pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

BUREAU OF POINT AND NON-POINT SOURCE MANAGEMENT

Wastewater Treatment System Operational Review

Of

Mapleton Area Joint Municipal Authority
Wastewater Treatment Facility
PA0087513

Mapleton Borough, Huntingdon County, Pennsylvania

Initial Review Date
January 11, 2013

Present During Review:
Robert DiGilarmo – DEP CO
Fred Clark- Water Quality Specialist
Bruce Richards – Facility Operator
Anita Stabile- Consulting Engineer

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Introduction

The Mapleton Depot wastewater treatment plant is a 0.1 MGD activated sludge, extended aeration system with an average annual daily flow of approximately 0.03 MGD. The customer base is 279 EDUs which is approximately 698 people, based on 2.5 persons/EDU. This review was requested by regional staff due to the facility struggling to achieve compliance with its suspended solids limits.

A review of the most recent Wasteload Management Report indicates the annual average organic loadings are 64.6 lbs BOD/day which is approximately 54% of the expected values based on population, while the flow per EDU is slightly below expected values at approximately 61 gallons/person/day. A recent flow meter recalibration may yield reduced flow values compared to previous readings. Organic loadings have trended downward over the past five years with little change in the EDU base. Generally, BOD loadings are not reduced by reductions in flow, such as Inflow and Infiltration work. BOD loading reductions are usually attributed to issues with influent sampling methods, reductions in population, or discharges of raw sewage from the collection system before treatment.

The treatment plant consists of three interconnected equalization tanks that discharge through adjustable weirs into three separate treatment trains. Each train is made up of four aeration tanks, one clarifier, and one sludge holding tank. The three sludge holding tanks are also interconnected and collect the waste sludge before ultimate disposal in a sludge bagger system.

This facility has retained the services of a consulting engineer whom will work with them to perform necessary increased process control testing and adjust the treatment process as necessary to address issues with non-compliance.

Findings

1. A review of the facility's sludge wasting data indicates the facility is not wasting enough sludge. Attachment 1-"Detail of sludge volume calculations" shows that the facility should be generating approximately 9,700 gallons of waste sludge on a monthly basis. This number is based upon current questionable organic loadings reported in the Chp 94 report, and 1% sludge solids in the sludge holding tanks.
    a. In order to better characterize the influent BOD loadings, it is suggested that the permittee collect 24 hour composite samples consisting of 24 hourly samples of at least the required volume. A composite sampler is currently used for influent sampling, so it's only a matter of changing the sampling program.

2. Average daily flows appear to be less than 0.04 MGD. Currently the entire treatment plant is used even though routine flows are less than 50% of the hydraulic design loading. Once the effluent compliance issues have been resolved and background data has been gathered, the facility consultant will be evaluating the need to operate the entire facility or a reduced volume of the tankage.

3. The facility is in need of increased process control testing. The consulting engineer will be working with the operator to create a spreadsheet that will be used to log necessary operating data. Since suspended solids are often an issue at this facility, increased testing

relating to solids management is a priority. Some relevant testing for the operator to consider: ½ hour settleability tests, mixed liquor suspended solids tests, use of a sludge judge to monitor sludge blanket depth (1-3 ft target depth), and others as determined by the facility consulting engineer.

Other tests to gather background data and ensure optimum performance could include: DO testing in the aeration basins, effluent alkalinity testing, influent alkalinity tests, influent ammonia testing and others as necessary.

4. DO levels are very high, at times over 7.0 mg/l. These levels generally do not accomplish any more treatment than if maintained at approximately ½ where they are now. A target range is between 2.0 and 4.0 mg/l. In fact, excessive DO levels do waste energy and can lead to flow shear which impacts settleability in the wastewater. Since suspended solids levels are of concern at this facility this item should be addressed. In order to address the high DO levels, some items to consider would be: reducing the air at the aeration tanks with the ball valves (this is often complicated to do equally between tanks), change the sheave size on the blower to reduce its speed (adjustable sheaves are commercially available), use of timers to control blower run times (drawback is no sludge return when aeration blowers off). The facility consulting engineer can also work with the facility to address these issues.

5. The clarifiers at this facility had some scum on the surface due to the skimmers being set at the incorrect depth; two of the three were corrected on site and began clearing the surface rather quickly. The third will need some additional work to free the surface skimming device.

6. The return sludge flow appears to be much higher than necessary. Generally the RAS would be 75-100% of forward flow based upon design. This facility is operating at approximately 50% or less of its hydraulic loading capacity and the RAS pumps of all three clarifiers are running full open. The RAS flow may be able to be reduced; the operator can perform bucket test calculations to measure the actual RAS flow. If reductions in flow continue to lead to clogged RAS lines, as the operator indicates, then a change of RAS pumps may be in order. Geiser pumps often work well at lower flows without reduced clogging issues.

7. Since sludge solids are not routinely hauled from the facility, the operator should track how many bags of sludge are produced on a weekly basis. Since this is the only means of disposal at this facility, the operator may then use this data, along with the gallons of sludge removed from the holding tanks to determine if the target levels are being achieved.

8. There is one bank of ultraviolet lights used for disinfection. Facilities experiencing issues with excess suspended solids in the effluent may also experience elevated values of fecal coliform. This is due to the fecal coliform bacteria being partially shielded by the solids particles passing through the UV light. The regional compliance staff are working with the facility to see that another UV system is installed per the facilities Water Management Part II Permit.

Attachment 1

Detail of sludge volume calculations

In order to evaluate the operational efficiency of the treatment facility, it is necessary to review the amount of sludge wasted by the facility as compared to the BOD removed by the facility. The EPA Composite Correction Approach was used in this calculation.

Step One – Determining BOD loadings and amount of BOD removed.
In step one, we look at the loadings as supplied by the facility chapter 94 report. We compare the loadings to the population served by the system. According to the Ten States Standard (basis for the PA design manual), you can expect between 0.17lbs.- 0.22 lbs. of BOD per person per day. For our calculation we will use a conservative number of 0.17.

2011 Data, Wasteload Management Report and Facility DMRs

PA Department of Environmental Protection
Sludge Volume Calculation Worksheet
1 year Calculation (365 Days)
Extended Aeration , Oxidation Ditch, SBR

			(mm/dd/yyyy)
Current Date:			1/4/2013
Begin Date:			01/01/11
End Date:			12/31/11
Facility Name:	Mapleton Depot STP	NPDES Permit Number:	PA0087513
Design Flow MGD:	0.10	Avg Daily Flow MGD:	0.46
Average Annual Inf BOD Lbs/Day (Per 94 report):	64.00	*Normal is 0.17 to 0.22 Lbs per day*	
Total Population served By Facility:	698	(94)Lbs BOD per person/per day	0.092
Average Annual Effluent BOD conc (mg/l):	3.25		
(Daily Average)Lbs of BOD per Day Discharged =	12.50		
Lbs of BOD per day expected (population based)	118.66	*Based on 0.17 Lbs per Person/Day*	
% of Reported BOD/Lbs of BOD expected (pop)	54%		
Lbs BOD /Day Removed (Ch94)	51.5	Lbs BOD/Day Removed (Population)	106.2

In this case we see that the influent BOD loading data reported in the Chapter 94 report is approximately one half of what we would expect based on the population number. In this case the population number is derived by taking the EDUs divided by 2.5 which equals approximately 698 persons. A difference in population will change the results above slightly; a reduction in population of 100 persons would still yield an influent loading of approximately 89 lbs/day.

Step Two – The actual amount of sludge removed, based on the Chp 94 report. These numbers are higher than actual according to the operator based upon when the sludge is hauled away. The facility waits for a full load before hauling the bagged sludge which can take as long as 18 months.

2011

Sludge Removed (1 year Period)

Dry Tons	Month/Year	% Total
		0%
2.25	Feb-11	100%
		0%
		0%
		0%
		0%
		0%
		0%
		0%
		0%
		0%
		0%

2.25	Total Year Dry Tons
4500	Total YrDry Pounds (x 2000)

Step Three – The actual calculation of sludge removed based on Chapter 94 data and population based numbers.

2011

Digestion Type	Factor
No Digestion	1
Aerobic HDT=10	0.9
Aerobic HDT = 15	0.8
Aerobic HDT = 20	0.7
Aerobic HDT= >30	0.65
Aer Thermophilic	0.5
Anaer HDT = 20	0.75
Anaer HDT = 30	0.65
Anaer HDT = 40	0.55

Enter Digestion Factor	0.8

Sludge Volume Calculation (1) Based on (94) Actual Numbers Reported		Sludge Volume Calculation (2) Based on Population BOD Numbers	
51.5	Lbs per Day Removed	106.2	Lbs Removed
X 0.65	Treatment Factor	X 0.65	Treatment Factor
33.48	Daily Sludge Production	69.01	Daily Sludge Prod
X 0.8	Digestion Factor	X 0.8	Digestion Factor
26.78	Digested Daily Production	55.21	Digested Daily
X 365	Days per year	X 365	Days per Year
9,776	Lbs produced /Year	20,150	Lbs produced /Yr
4,500	Lbs Actually Wasted/Year	4,500	Lbs Wasted/Year
5,276	Lbs. Missing Solids	15,650	Lbs Missing
46%	Expected Volume Wasted	22%	Expected Volume

As you can see, calculating it either way, based on reported data or based on population, there is less sludge solids being removed than is expected to be generated. In instances such as this, the sludge often discharges with the effluent leading to instances of suspended solids violations. A reduction in population of 100 persons would yield an expected volume of 27% instead of 22%. This establishes that the issue of not removing enough sludge solids from the process tanks is an operational issue and not just an issue based upon a calculation using an inaccurate population base.

Step Four - Calculate an approximate amount of sludge that should be generated monthly for removal. This is based upon the percent solids data for liquid sludge in a holding tank with no supplemental chemical addition.

2011

	Based upon Chp 94 Data	Based upon Population BOD Numbers
Lbs sludge produced/year	9776.0	20150.0
Dry tons sludge produced/year	2.25	2.25
Assumed % Solids in Digestor	1.0	1.0
Gallons sludge produced/year	117,213	241,607
Gallons sludge produced/month	9,768	20,134

This calculation shows that in order to remove enough sludge to meet the calculated values, the operator will need to bag approximately 9,768 gallons each month. As noted previously, the organic loading must be confirmed since higher loadings as anticipated based on the population, will generate higher volumes of sludge.

The amount of BOD removed was based upon actual DMR data provided by the permittee for 2011, which showed an average effluent CBOD of 3.25 mg/l.