket depth	As appropriate	In situ		x	
Waste Activated Sludge, SS and VSS	Waste Line	Grab			X
Final Effluent					
Alkalinity	Effluent	Grab			x
Parameters, sample types, and frequencies required by permit					
Modified from its original version					
Reference: Texas Commission on Environmental Quality, Guidance Document RG-002(Revised), October 2002					

Table M-1: Suggested sampling frequencies

Discussion of Process Monitoring and Control:

For this size of a treatment plant, though, we suggest that the battery of process monitoring tests be performed more frequently than once per week. Ideally, tests are done three times per week (Settleometry, Centrifuge, Water Chemistry, and Microscopy) at least until the operators have a 4-season set of reference data to which they may refer in future years. Whenever process or treatment methods change, the test data set would need to be reproduced. Also, whenever the facility experiences plant upset conditions, we recommend more frequent process monitoring and control testing be performed by the operators.

This testing is not the same as those performed by contract laboratories. Those tests are considered “compliance testing” and refer only to the need for the facility to report parameters required by the NPDES permit. Over the years, many small treatment facilities began to contract compliance testing to certified environmental laboratories. This eased the burden on operators, and it saved the facility owner the cost of maintaining certification of its own laboratory. However, over time, many facilities ceased to perform regular process monitoring tests, as well. Our position has been that it is important for operators to know the condition of their facilities and where and what are the qualities of the treatment solids (quality and quantity of "bugs.")

Thus we have adopted the process monitoring tests recommended by US-EPA and the professional trade organization, Water Environment Federation (WEF.) These tests include the following:
Solids Inventory:

- Centrifuge solids test: percent volume/volume measurement of activated sludge solids for activated sludge-type plants: Calculations stemming from this data include solids inventory (expressed as "sludge units" (SLU).)
- Clarifier blanket level: a core-sampling of the clarifier contents provides a proportional quantity of mixed liquor and supernatant that can be used for developing awareness of how much mixed liquor is detained in the effluent clarifier, representing part of the overall sludge inventory.
- Settleometry test: 30- and 60- minute activated sludge settling rates in wide half-gallon or 1-liter, calibrated vessels: Settled sludge volume (SSV) is expressed in standard 30-minute intervals and used to calculate Settled Sludge Concentration (SSC) which is a qualitative measure of how well the activated sludge settles in the clarifier, mimicking clarifier performance in terms of supernatant quality as well.
- Oxygen Uptake Rate (a.k.a. Soluble Oxygen Uptake Rate): By measuring the rate of dissolved oxygen depletion in a sample of mixed liquor, one may demonstrate the relative effect of BOD loading on the biomass, how quickly this material will be metabolized by the activated sludge organisms. Expressed in "milligrams Oxygen per hour," when mixed liquor volatile suspended solids concentration is known or can be extrapolated, then one may determine the actual Respiration Rate, in mg. Oxygen per hour per gram of activated sludge. OUR and RR are also useful for comparing the relative health of the biomass under toxic conditions, should there be undesirable contaminants in the raw wastewater, or anoxic conditions, should the aeration be insufficient to treat the incoming waste load using the available amount of oxygen.
- Raw Wastewater and Effluent Chemical Oxygen Demand (COD): an analog of the 5-day Biochemical Oxygen Demand test, COD can be determined in about three hours and give operators a quick assessment of relative strength of wastewater and/or the amount of material remaining in treated effluent, thereby providing an analog of treatment efficiency.

- Nutrient Tests: A portable wastewater laboratory provided during the WPPE consists of materials for conducting various colorimetric analyses for nutrients such as ammonia-nitrogen, nitrite, nitrate, Kjeldahl nitrogen, phosphorus, etc. to determine whether the facility is removing or treating nutrients.
- Various other tests included in the portable wastewater laboratory include alkalinity testing (the buffering capacity of the mixed liquor or the clarified supernatant,) chlorides, sulfides, halogens such as Total Residual Chlorine and Free Chlorine, and metals including aluminum and iron, known contaminants to downstream aquatic life.

The objective of all this testing is to develop a unique profile for the facility useful in developing operations trends, showing conditions that become predictive of how the facility responds to various beneficial or adverse conditions that could affect effluent quality and treatment efficiency. Once there exist sufficient data, operators should develop a cogent understanding of how the facility responds and what they must do to maintain it in good condition.

Typically, operators should determine an overall treatment strategy for their facility, using standard industry calculations for:

- Food to Mass Ratio (F/M)
- Mean Cell Residence Time (MCRT)
- Sludge Age or Dynamic Sludge Age

These values can be determined using the equipment described above. These calculations provide set-points unique to the facility that can be adjusted either through changes in sludge wasting rates or aeration capacity, assuming that the concentration of waste in the wastewater is a variable operators cannot control.

More complete understanding of the Process Monitoring and Control tests may be found in Activated Sludge Manual of Practice OM-9, Water Pollution Control Federation 1987 or in the freely downloadable (from EPA) Albert West series "Operational Control for the Activated Sludge Process," Parts I through V. These publications, while dated, broadly cover the basic process monitoring tests and calculations required for determining operational set-points.

Attachment L—NPDES Permitted Effluent Discharge Limits

PA0083607
Sewage, SIC: 4952, **Union Township Board of Supervisors**, R. D. 1, Box 1940, Jonestown, PA 17038.

This application is for renewal of an NPDES permit for an existing discharge of treated sewage to Forge Creek, in Union Township, **Lebanon County**.

The receiving stream is classified for warm water fishery, recreation, water supply and aquatic life. For the purpose of evaluating effluent requirements for TDS, NO_2-NO_3, fluoride and phenolics, the existing downstream potable water supply intake considered during the evaluation was Lebanon City located in Swatara Township, Lebanon County. The discharge is not expected to impact any potable water supply.

The proposed final effluent limits for Outfall 001 for a design flow of **0.10** mgd are:

NPDES Permit # PA0083607 Parameters	Mass (lb/day) Monthly Average	Weekly Average	Concentration (mg/l) Monthly Average	Weekly Average	Instantaneous Maximum (mg/l)	Analysis Frequency	Sample Type
Flow	0.10	xxx	xxx	xxx	xxx	Continuous	Meter
$CBOD_5$	20.8	33.3	25	40	50	2/month	8-hr comp
Suspended Solids	25	37.5	30	45	60	2/month	8-hr comp
NH_3-N							
(5-1 to 10-31)	2.5	xxx	3	xxx	6	2/month	8-hr comp
(11-1 to 4-30)	7.5	xxx	9	xxx	18	2/month	8-hr comp
Total Phosphorus	1.67	xxx	2	xxx	4	2/month	8-hr comp
Total Residual Chlorine	xxx		0.1	xxx	0.33	1/day	Grab
Dissolved Oxygen	xxx		minimum of 5.0 at all times			1/day	Grab
pH	xxx	xxx	6.0 min. to 9.0 max.			1/day	Grab
Fecal Coliforms							
(5-1 to 9-30)	xxx	xxx	200/100 ml as a geometric average			2/month	Grab
(10-1 to 4-30)	xxx	xxx	2,000/100 ml as a geometric average			2/month	Grab

Table L-1: NPDES Permit Conditions in effect in late 2009

The EPA waiver is not in effect.

Note: The new permit for an expanded facility increases flow to 0.15 MGD and adjusts effluent mass loading accordingly. Most importantly, the imposition of annual nutrient mass limits under the Chesapeake Bay Tributary Strategy, based on concentration limits of 16 mg/L TN and 2 mg/L TP, will limit these nutrient loadings to 7,306 lb and 974 lb, respectively.

Attachment M—Biosolids Production Worksheet

Union Township, Lebanon County, Authority WWTP

Date:	**2009 DMRS**
Plant Name:	**Lickdale**
Design Flow:	**0.1**
Design Loading:	**209**
Avg Daily Flow	0.444

Months	Actual Sludge Disposed
Jan	1.88
Feb	1.78
Mar	1.75
Apr	1.1
May	2.5
Jun	1.48
Jul	1.8
Aug	1.95
Sep	1.73
Oct	2.05
Nov	2.13
Dec	2.58
12	22.73
x	2000lbs/ton
	45,460
	actual lbs removed

BOD mass removed by STP

influent pounds BOD/day		100	lbs/day	*(as reported in Chapter 94 Report)*
effluent pounds BOD/day	–	1	lbs/day	*(use monthly avg loading value from permit)*
BOD mass removed by STP	=	99	lbs/day	*(from DMRs)*

pre-digestion sludge mass produced by STP

BOD mass removed by STP		99	lbs/day
sludge production factor *	x	0.65	
pre-digested sludge mass	=	64	lbs/day

** sludge production factors*
- extended aeration = .65
- oxidation ditches = .65
- conventional activated sludge = .85
- contact stabilization = 1.0

post-digestion sludge mass produced by STP **

***calculate only if plant has a digestor*

pre-digestion sludge mass		64	lbs/day
% of pre-digestion solids remaining	x	0.8	
post-digested sludge mass	=	51	lbs/day

solids reduction in digestors
- 0 days (no digestor)= 1
- 10 days = .9
- 15 days = .8 **default value**
- 20 days = .7
- >30 days = .65

estimated amount of sludge to be removed

sludge mass (pre or post)		51	lbs/day
days per year	x	365	days/yr
estimated sludge mass for disposal	=	18,733	lbs/yr

percentage of sludge mass for disposal

actual		45,460	lbs
estimated	/	18,733	lbs
		2.43	
	x	100	%
		243	% Sludge Removal Percentage

Typical Range: 100% ± 15%

Figure M-1: Biosolids Production Worksheet for Union Twp., Leb. Cty., Lickdale WWTP:
Note: Sludge production appears to outpace plant loading, according to available data. This could happen because Influent BOD test frequency is only 2 samples per and may be missing higher loading due to commercial and industrial contributors. The expected sludge output would be in a range of 7.5 to 11.5 dry ton.

Attachment N—Chesapeake Nutrient Reporting Worksheet

To review the calculation of annualized nutrient loading reports for the Chesapeake Bay Strategy Initiative, we have attached the following sample worksheet for calculating the total nitrogen and total phosphorus loadings. These loadings are calculated based on a summation of each month's *monthly mass load* (MML) where the average loading is multiplied by the number of days in the month to obtain the total load for each month. At the end of the reporting period, usually in November, the month sums are added to obtain the annualized load. Additional worksheets provided on the accompanying CD/DVD include sheets for deducting nutrient credits traded with other entities.

Example: The facility collected 10 flow-proportional or timed-interval compliance samples but ran only 5 TKN tests in December 2009; therefore, there are only 5 results for Total Nitrogen (TN). For each day where TN was calculated, multiply the TN concentration by the MGD flow for the sample date. Then average all 5 TN loadings. Multiply the product of this calculation by 31, the total number of days in the month. This value will then be added with the similar MML for the other 11 months to obtain the total nitrogen load emanating from the facility effluent.

(a) 1.51 lb/day x 31 day = 47 lb TN

(b) For the reporting year: $\sum MML_{TN}$ = ≤ 7,306 lb. TN, $\sum MML_{TP}$ = ≤ 974 lb. TP

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CHESAPEAKE BAY SUPPLEMENTAL REPORT
NUTRIENT MONITORING

Facility Name: Wilson Twp. STP | Month: 12 *(Select number)* | Year: 2009
Municipality: Wilson Township | County: Hartranft | NPDES Permit No.: | Outfall: 001
Watershed: 7-F | Renewal application due 180 days prior to expiration.
This permit will expire on:

DAY	FLOW MGD	Total P mg/l	Total P lbs/day	NH_3-N mg/l	NH_3-N lbs/day	TKN mg/l	TKN lbs/day	NO_2+NO_3 as N mg/l	NO_2+NO_3 as N lbs/day	Total N mg/l	Total N lbs/day
1	0.079	0.4	0.26	0.2	0.13	1.2	0.79	1.0	0.66	2.20	1.45
2	0.072	0.1	0.06	0.1	0.06			0.5	0.30		
3	0.052										
4	0.087										
5	0.075										
6	0.082										
7	0.086										
8	0.078	0.5	0.33	0.2	0.13	1.0	0.65	0.8	0.52	1.80	1.17
9	0.067	0.1	0.06	0.4	0.22			0.5	0.28		
10	0.066										
11	0.064										
12	0.08										
13	0.077										
14	0.077										
15	0.079	0.1	0.07	0.1	0.07	1.0	0.66	0.7	0.46	1.70	1.12
16	0.069	0.4	0.23	0.3	0.17			1.9	1.09		
17	0.066										
18	0.067										
19	0.069										
20	0.068										
21	0.093	0.4	0.31	0.1	0.08	1.0	0.78	1.3	1.01	2.30	1.78
22	0.114	0.5	0.48	0.1	0.10			1.6	1.52		
23	0.102										
24	0.088										
25	0.097										
26	0.084										
27	0.077										
28	0.075										
29	0.078	0.3	0.2	0.2	0.13	1.0	0.65	2.1	1.37	3.10	2.02
30	0.077	0.1	0.06	0.3	0.19			0.5	0.32		
31	0.086										
Avg	0.0784	0.29	0.20	0.20	0.13	1.04	0.71	1.09	0.75	2.22	1.51
Monthly Total Loads (lbs):			6		4		22		23		47

I certify under penalty of law that this document was prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. See 18 Pa. C.S. § 4904 (relating to unsworn falsification).

Prepared By: ______ License No.: ______
Title: Operator Date: ______