Town of Stevensville

Wastewater Treatment Plant Improvements

Preliminary Engineering Report

Phase 2 Improvements

Biosolids Analysis Amendment

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Section I. Executive Summary

This Preliminary Engineering Report (PER) biosolids analysis amendment serves as an update to the 2012 PER prepared for the Phase 2 Improvements Project and further evaluates the impact of the new system on the biosolids treatment and handling facilities.

The selected alternative of turning the excess capacity of the aerobic digester into a biological nutrient removal (BNR) facility will change the way the plant is run and impact the amount of solids produced. Careful attention will need to be taken with regard to solids handling and return flow to minimize the impact of phosphorus release and return to the biological process. Additionally, the BNR facility will utilize two of the four current aerobic digester cells, so an evaluation needs to be completed to determine alternatives for dealing with future additional sludge volumes. At the current flow rate, and 0.5% solids, the waste activated sludge (WAS) flow will be 3,275 gpd. At the future 2035 flow rate, the WAS will be 6,550 gpd. WAS production and flow quantities are summarized in Table1.

Table 1 – WAS Production

Flow	WAS Produced	WAS Flow (0.5% solids)
0.22 MGD (2012)	138 lbs/day	3275 gpd
0.40 MGD (2035)	276 lbs/day	6550 gpd

The volume of a single cell of the aerobic digester is 179,500 gallons, so under current conditions there is 55 days of storage available in a single aerobic digester cell. The sludge drying beds have capacity to hold about 135,000 gallons of material. Table 2 summarizes digester storage capacity under current and future conditions.

Table 2 – Digester Storage Capacity

Flow	Storage Days	
	One Digester	Two Digesters
0.22 MGD (2012)	55	110
0.40 MGD (2035)	27	55

To meet the EPA 40 CFR 503 regulations for biosolids digestion of Class B biosolids, the aerobic digester needs to have a detention time of between 60 days at 15 degrees Celsius and 40 days at 20 degrees Celsius. However, the disposal location for the Stevensville WWTP is EkoCompost in Missoula. At EkoCompost the biosolids are composted prior to disposal as beneficial compost. Therefore, the Class B requirements do not have to be met prior to transfer of the biosolids material to EkoCompost.

Section II. Evaluation of Alternatives

Option 1: No Improvements

If no improvements are made to the solids handling process, the facility will have 110 days of storage and digestion available at start-up, which will be reduced to 55 days as the flow increases to estimated 2035 conditions. Currently, sludge from the digesters is applied to the drying beds six times per year, about four times in the warmer months, and twice during the cold months. The sludge drying beds have enough capacity to hold approximately 135,000 gallons of biosolids material, so only ¾ of a digester can be emptied each time. Stevensville could continue operating with aerobic digestion and drying beds for dewatering the biosolids for approximately five years, but would eventually need to make a change due to the capacity of the drying beds, the concentration of the solids and the storage volume available in the digesters. It is recommended that improvements required to increase solids handling capacity for future conditions be included in the Phase 2 WWTP Improvements Project.

Table 3 – Digester Emptying Events to Sludge Drying Beds

Season	Digester Emptying Events to Drying Beds	Average Storage of Sludge in Digesters during Season
March to October	4	71 days
October to March	2	101 days

Option 2: Thicken the WAS

The anticipated concentration of solids in the WAS flow is 0.5%. If the WAS is thickened before digestion, the digester capacity can be increased greatly. For aerobic digestion, the solids concentration can be increased to as high as 3% solids, which would reduce the WAS flow to 550 gpd current and 1100 gpd future. The reduction of WAS volume would increase the capacity of the digester six-fold. It would also decrease the amount of time for sludge drying.

Table 4 – WAS Flows

Flow	WAS Flow (0.5% solids)	TWAS Flow (3% solids)
0.22 MGD (2012)	3275 gpd	550 gpd
0.40 MGD (2035)	6500 gpd	1100 gpd

Thickening the WAS can be completed in a number of ways. The most common technologies include:

- Dissolved Air Flotation Thickener or DAFT
- Rotary Screen Thickener or RST

In a DAFT, the entrained air bubbles from a blower or aspirator bring the solids particles up to the surface and the overflow product is typically around 3%. The DAFT can be operated with or without polymer addition to increase solids concentration. The underflow is drained back to the head of the plant. An exterior DAFT could be installed on the WAS line before the WAS is pumped into the digesters. This will require all of the DAFT equipment and additional pumps to move the TWAS to the digester. The DAFT tank would be installed outside to reduce costs and the pumps could be placed nearby in an existing building.

In an RST, the material is mixed with polymer and pumped through a screened drum, the thickened material falls into a hopper, and the drain is pumped back to the head of the plant. In this situation, the RST could be located on the upper deck of the digester facility and the TWAS could gravity flow into the digester. The existing WAS pumps could be used to feed the RST, reducing pumping costs. Alternatively, the RST could be located in the same area and only used when needed to recooperatively thicken the digester sludge and create more available volume. This could be done by modifying the discharge piping to the sludge drying beds and only used intermittently, as needed.

The cost estimate for the thickening options is shown below.

Table 5- Thickening Cost Estimates

Cost	DAFT	RST
Construction Cost	$416,000	$157,200
With Overhead, Tax and Contingencies	$580,000	$219,000
Escalated to 2014	$600,000	$227,000

Thickening the WAS increases the digester and sludge drying bed capacity cost effectively. However, solids management practices can have a significant impact on BNR operation particularly for biologic phosphorus removal. The longer the WAS digests, the more phosphorus is released from the microbe cells and recycled back to the plant as additional phosphorus loading. In addition to phosphorus, ammonia can also be recycled. Sidestream management needs to be considered when upgrading to a BNR facility.

Option 3: Dewatering the WAS

Since the capacity of the digesters is limited by the capacity of the sludge drying beds, mechanical dewatering of the digester sludge and the WAS was also considered. To completely remove the issue of the sidestream recycle from WAS digestion, and because digestion is not required for facilities that ultimately discharge their sludge to a compost operation, it was considered to bypass digestion completely. However, due to the anticipated odors of storage of undigested sludge at the site and lack of ability to transport to composting immediately, this option was no longer considered. To reduce odors and minimize the impact of phosphorus release, it is recommended to digest the sludge for 15 days and then dewater. To further reduce the dependency on weather, mechanical dewatering could be employed.

There are number of different options for mechanical dewatering. A belt filter press is a conventional technology, but is rather large, uses a great deal of wash water that must be recycled back to the head of the plant, and can be messy. A centrifuge can dewater to very high solids concentrations, but takes a considerable amount of electricity to spin at high rates. The type of dewatering equipment that makes the most sense for Stevensville is a screw press, which turns at a slow speed and has limited power consumption, a relatively small footprint, requires minimal operator attention and can be operated in a manner to minimize recycle loading to the biological process. The small footprint makes it possible to install a screw press on the deck of the aerobic digester. A small conveyor can move the dewatered biosolids outside of the digester complex to a loading dock, for further drying and storage on the sludge drying beds before transporting to the composting facility.

The preliminary cost of the dewatering option is shown below.

Table 6 – Dewatering Cost Estimates

Cost	Dewatering Screw Press
Construction Cost	$244,000
With Overhead, Tax and Contingencies	$312,000
Escalated to 2014	$323,000

Section III. Recommended Alternative

The recommended alternative is to install a screw press for solids dewatering. Although not the least expensive solution, it will provide the overall best value for the Town of Stevensville. The use of a screw press for dewatering will eliminate the need for additional sludge drying beds in the future, and reduce the impact of phosphorus release caused by long detention times and storage of biosolids in a digester.

The operations and maintenance costs of screw press and conveyor include additional minimal horsepower for the screw press and conveyor motor, as well as the polymer costs.

Table 7 – Operations and Maintenance Costs

Unit	Cost	Assumptions
Screw Press/Conveyor Electrical	$700/year	5 HP total
Polymer Usage	$1,700/year	17 lbs of polymer/dry ton