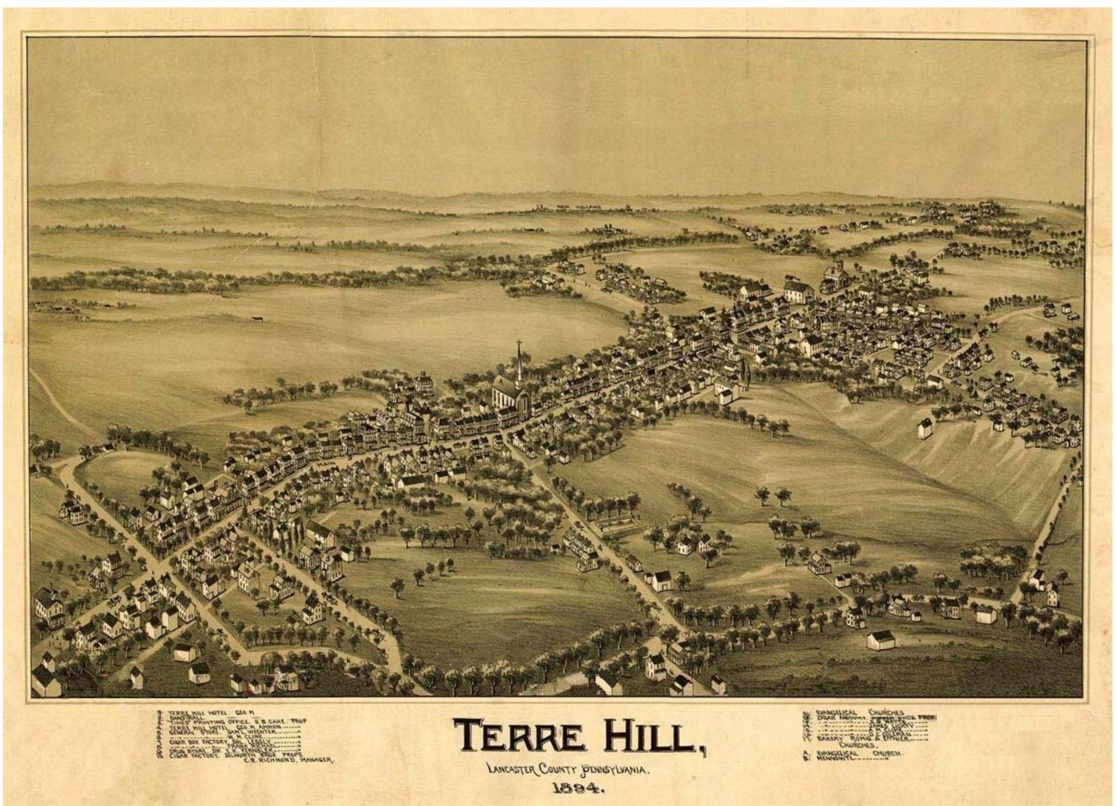
WASTEWATER PLANT PERFORMANCE EVALUATION

January 12, 2012 – March 8, 2012

Borough of Terre Hill

Wastewater Treatment Facility

NPDES # PA0020222



pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Point and Non-Point Source Management
POTW Optimization Program

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Plant Description:
Terre Hill Borough (Terre Hill) wastewater treatment plant (WWTP)

Project Summary
The Pennsylvania Department of Environmental Protection (DEP) conducted a Wastewater Plant Performance Evaluation (WPPE) of Terre Hill from January 12 through March 8, 2012. This evaluation looked at existing operations and practices and incorporated small-scale operational changes meant to optimize effluent quality in an effort to comply with or improve upon NPDES permit limits. Corollary intents are to improve operator performance, evaluate energy efficiency, support asset management and preventative maintenance, and recommend minor changes that may be accomplished without capital expenditures. During this WPPE, operators successfully demonstrated the use of “On/Off” aeration to denitrify secondary effluent, employing timing devices on the aeration blowers to reduce effluent nitrate-nitrogen by up to 26% over that of continuous aeration. At the same time, electrical consumption is reduced using this innovation.

An overall rating of “Satisfactory” was assigned based on a review of the facility’s past performance and current operating conditions.

The WPPE was performed by staff of DEP’s Technical Assistance Section, Bureau of Point and Non-Point Source Management. The WPPE program is conducted under terms of a federal grant administered by the United States Environmental Protection Agency (USEPA). Onsite evaluation lasted eight weeks. DEP’s staff attend the facility operation two or three days per week, conducting tests, evaluating operator performance, and using small, inexpensive methods to adjust effluent quality. Several continuously-recording digital chemical probes were installed at various significant points in the treatment process, to generate data depicting round-the-clock performance, capturing records of changes that often go unnoticed by operators during a typical work day. The operators have worked diligently within the limits of their aging facility to assure permit compliance and improve upon effluent quality.

In addition to Process Monitoring and Control for the facility, staff assisted in development of Chapter 94 documentation and calculation worksheets, for the 2011 reporting year, offered some energy efficiency evaluation and tips, and offered information on asset management using EPA software. One weekend open house was held to showcase the facility’s efforts.

Additional analytical data and information are included on the CD-ROM accompanying this report.

Operational Strengths

Terre Hill's facility operational strengths are found in the dedication of its workers to ongoing preventative maintenance and their interest in controlling costs through proactive operations. Below are listed some of the operational strengths observed during the WPPE:

- Facility reporting requirements are met using electronic database and reporting, eliminating the chance of error;
- Facility is maintained against normal wear and tear associated with operating a 24/7/365 schedule;
- Ongoing efforts to control Inflow/Infiltration include televising collection system lines, deploying manhole and clean-out inserts, surveillance for illegal connections including roof drains and sump pumps;
- Machinery is maintained according to a written schedule;
- Facility employs written operating procedures;
- Adequate safety measures are in place to assure workplace safety;
- Facility site security is adequately maintained;
- Operators are conscientious and strive to assure effluent quality at a minimum of labor cost to the Borough and the ratepayers.

Focus Points for Improvement

Because of physical plant limitations described by the operators, DEP's WPPE program review has identified performance-limiting factors that are focus points for improvement. Some of these suggest upgrades and additional instrumentation or laboratory equipment; others, additional labor requirements. And, while perhaps beyond the scope of the study, also listed are goals that would help the facility achieve its promise, although achieving them are not within the purview of operations staff or, perhaps, even of the facility owner and may entail capital upgrades or consolidation into another treatment system:

High

- The current facility is incapable of reducing Total Nitrogen (TN) concentrations to meet the expected Chesapeake limits of 6 mg/L in the effluent, or 3,836 pounds per year, without significant design changes that will necessitate replacement of much of the existing facility. These new limits will be established over the coming 5-year NPDES Permit cycle, during which time the facility owner will either have to significantly upgrade the physical plant or purchase pollution credits in order to continue at the present levels.
- The tentative plan for a facility upgrade is to install an oxidation ditch based on the Orbal® Multichannel Oxidation Ditch employing fixed

subsurface find-bubble aerators. When considering facility upgrades, it is important to review the available technologies rather than to simply rely on one or two professional opinions. Terre Hill has sufficient land available for a variety of useful solutions. Sequencing Batch Reactors (SBR) are often recommended for communities of this size that have variable inflow and infiltration (I/I). Some modifications to the general design may include a raw wastewater equalization tank to attenuate flow and loading; alternatively, an SBR might be better operated in an ICEAS (intermittent cycle extended aeration system) mode to withstand variability of flows. In addition, further consideration must be given to the biological nutrient reduction needs. The technology is rapidly advancing in the presence of microprocessor-mediated treatment, such that even the current nitrate-to-nitrogen methods (e.g., Modified Ludzak-Ettinger (MLE) is being replaced by nitrite-shunt to save energy.) It must be noted that major facility replacement is likely to cost beyond what the limited customer base is able to bear, even within a 35-year life cycle.

- Plant headworks comminutor allows solid and synthetic material to enter the facility, causing premature wear on the equipment downstream. It is better to remove this material at the headworks than to wait to remove it as part of the wasted sludge or during periodic tank overhauls. The plant headworks could be rebuilt employing fine-screening facilities as a separate project from the nutrient removal upgrade, although it is financially cheaper to contract its replacement at the same time.
    - As a temporary alternative, the sludge material in Tank 1 should be completely drained and wasted on a periodic basis, at least one time per quarter-year, in order to prevent this comminuted material from accumulating in tanks and fouling equipment downstream.
    - Sludge from Tank 1, which contains adsorbed organic matter, may be seeded to downstream units; however, doing so will require additional maintenance of those downstream units to remove inorganics and trash.
    - If the headworks is replaced or upgraded, in order to maintain sufficient available carbon for denitrification process, the material screened at the head of the plant could be rinsed with plant effluent to provide useful soluble carbon for diversion and use downstream.
- Use laboratory equipment to measure and track waste strength of hauled-in wastes. Do not accept any hauled-in wastes whose source cannot be accounted for or which may contain constituents known to

harm activated sludge biomass, or which would exceed the organic load capability of the facility.
- Manage odor component of hauled in wastes.

Medium

- Equip the wastewater laboratory with general activated sludge monitoring tools similar to those used during the WPPE; at a minimum, the facility should have
    - Solids centrifuge. (Raven Products Corp. manufactures a relatively low-priced one for wastewater applications;) Done.
    - BOD probe for DO meter & bottles for performing oxygen uptake rate tests on mixed liquor samples; Done.
    - Microscope for viewing activated sludge flora;
    - Spectrophotometer for colorimetric wastewater chemistry; Done.
    - Water test kits for domestic wastewater; with augmentations for detecting commonly occurring commercial and industrial pollutants. Done.

  At present, the lab is equipped with a pH probe and dissolved oxygen test kit, as well as the minimum-required effluent quality reporting equipment. Additional equipment that is useful includes:
    - Portable dissolved oxygen and pH meter and probes, as the tests are more accurate if measured *in situ* rather than at the lab bench, and portability would allow for monitoring of DO of the receiving stream, the pump station, and at the digester;
    - Optional COD reactor block and test kits, for more frequent regular testing of both raw wastewater and septage strengths;
    - Influent wastewater sample compositor, used for obtaining 24-hour composite samples of raw wastewater at the head of the plant or anywhere in the collection system, to appropriately characterize the wastewater strength. Composite samples produce more reliable data than do grab samples or manually composited grab samples. A key feature is the ability to flow-pace the sampler, using the 1-20 mA signal from the facility's flow meter. Use of timed sample aliquots allows operators to determine the time of slug loads or illegal discharges to the sewer.
- Laboratory equipment needs to be maintained. The salt build-up on the pH probe may prevent the probe from reading accurately, even if it has been calibrated daily against standard solutions. Gently remove the salt build-up and wash the probe with an 0.1 Molar HCl solution. Then assure that the probe is filled to the proper level with electrolyte solution, usually a KCl solution from the manufacturer

- The Dissolved Oxygen probe that is used for daily DO tests and reporting needs to be calibrated prior to use. A record of this calibration, similar to that of the pH probe, should be maintained and be available for review by the inspectors. (Note: new Hach LDO probe does not require calibration prior to each use; however, Hach has recently provided for calibration to air in the most recent firmware. This requires that the elevation-above-sea-level for the facility be entered prior to first-use.)
- Plant records should indicate every time that the blowers are turned off to allow sludge wasting. If the facility does begin to employ an on/off aeration scheme for voluntary denitrification, the records need only indicate the schedule, such as "fifteen minutes out of every ninety minutes."
- Effort should be made to include a second air source for the post-disinfection tank, to assure effluent dissolved oxygen is adequate for its long travel time to the outfall. The operator indicated that he planned to install a second line so that freshening the effluent would continue during wasting periods, when the aerators are shut down. Another remedy may be to add a smaller blower to exclusively re-aerate the post-disinfection effluent. A third idea would be to use a small sewage pump to splash pumped effluent over a passive aeration cascade of block and brick prior to discharge, since the actual outfall is embedded in the creek bed.
- Erect appropriate barriers to stormwater run-off originating outside the facility's border, especially along the perimeter near the septage holding tank, in order to prevent unnecessary erosion. Simple silt-fencing ought to suffice.

Low

- Install hour-meters and amp meters on all motor starters for electrical equipment used in the treatment plant. Regularly record equipment use times and average power draws in order to optimize energy efficiency at the facility.
- Provide an operations software program for recording operational data, reports, graphs, and projections, instead of relying solely upon hand-written records and log books. There are many vendors available of software suitable for this purpose, from relatively simple spreadsheet programs such as RTW's "Activated Sludge Operations Toolset" to complex database systems such as Allmax "Operator-10" or Hach's "WIMS" package. Given the size of this facility, a much simpler product would prove most useful.

- Periodically seed activated sludge with prepared microlife infusoria to enhance microlife population with increased genetic diversity. This may contribute to overall treatment efficiency.
- Enact a digitized asset management program to track equipment maintenance and replacement. During the WPPE, we recommended the use of EPA's CUPSS program and installed it on the local computer. While the front-loading clerical tasks of entering data may prove cumbersome at first, the effort will pay off when the program is up and running. Money saved through the use of planned maintenance/replacements will more than offset the initial start-up costs.
- Update / replace lighting with energy-efficient methods; turn off lights and heaters when not really necessary.

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 **Satisfactory**, chiefly because the operators have implemented steps which optimize their facility for nitrate reduction and established a process monitoring testing program for the activated sludge process while working within the technological limits of the facility.

ATTACHMENT A—WPPE PROGRAM PARTICIPANTS

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ATTACHMENT B—SITE SCHEMATIC & EQUIPMENT DIAGRAM

The treatment plant design is a three-stage, high rate, modified activated sludge type plant. The original wastewater treatment plant was constructed in 1962. The facility was four times over the years to meet new challenges and improve effluent quality, most recently in 2008, when polishing lagoons were removed from the permit and demolished. The current plant permitted capacity is 0.210 million gallons per day (MGD) with an annual average daily flow of 0.164 MGD. The design organic load is 357 lb./day BOD5, with an average daily load of 169 lb./day in 2011.

The treatment scheme that follows depicts flow entering the facility, passing through a comminutor and Parshall flume and flowing to one of two Eimco process consolidated activated sludge and clarifier units. Effluent following treatment here flows on to a second stage extended aeration treatment that includes a second Eimco unit. Clarified effluent flows on to a disinfection tank where the water is treated with a hypochlorite solution. Effluent of the disinfection tank flows to an aerated wet well and thence to an in-stream manifold for discharge.

Waste activated sludge is removed by de-aerating the facility and pumping return sludge to a storage tank from which solids approximating 1% are transferred to an off-site wastewater plant for further treatment and dewatering.

An additional feature of the facility is its septage receiving station that includes an aerated holding tank from which freshened septage is slowly added to the raw wastewater at the headworks. This feature assures that adequate food is available during periods of reduced loading from the collection system.

The treatment scheme is depicted following:

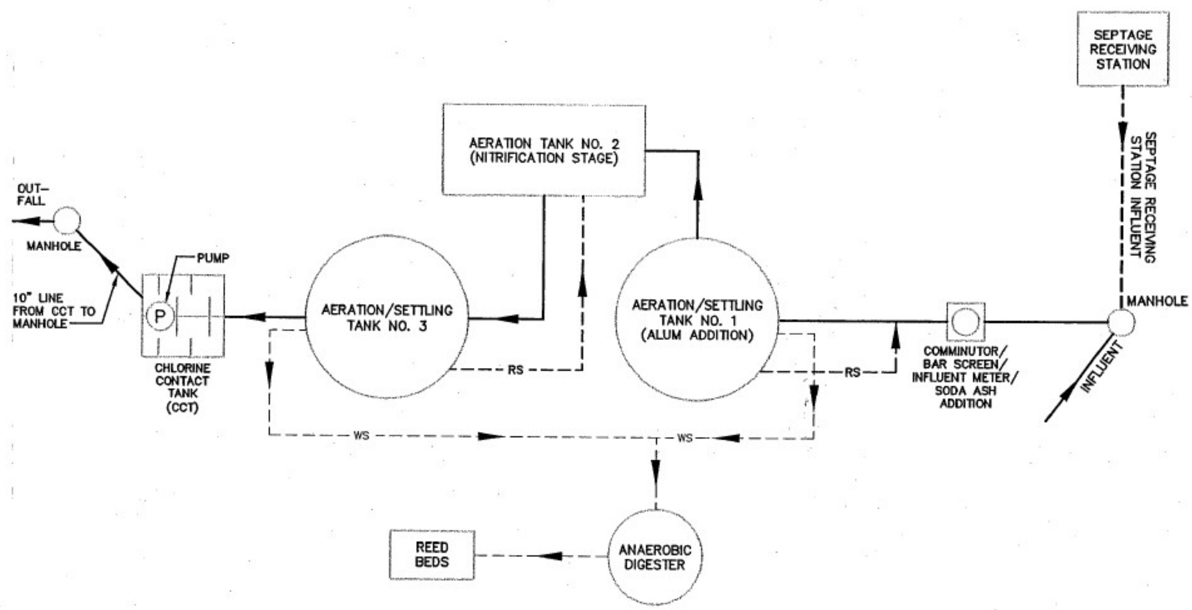


Figure C-1: Schematic of Terre Hill Borough WWTP

The Facility Operations and Maintenance (O&M) Manual emphasizes care and maintenance of equipment, and Mr. Rissler keeps maintenance records electronically.

ATTACHMENT C— EVALUATION ACTIVITIES

WPPE equipment described in Attachment E was deployed at the Terre Hill Borough WWTP on January 14, 2012, following a discussion of the treatment plant evaluation program with the operators. The WPPE equipment consisted of seven continuously-recording digital chemical probes, a pair of linked SCADA computers, a recording computer, and a portable wastewater laboratory used for conducting process monitoring tests and probe calibrations. The location of these instruments is depicted in the schematic in Attachment C. Facility staff assisted in deployment of the instruments.

The recording computer was located in a room beside the mechanical room, with the data line conveniently pulled through existing conduit. Additional laboratory equipment was set up in this room, including a spectrophotometer, chemical digester, recording microscope, and a field test kit for nutrients and metals.

Settlometers and a solids centrifuge were located in the facility's laboratory, and an additional dissolved oxygen probe and pH meter were also made available.

For the first two weeks, data was gathered from the facility showing its typical operation. An ammonia-nitrogen probe in the effluent from the stage one clarifier recorded the typical NH3-N available for nitrification. A corresponding nitrate-nitrogen probe was located in the aeration tank of Eimco unit number 2, which showed that ammonia-nitrogen was usually completely oxidized to nitrate in the Terre Hill facility. Other probes included two dissolved oxygen probes co-located in tanks two and three, a total solids probe in aeration tank three, two oxidation/reduction probes collocated in tanks two and three, used to measure the favorability of nitrification versus denitrification. A pH probe in tank three was used for both pH and temperature in the second-stage processes.

Performance Issues

Prior to the WPPE, the facility had experienced NPDES permit violations for Total Suspended Solids. There had been two effluent lagoons following the secondary treatment, but it was observed by the owner/operators over time that growth of certain algae and duckweed in the lagoons, combined with the attractive conditions for water fowl, caused additional growth and DO depletion to take place, hindering efforts to maintain permit limits. The lagoons were removed prior to the start of the evaluation, and the discharge line was modified to provide for alternative discharge location and an in-stream effluent manifold, assuring better stream mixing and reintegration of effluent into the receiving waters.

The existing mode of operating the first Eimco unit independently of the other two aeration tanks helps contain the worst of the comminuted trash to the biomass in that tank; however, most of the organic loading entering the facility is adsorbed in this tank, leaving the remaining two tanks relatively under-loaded. Both carbon and alkalinity are required by the biomass for effective nitrification to succeed during times the facility is operating at or near capacity. The lack of intermixing of the biomass populations may result in operational difficulties.

Operations Testing and Trending

Over the course of the evaluation, operating conditions were observed and recorded. Test results generally supported the salient points made in the report. DEP staff demonstrated use of the portable lab equipment to the operators and asked them to participate by running comparative tests alongside those they were routinely performing.

Prior to the evaluation, facility operators did not routinely perform activated sludge process monitoring at the facility. Like most small facilities, operators perform the required daily compliance testing of the effluent for dissolved oxygen, pH, temperature, and total residual chlorine. Sludge settling tests are performed every few days to characterize settling in the clarifiers. Mixed liquor grab, raw wastewater composites, and weekly composite samples of effluent were collected and sent to an independent commercial lab. Biosolids accounting included the haulers invoices showing capacity and percent solids for sludge loads being hauled off site for treatment elsewhere. Although the facility has septage receiving and off-loading facilities, along with a holding tank, there is no standardized program for measuring and accounting for hauled-in wastes, other than the hauler’s bill of lading and occasional sampling to verify those reported numbers.

Process monitoring (PM) is vitally important to maintaining a healthy treatment system. These tests include solids inventory assays, in-process nutrient and alkalinity tests, oxygen uptake rate for mixed liquor, microscopy, and regular assessments of raw wastewater composite samples. One of the extended purposes of the activated sludge PM tests is to develop records and trend data that show ranges where the facility operates best and alerts operators to gradual changes that could affect the health and effectiveness of the living biomass that treats the wastewater.

During the evaluation, DEP staff provided equipment and instruction on simple process monitoring tests as developed by Albert West in the 1970s and since employed in many basic guides, including the WPCF's Activated Sludge Manual of Practice OM-9, which was offered as a training manual. The tests included solids by volume percent, using a centrifuge, settleometers for 30- and 60- minute settling and sludge volume index, portable dissolved oxygen and pH meters for testing tank conditions, a BOD probe used for oxygen uptake and respiration rate tests on the mixed liquor, and a complete industrial wastewater lab that included a spectrophotometer and wet-chemistry equipment, as well as quick-to-manage nutrient test kits.

Following is a recommended schedule of process monitoring and control tests for activated sludge wastewater treatment facilities having annual average daily flow less than 1.0 MGD:

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	Influent	Totalizer	Daily		
* Frequency of sampling may need to be increased or decreased depending on plant size or conditions					
Aeration Basin					
MLSS / MLVSS (or centrifuge, with coorelated data from periodic MLVSS values	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					

Table D-2: Suggested sampling frequencies

These parameters and frequencies are the minimum for facilities with flows rated less than 1.0 MGD. It is recommended that facilities equipped with adequate laboratory equipment should perform process monitoring tests three times per week throughout the year, under normal circumstances. More frequent testing is required whenever the facility is upset or whenever a substantial process change is made (e.g., additional tanks added or removed from service, chemical feed rates change, or waste characteristics change.) While it is not required that a facility test hauled-in waste and septage provided there is plant inflow sampling downstream of the addition point of same, it is recommended that hauled-in wastes and septage be sampled frequently by itself in order to characterize these often potent sources of oxygen demand, ammonia, and salts. No industrial wastes from unknown haulers should be accepted as hauled-in wastes unless first being fully characterized by thorough testing for priority pollutants.

Oxidation/Reduction Potential (ORP)

ORP probes were placed in both Aeration Tanks 2 and 3 to record oxidation-reduction potentials in each of those processes. For conventional activated sludge plants where nutrient reduction is not a consideration, ORP levels will stay above +250mV, showing a well-oxidized biomass. More importantly, where facilities are required to biologically remove nitrogen, ORP can be used by the operators to assess and control periods of aerobic or anoxic treatment conditions for nitrification and denitrification. The following table depicts ORP values at which nitrogen conversions occur:

ORP (mV)	Process	Electron Acceptors	Condition
> +100	1	O2	Aerobic
≤ +100	2	NO3	Anoxic
≥ -100	2	NO3	Anoxic
< -100	3	SO4	Anaerobic

1= Nitrification

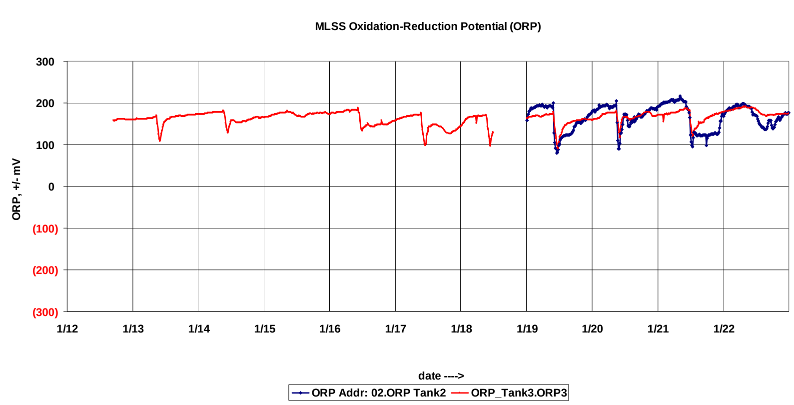
2= De-Nitrification

3= Methane Formation

Table D-3: Oxidation Reduction Potential (ORP) ranges for bacterial activity

ORP readings are typically used in conjunction with the DO readings to identify the effectiveness of a given biological treatment process and the condition of each zone. An attempt was made at Terre Hill to employ an “ON/OFF” Aeration Scheme to demonstrate voluntary reduction of nitrates in the discharge, and the ORP readings could be judged to show if and where denitrification was taking place. At times during this part of the evaluation, the DO levels dropped to 0 mg/L. Had we not been monitoring with the ORP, we would not have known what stage of the biological process was in, i.e. nitrification, denitrification, anoxic, or anaerobic.

The chart shown here depicts the ORP histogram for the first ten days of the evaluation. Typically, under aeration, the ORP was above 150 mV, and it demonstrated small dips toward +100 mV



during wasting periods, when aeration was turned off. This hinted that the facility could denitrify using the on/off aeration scheme that was done later in the evaluation. Table values below -200 mV show that anaerobic conditions promote formation of reduced sulfides and fermentation by-products. That is not a factor in the operation of the Terre Hill facility.

Phosphorus Removal

Terre Hill has a NPDES phosphorus limit of 2.0 mg/L concentration and a loading limit 3.5 lb/day average monthly. The facility uses aluminum sulfate salts to chemically remove phosphate through precipitation with the wasted biosolids. There are no current plans to attempt biological phosphorus removal at the facility under the present conditions; however, there are many designs where this may prove favorable should the facility upgrade in the future.

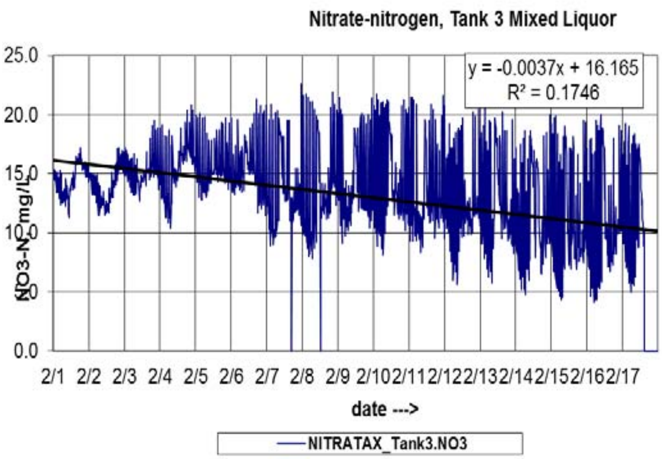
Effluent phosphorus concentrations during the WPPE averaged 1 mg/L, with loading values averaging 0.2 lb/day. Comparatively, the influent phosphorus concentrations during the WPPE averaged 8 mg/L, with loading values averaging 1.8 lb/day. Treatment efficiency averaged 87%.

Biological Nitrogen Removal

During the evaluation, we experimented with the benefits of On/Off Aeration as a method to voluntarily reduce the amount of Total Nitrogen (TN) and Nitrate-nitrogen (NO3-N) in the final effluent. The idea was to deaerate the three reactors for periods of time during the day and allow facultative heterotrophic bacteria to consume nitrate ion as an oxygen source while converting carbonaceous waste to carbon dioxide under anoxic conditions where oxidation reduction potential (ORP) values dropped below +100 mV. Typically, the facility when running full time under aeration produced nitrate ion in the range of 30 mg/L to 35 mg/L. Using timers to artificially create anoxic conditions in the aeration tanks, we were able to achieve reductions of about 37%.

Optimum pH values for denitrification are between 7.0 and 8.5. In addition, some oxygen is also recovered during denitrification, which ultimately reduces the energy demand for aeration.

The graph at right shows the average concentration of nitrate ion in the third reactor dropping from 16 mg/L to 10 mg/L over time with the application of On/Off Aeration technique. This is a 37% reduction.



The denitrification reaction also produces approximately 3.0 to 3.6 pounds of alkalinity (as $CaCO_3$) is produced per pound of nitrate converted, thus partially mitigating the acidification of mixed liquor caused by nitrification.

Solids Management

THB was initially equipped with an anaerobic digester and heat exchanger, but the facility is not in use as designed. Instead, wasted sludge is stored in the digester space and hauled offsite to other wastewater treatment facilities in Manheim and Pottstown for further treatment. As such, there is no expected reduction of volatile content in material that is stored. As part of the study, the sludge production numbers were found to be 129% of expected production values. This excess may be accounted for by the addition of aluminum sulfate for phosphorus reduction, which typically increases the volume of waste sludge, because aluminum phosphate precipitate is hygroscopic.

Tentative plans for a facility upgrade, as discussed earlier, provide for converting the existing digester space and that of aeration tank #2 to aerobic digesters that will provide for some volatile content reduction, and plans also anticipate installation of additional reed bed chambers.

The table below illustrates the sludge production calculation:

Terre Hill Borough WWTP

Date: **2010 DMRs**

Plant Name: **Terre Hill Borough**

Design Flow: **0.210**

Design Loading: **357**

Avg Daily Flow: 0.121

Months	Actual Sludge Disposed
Jan	2.9
Feb	1.8
Mar	1.9
Apr	3.1
May	3.3
Jun	4.4
Jul	3.9
Aug	4.4
Sep	3.5
Oct	1.4
Nov	5.4
Dec	2.0
12	38.0
x	2000lbs/ton
	75,960
	actual lbs removed

BOD mass removed by STP

influent pounds BOD/day		181	lbs/day	*(as reported in Chapter 94 Report)*
effluent pounds BOD/day	–	20	lbs/day	*(use monthly avg loading value from permit)*
BOD mass removed by STP	=	161	lbs/day	*(from DMRs)*

pre-digestion sludge mass produced by STP

BOD mass removed by STP		161	lbs/day
sludge production factor *	x	1	
pre-digested sludge mass	=	161	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		161	lbs/day
% of pre-digestion solids remaining	x	1	
post-digested sludge mass	=	161	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)		161	lbs/day
days per year	x	365	days/yr
estimated sludge mass for disposal	=	58,838	lbs/yr

percentage of sludge mass for disposal

actual		75,960	lbs
estimated	/	58,838	lbs
		1.29100241	
	x	100	%
		129.1002	%

Sludge Removal Percentage
Typical Range: 100% ± 15%

Table K-1: 2010 Sludge Production (based on Chapter 94 Report)

ATTACHMENT D—EQUIPMENT DEPLOYED

Digital, Continuously Monitoring Probes:

1 – Laptop computer with signal converter
2 – SC1000 SCADA Base Unit
1 – LDO probe
1 – pH probe
2 – ORP probe
1 – NH4D probe w/Cleaning System
1 – Nitratax probes
1 – Solitax probes
Including all mounting appurtenances and supplies

Laboratory Equipment On-loan:

1 – Hach HQ40d handheld pH and LDO meter
1 – LBOD probe
1 – DR2800 spectrophotometer
1 – Hach Industrial Wastewater Field Test Kit
1 – Raven centrifuge
2 – Raven settleometers
1 – COD Heater Block
1 – Microscope with photographic/video capability

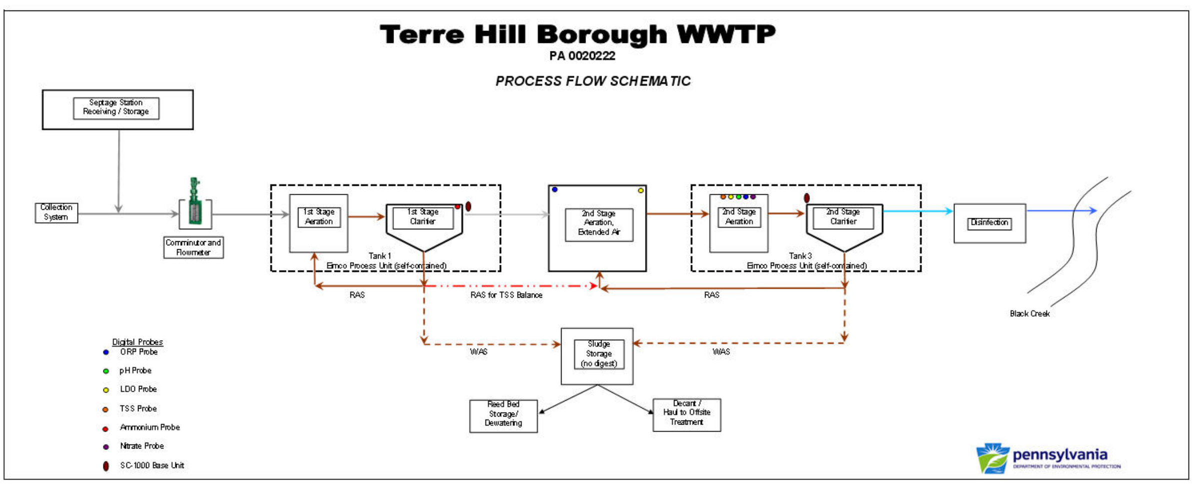


Figure E-1: Equipment Placement, with legend

ATTACHMENT E—SELECTED DATA CHARTS

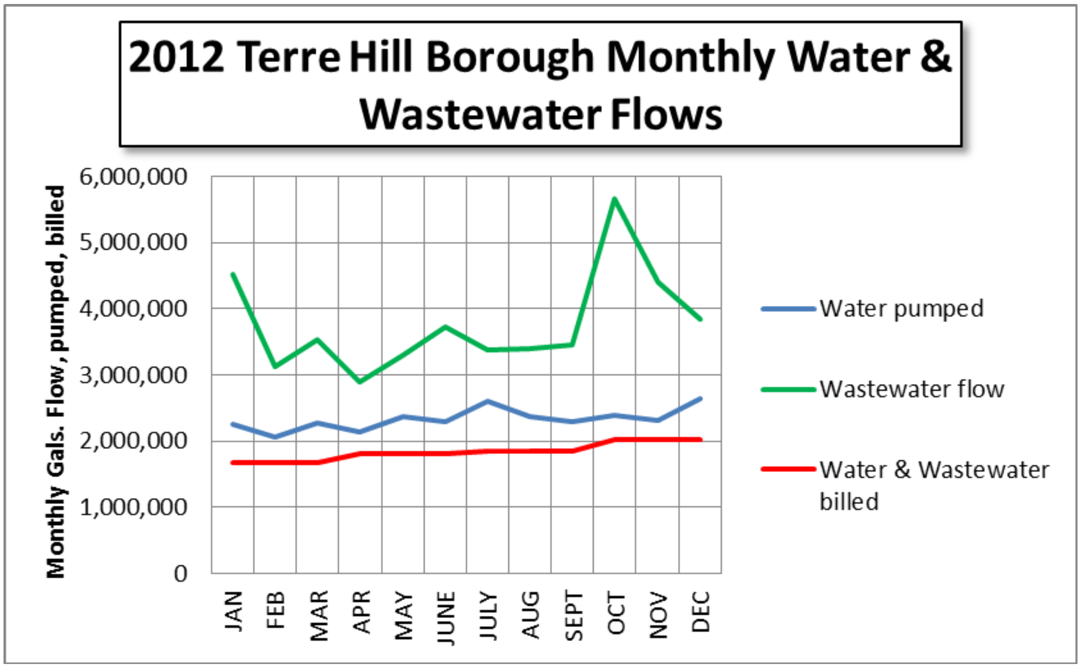


Figure F-1: 2012 Wastewater Flows

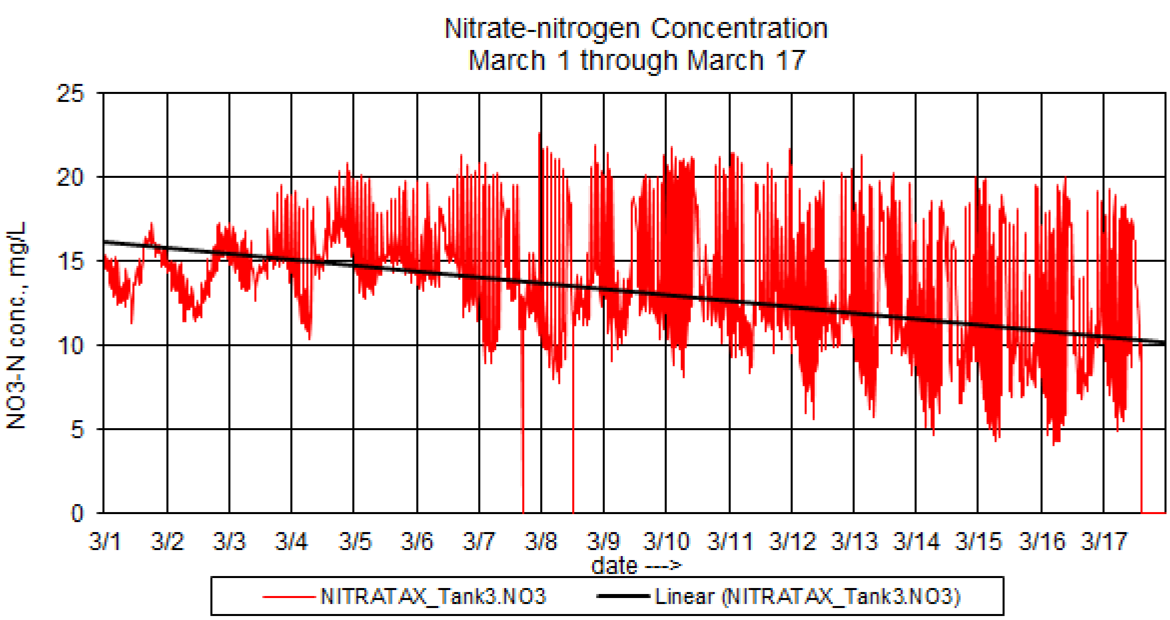


Figure F-2: Declines in Nitrate-nitrogen as a result of timed ON/OFF aeration cycles

ATTACHMENT F—SITE PHOTOGRAPHY

Figure G-1: Treatment System showing three aeration tanks, septage station, control building, and reed beds.

Figure G-2: View of Eimco Treatment Units with Hach SCADA equipment in place for study.

Figure G-2: Laboratory Bench

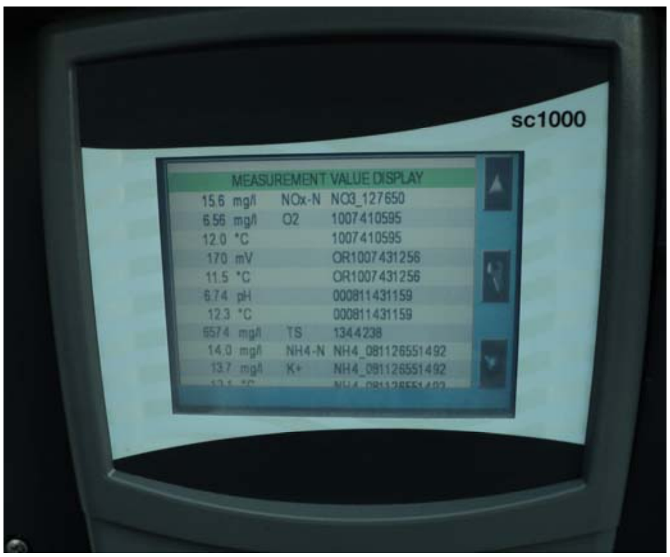


Figure G-5: SC-1000 Probe Display showing readings.

Figure G-6: Probes in Tank 3

Figure G-9: PD Blowers in Control Building

Figure G-10: $40 timer used to control blowers

Figure G-11: Blower motor starters with timer attached.

Figure G-12: Permanent installation of Blower timers, done after the evaluation.

Figure G-13: Ammonia probe and controller unit in Tank 1.

Figure G-14: WPPE Bench with SCADA recorder

Figure G-15: Centrifuge and Settleometers

ATTACHMENT G—NPDES PERMIT PARTICULARS

FACILITY:	Terre Hill STP	**PERMIT NO.**	PA0020222	**REGION:**	SCRO
PERMITTEE:	Terre Hill Boro				
	Lancaster Cnty	**OUTFALL:**	001	**COUNTY:**	LANCASTER
	POB 250			**CITY:**	TERRE HILL
ADDRESS:	Terre Hill, PA 17581-0250	**MONITORING PERIOD:**			

NPDES #PA0020222 Effluent Limitations									
Discharge Parameter	**Mass Units (lbs/day)**			**Concentrations (mg/L)**				**Monitoring Requirements**	
	Average	**Maximum**	**Units**	**Minimum**	**Monthly Average**	**Maximum**	**Units**	**Minimum Measurement Frequency**	**Required Sample Type**
Dissolved Oxygen Parameter Code: 00300 Stage Code 1	*****	*****		**5.0**	*****	*****	**mg/L**	**1/ Day**	**Grab**
BOD-5 Parameter Code: 00310 Stage Code RI	**Report Average Monthly**	**Report Daily Maximum**	**lb/day**	*****	**Report Average Monthly**	*****	**mg/L**	**1/Week**	**24-hr comp**
pH Parameter Code: 00400 Stage Code 1	*****	*****		**6.0**	*****	**9.0**	**s.u.**	**1/ Day**	**Grab**
Total Suspended Solids Parameter Code: 00530 Stage Code 1	**53**	**79**	**lb/day**	*****	**30 monthly average**	**45 weekly average**	**mg/L**	**1/ Week**	**8-hr Comp**
Total Suspended Solids Parameter Code: 00530 Stage Code RI	**Report Average Monthly**	**Report Daily Maximum**	**lb/day**	*****	*****	**Report Average Monthly**	**mg/L**	**1/ Week**	**24-hr Comp**
Ammonia – N Parameter Code: 00610 Stage Code: 1	**42**		**lb/day**	*****	**24**	*****	**mg/L**	**1/Week**	**8-hr comp**
Total Phosphorus Parameter Code: 00665 Stage Code: 1	**3.5**		**lb/day**	*****	**2.0**	*****	**mg/L**	**1/ Week**	**8-hr Comp**
Flow Parameter Code: 50050 Stage Code: 1	**Report Average Monthly**	**Report Daily Maximum**	**MGD**	*****	*****	*****	*****	**Continuous**	**Measured**
Total Residual Chlorine Parameter Code: 50060 Stage Code: 1	*****	*****		**Report Minimum**	**0.5**	**Report Maximum**	**mg/L**	**1/ Day**	**Grab**
Fecal Coliform Parameter Code: 74055 Stage Code: 1	*****	*****		*****	**2000 Geometric Mean**	*****	**CFU / 100 ml.**	**1/ Week**	**Grab**
CBOD5 Parameter Code: 00315	**44 Average Monthly**	**70 Weekly Average**	**lb/day**	*****	**25 Average Monthly**	**40 Weekly Average**	**mg/L**	**1/ Week**	**8-hr Comp**

Figure H-1: NPDES Permit Effluent Discharge Parameters