

312 W Whitewater Street | Whitewater, WI 53190

Wastewater Facility Plan

Technical Memorandum 4

Digestion Complex and Energy Production

City of Whitewater
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Donohue Project No.: 12600

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CHAPTER I –PURPOSE AND EXISTING CONDITIONS

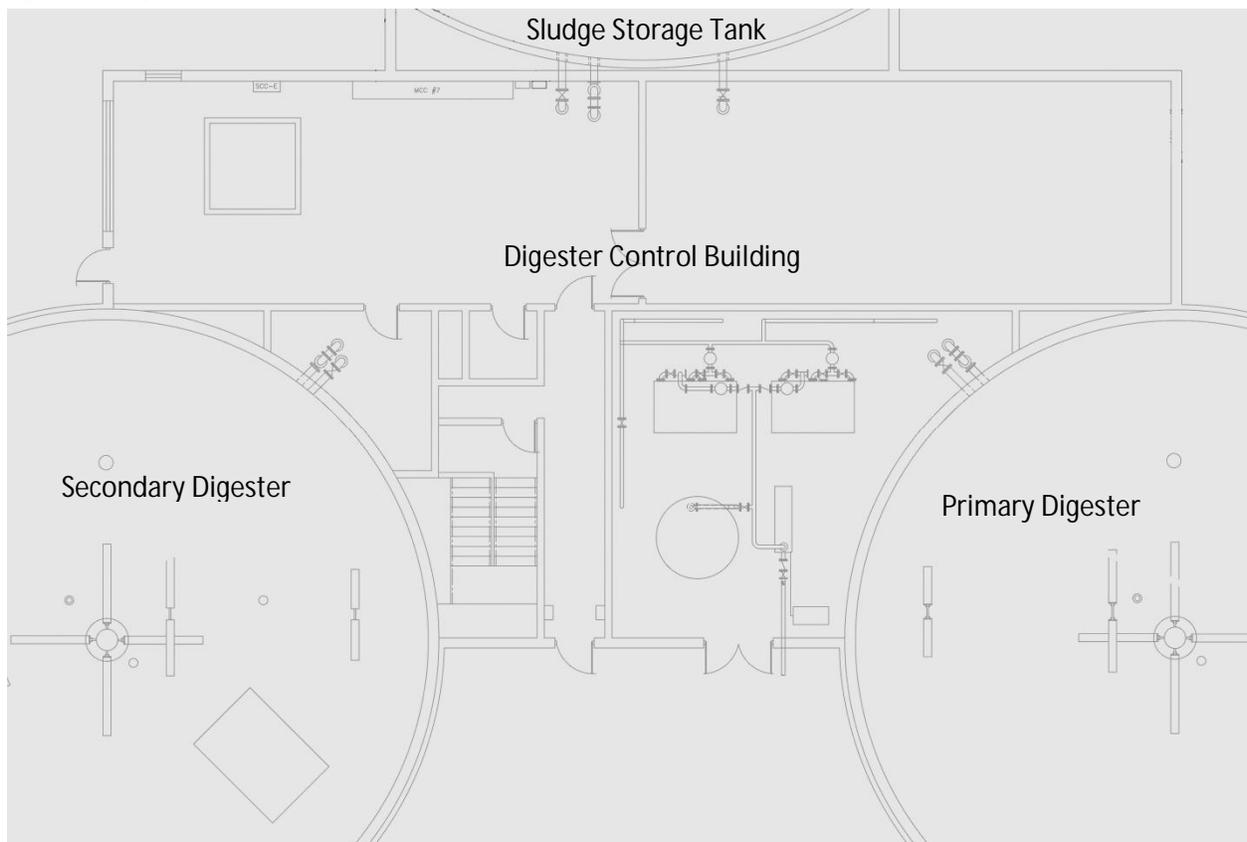
1.1 PURPOSE

The purpose of this Technical Memorandum (TM 4) is to assess the condition of the current anaerobic digestion complex and to recommend improvement alternatives to correct deficiencies and/or improve performance.

1.2 EXISTING CONDITIONS

The digestion complex consists of two 60 ft diameter digesters with approximately 78,500 ft³ of volume each and one 85 ft diameter sludge storage tank (157,000 ft³) with a digester control building in between, see Figure 1. The upper level of the digester control building contains electrical equipment, a sludge boiler, and sludge heat exchangers while the lower level contains sludge pumps and digester gas handling equipment. The primary digester is mixed using a jet mixing system with two 1,800 gpm chopper pumps. The sludge storage tank is mixed via a similar system with two 3,600 gpm pumps. The secondary (west) digester is unmixed.

Figure 1: Digestion Complex



CHAPTER II – CAPACITY

2.1 ANAEROBIC DIGESTION CAPACITY

The WAC NR 110 Code requires a minimum detention time of 15 days and maximum system loading of 80 lbs volatile solids (VS) per 1,000 ft³ of volume per day in primary anaerobic digesters. With only one of the current digesters serving as a primary digester, digestion capacity is limited to 39,000 gallons per day of combined primary and secondary sludge with a VS loading of 6,280 lbs VS/day.

Table 1 shows the expected loadings to the digesters over the twenty year planning period.

Table 1: Primary Digester Loadings

Loadings	Current Average	Future Average	Current Max Month	Future Max Month
Plan Influent Flow, mgd	1.5	1.85	3.1	3.80
Primary Sludge				
Flow at 2% Solids	14,029	17,257	21,772	26,779
Flow at 3% Solids	9,353	11,504	14,515	17,853
Flow at 4% Solids	7,015	8,628	10,886	13,389
TSS, ppd	2,340	2,878	3,632	4,467
VSS, ppd	1,970	2,424	3,058	3,761
Chemical Sludge, ppd	56	56	56	56
Thickened WAS				
Flow at 2% Solids	4,929	5,949	6,025	6,962
Flow at 4% Solids	2,465	2,974	3,013	3,481
Flow at 6% Solids	1,643	1,983	2,008	2,321
TSS, ppd	822	992	1,005	1,161
VSS, ppd	617	744	754	871
Total Sludge to Digester				
Flow at 2% Primary and 2% TWAS	18,959	23,206	27,797	33,741
Flow at 3% Primary and 4% TWAS	11,818	14,479	17,527	21,334
Flow at 4% Primary and 6% TWAS	8,658	10,611	12,895	15,710
TSS, ppd	3,162	3,870	4,636	5,628
VSS, ppd	2,587	3,167	3,811	4,631
Chemical Sludge, ppd	56	56	56	56

With the lowest solids concentration considered the primary digester would still provide a 17 day detention time at the future maximum month condition. The future maximum month VSS loading of 4,631 ppd results in a volumetric loading of 59 lbs VSS/day per 1,000 ft³. The single primary digester has the capacity to satisfy the NR110 detention time and volatile solids loading criteria for the twenty year planning period.

2.2 SLUDGE STORAGE CAPACITY

With only one digester being required for digestion, both the second digester and sludge storage tank are available for digested sludge storage for a combined total storage volume of 235,500 ft³ (1.75 million gallons). According to past plant data, digested sludge hauled to farmland had a total solids concentration of 4.4 percent. At the future average day sludge production rate, assuming a volatile solids destruction rate of 60 percent, approximately 5,370 gpd of digested sludge would be sent to sludge storage. This equates to approximately 109 days of storage in the secondary digester and 218 days of storage in the sludge storage tank for a total of 327 days. This storage capacity is well in excess of the required 180 days. As a worst-case planning condition, assuming only 40 percent volatile destruction the daily volume of sludge requiring storage increases to 7,246 gpd. In which case the secondary digester would provide 81 days of storage and the storage tank another 162 days for a total of 243 days.

Should operation of the new biological activated sludge process restrict the plant's ability to remove supernatant from the digesters, the solids concentration of the stored and subsequently hauled biosolids would be reduced. Assuming the solids content is reduced to approximately 2.7 percent (without supernating) from the current 4.4 percent (with supernating) approximately 8,750 gpd of digested sludge would be sent to storage. At this lower solids concentration, the secondary digester would provide 67 days of storage and the sludge storage tank would provide 134 days of storage for a total of 201 days of storage.

Operating at a lower solids concentration of 2.7 percent would increase current annual hauled sludge volumes from 1.6 million gallons to 2.6 million gallons. These operating parameters and conditions will be taken into account in the subsequent alternatives evaluation.

CHAPTER III –IMPROVEMENT ALTERNATIVES

Each improvement alternative will be categorized as listed below.

- Essential – Improvements that are essential to maintaining a safe and properly functioning anaerobic digestion system and biosolids land application program.
- Recommended – Improvements that either address issues that will become critical in the 20-year planning horizon or they enhance performance, efficiency, and/or cost effectiveness.
- Discretionary – Improvements that warrant consideration because they add value in some manner: tangible or intangible.

3.1 ESSENTIAL IMPROVEMENTS

3.1.1 REPLACE LINK-SEALS

Several modular mechanical seals (link-seals) have failed at locations within the digestion complex resulting in leaks. A few have already been fixed; however, the 3" non-potable water line entering the west side of lower level has shifted and will need to be excavated to be fixed.

The excavation and replacement of the link seal would cost approximately \$1,300 assuming the digester is already empty. Appendix A includes detailed cost estimates for the alternatives considered.

3.1.2 REPAIR DECKING

Structural steel decking supporting the concrete floor has corroded and is failing (Figure 2) on the west side of the complex underneath the overhead door and requires replacement.

Figure 2: Steel Decking Corrosion



Repairing the decking would require removing the floor to the next eastern beam and replacing the steel and concrete. Such a repair would cost approximately \$13,000.

3.1.3 NEW MCC AND REPAIR DUCTBANK WATER LEAKAGE

The existing concrete electrical ductbank serving the motor control center on the north side has cracked allowing water to penetrate into the conduits and building creating an unsafe condition, shown in Figure 3.

Figure 3: Leaking Ductbank



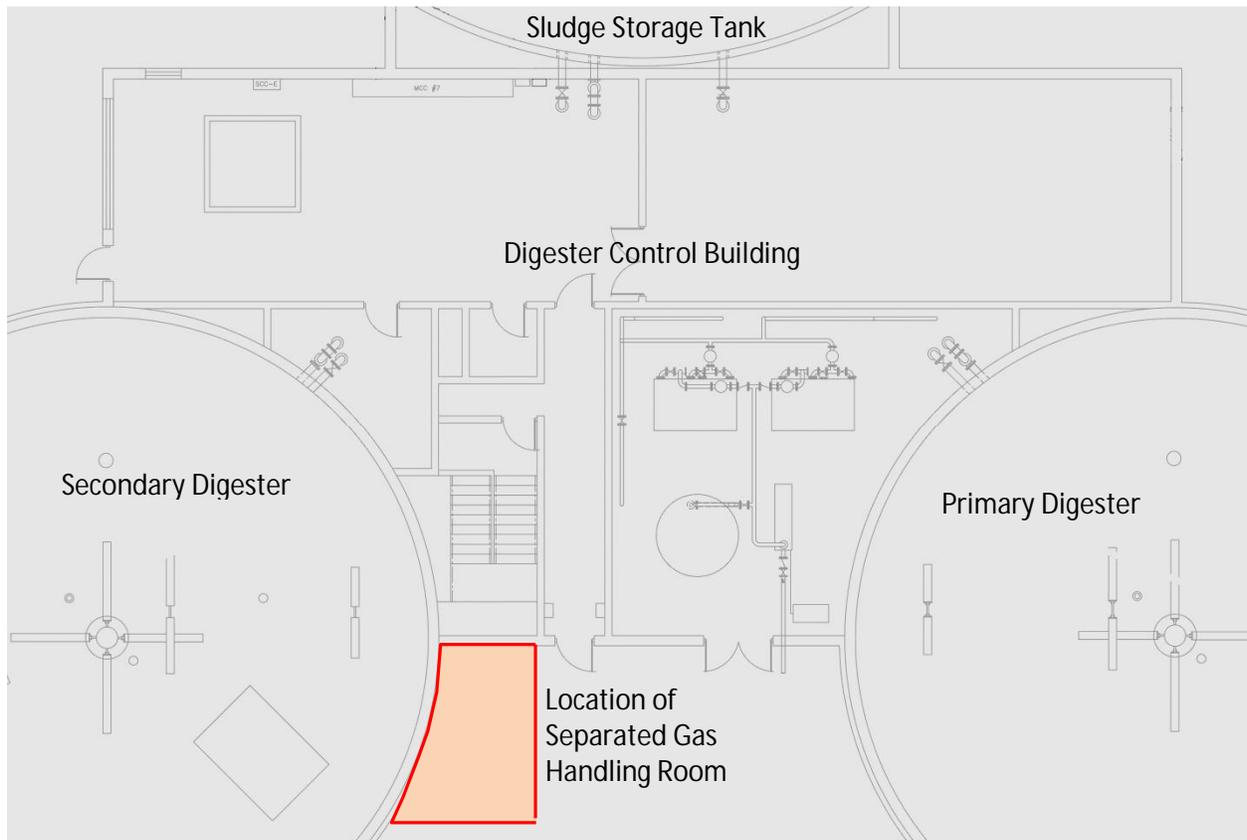
Donohue recommends replacing the 35 year old MCC equipment (similar to what is planned for other facility MCCs) and constructing a new duct bank to the digester complex. The old conduits entering the building should be cut and plugged at the wall along with epoxy injection of any other leaks identified. The estimated cost for these improvements is approximately \$172,000.

3.1.4 CORRECT NFPA 820 ISSUES

The digester complex currently contains several issues related to NFPA 820, *Standard for Fire Protection in Wastewater Treatment and Collection Facilities*. TM 7 discusses plant wide NFPA 820 issues in more detail. Due to the presence of gas handling equipment (condensate/sediment traps and drip traps) within the building, NFPA 820 dictates that the entire space be considered a hazardous area regardless of the ventilation provided. In order for the Digester Control Building to be considered a non-hazardous area under NFPA 820, the gas handling equipment needs to be separated into its own room isolated from the rest of the building. After isolation of the gas handling equipment, the sludge pumps on the lower level would require the entire building be ventilated at 6 AC/h in order to consider the building non-hazardous.

Construction of a separate gas handling room along with ventilation improvements to the existing building would cost approximately \$610,000. Figure 4 displays the identified location of the new gas handling room, which would have its own entry and stairs to the lower level.

Figure 4: Location of Separate Gas Handling Room



3.2 RECOMMENDED IMPROVEMENTS

3.2.1 DUAL FUEL BOILERS

The Control Building and Digester Building are currently heated using a natural gas fueled hot water system. In an effort to reduce energy costs and utilize digester gas, Donohue recommends new dual fuel (digester gas or natural gas) boilers be installed in the digester complex to provide hot water heat for both the digestion process and the Control Building. The old gas handling room in the Digester Control Building is currently being used for storage and has space to house the new boilers. Installation of these boilers along the required piping and controls would cost approximately \$174,000.

3.2.2 POST DIGESTION THICKENING

The plant has no means of thickening sludge after digestion. Currently the plant withdraws supernatant from the digesters to achieve a 4.4 percent solids concentration in the land applied biosolids. With the conversion to a biological phosphorus removal activated sludge system the amount of supernatant being returned to the plant may be reduced since the characteristics of this sludge tend to reduce settling and supernating. In such a case the volume of liquid biosolids to be land applied annually will increase.

A mechanical thickening system could be installed in order to increase solids concentration prior to sludge storage. Since a mechanical thickening system is already being designed for waste activated sludge, a viable method to accomplish digested sludge thickening could involve selecting a thickening technology that can be used for dual-purpose (both waste activated sludge thickening and digested sludge thickening). The thickener unit could be sized to allow scheduling the two thickening activities at differing time periods during the day. This method maximizes utilization of the equipment and eliminates a second thickening system at the facility.

The current dissolved air floatation waste activated sludge thickening system is not compatible with dual-purpose operation. Switching this system to a thickening centrifuge would allow dual-purpose operation and provide the added benefit of eliminating polymer conditioning for waste activated sludge (polymer will still be needed for digested sludge thickening). In order to equalize recycle loadings on the activated sludge system from digested sludge thickening, Donohue recommends installing a storage and pumping system for the centrate flow. The facility has 2 buried 11,500 gallon storage tanks for hauled waste storage that can be utilized for centrate equalization. In order to accomplish this, centrate piping would be installed from the new Process Building to the buried tanks and a centrate pump system would be installed in one of the tanks.

The increase in project cost for a centrifuge thickening system instead of a dissolved air floatation system along with installation of centrate piping and modifying the existing hauled waste storage tanks to equalize the centrate would add approximately \$294,000 to the overall project cost.

3.2.3 PASSIVE OVERFLOW TRANSFER

Currently sludge must be transferred from the primary digester to the secondary digester and the sludge storage tank using pumps. Installing passive gravity overflows from the primary to the secondary digester and to sludge storage would simplify operation. Installation of gravity overflows would cost approximately \$41,000.

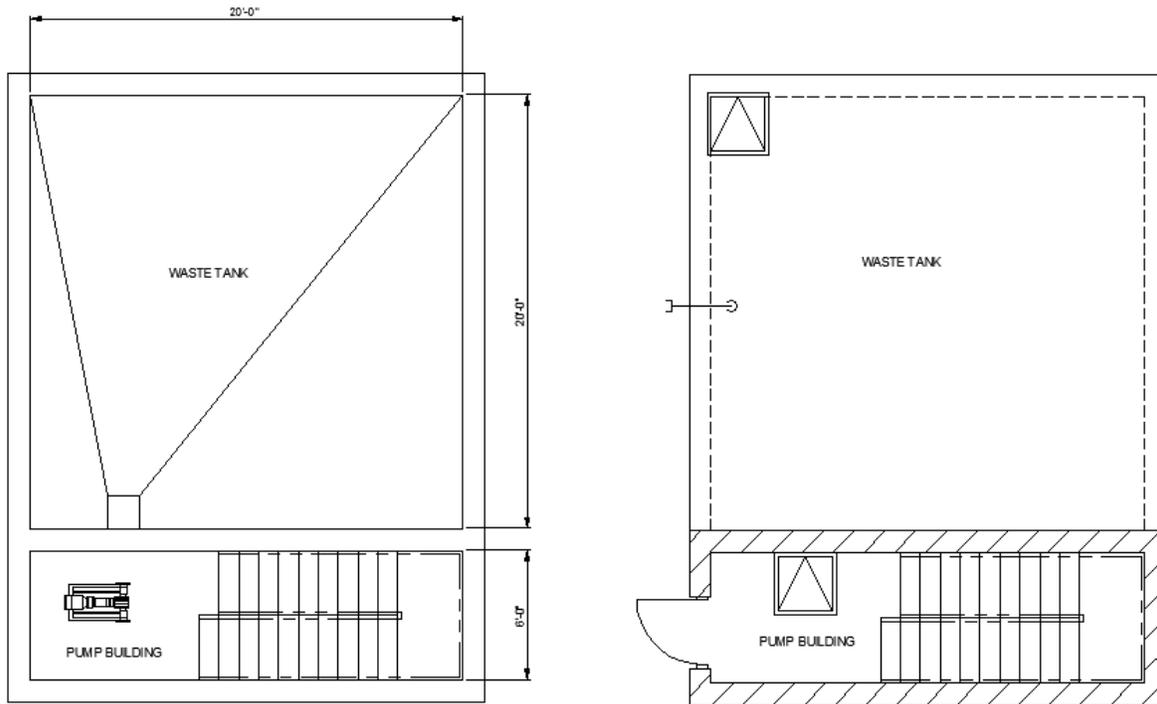
3.2.4 HAULED WASTE RECEIVING STATION

The plant currently lacks a way to add waste directly to the digesters. Construction of a hauled waste receiving station would allow the plant to utilize excess digester capacity to treat high strength waste or sludge from other sources and generate additional digester gas and revenue.

One alternative for creating a hauled waste receiving station is to retrofit the existing Secondary Clarifier 2 into a waste storage tank by removing the clarifier mechanism, coating the interior concrete surfaces with a high performance coating, installing a fiberglass dome cover, and installing a new high strength waste pump in the lower portion of the existing Secondary Pump Building. These improvements would cost approximately \$416,000.

A second alternative would be to construct an entirely new facility consisting of a 25,000 gallon in-ground, coated concrete storage tank with an attached dry pit pump station. Such a station would cost approximately \$299,000. Figure 5 shows a conceptual layout of the structure.

Figure 5: Hauled Waste Receiving Station



3.2.5 COATINGS

The Digester No. 2 tank coating is in poor condition and should be recoated to maximize the life of the tank. The digester cover is rusting as well (in particular the underside of Digester No. 2) and should be recoated to extend its life. Cleaning and recoating the digester surfaces would cost approximately \$476,000.

3.3 DISCRETIONARY IMPROVEMENTS

3.3.1 DIGESTER MIXING MODIFICATIONS

Currently Digester No. 2 is only mixed via the sludge recirculation pump, which provides minimal practical effect. Installation of new mixing system similar to that in Digester No. 1 would significantly improve the digestion performance.

Also, the only method to transfer sludge from Digester No. 2 to 1 is with small capacity pumps. When tanks need to be taken out of service it would be beneficial to have large capacity transfer pumps. The mixing pumps for the sludge storage tank can be used to pump into Digester No. 1 or 2 and the Digester No. 1 mixing pump can pump to Digester No. 2. Modifying the piping to allow these pumps to also pump from Digester No. 2 to 1 and from Digester Nos. 1 and 2 to storage would greatly increase transfer speed and improve operation and maintenance of the system.

Installing a jet mixing system for Digester No. 2, modifying the existing piping to allow the mixing pumps to transfer sludge between tanks, and installing VFDs and harmonic filters for the mixing pumps would cost approximately \$450,000.

3.3.2 SLUDGE DISPOSAL EQUIPMENT

The City's sludge disposal equipment is becoming antiquated. The newest piece of equipment is from 1985. Replacement sludge hauling vehicles and land application equipment will be required eventually unless the City switches to contracting with a private company for disposal. The City currently owns the following equipment that will need to be replaced:

- Semi Tractor with Tanker Trailer
- Tandem Hauler Tanker
- Terra-gator Liquid Applicator
- 8 Foot Disc Harrow
- Landall Weatherproofer

Replacing all the existing disposal equipment would cost approximately \$630,000 depending on the make and model of the equipment chosen.

3.4 ALTERNATIVES COST SUMMARY

Table 2 below summarizes the various improvement alternatives considered along with their estimated construction cost.

Table 2: Improvement Alternatives Cost Summary

Alternative	Estimated Construction Cost
Essential Improvements	
Replace Link-Seals	\$1,300
Repair Decking	\$13,000
New MCC and Repair Ductbank Water Leakage	\$172,000
Correct NFPA 820 Issues	\$607,000
Recommended Improvements	
Dual Fuel Boilers	\$174,000
Post Digestion Thickening	\$294,000
Passive Overflow Transfer	\$41,000
Hauled Waste Receiving Station (Retrofit)	\$416,000
Hauled Waste Receiving Station (New)	\$299,000
Coatings	\$476,000
Discretionary Improvements	
Digester Mixing Modifications	\$450,000
Sludge Disposal Equipment	\$630,000

CHAPTER IV –EVALUATION

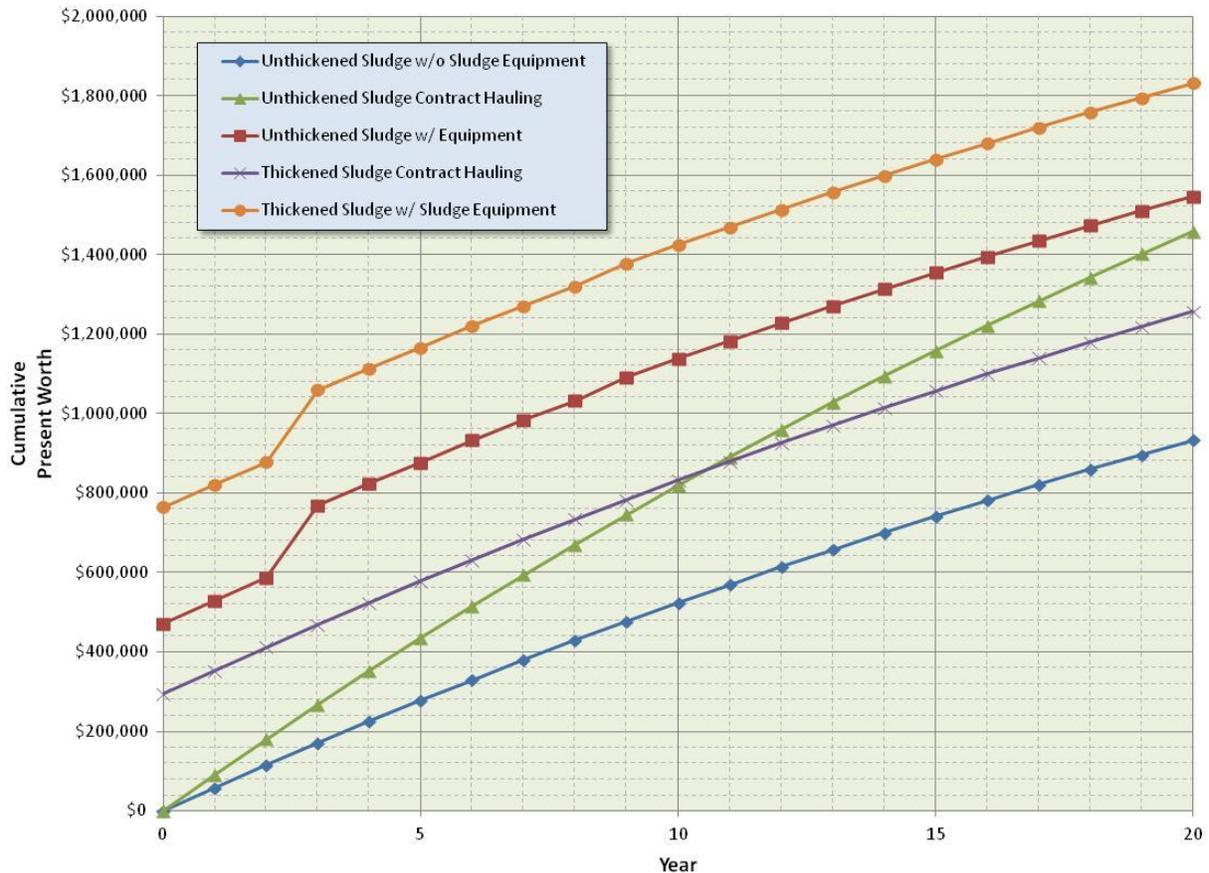
4.1 SLUDGE DISPOSAL EVALUATION

Considering the City's current sludge handling and disposal program, the upcoming plant improvements project, and several of the alternatives discussed in this TM there are several different scenarios the City should consider:

1. In-House Hauling of Unthickened Sludge without New Equipment – Under this scenario it is assumed that solids concentration of the hauled product has been reduced from the current 4.4 percent to 2.7 percent due to a reduction in digester supernating with the new activated sludge process. This would increase the annual hauled sludge volume from 1.6 million gallons to 2.6 million gallons. Disposal costs based on actual 2011-2013 operating records would be assumed to remain at \$0.023/gallon.
2. In-House Hauling of Unthickened Sludge with New Equipment – This scenario is the same as the first but includes the purchase of new land application equipment and semi tractor and trailer in the first year with the purchase of a new tandem hauling truck in 3 years, a new disk harrow in 6 years, and a new weatherproofer in 9 years.
3. Contract Hauling of Unthickened Sludge – In this scenario the 2.6 million gallons per year of 2.7 percent sludge from the first two scenarios would be disposed of by an outside contractor rather than City. The City has received a budgetary price of \$0.035/gallon for this service.
4. In-House Hauling of Thickened Sludge – This scenario would have the City install the new post digestion thickening equipment and new land application equipment as discussed previously. Thickening would allow the City to reduce the annual volume from the current 1.6 million gallons to 1.4 million gallons at 5% solids. Disposal costs are assumed to remain at \$0.023/gallon but additional operating cost for thickening (O&M, polymer, and power) will be required.
5. Contract Hauling of Thickened Sludge – In this scenario the City would install the new thickening equipment but contract out the disposal for \$0.035/gallon.

Appendix B contains present worth analyses for the scenarios described above. Figure 6 summarizes the results of this analysis.

Figure 6: Digested Sludge Disposal Present Worth Analysis



4.2 ENERGY PRODUCTION EVALUATION

In 2014 Trane and Black & Veatch conducted a Feasibility Study that evaluated the possibility of utilizing the facility’s unused anaerobic digestion capacity to treat high strength hauled in waste to generate additional biogas to produce energy. The study examined adding high strength waste receiving facilities, improvements to the existing digesters, biogas treatment systems, biogas storage, and biogas utilization equipment. The study concluded that a large energy generation project was not cost effective.

However, smaller scale projects in which the capital costs can be matched with the expected energy savings may yet be feasible. These projects could be staged such that large capital expenses are not made without a high level of confidence in their potential for energy production. The first stage would be to install hauled waste receiving station proposed previously to generate additional biogas along the previously proposed dual fuel boilers to make us of the gas. This would have a combined construction cost of approximately \$473,000. This project would save approximately \$50,000 a year in natural gas and should reach \$30,000 a year in tipping fees. With an estimated total revenue of \$80,000 the project has simple payback period of approximately 6 years.

Depending on additional gas production from the hauled in waste the second phase could add electricity production the form of engine generators to utilize any gas not being consumed by the dual fuel boilers.

Additional engine generators could be added in a later stage should the receiving program continue to be successful.

4.3 RECOMMENDATIONS

Based on the outcome of the sludge disposal evaluation, it initially appears the most cost effective scenario for the City would be to continue their current sludge program. However, this alternative has no operating flexibility for changing conditions or peak loading periods of the year. Also, this alternative is not entirely feasible over the next 20 years since the land application equipment is already more than 30 years old and unlikely to last the next 20. Considering these items, the second-most cost effective alternative would be to install the combination thickening equipment and contract with an outside party for disposal.

Based upon further discussion with plant staff with regards to needs and estimated costs the improvements listed in Table 3 below are recommended for implementation.

Table 3: Recommended Improvements

Alternative	Estimated Project Cost
Essential Improvements	
Replace Link-Seals	\$1,300
Repair Decking	\$13,000
New MCC and Repair Ductbank Water Leakage	\$172,000
Correct NFPA 820 Issues	\$607,000
Recommended Improvements	
Dual Fuel Boilers	\$174,000
Post Digestion Thickening	\$294,000
Passive Overflow Transfer	\$41,000
Hauled Waste Receiving Station (New)	\$299,000
Discretionary Improvements	
Digester Mixing Modifications	\$450,000
Total Estimated Project Cost	\$2,052,000

Appendix TM4-A
Cost Estimates

**CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI**

Replace Link Seals

INITIAL COST ESTIMATE

General Description

Cost estimate to remove leaking link seals on the 3" W3 and 4" Digester 2 Level Sensor Line in the digester complex. Digester 2 will use a double link seal.

<u>ITEM</u>	<u>Units</u>	<u>Quantity</u>	<u>Unit Cost (\$)</u>	<u>Initial Cost (\$)</u>
Architectural/Structural				
Earthwork	See Worksheet for Detailed Cost Breakdown			100
Concrete	See Worksheet for Detailed Cost Breakdown			0
Metals	See Worksheet for Detailed Cost Breakdown			0
Buildings	See Worksheet for Detailed Cost Breakdown			0
Demolition	See Worksheet for Detailed Cost Breakdown			300
3" W3 Link Seal	LS	1	300	300
4" Digester 2 Level Sensor Link Seal	LS	0	500	0
Civil Not Listed Above	%		0%	\$0
Process-Mechanical Piping Not Listed Above	%		0%	\$0
Electrical Not Listed Above	%		0%	\$0
Instrumentation and Control Not Listed Above	%		0%	\$0
Plumbing Not Listed Above	%		0.0%	\$0
HVAC Not Listed Above	%		0%	\$0
Subtotal				700
<u>Minus Major Equipment</u>				
Subtotal				700
Contingency (w/o Major Equipment)			30%	210
Subtotal				910
Contractor Overhead & Profit (w/o Major Equipment)			25%	228
Major Equipment Contingency			10%	0
Total Construction Cost				1,138
Engineering			15%	171
Total Initial Cost				1,308

CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI

Replace Link Seals

ARCHITECTURAL/STRUCTURAL WORKSHEET

ITEM	Units	Quantity	Unit Cost (\$)	Initial Cost (\$)
Earthwork: Dewatering	lump sum		25	0
Earthwork: Excavation	cu yds	10	10	100
Earthwork: Underdrain System	sq yds			
Earthwork: Pile Foundation	ft			
Earthwork: Flood Protection Levee	cu yds			
Earthwork: Flood Protection Gravel Road	sq yds			
Earthwork:				
Earthwork				100
Concrete: Footings	cu yds		330	0
Concrete: Base Slab	cu yds		330	0
Concrete: Walls	cu yds		965	0
Concrete: Floor Slabs	cu yds		350	0
Concrete: Structural Slabs	cu yds		775	0
Concrete: Columns	cu yds			
Concrete: Channels	cu yds		1,009	0
Concrete: Class B Fill	cu yds		305	0
Concrete				0
Metals: Aluminum Grating	sq ft		28	0
Metals: Aluminum Handrail	ft		53	0
Metals: Aluminum Stairway	risers		414	0
Metals: Baffles and Weirs	sq ft		70	0
Metals:				
Metals				0
Building: One Story Brick and Block	sq ft		125	0
Building: Two Story Brick and Block	sq ft		300	0
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Buildings				0
Demolition: Selective Concrete	cu ft		30	0
Demolition: Structure	cu ft		0.70	0
Demolition: Mechanical	lump sum			
Demolition: Concrete Cores	lump sum	1	300	300
Demolition				300

**CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI**

Repair Concrete Decking

INITIAL COST ESTIMATE

General Description

Cost estimate to repair corroding steel decking under concrete slab at overhead door by removing concrete and steel decking to first beam and replacing.

<u>ITEM</u>	<u>Units</u>	<u>Quantity</u>	<u>Unit Cost</u> <u>(\$)</u>	<u>Initial Cost</u> <u>(\$)</u>
Architectural/Structural				
Earthwork		See Worksheet for Detailed Cost Breakdown		0
Concrete		See Worksheet for Detailed Cost Breakdown		5,000
Metals		See Worksheet for Detailed Cost Breakdown		0
Buildings		See Worksheet for Detailed Cost Breakdown		0
Demolition		See Worksheet for Detailed Cost Breakdown		2,000
Civil Not Listed Above	%		0%	\$0
Process-Mechanical Piping Not Listed Above	%		0%	\$0
Electrical Not Listed Above	%		0%	\$0
Instrumentation and Control Not Listed Above	%		0%	\$0
Plumbing Not Listed Above	%		0.0%	\$0
HVAC Not Listed Above	%		0%	\$0
Subtotal				7,000
<u>Minus Major Equipment</u>				
Subtotal				7,000
Contingency (w/o Major Equipment)			30%	2,100
Subtotal				9,100
Contractor Overhead & Profit (w/o Major Equipment)			25%	2,275
Major Equipment Contingency			10%	0
Total Construction Cost				11,375
Engineering			15%	1,706
Total Initial Cost				13,081

CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI

Repair Concrete Decking

ARCHITECTURAL/STRUCTURAL WORKSHEET

ITEM	Units	Quantity	Unit Cost (\$)	Initial Cost (\$)
Earthwork: Dewatering	lump sum		0	
Earthwork: Excavation	cu yds		10	0
Earthwork: Underdrain System	sq yds			
Earthwork: Pile Foundation	ft			
Earthwork: Flood Protection Levee	cu yds			
Earthwork: Flood Protection Gravel Road	sq yds			
Earthwork:				
Earthwork				0
Concrete: Footings	cu yds		330	0
Concrete: Base Slab	cu yds		330	0
Concrete: Walls	cu yds		800	0
Concrete: Floor Slabs	cu yds		350	0
Concrete: Structural Slabs	cu yds		775	0
Concrete: Columns	cu yds			
Concrete: Channels	cu yds		1,009	0
Concrete: Replace Floor	lump sum	1	5,000	5,000
Concrete				5,000
Metals: Aluminum Grating	sq ft		28	0
Metals: Aluminum Handrail	ft		53	0
Metals: Aluminum Stairway	risers		414	0
Metals: Baffles and Weirs	sq ft		70	0
Metals:				
Metals				0
Building: One Story Brick and Block	sq ft		125	0
Building: Two Story Brick and Block	sq ft		300	0
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Buildings				0
Demolition: Selective Concrete	cu ft		30	0
Demolition: Structure	cu ft		0.70	0
Demolition: Saw Cut and Remove Deck	lump sum	1	2,000	2,000
Demolition:	lump sum			
Demolition				2,000

CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI

New MCC and Ductbank Wall Repair

INITIAL COST ESTIMATE

General Description

Cost estimate to repair the leaking ductbank connect at the north wall of the digester building and install a new MCC.

ITEM	Units	Quantity	Unit Cost (\$)	Initial Cost (\$)
Architectural/Structural				
Earthwork			See Worksheet for Detailed Cost Breakdown	0
Concrete			See Worksheet for Detailed Cost Breakdown	1,500
Metals			See Worksheet for Detailed Cost Breakdown	0
Buildings			See Worksheet for Detailed Cost Breakdown	0
Demolition			See Worksheet for Detailed Cost Breakdown	500
Civil Not Listed Above	LS	1	0	
Process-Mechanical Piping Not Listed Above	LS	1	0	
Electrical Not Listed Above	LS	1	80,000	80,000
Instrumentation and Control Not Listed Above	LS	1	10,000	10,000
Plumbing Not Listed Above				
HVAC Not Listed Above				
Subtotal				92,000
<u>Minus Major Equipment</u>				
Subtotal				92,000
Contingency (w/o Major Equipment)			30%	27,600
Subtotal				119,600
Contractor Overhead & Profit (w/o Major Equipment)			25%	29,900
Major Equipment Contingency			10%	0
Total Construction Cost				149,500
Engineering			15%	22,425
Total Initial Cost				171,925

CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI

New MCC and Ductbank Wall Repair

ARCHITECTURAL/STRUCTURAL WORKSHEET

ITEM	Units	Quantity	Unit Cost (\$)	Initial Cost (\$)
Earthwork: Dewatering	lump sum		0	
Earthwork: Excavation	cu yds		10	0
Earthwork: Underdrain System	sq yds			
Earthwork: Pile Foundation	ft			
Earthwork: Flood Protection Levee	cu yds			
Earthwork: Flood Protection Gravel Road	sq yds			
Earthwork:				
Earthwork				0
Concrete: Footings	cu yds		330	0
Concrete: Base Slab	cu yds		330	0
Concrete: Walls	cu yds		800	0
Concrete: Floor Slabs	cu yds		350	0
Concrete: Structural Slabs	cu yds		775	0
Concrete: Columns	cu yds			
Concrete: Channels	cu yds		1,009	0
Concrete: Epoxy resin injection	Lump Sum	1	1,500	1,500
Concrete				1,500
Metals: Aluminum Grating	sq ft		28	0
Metals: Aluminum Handrail	ft		53	0
Metals: Aluminum Stairway	risers		414	0
Metals: Baffles and Weirs	sq ft		70	0
Metals:				
Metals				0
Building: One Story Brick and Block Process Bldg	sq ft		125	0
Building: One Story Brick and Block Thickening Bldg	sq ft		125	0
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Buildings				0
Demolition: Selective Concrete	cu ft		30	0
Demolition: Structure	cu ft		0.70	0
Demolition: Mechanical	lump sum	1	500	500
Demolition:	lump sum			
Demolition				500

**CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI**

Correct NFPA 820 Issues

INITIAL COST ESTIMATE

General Description

Cost estimate to construct a new gas handling room outside the existing digester complex and ventilate the control building so the space can be considered a non-hazardous environment.

<u>ITEM</u>	<u>Units</u>	<u>Quantity</u>	<u>Unit Cost (\$)</u>	<u>Initial Cost (\$)</u>
Architectural/Structural				
Earthwork	See Worksheet for Detailed Cost Breakdown			0
Concrete	See Worksheet for Detailed Cost Breakdown			0
Metals	See Worksheet for Detailed Cost Breakdown			0
Buildings	See Worksheet for Detailed Cost Breakdown			0
Demolition	See Worksheet for Detailed Cost Breakdown			0
NFPA 820 Modifications per TM 7	LS	1	325,000	325,000
Civil Not Listed Above	%	1	0%	\$0
Process-Mechanical Piping Not Listed Above	%	1	0%	\$0
Electrical Not Listed Above	%	1	0%	\$0
Instrumentation and Control Not Listed Above	%	1	0%	\$0
Plumbing Not Listed Above	%	1	0.0%	\$0
HVAC Not Listed Above	%	1	0%	\$0
Subtotal				325,000
<u>Minus Major Equipment</u>				
0	0	0	0	
Subtotal				325,000
Contingency (w/o Major Equipment)			30%	97,500
Subtotal				422,500
Contractor Overhead & Profit (w/o Major Equipment)			25%	105,625
Major Equipment Contingency			10%	0
Total Construction Cost				528,125
Engineering			15%	79,219
Total Initial Cost				607,344

CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI

Correct NFPA 820 Issues

ARCHITECTURAL/STRUCTURAL WORKSHEET

ITEM	Units	Unit Cost (\$)	Initial Cost (\$)
Earthwork: Dewatering	lump sum	0	
Earthwork: Excavation	cu yds	10	0
Earthwork: Underdrain System	sq yds		
Earthwork: Pile Foundation	ft		
Earthwork: Flood Protection Levee	cu yds		
Earthwork: Flood Protection Gravel Road	sq yds		
Earthwork:			
Earthwork			0
Concrete: Footings	cu yds	330	0
Concrete: Base Slab	cu yds	330	0
Concrete: Walls	cu yds	800	0
Concrete: Floor Slabs	cu yds	350	0
Concrete: Structural Slabs	cu yds	775	0
Concrete: Columns	cu yds		
Concrete: Channels	cu yds	1,009	0
Concrete: Class B Fill	cu yds	305	0
Concrete			0
Metals: Aluminum Grating	sq ft	28	0
Metals: Aluminum Handrail	ft	53	0
Metals: Aluminum Stairway	risers	414	0
Metals: Baffles and Weirs	sq ft	70	0
Metals:			
Metals			0
Building: One Story Brick and Block Process Bldg	sq ft	125	0
Building: One Story Brick and Block Thickening Bldg	sq ft	125	0
Building:	sq ft		
Buildings			0
Demolition: Selective Concrete	cu ft	30	0
Demolition: Structure	cu ft	0.70	0
Demolition: Mechanical	lump sum	100,000	0
Demolition:	lump sum		
Demolition			0

**CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI**

Dual Fuel Boilers

INITIAL COST ESTIMATE

General Description

Cost estimate to install two new dual fuel boilers in the old gas handling room to provide heat for the plant.

<u>ITEM</u>	<u>Units</u>	<u>Quantity</u>	<u>Unit Cost (\$)</u>	<u>Initial Cost (\$)</u>
Architectural/Structural				
Earthwork	See Worksheet for Detailed Cost Breakdown			0
Concrete	See Worksheet for Detailed Cost Breakdown			0
Metals	See Worksheet for Detailed Cost Breakdown			0
Buildings	See Worksheet for Detailed Cost Breakdown			0
Demolition	See Worksheet for Detailed Cost Breakdown			5,000
Primary Hot Water Pump	Each	1	860	860
Building Heating Pump	Each	4	550	2,200
Hot Water Separator - 8"	Each	1	500	500
Digester Gas Boiler	Each	2	31,000	62,000
DG Boiler Pump	Each	1	850	850
Hot Water Expansion Tank	Each	1	500	500
Chemical Feeder	Each	1	1,000	1,000
Civil Not Listed Above	LS	0	0	
Process-Mechanical Piping Not Listed Above	LS	1	20,000	20,000
Electrical Not Listed Above	LS	1	10,000	10,000
Instrumentation and Control Not Listed Above	LS	1	10,000	10,000
Plumbing Not Listed Above	LS	0	0	
HVAC Not Listed Above	LS	0	0	
Subtotal				112,910
<u>Minus Major Equipment</u>				
Digester Gas Boiler	Each	2	31,000	62,000
Subtotal				50,910
Contingency (w/o Major Equipment)			30%	15,273
Subtotal				66,183
Contractor Overhead & Profit (w/o Major Equipment)			25%	16,546
Major Equipment Contingency			10%	6,200
Total Construction Cost				150,929
Engineering			15%	22,639
Total Initial Cost				173,568

CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI

Dual Fuel Boilers

ARCHITECTURAL/STRUCTURAL WORKSHEET

ITEM	Units	Quantity	Unit Cost (\$)	Initial Cost (\$)
Earthwork: Dewatering	lump sum		0	
Earthwork: Excavation	cu yds		10	0
Earthwork: Underdrain System	sq yds			
Earthwork: Pile Foundation	ft			
Earthwork: Flood Protection Levee	cu yds			
Earthwork: Flood Protection Gravel Road	sq yds			
Earthwork:				
Earthwork				0
Concrete: Footings	cu yds		330	0
Concrete: Base Slab	cu yds		330	0
Concrete: Walls	cu yds		800	0
Concrete: Floor Slabs	cu yds		350	0
Concrete: Structural Slabs	cu yds		775	0
Concrete: Columns	cu yds			
Concrete: Channels	cu yds		1,009	0
Concrete: Class B Fill	cu yds		305	0
Concrete				0
Metals: Aluminum Grating	sq ft		28	0
Metals: Aluminum Handrail	ft		53	0
Metals: Aluminum Stairway	risers		414	0
Metals: Baffles and Weirs	sq ft		70	0
Metals:				
Metals				0
Building: One Story Brick and Block	sq ft		125	0
Building: Two Story Brick and Block	sq ft		300	0
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Buildings				0
Demolition: Selective Concrete	cu ft		30	0
Demolition: Structure	lump sum		0.70	0
Demolition: Mechanical (Clarifier Conversion)	cu ft		0.60	0
Demolition:	lump sum	1	5,000	5,000
Demolition				5,000

**CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI**

Post Digestion Thickening

INITIAL COST ESTIMATE

General Description

Cost estimate to provide a thickening centrifuge in the new Process Building instead of a DAF. The centrifuge would be used for both thickening WAS and digested sludge.

<u>ITEM</u>	<u>Units</u>	<u>Quantity</u>	<u>Unit Cost (\$)</u>	<u>Initial Cost (\$)</u>
Architectural/Structural				
Earthwork				0
Concrete				0
Metals				0
Buildings				0
Demolition				0
Thickening Equipment adder DAF to Centrifuge	Each	1	140,000	140,000
Buried digested sludge piping	LF	300	50	15,000
Buried thickened digested sludge piping	LF	350	50	17,500
Buried filtrate piping	LF	250	50	12,500
Filtrate pump system in hauled waste storage tank	LS	1	15,000	15,000
Civil Not Listed Above	%		0%	\$0
Process-Mechanical Piping Not Listed Above	%		4%	\$8,879
Electrical Not Listed Above	%		4%	\$8,879
Instrumentation and Control Not Listed Above	%		2%	\$4,218
Plumbing Not Listed Above	%		0.0%	\$0
HVAC Not Listed Above	%		0%	\$0
Subtotal				221,976
<u>Minus Major Equipment</u>				
Thickening Equipment adder DAF to Centrifuge	Each	1	140,000	140,000
Buried digested sludge piping	LF	300	50	15,000
Buried thickened digested sludge piping	LF	350	50	17,500
Buried filtrate piping	LF	250	50	12,500
Filtrate pump system in hauled waste storage tank	LS	1	15,000	15,000
Subtotal				21,976
Contingency (w/o Major Equipment)			30%	6,593
Subtotal				28,568
Contractor Overhead & Profit (w/o Major Equipment)			25%	7,142
Major Equipment Contingency			10%	20,000
Total Construction Cost				255,710
Engineering			15%	38,357
Total Initial Cost				294,067

CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI

Post Digestion Thickening

ARCHITECTURAL/STRUCTURAL WORKSHEET

ITEM	Units	Quantity	Unit Cost (\$)	Initial Cost (\$)
Earthwork: Dewatering	lump sum		0	
Earthwork: Excavation	cu yds		10	0
Earthwork: Underdrain System	sq yds			
Earthwork: Pile Foundation	ft			
Earthwork: Flood Protection Levee	cu yds			
Earthwork: Flood Protection Gravel Road	sq yds			
Earthwork:				
Earthwork				0
Concrete: Footings	cu yds		330	0
Concrete: Base Slab	cu yds		330	0
Concrete: Walls	cu yds		800	0
Concrete: Floor Slabs	cu yds		350	0
Concrete: Structural Slabs	cu yds		775	0
Concrete: Columns	cu yds			
Concrete: Channels	cu yds		1,009	0
Concrete: Class B Fill	cu yds		305	0
Concrete				0
Metals: Aluminum Grating	sq ft		28	0
Metals: Aluminum Handrail	ft		53	0
Metals: Aluminum Stairway	risers		414	0
Metals: Baffles and Weirs	sq ft		70	0
Metals:				
Metals				0
Building: One Story Brick and Block Process Bldg	sq ft		125	0
Building: One Story Brick and Block Thickening Bldg	sq ft	0	125	0
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Buildings				0
Demolition: Selective Concrete	cu ft		30	0
Demolition: Structure	cu ft		0.70	0
Demolition: Mechanical	lump sum			
Demolition:	lump sum			
Demolition				0

CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI

Post Digestion Thickening

INITIAL ANNUAL O&M COST ESTIMATE

O&M Labor

<u>ITEM</u>	<u>Units</u>	<u>Annual Quantity</u>	<u>Unit Cost (\$)</u>	<u>Annual Cost (\$)</u>
Maintenance	hours	208	35	7,280
Sludge Hauling	gallons	1,400,000	0.035	49,000

Electricity

<u>ITEM</u>	<u>Units</u>	<u>Annual Quantity</u>	<u>Unit Cost (\$)</u>	<u>Annual Cost (\$)</u>
Feed Pumps	kwh	6,204	0.086	534
Thickened Sludge Pumps	kwh	12,408	0.086	1,067
Drive		9,306	0.086	800

Natural Gas

<u>ITEM</u>	<u>Units</u>	<u>Annual Quantity</u>	<u>Unit Cost (\$)</u>	<u>Annual Cost (\$)</u>
	therm		0.71	0

Chemicals

<u>ITEM</u>	<u>Units</u>	<u>Annual Quantity</u>	<u>Unit Cost (\$)</u>	<u>Annual Cost (\$)</u>
Polymer (assume centrifuge does not need polymer)	lb	0	2.50	0

**CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI**

Passive Overflow Transfer

INITIAL COST ESTIMATE

General Description

Cost estimate for installing a passive overflow sludge transfer line from Digester 1 to 2 and from 2 to storage.

<u>ITEM</u>	<u>Units</u>	<u>Quantity</u>	<u>Unit Cost (\$)</u>	<u>Initial Cost (\$)</u>
Architectural/Structural				
Earthwork	See Worksheet for Detailed Cost Breakdown			0
Concrete	See Worksheet for Detailed Cost Breakdown			6,663
Metals	See Worksheet for Detailed Cost Breakdown			0
Buildings	See Worksheet for Detailed Cost Breakdown			0
Demolition	See Worksheet for Detailed Cost Breakdown			2,000
Overflow Piping	Lump Sum	1	20,000	20,000
Civil Not Listed Above	%		0%	
Process-Mechanical Piping Not Listed Above	%		0%	
Electrical Not Listed Above	%		0%	
Instrumentation and Control Not Listed Above	%		0%	
Plumbing Not Listed Above	%		0%	
HVAC Not Listed Above	%		0%	
Subtotal				28,663
<u>Minus Major Equipment</u>				20,000
Subtotal				8,663
Contingency (w/o Major Equipment)			30%	2,599
Subtotal				11,261
Contractor Overhead & Profit (w/o Major Equipment)			25%	2,815
Major Equipment Contingency			10%	2,000
Total Construction Cost				36,077
Engineering			15%	5,411
Total Initial Cost				41,488

CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI

Passive Overflow Transfer

ARCHITECTURAL/STRUCTURAL WORKSHEET

ITEM	Units	Quantity	Unit Cost (\$)	Initial Cost (\$)
Earthwork: Dewatering	lump sum		0	
Earthwork: Excavation	cu yds		10	0
Earthwork: Underdrain System	sq yds			
Earthwork: Pile Foundation	ft			
Earthwork: Flood Protection Levee	cu yds			
Earthwork: Flood Protection Gravel Road	sq yds			
Earthwork:				
Earthwork				0
Concrete: Footings	cu yds		330	0
Concrete: Base Slab	cu yds		330	0
Concrete: Walls	cu yds	5	800	4,000
Concrete: Floor Slabs	cu yds		350	0
Concrete: Structural Slabs	cu yds	2	775	1,163
Concrete: Drilled in Dowels	Lump Sum	1	1,500	1,500
Concrete: Channels	cu yds		1,009	0
Concrete: Class B Fill	cu yds		305	0
Concrete				6,663
Metals: Aluminum Grating	sq ft		28	0
Metals: Aluminum Handrail	ft		53	0
Metals: Aluminum Stairway	risers		414	0
Metals: Baffles and Weirs	sq ft		70	0
Metals:				
Metals				0
Building: One Story Brick and Block	sq ft		125	0
Building: Two Story Brick and Block	sq ft		300	0
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Buildings				0
Demolition: Selective Concrete	cu ft		30	0
Demolition: Structure	lump sum		0.70	0
Demolition: Mechanical (Clarifier Conversion)	cu ft		0.60	0
Demolition:	lump sum	1	2,000	2,000
Demolition				2,000

**CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI**

Hauled Waste Receiving Station (Retrofit)

INITIAL COST ESTIMATE

General Description

Cost estimate to retrofit Secondary Clarifier No. 2 into a 345,000 gallon hauled waste receiving tank by coating the concrete and adding a cover. A digester feed pump would be located on the lower level of the Secondary Pump Building.

<u>ITEM</u>	<u>Units</u>	<u>Quantity</u>	<u>Unit Cost (\$)</u>	<u>Initial Cost (\$)</u>
Architectural/Structural				
Earthwork	See Worksheet for Detailed Cost Breakdown			0
Concrete	See Worksheet for Detailed Cost Breakdown			0
Metals	See Worksheet for Detailed Cost Breakdown			0
Buildings	See Worksheet for Detailed Cost Breakdown			154,345
Demolition	See Worksheet for Detailed Cost Breakdown			10,000
HSW Pump	Each	1	26,400	26,400
Civil Not Listed Above	LS	1	25,000	25,000
Process-Mechanical Piping Not Listed Above	LS	1	7,500	7,500
Electrical Not Listed Above	LS	1	3,000	3,000
Instrumentation and Control Not Listed Above	LS	1	5,000	5,000
Plumbing Not Listed Above				
HVAC Not Listed Above				
Subtotal				231,245
<u>Minus Major Equipment</u>				
HSW Pump	Each	1	26,400	26,400
Subtotal				204,845
Contingency (w/o Major Equipment)			30%	61,453
Subtotal				266,298
Contractor Overhead & Profit (w/o Major Equipment)			25%	66,575
Major Equipment Contingency			10%	2,640
Total Construction Cost				361,913
Engineering			15%	54,287
Total Initial Cost				416,200

CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI

Hauled Waste Receiving Station (Retrofit)

ARCHITECTURAL/STRUCTURAL WORKSHEET

ITEM	Units	Quantity	Unit Cost (\$)	Initial Cost (\$)
Earthwork: Dewatering	lump sum		0	
Earthwork: Excavation	cu yds		10	0
Earthwork: Underdrain System	sq yds			
Earthwork: Pile Foundation	ft			
Earthwork: Flood Protection Levee	cu yds			
Earthwork: Flood Protection Gravel Road	sq yds			
Earthwork:				
Earthwork				0
Concrete: Footings	cu yds		330	0
Concrete: Base Slab	cu yds		330	0
Concrete: Walls	cu yds		800	0
Concrete: Floor Slabs	cu yds		350	0
Concrete: Structural Slabs	cu yds		775	0
Concrete: Columns	cu yds			
Concrete: Channels	cu yds		1,009	0
Concrete: Class B Fill	cu yds		305	0
Concrete				0
Metals: Aluminum Grating	sq ft		28	0
Metals: Aluminum Handrail	ft		53	0
Metals: Aluminum Stairway	risers		414	0
Metals: Baffles and Weirs	sq ft		70	0
Metals:				
Metals				0
Building: One Story Brick and Block	sq ft		125	0
Building: Two Story Brick and Block	sq ft		300	0
Building: Fiberglass Dome	sq ft	4,072	25	101,800
Building: HSW Coating	sq ft	7,072	7.43	52,545
Building:	sq ft			
Building:	sq ft			
Buildings				154,345
Demolition: Selective Concrete	cu ft		30	0
Demolition: Structure	lump sum		0.70	0
Demolition: Mechanical (Clarifier Conversion)	cu ft		0.60	0
Demolition:	lump sum	1	10,000	10,000
Demolition				10,000

**CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI**

Hauled Waste Receiving Station (New)

INITIAL COST ESTIMATE

General Description

Cost estimate to construct a 25,000 gallon in ground concrete high strength waste storage tank with a attached dry pit pump station.

<u>ITEM</u>	<u>Units</u>	<u>Quantity</u>	<u>Unit Cost (\$)</u>	<u>Initial Cost (\$)</u>
Architectural/Structural				
Earthwork	See Worksheet for Detailed Cost Breakdown			0
Concrete	See Worksheet for Detailed Cost Breakdown			51,405
Metals	See Worksheet for Detailed Cost Breakdown			10,764
Buildings	See Worksheet for Detailed Cost Breakdown			26,726
Demolition	See Worksheet for Detailed Cost Breakdown			0
HSW Pump	Each	1	26,400	26,400
Civil Not Listed Above	LS	1	30,000	30,000
Process-Mechanical Piping Not Listed Above	LS	1	7,500	7,500
Electrical Not Listed Above	LS	1	3,000	3,000
Instrumentation and Control Not Listed Above	LS	1	5,000	5,000
Plumbing Not Listed Above				
HVAC Not Listed Above	LS	1	7,500	7,500
Subtotal				168,295
<u>Minus Major Equipment</u>				
HSW Pump	Each	1	26,400	26,400
Subtotal				141,895
Contingency (w/o Major Equipment)			30%	42,568
Subtotal				184,463
Contractor Overhead & Profit (w/o Major Equipment)			25%	46,116
Major Equipment Contingency			10%	2,640
Total Construction Cost				259,619
Engineering			15%	38,943
Total Initial Cost				298,562

CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI

Hauled Waste Receiving Station (New)

ARCHITECTURAL/STRUCTURAL WORKSHEET

ITEM	Units	Quantity	Unit Cost (\$)	Initial Cost (\$)
Earthwork: Dewatering	lump sum		0	
Earthwork: Excavation	cu yds		10	0
Earthwork: Underdrain System	sq yds			
Earthwork: Pile Foundation	ft			
Earthwork: Flood Protection Levee	cu yds			
Earthwork: Flood Protection Gravel Road	sq yds			
Earthwork:				
Earthwork				0
Concrete: Footings	cu yds		330	0
Concrete: Base Slab	cu yds	16	330	5,280
Concrete: Walls	cu yds	47	800	37,600
Concrete: Floor Slabs	cu yds		350	0
Concrete: Structural Slabs	cu yds	11	775	8,525
Concrete: Columns	cu yds			
Concrete: Channels	cu yds		1,009	0
Concrete: Class B Fill	cu yds		305	0
Concrete				51,405
Metals: Aluminum Grating	sq ft		28	0
Metals: Aluminum Handrail	ft		53	0
Metals: Aluminum Stairway	risers	26	414	10,764
Metals: Baffles and Weirs	sq ft		70	0
Metals:				
Metals				10,764
Building: One Story Brick and Block	sq ft	136	125	17,000
Building: Two Story Brick and Block	sq ft		300	0
Building: HSW Coating	sq ft	1,309	7.43	9,726
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Buildings				26,726
Demolition: Selective Concrete	cu ft		30	0
Demolition: Structure	lump sum		0.70	0
Demolition: Mechanical (Clarifier Conversion)	cu ft		0.60	0
Demolition:	lump sum			
Demolition				0

**CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI**

Digester Coatings

INITIAL COST ESTIMATE

General Description

Cost estimate to coat the interior surfaces and the Cover of Digester 2.

<u>ITEM</u>	<u>Units</u>	<u>Quantity</u>	<u>Unit Cost (\$)</u>	<u>Initial Cost (\$)</u>
Architectural/Structural				
Earthwork	See Worksheet for Detailed Cost Breakdown			0
Concrete	See Worksheet for Detailed Cost Breakdown			0
Metals	See Worksheet for Detailed Cost Breakdown			0
Buildings	See Worksheet for Detailed Cost Breakdown			0
Demolition	See Worksheet for Detailed Cost Breakdown			0
Digester cover inspection by manufacturer	Each	1	10,000	10,000
Sand blast and paint digester cover	Each	1	143,500	143,500
Sludge removal and cleaning	Gallons	20,000	1	10,000
500 ton crane mobilization	Each	2	19,000	38,000
500 ton crane rental	Hour	16	710	11,360
50 ton assist crane rental	Hour	16	175	2,800
Cribbing rental	Lump Sum	1	1,000	1,000
Extra crane rigging rental	Lump Sum	1	5,500	5,500
Digester Coatings	SF	8,106	4.00	32,424
Subtotal				254,584
Contingency (w/o Major Equipment)			30%	76,375
Subtotal				330,959
Contractor Overhead & Profit (w/o Major Equipment)			25%	82,740
Major Equipment Contingency			10%	0
Total Construction Cost				413,699
Engineering			15%	62,055
Total Initial Cost				475,754

CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI

Digester Coatings

ARCHITECTURAL/STRUCTURAL WORKSHEET

ITEM	Units	Quantity	Unit Cost (\$)	Initial Cost (\$)
Earthwork: Dewatering	lump sum		0	
Earthwork: Excavation	cu yds		10	0
Earthwork: Underdrain System	sq yds			
Earthwork: Pile Foundation	ft			
Earthwork: Flood Protection Levee	cu yds			
Earthwork: Flood Protection Gravel Road	sq yds			
Earthwork:				
Earthwork				0
Concrete: Footings	cu yds		330	0
Concrete: Base Slab	cu yds		330	0
Concrete: Walls	cu yds		800	0
Concrete: Floor Slabs	cu yds		350	0
Concrete: Structural Slabs	cu yds		775	0
Concrete: Columns	cu yds			
Concrete: Channels	cu yds		1,009	0
Concrete: Class B Fill	cu yds		305	0
Concrete				0
Metals: Aluminum Grating	sq ft		28	0
Metals: Aluminum Handrail	ft		53	0
Metals: Aluminum Stairway	risers		414	0
Metals: Baffles and Weirs	sq ft		70	0
Metals:				
Metals				0
Building: One Story Brick and Block	sq ft		125	0
Building: Two Story Brick and Block	sq ft		300	0
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Buildings				0
Demolition: Selective Concrete	cu ft		30	0
Demolition: Structure	lump sum		0.70	0
Demolition: Mechanical (Clarifier Conversion)	cu ft		0.60	0
Demolition:	lump sum			
Demolition				0

**CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI**

Digester Mixing Modifications

INITIAL COST ESTIMATE

General Description

Cost estimate to provide a jet mixing system for Digester 2 similar to that installed for both Digester 1 and the Sludge Storage Tank and modify jet mixing system piping to allow the mixing pumps to transfer sludge between tanks. Costs also include VFD drives and harmonic filters for the pumps.

<u>ITEM</u>	<u>Units</u>	<u>Quantity</u>	<u>Unit Cost (\$)</u>	<u>Initial Cost (\$)</u>
Architectural/Structural				
Earthwork	See Worksheet for Detailed Cost Breakdown			0
Concrete	See Worksheet for Detailed Cost Breakdown			0
Metals	See Worksheet for Detailed Cost Breakdown			0
Buildings	See Worksheet for Detailed Cost Breakdown			0
Demolition	See Worksheet for Detailed Cost Breakdown			10,000
Digester Mixing Equipment	Lump Sum	1	68,000	68,000
Civil Not Listed Above	LS	0	0	
Process-Mechanical Piping Not Listed Above	LS	1	75,000	75,000
Electrical Not Listed Above	LS	1	85,000	85,000
Instrumentation and Control Not Listed Above	LS	1	25,000	25,000
Plumbing Not Listed Above	LS	0	0	
HVAC Not Listed Above	LS	0	0	
Subtotal				263,000
<u>Minus Major Equipment</u>				
Digester Mixing Equipment		1	68,000	68,000
Subtotal				195,000
Contingency (w/o Major Equipment)			30%	58,500
Subtotal				253,500
Contractor Overhead & Profit (w/o Major Equipment)			25%	63,375
Major Equipment Contingency			10%	6,800
Total Construction Cost				391,675
Engineering			15%	58,751
Total Initial Cost				450,426

CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI

Digester Mixing Modifications

ARCHITECTURAL/STRUCTURAL WORKSHEET

ITEM	Units	Quantity	Unit Cost (\$)	Initial Cost (\$)
Earthwork: Dewatering	lump sum		0	
Earthwork: Excavation	cu yds		10	0
Earthwork: Underdrain System	sq yds			
Earthwork: Pile Foundation	ft			
Earthwork: Flood Protection Levee	cu yds			
Earthwork: Flood Protection Gravel Road	sq yds			
Earthwork:				
Earthwork				0
Concrete: Footings	cu yds		330	0
Concrete: Base Slab	cu yds		330	0
Concrete: Walls	cu yds		800	0
Concrete: Floor Slabs	cu yds		350	0
Concrete: Structural Slabs	cu yds		775	0
Concrete: Columns	cu yds			
Concrete: Channels	cu yds		1,009	0
Concrete: Class B Fill	cu yds		305	0
Concrete				0
Metals: Aluminum Grating	sq ft		28	0
Metals: Aluminum Handrail	ft		53	0
Metals: Aluminum Stairway	risers		414	0
Metals: Baffles and Weirs	sq ft		70	0
Metals:				
Metals				0
Building: One Story Brick and Block	sq ft		125	0
Building: Two Story Brick and Block	sq ft		300	0
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Buildings				0
Demolition: Selective Concrete	cu ft		30	0
Demolition: Structure	lump sum		0.70	0
Demolition: Mechanical (Clarifier Conversion)	cu ft		0.60	0
Demolition:	lump sum	1	10,000	10,000
Demolition				10,000

CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI

Sludge Disposal Equipment

INITIAL COST ESTIMATE

General Description

ITEM	Units	Quantity	Unit Cost (\$)	Initial Cost (\$)
Architectural/Structural				
Earthwork			See Worksheet for Detailed Cost Breakdown	0
Concrete			See Worksheet for Detailed Cost Breakdown	0
Metals			See Worksheet for Detailed Cost Breakdown	0
Buildings			See Worksheet for Detailed Cost Breakdown	0
Demolition			See Worksheet for Detailed Cost Breakdown	0
Semi-Tractor and Tanker	Ea	1	150,000	150,000
Tandem Hauler	Ea	1	110,000	110,000
Terragator	Ea	1	222,000	222,000
8 ft Disc Harrow	Ea	1	5,000	5,000
Landall Weatherproofer	Ea	1	11,000	11,000
Subtotal				498,000
<u>Minus Major Equipment</u>				
Semi-Tractor and Tanker	Ea	1	150,000	150,000
Tandem Hauler	Ea	1	110,000	110,000
Terragator	Ea	1	222,000	222,000
8 ft Disc Harrow	Ea	1	5,000	5,000
Landall Weatherproofer	0	1	11,000	11,000
Subtotal				0
Contingency (w/o Major Equipment)			30%	0
Subtotal				0
Contractor Overhead & Profit (w/o Major Equipment)			25%	0
Major Equipment Contingency			10%	49,800
Total Construction Cost				547,800
Engineering			15%	82,170
Total Initial Cost				629,970

CITY OF WHITEWATER
WASTEWATER FACILITY PLAN
WHITEWATER, WI

Sludge Disposal Equipment

ARCHITECTURAL/STRUCTURAL WORKSHEET

ITEM	Units	Quantity	Unit Cost (\$)	Initial Cost (\$)
Earthwork: Dewatering	lump sum		0	
Earthwork: Excavation	cu yds		10	0
Earthwork: Underdrain System	sq yds			
Earthwork: Pile Foundation	ft			
Earthwork: Flood Protection Levee	cu yds			
Earthwork: Flood Protection Gravel Road	sq yds			
Earthwork:				
Earthwork				0
Concrete: Footings	cu yds		330	0
Concrete: Base Slab	cu yds		330	0
Concrete: Walls	cu yds		800	0
Concrete: Floor Slabs	cu yds		350	0
Concrete: Structural Slabs	cu yds		775	0
Concrete: Columns	cu yds			
Concrete: Channels	cu yds		1,009	0
Concrete: Class B Fill	cu yds		305	0
Concrete				0
Metals: Aluminum Grating	sq ft		28	0
Metals: Aluminum Handrail	ft		53	0
Metals: Aluminum Stairway	risers		414	0
Metals: Baffles and Weirs	sq ft		70	0
Metals:				
Metals				0
Building: One Story Brick and Block	sq ft		125	0
Building: Two Story Brick and Block	sq ft		300	0
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Building:	sq ft			
Buildings				0
Demolition: Selective Concrete	cu ft		30	0
Demolition: Structure	lump sum		0.70	0
Demolition: Mechanical (Clarifier Conversion)	cu ft		0.60	0
Demolition:	lump sum			
Demolition				0

Appendix TM4-B
Sludge Disposal Economic Evaluation

**City of Whitewater
Wastewater Facility Plan
Whitewater, WI**

In-House Hauling of Unthickened Sludge w/o New Equipment

Present Worth Analysis Factors

Discount Rate	3.0%
Inflation Rate	0.5%
Escalation Rate (Above Inflation)	
Electricity (0-5 years)	2.0%
Electricity (6-20 years)	2.0%
Natural Gas	2.0%
Chemicals	2.0%

Comments

Electricity Escalation Rate = 2%

National Institute of Standards, Annual Supplement to NIST Handbook 135
Discount Rate = 3%
Inflation Rate = 0.5%
Natural Gas Escalation Rate = 2%
\$0.023/gallon Sludge Disposal Cost (2011-2013 Average)

Life Cycle Cost Analysis

Initial Cost										
Year (n)	Periodic Costs		Annual Operational Costs				PW Periodic	PW Annual	PW Cumulative	
	Replace	Salvage	O&M	Electricity	Natural Gas	Chemicals				Total Annual
0			59,800		0					0
1			60,099	0	0	0	60,099	0	58,349	58,349
2			60,399	0	0	0	60,399	0	56,932	115,281
3			60,701	0	0	0	60,701	0	55,550	170,831
4			61,005	0	0	0	61,005	0	54,202	225,033
5			61,310	0	0	0	61,310	0	52,887	277,920
6			61,617	0	0	0	61,617	0	51,603	329,523
7			61,925	0	0	0	61,925	0	50,350	379,873
8			62,234	0	0	0	62,234	0	49,128	429,002
9			62,545	0	0	0	62,545	0	47,936	476,938
10			62,858	0	0	0	62,858	0	46,772	523,710
11			63,172	0	0	0	63,172	0	45,637	569,347
12			63,488	0	0	0	63,488	0	44,529	613,877
13			63,806	0	0	0	63,806	0	43,449	657,325
14			64,125	0	0	0	64,125	0	42,394	699,719
15			64,445	0	0	0	64,445	0	41,365	741,084
16			64,768	0	0	0	64,768	0	40,361	781,445
17			65,091	0	0	0	65,091	0	39,381	820,827
18			65,417	0	0	0	65,417	0	38,426	859,252
19			65,744	0	0	0	65,744	0	37,493	896,745
20			66,073	0	0	0	66,073	0	36,583	933,328

20-Year Present Worth **933,328**

In-House Hauling of Unthickened Sludge w/o New Equipment		
Initial Cost		0
20-Year Present Worth		933,328
Average Annual Cost		63,041

Notes

**City of Whitewater
Wastewater Facility Plan
Whitewater, WI**

In-House Hauling of Unthickened Sludge w/ New Equipment

Present Worth Analysis Factors

Discount Rate	3.0%
Inflation Rate	0.5%
Escalation Rate (Above Inflation)	
Electricity (0-5 years)	2.0%
Electricity (6-20 years)	2.0%
Natural Gas	2.0%
Chemicals	2.0%

Comments

Electricity Escalation Rate = 2%

National Institute of Standards, Annual Supplement to NIST Handbook 135
Discount Rate = 3%
Inflation Rate = 0.5%
Natural Gas Escalation Rate = 2%
\$.023/gallon Sludge Disposal Cost (2011-2013 Average)

Life Cycle Cost Analysis

Initial Cost		471,000	Terra-Gator and Semi-Tractor and Trailer							
Year (n)	Periodic Costs		O&M	Annual Operational Costs			Total Annual	PW Periodic	PW Annual	PW Cumulative
	Replace	Salvage		Electricity	Natural Gas	Chemicals				
0			59,800	0	0	0	59,800			471,000
1			60,099	0	0	0	60,099	0	58,349	529,349
2			60,399	0	0	0	60,399	0	56,932	586,281
3	139,150	Tandem	60,701	0	0	0	60,701	127,342	55,550	769,173
4			61,005	0	0	0	61,005	0	54,202	823,375
5			61,310	0	0	0	61,310	0	52,887	876,262
6	6,300	Disc	61,617	0	0	0	61,617	5,276	51,603	933,141
7			61,925	0	0	0	61,925	0	50,350	983,491
8			62,234	0	0	0	62,234	0	49,128	1,032,620
9	14,000	Landall	62,545	0	0	0	62,545	10,730	47,936	1,091,286
10			62,858	0	0	0	62,858	0	46,772	1,138,058
11			63,172	0	0	0	63,172	0	45,637	1,183,695
12			63,488	0	0	0	63,488	0	44,529	1,228,224
13			63,806	0	0	0	63,806	0	43,449	1,271,673
14			64,125	0	0	0	64,125	0	42,394	1,314,067
15			64,445	0	0	0	64,445	0	41,365	1,355,432
16			64,768	0	0	0	64,768	0	40,361	1,395,793
17			65,091	0	0	0	65,091	0	39,381	1,435,175
18			65,417	0	0	0	65,417	0	38,426	1,473,600
19			65,744	0	0	0	65,744	0	37,493	1,511,093
20			66,073	0	0	0	66,073	0	36,583	1,547,676

20-Year Present Worth **1,547,676**

In-House Hauling of Unthickened Sludge w/ New Equipment	
Initial Cost	471,000
20-Year Present Worth	1,547,676
Average Annual Cost	71,014

Notes

**City of Whitewater
Wastewater Facility Plan
Whitewater, WI**

Contract Hauling of Unthickened Sludge

Present Worth Analysis Factors

Discount Rate	3.0%
Inflation Rate	0.5%
Escalation Rate (Above Inflation)	
Electricity (0-5 years)	2.0%
Electricity (6-20 years)	2.0%
Natural Gas	2.0%
Chemicals	2.0%

Comments

Electricity Escalation Rate = 2%
 National Institute of Standards, Annual Supplement to NIST Handbook 135
 Discount Rate = 3%
 Inflation Rate = 0.5%
 Natural Gas Escalation Rate = 2%
 \$0.035/gallon Sludge Disposal Cost (per United) and 10% of City's Current Labor Cost (\$2,500 /y)

Life Cycle Cost Analysis

Initial Cost									
Year (n)	Periodic Costs		Annual Operational Costs				PW Periodic	PW Annual	PW Cumulative
	Replace	Salvage	O&M	Electricity	Natural Gas	Chemicals			
0			93,500		0				0
1			93,968	0	0	0	93,968	0	91,231
2			94,437	0	0	0	94,437	0	89,016
3			94,910	0	0	0	94,910	0	86,856
4			95,384	0	0	0	95,384	0	84,748
5			95,861	0	0	0	95,861	0	82,691
6			96,340	0	0	0	96,340	0	80,683
7			96,822	0	0	0	96,822	0	78,725
8			97,306	0	0	0	97,306	0	76,814
9			97,793	0	0	0	97,793	0	74,950
10			98,282	0	0	0	98,282	0	73,131
11			98,773	0	0	0	98,773	0	71,356
12			99,267	0	0	0	99,267	0	69,624
13			99,763	0	0	0	99,763	0	67,934
14			100,262	0	0	0	100,262	0	66,285
15			100,763	0	0	0	100,763	0	64,676
16			101,267	0	0	0	101,267	0	63,106
17			101,773	0	0	0	101,773	0	61,575
18			102,282	0	0	0	102,282	0	60,080
19			102,794	0	0	0	102,794	0	58,622
20			103,308	0	0	0	103,308	0	57,199

20-Year Present Worth **1,459,301**

Contract Hauling of Unthickened Sludge	
Initial Cost	0
20-Year Present Worth	1,459,301
Average Annual Cost	98,568

Notes

**City of Whitewater
Wastewater Facility Plan
Whitewater, WI**

In-House Hauling of Thickened Sludge

Present Worth Analysis Factors

Discount Rate	3.0%
Inflation Rate	0.5%
Escalation Rate (Above Inflation)	
Electricity (0-5 years)	2.0%
Electricity (6-20 years)	2.0%
Natural Gas	2.0%
Chemicals	2.0%

Comments

Electricity Escalation Rate = 2%
 National Institute of Standards, Annual Supplement to NIST Handbook 135
 Discount Rate = 3%
 Inflation Rate = 0.5%
 Natural Gas Escalation Rate = 2%
 \$.023/gallon Sludge Disposal Cost (2011-2013 Average)

Life Cycle Cost Analysis

Initial Cost		765,067		Thickening Facilities, Terra-Gator, and Semi-Tractor and Trailer						
Year (n)	Periodic Costs		Annual Operational Costs				PW Periodic	PW Annual	PW Cumulative	
	Replace	Salvage	O&M	Electricity	Natural Gas	Chemicals				Total Annual
0			56,280	2,401	0	0	58,681			765,067
1			56,561	2,461	0	0	59,022	0	57,303	822,370
2			56,844	2,523	0	0	59,367	0	55,959	878,329
3	139,150	Tandem	57,128	2,586	0	0	59,714	127,342	54,647	1,060,318
4			57,414	2,650	0	0	60,064	0	53,366	1,113,684
5			57,701	2,717	0	0	60,418	0	52,117	1,165,801
6	6,300	Disc	57,990	2,784	0	0	60,774	5,276	50,897	1,221,975
7			58,280	2,854	0	0	61,134	0	49,707	1,271,682
8			58,571	2,925	0	0	61,496	0	48,546	1,320,228
9	14,000	Landall	58,864	2,999	0	0	61,862	10,730	47,412	1,378,370
10			59,158	3,074	0	0	62,232	0	46,306	1,424,676
11			59,454	3,150	0	0	62,604	0	45,227	1,469,903
12			59,751	3,229	0	0	62,980	0	44,173	1,514,076
13			60,050	3,310	0	0	63,360	0	43,145	1,557,221
14			60,350	3,393	0	0	63,743	0	42,142	1,599,363
15			60,652	3,477	0	0	64,129	0	41,162	1,640,525
16			60,955	3,564	0	0	64,520	0	40,206	1,680,731
17			61,260	3,653	0	0	64,913	0	39,274	1,720,005
18			61,566	3,745	0	0	65,311	0	38,363	1,758,368
19			61,874	3,838	0	0	65,713	0	37,475	1,795,843
20			62,184	3,934	0	0	66,118	0	36,608	1,832,451

20-Year Present Worth **1,832,451**

In-House Hauling of Thickened Sludge	
Initial Cost	765,067
20-Year Present Worth	1,832,451
Average Annual Cost	70,446

Notes

**City of Whitewater
Wastewater Facility Plan
Whitewater, WI**

Contract Hauling of Thickened Sludge

Present Worth Analysis Factors

Discount Rate	3.0%
Inflation Rate	0.5%
Escalation Rate (Above Inflation)	
Electricity (0-5 years)	2.0%
Electricity (6-20 years)	2.0%
Natural Gas	2.0%
Chemicals	2.0%

Comments

Electricity Escalation Rate = 2%
 National Institute of Standards, Annual Supplement to NIST Handbook 135
 Discount Rate = 3%
 Inflation Rate = 0.5%
 Natural Gas Escalation Rate = 2%
 \$0.035/gallon Sludge Disposal Cost (per United) and 10% of City's Current Labor Cost (\$2,500 /y)

Life Cycle Cost Analysis

Initial Cost		294,067	Thickening Facilities							
Year (n)	Periodic Costs		Annual Operational Costs				PW Periodic	PW Annual	PW Cumulative	
	Replace	Salvage	O&M	Electricity	Natural Gas	Chemicals				Total Annual
0			58,780	2,401	0	0	61,181			294,067
1			59,074	2,461	0	0	61,535	0	59,743	353,810
2			59,369	2,523	0	0	61,892	0	58,339	412,149
3			59,666	2,586	0	0	62,252	0	56,969	469,118
4			59,964	2,650	0	0	62,615	0	55,632	524,750
5			60,264	2,717	0	0	62,981	0	54,328	579,078
6			60,566	2,784	0	0	63,350	0	53,055	632,133
7			60,868	2,854	0	0	63,722	0	51,812	683,945
8			61,173	2,925	0	0	64,098	0	50,600	734,545
9			61,479	2,999	0	0	64,477	0	49,416	783,961
10			61,786	3,074	0	0	64,860	0	48,262	832,223
11			62,095	3,150	0	0	65,245	0	47,135	879,357
12			62,405	3,229	0	0	65,635	0	46,035	925,392
13			62,717	3,310	0	0	66,027	0	44,961	970,353
14			63,031	3,393	0	0	66,424	0	43,914	1,014,267
15			63,346	3,477	0	0	66,824	0	42,892	1,057,159
16			63,663	3,564	0	0	67,227	0	41,894	1,099,052
17			63,981	3,653	0	0	67,635	0	40,920	1,139,973
18			64,301	3,745	0	0	68,046	0	39,970	1,179,942
19			64,623	3,838	0	0	68,461	0	39,042	1,218,985
20			64,946	3,934	0	0	68,880	0	38,137	1,257,122

20-Year Present Worth **1,257,122**

Contract Hauling of Thickened Sludge	
Initial Cost	294,067
20-Year Present Worth	1,257,122
Average Annual Cost	65,109

Notes