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Report

Wastewater Treatment Plant Facilities Plan

City of

Whitewater, WI

December 2010

DRAFT

Report for

City of Whitewater, Wisconsin

Wastewater Treatment Plant Facilities Plan

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December 2010

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SECTION 1
INTRODUCTION

1.01 PURPOSE AND SCOPE OF REPORT

The City of Whitewater operates wastewater collection and treatment facilities that provide service to City residences, businesses, industries, and public institutions within the City of Whitewater.

This Facilities Plan was prepared for the purpose of developing an overall plan for wastewater management at the Whitewater Wastewater Treatment Plant (WWTP) for the next 20 years and beyond. This plan was developed to meet the requirements of federal and state regulations related to water quality in Whitewater Creek. The current facilities at the Whitewater WWTP were placed in operation in 1982. The last major renovation of the facility was completed in 1996. An equipment replacement and rehabilitation project has been constructed in 2010, replacing some of the aging equipment. Based on the age of the remaining facilities and changes in the contributory flows to the Whitewater WWTP, there is a need to conduct a comprehensive review of the facilities.

This report provides a review of the condition and capacity of the existing Whitewater WWTP facilities. The evaluations address compliance with the Wisconsin Administrative Code (WAC) since the facility was last renovated, including the impacts of anticipated effluent limit changes. Facilities are evaluated for a 20-year planning period, which includes anticipated treatment needs through the planning year of 2032.

A specific plan for modifications to the Whitewater WWTP is recommended and supported by an evaluation of monetary costs, environmental impacts, and other nonmonetary considerations.

1.02 LOCATION OF STUDY

The Whitewater WWTP provides wastewater treatment for the City of Whitewater. Figure 1.02-1 shows the current sewer service area and city limits. The City is located in northwest Walworth County and southwest Jefferson County in southeastern Wisconsin.

1.03 RELATED STUDIES AND REPORTS

The following reports were used in the preparation of this Facilities Plan.

A. *Wastewater Treatment Facilities Evaluation*, Strand Associates, Inc.®, March 1995.

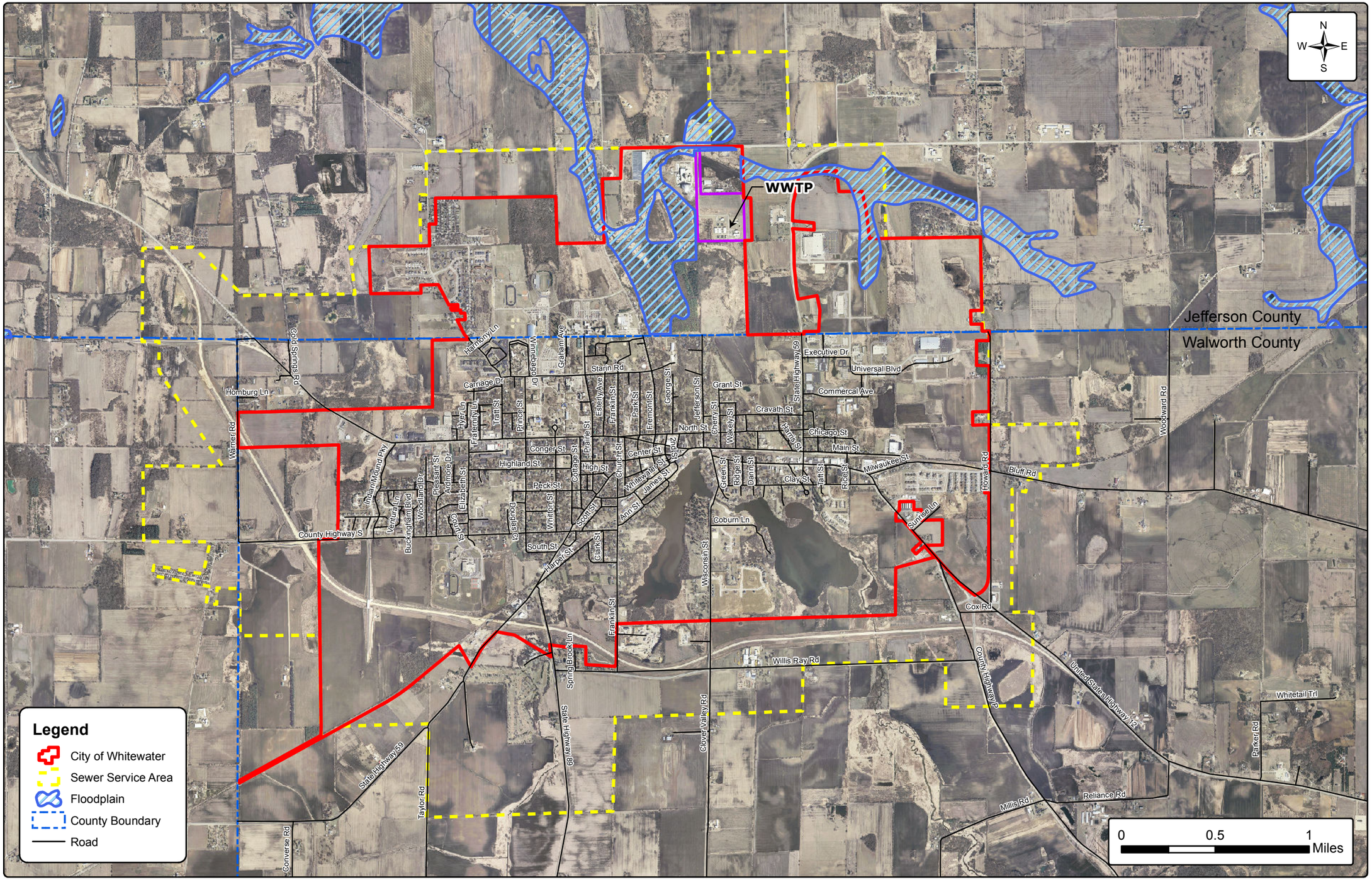
B. *Sanitary Sewer Service Area for the City of Whitewater,* Southeastern Wisconsin Regional Planning Commission, March 1995.

C. *Amendment to the Regional Water Quality Management Plan for the City of Whitewater,* Southeastern Wisconsin Regional Planning Commission, September 2003.

D. *Whitewater Wastewater Treatment Plant Energy Survey Report,* Focus on Energy, June 2003.

E. *Wastewater Treatment Plant Equipment Replacement and Rehabilitation*, Strand Associates, Inc.®, May 2009.

F. *Wastewater Treatment Plant Anaerobic Digestion Study*, Strand Associates, Inc.®, May 2010.



SEWER SERVICE AREA

WASTEWATER TREATMENTPLANT FACILITIES PLAN
CITY OF WHITEWATER, WISCONSIN

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 1.02-1
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1.04 RELATED DRAWINGS AND SPECIFICATIONS

The following were used in the preparation of this Facilities Plan.

A. *City of Whitewater Wastewater Treatment Plant,* R.A. Smith and Associates, 1979.

B. *Wastewater Treatment Plant Modifications*, Strand Associates, Inc.®, December 1995.

C. *Wastewater Treatment Plant Improvements*, Strand Associates, Inc.®, June 2009.

D. *Wastewater Treatment Plant Digester Boiler*, Strand Associates, Inc.®, November 2010.

1.05 DEFINITIONS

The following definitions are provided as an aid to the reader:

AHU	air handling unit
avg	average
BFP	belt filter press
BOD_5	five day biochemical oxygen demand
BNR	biological nutrient removal
BPR	biological phosphorus removal
cf/day	cubic feet per day
cfm	cubic feet per minute
cfs	cubic feet per second
CMAR	Compliance Maintenance Annual Reports
CMOM	Capacity, Management, Operation, and Maintenance
col/100 mL	colonies (bacteria) per 100 milliliters
CPR	chemical phosphorus removal
CWA	Clean Water Act of 1972
CWF	Clean Water Fund
DAF	design average flow
DAFT	dissolved air flotation thickener
DDC	direct digital controls
DO	dissolved oxygen
DOA	Wisconsin Department of Administration
DSL	digested sludge
E. coli	*Escherichia coli*
FACA	Federal Advisory Committee Act
ft	feet
ft^2	square feet
ft^3	cubic feet
GBT	gravity belt thickener
gcd	gallons per capita per day
GIS	Geographical Information Systems
gpd	gallons per day

gpd/in-dia-mi	gallons per inch diameter per mile per day
gpm	gallons per minute
gpm/sf	gallons per minute per square foot
Group	Rock River TMDL Group
hp	horsepower
HPS	high pressure sodium
HRT	hydraulic retention time
HVAC	heating, ventilating, and air-conditioning
I/I	infiltration/inflow
in	inches
IWC	instream waste concentration
lb/day	pounds/day
lf	linear feet
max	maximum
MBR	membrane bioreactor
MCC	motor control center
mgd	million gallons per day
mg/Kg	milligrams per kilogram
mg/L	milligrams per liter (parts per million in dilute solutions)
ML	mixed liquor
MLSS	mixed liquor suspended solids
MLVSS	mixed liquor volatile suspended solids
mm	millimeter
MPN	most probable number
NEC	National Electric Code
ng/L	nanograms per liter
NH_3N	ammonia nitrogen
NPDES	National Pollutant Discharge Elimination System
NPW	nonpotable water
O&M	operation and maintenance
P	phosphorus
PCB	polychlorinated Biphenyl
pcd	pounds per capita per day
PE	population equivalent
PHF	peak hourly flow
PLC	programmable logic controller
PMP	pollutant minimization plan
POTW	publicly owned treatment works
psig	pounds per square inch gauge
PSL	primary sludge
RAS	return activated sludge
RBC	rotating biological contactor
RBCE	RBC Effluent
RDT	rotary drum thickeners
RW	raw wastewater
$SBOD_5$	soluble BOD_5

SBR	sequencing batch reactor
SCADA	supervisory control and data acquisition
scfm	standard cubic feet per minute
SECAP	system evaluation and capacity assurance plan
SOLR	soluble organic loading rate
SOR	surface overflow rate
SOTE	standard oxygen transfer efficiency
sq ft	square feet
SS	suspended solids
SSL	secondary sludge
SSO	sanitary sewer overflows
SSES	sewer system evaluation survey
SWD	side water depth
TAC	technical advisory committee
TDH	total dynamic head
TKN	total Kjeldahl nitrogen (NH_3N plus organic N)
TMDL	total maximum daily load
TN	total nitrogen (TKN plus nitrate and nitrite N)
TP	total phosphorus
TPSL	thickened primary sludge
TS	total solids
TSS	total suspended solids
TWAS	thickened waste activated sludge
μg	micrograms
μg/L	micrograms per liter (parts per billion in dilute solutions)
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UV	ultraviolet light
VFD	variable frequency drive
VS	volatile solids
VSS	volatile suspended solids
WAC	Wisconsin Administrative Code
WAS	waste activated sludge
WDNR	Wisconsin Department of Natural Resources
WEF	Water Environment Federation
WLA	waste load allocation
WWTP	wastewater treatment plant
WPDES	Wisconsin Pollutant Discharge Elimination System
WQBEL	water quality-based effluent limits

SECTION 2
EXISTING WASTEWATER CONVEYANCE FACILITIES

2.01 BACKGROUND

The City of Whitewater presently operates and maintains collection and conveyance facilities that serve the residential, industrial, and commercial users in the City. This section provides a brief overview of the existing wastewater collection and conveyance system, reviews infiltration/inflow (I/I), describes any known system deficiencies, and develops a collection system value.

2.02 COLLECTION SYSTEM REVIEW

Table 2.02-1 summarizes the key components in the existing collection system. Figure 2.02-1 shows sewers, force mains, pumping stations, and the WWTP within the City of Whitewater sewer service area.

2.03 FLOW PROJECTIONS–SEWER SERVICE AREA

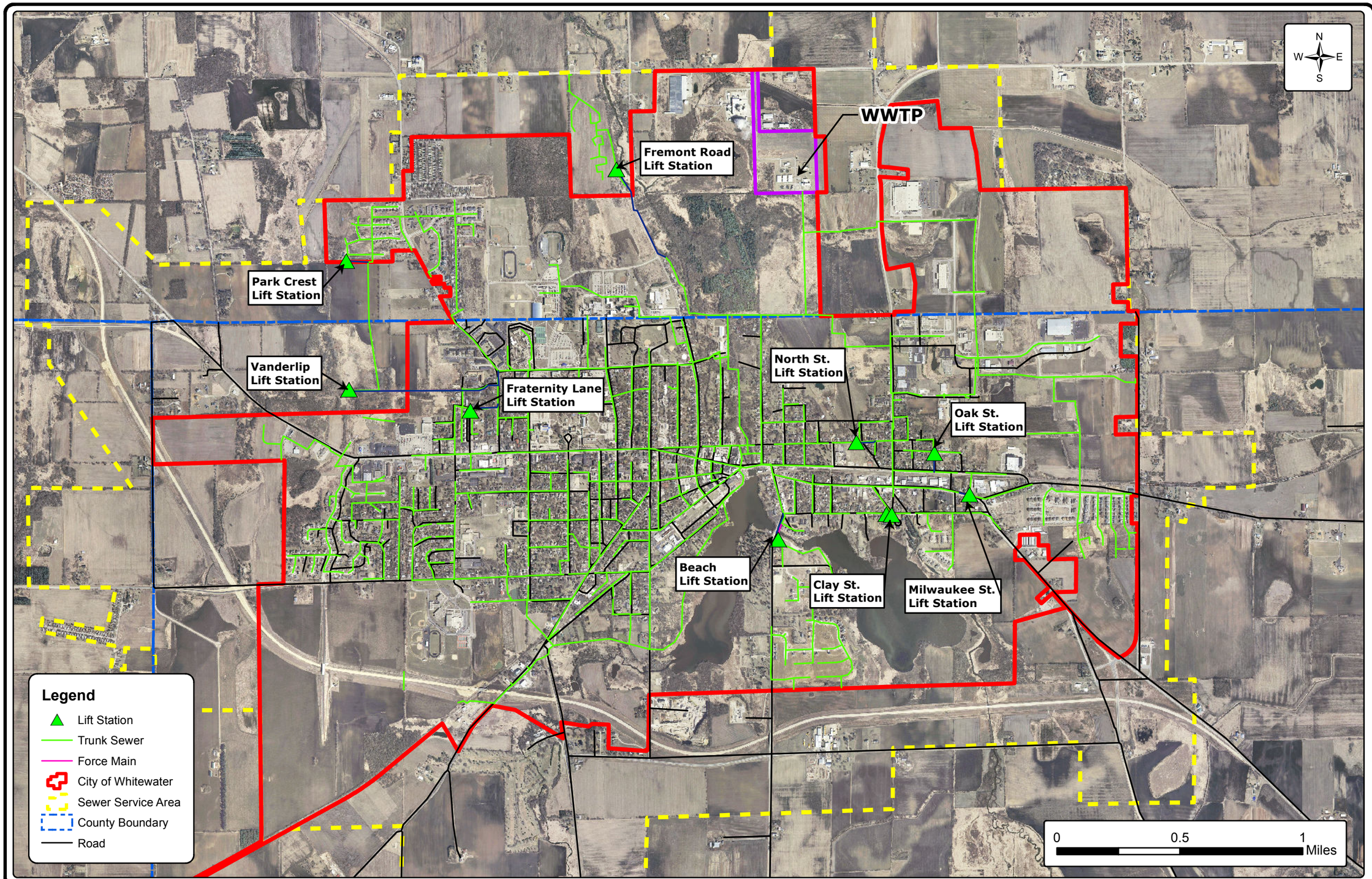
Flows contributed by existing users are summarized in Section 3. Flow projections for alternative evaluations are presented in Section 4.

2.04 INFILTRATION/INFLOW EVALUATION

The City has I/I entering its sewer system. This section analyzes estimates of I/I.

The I/I components for this report were projected based on flow records from 2004 through 2009. The estimated infiltration was obtained by subtracting the industrial and commercial flows (water sales) from the metered annual average WWTP flow. The estimated inflow was obtained by subtracting the industrial and commercial flows (water sales) from the metered maximum weekly WWTP flow. Appendix A presents the estimated per capita flows that were developed to compare to United States Environmental Protection Agency (USEPA) nonexcessive criteria. For 2007-2009, the estimated annual average residential per capita infiltration flow of 110 gallons per capita per day (gcd) is less than the USEPA criteria of 120 gcd for excessive infiltration during dry weather. The total flow including inflow based on maximum weekly flow is estimated to be 310 gcd between 2007 and 2009; for the entire 2004 to 2009 period, the maximum weekly inflow is 250 gcd. Therefore the system inflow appears to be at about the USEPA's identified nonexcessive inflow guidance value of 275 gcd for average wet weather flows. Based on these comparisons, infiltration does not appear to be excessive and inflow appears to be approximately at the threshold that would be considered excessive.

According to current sewer mapping for the City of Whitewater, the annual average amount of infiltration in terms of sewer size and length for 2007 through 2009 is 1,967 gallons per inch diameter per mile per day (gpd/in-dia-mi) (see Table 2.04-1); for the 2004 through 2009 period, the value is 1,568. According to the *Recommended Standards for Wastewater Treatment Facilities* (Great Lakes, 1997), typical acceptable infiltration rates for new sewers are 200 gpd/in-dia-mi. According to *Design of Municipal Wastewater Treatment Plants* MOP 8 (WEF 1998), "acceptable infiltration values before replacement or rehabilitation becomes appropriate in older, existing sewers can be ten or more times higher" or 2,000 gpd/in-dia-mi. In other words, it may not be cost-effective to remove the infiltration until rates exceed 2,000 gpd/in-dia-mi. If it is not cost-effective, the infiltration is not "excessive" according to the WAC Chapter NR 110 definition. By this standard, Whitewater's infiltration rate appears to be approaching the threshold value when considering the 2007 through 2009 period but not excessive considering the entire 2004 through 2009 period. This suggests it would not be cost-effective to remove infiltration from the collection system.



COLLECTION SYSTEM

WASTEWATER TREATMENTPLANT FACILITIES PLAN
CITY OF WHITEWATER, WISCONSIN

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 2.02-1
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TABLE 2.02-1

COLLECTION SYSTEM SUMMARY

Gravity Sewers and Interceptors		
Diameter (in)	**Approximate Lineal Feet**	**Approximate (in-dia-mi)**
4	60	0.05
6	3,300	4
8	166,000	252
10	16,700	32
12	10,800	25
14	500	1
15	12,600	36
18	11,700	40
21	6,000	24
24	6,600	30
27	3,600	18
30	700	4
36	3,200	22
42	1,700	14
48	2,600	24
Total	**246,100**	**524**

Force Mains	
Diameter (in)	**Approximate Lineal Feet**
4	1,280
6	1,362
8	5,838
Total	**8,480**

Pumping Stations		
Name	**Type**	**Capacity (gpm)**
Park Crest Lift Station	Submersible	230
Vanderlip Lift Station	Submersible	470
Fraternity Lane Lift Station	Submersible	300
Fremont Road Lift Station	Submersible	360
North Street Lift Station	Submersible	225
Oak Street Lift Station	Submersible	210
Milwaukee Street Lift Station	Submersible	320
Beach Lift Station	Submersible	230
Clay Street Lift Station	Submersible	290

Year	Annual Average Infiltration[1] (mgd)	Annual Average Infiltration Rate[2] (gpd/in-dia-mi)
2004	0.70	1,330
2005	0.37	700
2006	0.78	1,480
2007	0.97	1,850
2008	1.05	2,010
2009	1.07	2,040
Annual Averages		
2004-2007	0.70	1,340
2007-2009	1.03	1,967
2004-2009	0.82	1,568

Notes:
1. See Table 4.04-1 for development of annual average infiltration.
2. See Table 2.02-1 for summary of collection system sewers.

Table 2.04-1 Infiltration Analysis

2.05 EXISTING OPERATING DEFICIENCIES

The City of Whitewater recognizes that I/I needs to be reduced and investigates, tracks, and prioritizes problem areas in the collection system. In 2007, the City rehabilitated manholes by raising manhole lids to reduce I/I. In collaboration with the Water Utility, the WWTP began inspecting sump pump connections in September 2008 and this work and they intend to continue. Any sump pumps that are found to be connected to the sanitary sewer system are required to be disconnected. The City is replacing manhole seals and boots in the sewer system. Lateral installations are being inspected. New sewers are mandrel-tested. The City has also implemented stricter manhole and sewer standards in low areas. The City will continue to implement I/I reduction measures as part of an ongoing collection system maintenance program.

2.06 COLLECTION SYSTEM VALUE

The City of Whitewater owns and maintains approximately 47 miles of sewers, 1.6 miles of force mains, and nine lift stations. According to Whitewater Financial Statements, the total collection system book value on December 31, 2008 was $11,151,921. This included $682,699 for pumping stations, $115,800 for force mains, and $10,353,422 for gravity sewers. To determine the value of the collection system in December 2010 dollars, the length of gravity sewers was first identified by using Whitewater Geographic Information System (GIS) data. An approximate unit cost, which includes design and construction costs, was applied to each pipe size to yield a replacement cost. Table 2.06-1 shows the approximate value of the Whitewater sewer system in December 2010 dollars as approximately $16.4 million.

Sewer Diameter (in)	Lineal Feet	Unit Price ($/LF)	Estimated Collection System Value (December 2010)
4	60	40	$ 2,000
6	3,300	45	149,000
8	166,000	50	8,300,000
10	16,700	60	1,002,000
12	10,800	70	756,000
14	500	80	40,000
15	12,600	90	1,134,000
18	11,700	100	1,170,000
21	6,000	110	660,000
24	6,600	125	825,000
27	3,600	150	540,000
30	700	175	123,000
36	3,200	200	640,000
42	1,700	225	383,000
48	2,600	250	650,000
			$ 16,374,000

Table 2.06-1 Gravity Sewer Value

2.07 POTENTIAL COLLECTION SYSTEM REPLACEMENT FUND

Contribution to a collection system replacement fund is recommended to give the City the ability to pay for replacing aging sewers. The City can annually set aside funds to pay for anticipated future sewer work. Collecting and interceptor mains are approximately 90 percent of the value of the collection system according to the recent Whitewater Municipal Water and Wastewater Utilities Financial Statements. Therefore, the value of the sewers is a reasonable measure for the City to use to budget for a collection system replacement fund. The recommended annual collection system replacement fund contribution assuming a typical sewer lifespan of 75 years is $218,000. The City presently has a budget of $100,000 a year in its capital improvements plan for sewer rehabilitation and replacement.

Using the ratio of replacement cost to book value for gravity sewers and applying it to pumping stations, the replacement cost of the pumping stations would be approximately $1.1 million. Approximately one quarter of this cost would be associated with equipment having a 20-year design life. The wastewater treatment plant equipment replacement fund currently includes an annual deposit of $2,400 to replace pumps and motors; it may be appropriate to increase this deposit amount to about $10,000 to $15,000.

SECTION 3
EXISTING WASTEWATER TREATMENT FACILITIES

3.01 BACKGROUND

The City of Whitewater operates an advanced secondary WWTP that discharges to Whitewater Creek. The majority of WWTP facilities were constructed in 1982, with supplemental air blowers for the rotating biological contactors (RBCs) installed in 1989. In 1996, screening, grit removal, chemical phosphorus removal (CPR), and septage receiving facilities were constructed. In 2009, a project was bid to replace aging equipment throughout the WWTP (referred to as the "2010 construction project"). Current flows and loadings are lower than original design values because of the closure of a significant food processing industry. This section presents a summary of the existing process and equipment as well as a review of the facility performance from January 2004 through December 2009.

3.02 DESCRIPTION OF EXISTING FACILITIES

This section describes the basis for design of the existing facilities including current effluent limitations, unit design capacities, and rated capacities. It also indicates equipment that has been replaced or rehabilitated as part of the 2010 construction project.

Wastewater treatment plants are required to meet effluent limitations established by the Wisconsin Department of Natural Resources (WDNR). The current effluent limitations are shown in Table 3.02-1. A copy of the current Wisconsin Pollutant Discharge Elimination System (WPDES) permit is provided in Appendix C. The permit (WI-0020001) was recently reissued and is scheduled to expire December 31, 2013.

An aerial photo of the existing plant is shown in Figure 3.02-1. Figure 3.02-2 presents a schematic drawing of the existing WWTP. The unit design criteria are listed in Table 3.02-2.

Wastewater is conveyed to the treatment plant from the City of Whitewater through a 48-inch-diameter influent sewer. Raw wastewater passes through a 2-inch manual bar screen as it enters the influent wet well. Three influent pumps discharge wastewater from this wet well through a magnetic flow meter. The three pumps have been removed and four new pumps have been installed as part of the 2010 construction project. The raw wastewater is sampled immediately downstream of the flow meter. The metered flow is conveyed to a mechanically cleaned bar screen with 3/8-inch openings. Screenings are pressed, discharged to a dumpster, and landfilled. The existing screenings press has been replaced with a new wash press in 2010. Screened wastewater flows to a vortex grit collector. This unit process removes grit from the influent before introduction to the primary clarifiers. Grit is dewatered in a classifier and landfilled.

The influent wastewater is divided between two primary clarifiers. In these units, settleable solids are removed by providing an area of quiescent settling. Primary clarifier collection and sludge pumping equipment have been replaced and other associated items have been rehabilitated in 2010. Primary clarifier effluent flows to the RBC units.

Biological treatment occurs in the RBCs, which are housed in three buildings. Each building contains two trains of eight RBC units. Wastewater flows perpendicular to the shafts. The last four units in each train are high-density media RBCs. Staging is accomplished by using baffles

between the RBC units. Supplemental air is provided by two blowers to increase dissolved oxygen (DO) levels and provide a means to strip the RBC shafts of excess biomass. Because of changes in industrial loadings, influent loadings are much lower than design, and Whitewater currently uses only two of the three RBC buildings for treatment. Evaluations have shown that it may be possible to use only one of the three buildings for treatment during the summer; however, this may restrict hydraulic capacity to unacceptable levels.

RBC effluent flows are split between two secondary clarifiers at a division box. Phosphorus removal chemical (alum) is added to the RBC effluent upstream of the secondary clarifiers in the division box. With the 2010 project, secondary clarifier collection and sludge pumping equipment has been replaced and other associated items have been rehabilitated.

Secondary clarifier effluent flows to a four-cell gravity filter. This unit serves to remove additional solids from the secondary effluent before entering the chlorine contact tank. The filtration facilities were rehabilitated during the 2010 project.

Prior to the 2010 project, chlorine solution was added in the chlorine contact tank to inactivate living wastewater-borne microorganisms. Contact time for the chlorine is provided in the tank. To dechlorinate, sulfur dioxide was added near the end of the chlorine contact tank to react with the remaining chlorine residual. The chlorination/dechlorination facilities have been replaced with UV disinfection as part of the 2010 project.

Effluent from the chlorine contact tank flows to the postaeration tank where air is added to increase DO levels above discharge permit requirements. Plant effluent is metered in a Parshall flume and discharged to Whitewater Creek.

Secondary sludge that has settled in the secondary clarifiers is pumped into the primary clarifier division box. This serves to cothicken the secondary solids along with the primary solids in the primary clarifier. Primary and secondary sludge that settles in the primary sedimentation tanks is withdrawn and pumped directly to the primary digesters. Secondary sludge can also be pumped directly to the primary digesters without cothickening, if desired.

The two primary anaerobic digesters provide an environment where organic matter is digested and the solids stabilized. Digested sludge is transferred to the secondary digester (sludge storage tank) for storage. Sludge storage tank supernatant is returned to the influent wet well. Sludge from the secondary digester can be loaded onto trucks at the liquid sludge loading station. One of the two primary digesters has been rehabilitated and provided with a new recirculation pump and mixing system as part of the 2010 project, and the sludge storage tank has also been provided with a new mixing system. Digested sludge is field-applied directly in liquid form. Methane gas produced by the digesters is flared to a waste gas burner, which was replaced in 2010. Methane utilization equipment, including a compressor and gas storage sphere, is no longer used.

City of Whitewater

Wastewater Treatment Plant

1. Influent Pumping
2. Preliminary Treatment and Chemical Feed Building
3. Primary Clarifiers
4. Primary Pump Building
5. Rotating Biological Contractors
6. Secondary Clarifiers
7. Secondary Pump Building
8. Effluent Filtration
9. Chlorine Contact Tank
10. Post Aeration
11. Administration Building
12. Anaerobic Digestion
13. Gas Storage Sphere
14. Hauled Waste Receiving Stations and Holding Tanks
15. Blower Building, Blower Building
16. Septage Receiving Station

F1 Influent Flow Meter

F2 Effluent Flow Meter

S1 Influent Sampler

S2 Effluent Sampler

N
W E
S

0 100 200 Feet

EXISTING SITE PLAN

WASTEWATER TREATMENTPLANT FACILITIES PLAN
CITY OF WHITEWATER, WISCONSIN

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 3.02-1
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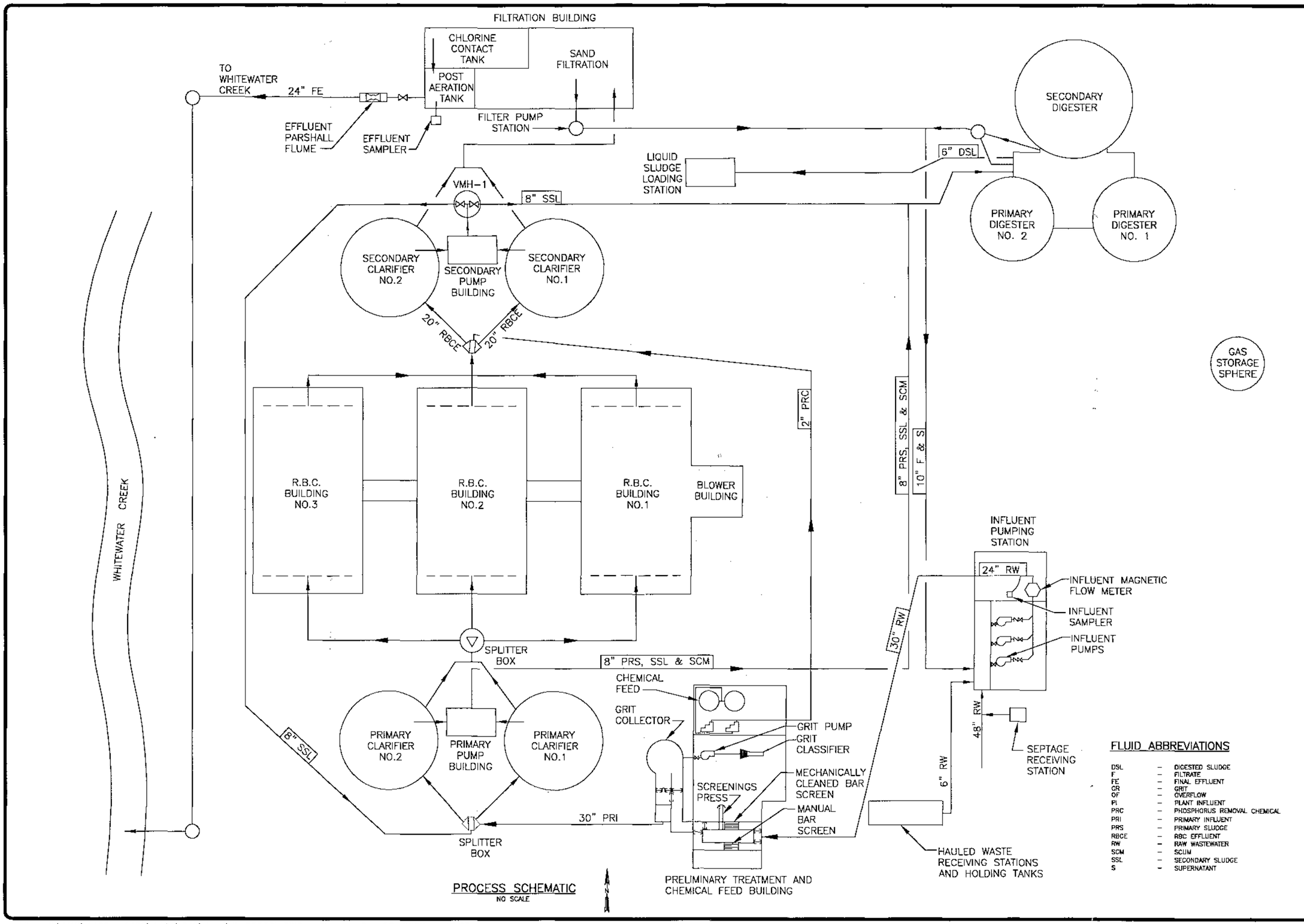

EXISTING PROCESS SCHEMATIC

WASTEWATER TREATMENT PLANT FACILITIES PLAN
CITY OF WHITEWATER, WISCONSIN

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FIGURE NO. 3.02-2
1407-039

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TABLE 3.02-1

EXISTING WPDES EFFLUENT LIMITATIONS[1,2]

Parameter	Time Period	Monthly Average	Weekly Average	Daily Minimum	Daily Maximum
BOD_5	May to October	10 mg/L	10 mg/L		
	November to April	20 mg/L	20 mg/L		
TSS	May to October	10 mg/L	10 mg/L		
	November to April	20 mg/L	20 mg/L		
Total NH_3-N	January	4.4 mg/L	10.5 mg/L		16.8 mg/L
	February	4.4 mg/L	10.6 mg/L		16.8 mg/L
	March	4.8 mg/L	11.3 mg/L		16.8 mg/L
	April	4.3 mg/L	9.8 mg/L		16.8 mg/L
	May	4.0 mg/L	9.2 mg/L		16.8 mg/L
	June	3.2 mg/L	6.3 mg/L		16.8 mg/L
	July	3.0 mg/L	6.3 mg/L		16.8 mg/L
	August	3.0 mg/L	6.3 mg/L		16.8 mg/L
	September	3.0 mg/L	6.3 mg/L		16.8 mg/L
	October	4.1 mg/L	9.6 mg/L		16.8 mg/L
	November	4.5 mg/L	10.7 mg/L		16.8 mg/L
	December	4.4 mg/L	10.6 mg/L		16.8 mg/L
TP		1.0 mg/L			
pH				6.0 s.u.	9.0 s.u.
Dissolved Oxygen				6.0 mg/L	
Total Residual Chlorine	May to September and when chlorinating		11 μg/L		38 μg/L
Fecal Coliform	May to September	400 col/100 mL Geo. Mean			
Mercury, Total Recoverable					3.89 ng/L
Cyanide, Amenable			17 μg/L		

Notes:
1. Taken from WPDES Permit dated January 1, 2009.
2. Permit expires December 31, 2013.

TABLE 3.02-2

WHITEWATER WWTP EXISTING FACILITIES DESIGN CRITERIA

A. Preliminary Treatment

Influent Pumping–Replaced in 2010	
Number	3
Type	Centrifugal, variable speed
Capacity, each	3,225 gpm
Capacity, firm	6,450 gpm (9.3 mgd)
Influent Pumping–New in 2010	
Number	4
Type	Centrifugal, variable speed
Capacity, each	2,560 gpm
Capacity, firm	7,680 gpm (11.0 mgd)
Screening	
Number	2
Type	Mechanically cleaned bar screen (1) and manual (1)
Capacity, each (per manufacturer's literature)[1]	10.0 mgd
Screenings Wash Press–New in 2010	
Number	1
Type	Washer-compacter
Capacity, each	Up to 99 ft^3 screenings/hr
Grit Removal	
Number	1
Type	Vortex
Capacity	12.0 mgd
Influent Flow Measurement	
Number	1
Type	Magnetic flow meter
Size	12-inch
Capacity	Approx. 16 mgd

B. Primary Treatment

Primary Clarifiers	
Number	2
Type	Circular
Size	70-foot-diameter x 10.3 feet Side Water Depth (SWD)
Surface Area, Total	7,700 ft^2
Weir Length, Total	405 ft
Weir Loading Rate @ DAF = 3.65 mgd	9,000 gpd/ft
Surface Overflow Rate @DAF = 3.65 mgd	470 gpd/ft^2
Surface Overflow Rate @ PHF = 7.3 mgd	950 gpd/ft^2
Volume, Total	89,000 ft^3 (669,000 gal)
Hydraulic Retention Time @ PHF = 7.3 mgd	2.2 hr

C. Secondary Treatment

RBC Units	
Number of Trains	6
Number of Units/Trains	8
Type	24 standard media and 24 high density media
Area, standard media, each	104,000 ft^2
Area, high density media, each	156,000 ft^2
Area, Total	6,240,000 ft^2
Supplemental Aeration	Combination Fine Bubble–REEF (first 4 units/train) Course Bubble–Flexcap (last 4 units/train)
RBC Blowers	
Number	2
Type	Positive Displacement
Capacity, each	2,400 scfm @ 5 psig
Secondary Clarifiers	
Number	2
Type	Circular
Size	70-foot-diameter x 10.3 ft SWD
Surface Area, Total	7,700 ft^2
Weir Length, Total	405 ft
Weir Loading Rate @ DAF = 3.65 mgd	9,000 gpd/ft
Surface Overflow Rate @ PHF = 7.3 mgd	950 gpd/ft^2
Volume, Total	89,000 ft^3 (669,000 gal)
Hydraulic Retention Time @ PHF = 7.3 mgd	2.2 hr
Chlorine Contact Tank	
Number	1
Depth	9.9 ft SWD
Volume, Total	22,000 ft^3 (165,000 gal)
Hydraulic Retention Time @ PHF = 7.3 mgd	32.6 min
Mixer	1.7 hp
Chlorination–Replaced in 2010 (equipment to remain for occasional filter chlorination)	
Number	1
Type	Gaseous Chlorination
Capacity	50 lb/day
Ultraviolet (UV) System–New in 2010	
Type	Low Pressure, High Intensity
Number of Channels	1
Number of Banks Installed	2
Number of UV Modules per Bank	8
Total Number of UV Lamps	128
UV Transmittance (minimum)	65 percent

Dechlorination–Removed in 2010

Number	1
Type	Gaseous Sulfur Dioxide
Capacity	10 lb/day

Postaeration Tank

Number	1
Type	Tubular Diffusers
Size	38 ft x 24 ft x 9 ft SWD
Volume	8,200 ft^3 (61,400 gal)

Postaeration Blowers

Number	3
Type	Positive Displacement
Capacity	1 @ 119 cfm, 2 @ 238 cfm

D. Advanced Secondary

Phosphorus Removal Chemical Pumps

Number	2
Type	Diaphragm
Capacity	0.4 to 25 gph

Filter Beds (Rehabilitated in 2010)

Number	1
Cells	4
Type	Anthracite Media (30-in depth), Gravity
Size, Cell	22 ft x 20 ft
Area, Cell	440 ft^2
Area, Total	1,760 ft^2
Capacity (one cell out of service)	9.50 mgd

Air Wash Blower

Number	1
Type	Positive Displacement
Capacity	2,200 cfm @ 5 psig

Filter Backwash Pumps (Replaced in 2010 with like-sized pumps)

Number	2
Type	14-inch propeller
Capacity	5,336 gpm @ 14.0 ft TDH

Filter Wastewater Pumps (Replaced in 2010 with like-sized pumps)

Number	2
Type	submersible
Capacity, each	240 gpm

Effluent Flow Measurement

Number	1
Type	Parshall Flume
Size	18-inch
Capacity	0.112 to 15.9 mgd

E. Sludge Handling

Primary Anaerobic Digesters	
Number	2
Type	Heated, Mixed
Size, each	60-ft-diameter x 25 ft SWD
Volume, Total	157,000 ft^3 (1,170,000 gal)
Primary Digester No. 1 Recirculation Pump (Replaced in 2010 with like-sized pump)	
Number	1
Type	centrifugal
Capacity, each	350 gpm
Primary Digester No. 1 Mixing System (New in 2010 to Replace Gas Mixing)	
Type	Pumped, Jet-Mix
Number of Pumps	2
Size, Each	1,800 gpm
Sludge Storage Tank	
Number	1
Size, each	85-ft-diameter x 25 ft SWD
Volume, Total	157,000 ft^3 (1,170,000 gal)
Sludge Storage Tank Mixing System (New in 2010 to Replace Gas Mixing)	
Type	Pumped, Jet-Mix
Number of Pumps	2
Size, Each	3,600 gpm
Sludge Storage Supernatant System (New in 2010)	
Type	Submersible Pump with Weir Box
Number of Pumps	1
Size, each	40 gpm
Methane Storage Sphere	
Size, diameter	35 ft

F. Nonpotable Water System

Nonpotable Water Pumps (Replaced in 2010 with like-sized pumps)	
Number	2
Type	Centrifugal Booster
Size, each	300 gpm at 136 ft TDH

Notes:
[1]Additional capacity may be available depending on hydraulics and rake runtimes.

3.03 INFLUENT FLOWS AND LOADINGS

A. Influent Flows and Loadings

Flow records for average daily flow from 2004 through 2009 are presented in Table 3.03-1. These values are monthly averages of average daily flows. The average flow from the recent period 2007 to 2009 is approximately 1.82 million gallons per day (mgd). The design average flow (DAF) for the WWTP is 3.65 mgd with a design peak hourly flow (PHF) of 7.3 mgd.

Year	Annual Average				
	Influent Flow (mgd)	BOD_5 (lbs/day)	TSS (lbs/day)	NH3 (lbs/day)	TP (lbs/day)
2004	1.59	2,176	2,597		
2005	1.35	2,116	2,540		
2006	1.67	2,160	2,571		
2007	1.84	2,164	2,361	281	64
2008	1.88	2,279	2,472	293	78
2009	1.73	2,238	2,318	299	75
Averages					
2004-2007	1.61	2,154	2,517	281	64
2007-2009	1.82	2,227	2,384	291	72
2004-2009	1.68	2,189	2,477	291	72

Table 3.03-1 Average Daily Influent Flows and Loadings

To determine the PHF to the WWTP from 2004 to 2009, influent flow charts were reviewed. On a number of wet weather occasions, the recorded flow exceeded 10 mgd, which is the top value set in the Supervisory Control and Data Acquisition (SCADA) system for influent flow metering. In April 2007, the PHF was 9.8 mgd. A higher PHF may have been received at the facility. A higher PHF has been used for future design, as discussed in Section 4.

The annual average loadings for five-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) from 2004 through 2009 are presented in Table 3.03-1. Values contained in these tables are based on average monthly loadings.

From 2007 to 2009, the influent BOD_5 and TSS loadings averaged 2,227 and 2,384 pounds per day (lb/day), respectively. The design BOD_5 and TSS loadings for the existing plant are 11,500 lb/day and 10,800 lb/day, respectively. Therefore, the plant design loadings have not been exceeded, and the plant is loaded at about 20 percent of the BOD capacity and at about 22 percent of the TSS capacity. However, the RBCs may not remove BOD and nitrify during winter months to meet permit limits at these design loads. See Section 5.01 for additional discussion on plant capacity.

B. Flow Peaking Factors (Maximum Daily, Maximum Weekly, and Maximum Monthly)

Peaking factors for the maximum daily flow, maximum weekly flow, and maximum monthly flow were developed using data from 2004 to 2009 and the protocol established by the WDNR for estimating the design peaking factor. Maximum daily flow is based on the maximum value

recorded for each year. Maximum weekly flow is based on the weekly average flow associated with the four highest maximum daily flows. Maximum monthly flow is based on the maximum average monthly flow for the year. Table 3.03-2 presents a summary of the data analysis completed using those procedures.

Year	Maximum Daily Factor	Maximum Weekly Factor	Maximum Monthly Factor
2004	4.41	2.81	1.58
2005	1.80	1.84	1.27
2006	2.47	1.62	1.28
2007	3.66	2.62	1.50
2008	4.43	2.10	1.65
2009	2.30	1.71	1.49
Annual Averages			
2004-2007	3.09	2.22	1.41
2007-2009	3.18	2.08	1.47
2004-2009	3.18	2.12	1.46

Table 3.03-2 Estimated Influent Flow Peaking Factors

C. Loadings Peaking Factors (Maximum Week and Maximum Month)

Loading peaking factors were developed using 2004 to 2009 data. Annual average-based peaking factors were developed for the maximum month and maximum week conditions. The maximum week loading peaking factor was calculated by taking the average of the weekly average loads associated with the four highest maximum daily loads for each year between 2004 and 2009. These annual peaking factors were averaged. The maximum monthly load peaking factor was calculated by taking the average of the maximum average monthly load for each year between 2004 and 2009. The BOD_5 peaking factors were applied to determine the maximum month and maximum week loadings for total Kjeldahl nitrogen (TKN) and phosphorus. Table 3.03-3 presents a summary of the data analysis completed using this protocol.

Year	BOD_5		TSS	
	Maximum Weekly Factor	Maximum Monthly Factor	Maximum Weekly Factor	Maximum Monthly Factor
2004	1.65	1.38	1.85	1.61
2005	1.38	1.37	1.85	1.49
2006	1.37	1.32	2.46	1.65
2007	1.28	1.13	1.83	1.71
2008	1.37	1.33	2.86	2.55
2009	1.36	1.23	1.39	1.25
Annual Averages				
2004-2007	1.42	1.30	2.00	1.62
2007-2009	1.34	1.23	2.03	1.84
2004-2009	1.40	1.29	2.04	1.71

Table 3.03-3 Estimated BOD_5 and TSS Loadings Peaking Factors

3.04 ESTIMATED RECYCLE FLOWS AND LOADINGS

Filter backwash and digester supernatant are the two major in-plant recycle flows that impact the flows and loads to the WWTP. Hauled waste receiving also impacts flows and loads. This section discusses the impacts and estimates the quantity of these recycle flows.

Filter backwash wastewater is pumped from the backwash storage tank located below the filters to the plant sewer. A flow meter was added to this line during the 2010 project. Previously digester supernatant was pumped from the secondary digester using a small (approximately 20 gpm) pump to meter the supernatant into the plant sewer. This pump was replaced in 2010 and a weir box added for measuring the flow. The plant sewer discharges to the influent pumping station wet well. The hauled waste receiving station also discharges directly into the influent pumping station wet well. These streams are not independently metered or sampled, and all of them are combined with raw wastewater and included in the total plant influent metering and sampling.

Physical metering and measuring of recycle flows were beyond the scope of this study. However, estimates were made as part of the 1995 Wastewater Treatment Facilities Evaluation and are included in a material balance in that report. The material balance was done using 1993 data. Based on the 1995 study, digester supernatant at the Whitewater WWTP had a BOD_5 concentration of 350 milligrams per liter (mg/L), a suspended solids concentration of 5,000 mg/L, and an ammonia nitrogen concentration of 590 mg/L. At that time, plant operating staff used a 20 gpm pump to meter the supernatant discharge into the plant sewer during the winter months only. On an annual basis, 730,000 gallons of supernatant were recycled. The daily supernatant loadings of BOD_5, TSS, and NH_3-N were, therefore, 6, 83, and 10 lb/day, respectively. These were all less than 5 percent of the current loadings and less than 3 percent of the projected capacity loadings.

The 1993 influent and effluent data appear similar to 2004 through 2009 influent data. However, the amount of liquid sludge land-applied in 1993 (1.4 million gallons) was slightly higher than the amount land-applied in 2004 through 2009 (1.3 million gallons on average). This could be caused by differences in digester performance or other factors, but it appears to most likely be the result of increased supernating in more recent years. For example, supernating now tends to occur year-round. Assuming approximately 200,000 gallons of additional supernatant for a total flow of 930,000 gallons per year, and the same concentrations as in 1993, the supernatant loadings of BOD_5, TSS, and NH_3-N would be 7, 106, and 13 lb/day. These are still less than 5 percent of the current total plant influent loadings. Note that the digester supernatant will also contribute significant phosphorus; however, this was not measured for the 1995 study.

According to staff, the WWTP currently accepts an average of 4.0 million gallons of septage and holding tank waste annually. Hauled waste flows have been higher on occasions in the past. Typical septage and holding tank pollutant concentrations based on literature values and our experience at other facilities are shown in Table 3.04-1.

Year	Septage	Holding Tank Waste
BOD_5 , mg/L	5,000	600
TSS, mg/L	15,000	1,800
TN, mg/L	700	80
TP, mg/L	250	30

Table 3.04-1 Typical Septage and Holding Tank Waste Quality

Assuming the WWTP received roughly 0.5 million gallons of septage and 3.5 million gallons of holding tank wastes, the corresponding influent loadings for BOD_5, TSS, TN, and TP would be 105, 315, 14, and 5 lb/day, respectively.

3.05 WASTEWATER TREATMENT PLANT PERFORMANCE

This section reviews the performance of the forward flow treatment process. The Whitewater WWTP has consistently met BOD_5, TSS, ammonia-N, phosphorus, and fecal coliform permitted effluent limits. Table 3.05-1 shows the annual average effluent quality for these parameters from January 2004 to December 2009. See Table 3.02-1 to compare the measured effluent quality with the WPDES effluent limitations.

	Summary of Effluent Quality (mg/L unless noted)					
Parameter	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
BOD_5	2.3	2.1	2.1	2.4	2.4	3.3
TSS	3.6	2.5	1.9	2.9	2.6	3.0
Ammonia-N	0.1	0.2	0.2	0.2	0.3	0.5
Phosphorus	0.7	0.6	0.5	0.6	0.5	0.6
Fecal Coliform	50	52	54	46	43	65

1. Effluent values taken from Discharge Monitoring Reports 2004-2010.
2. Annual average effluent values are shown and are based on the average of the monthly average daily effluent.
3. Permit requires monitoring of fecal coliforms from May to September only. Fecal coliform results are in number of colonies per 100 mL.

Table 3.05-1 Average Effluent Quality

Monthly average effluent BOD_5 ranged from 2.0 to 6.6 mg/L from 2004 to 2009, which is below the permitted limit of 10 mg/L. Monthly average effluent TSS ranged from 0.7 to 6.9 mg/L over the same period, which is also below the permitted limit of 10 mg/L. Monthly average effluent ammonia nitrogen ranged from 0.1 to 2.3 mg/L, meeting the permitted limits throughout the entire time period.

The WWTP has a 1 mg/L (monthly average) categorical standard for phosphorus removal. Monthly average effluent phosphorus ranged from 0.3 to 1.0 mg/L. In September 2007, the WWTP reached an effluent phosphorus monthly average of 1.0 mg/L, but it did not exceed the permitted limit of 1.0 mg/L.

The WWTP is required to provide effluent disinfection from May 1 to September 30. During this period, plant staff collects fecal coliform grab samples twice a week. The plant has consistently met the monthly geometric mean of 400/100 mL fecal coliform limit.

3.06 BIOSOLIDS DISPOSAL PROGRAM

The City of Whitewater anaerobically digests primary and secondary solids. Following digestion, the liquid biosolids are pumped to the secondary digester for supernatant withdrawal and storage. The City uses its own truck and personnel for land application of stabilized, liquid biosolids onto agricultural fields. Table 3.06-1 summarizes the quantities of biosolids that were land-applied from 2004 to 2009.

Table 3.06-2 compares the Whitewater biosolids metals concentrations in samples from 2004 to 20010 with regulatory values for land application as listed in WAC Chapter NR 204. Based on this data, the biosolids from the Whitewater WWTP meet all metals requirements for land application.

Year	Biosolids Land Applied (gallons)
2004	1,114,100
2005	1,043,994
2006	1,400,850
2007	1,221,400
2008	1,461,600
2009	1,685,097
Yearly Averages	
2004-2007	1,195,086
2007-2009	1,456,032
2004-2009	1,321,174

Table 3.06-1 Annual Biosolids Disposal

Parameter	Units	2004	2005	2006	2007	2008	2009	High Quality Limit[2]	Ceiling Limit[3]	Class B Limit[5]
Arsenic	mg/kg	28	< 27	< 21	< 35	9.7	30	41	75	NA
Cadmium	mg/kg	2.8	4.9	4.2	4.5	<2	1.6	39	85	NA
Copper	mg/kg	620	680	580	490	200	710	1500	4300	NA
Lead	mg/kg	25	37	30	29	<13	21	300	840	NA
Mercury	mg/kg	1.3	1.2	3	2.5	0.28	0.54	17	57	NA
Molybdenum	mg/kg	28	27	20	22	4.3	4.9	NA	75	NA
Nickel	mg/kg	19	28	17	18	8.2	20	420	420	NA
Selenium	mg/kg	28	< 49	< 38	<64	<8.6	<10	100	100	NA
Zinc	mg/kg	970	930	920	860	310	980	2,800	7,500	NA
Fecal Coliforms[4]	cfu/gTS	72,434	233,497	135,409	92,241	140,000	110,000	NA	NA	2,000,000

[1] Data taken from Compliance Maintenance Annual Reports from 2004 to 2010.
[2] High quality maximum values for land application according to Chapter NR 204, Table 3
[3] Maximum values for land application according to Chapter NR 204, Table 1.
[4] Geometric mean of seven fecal coliform samples taken per year.
[5] From NR 204.

Table 3.06-2 Biosolids Quality

The annual geometric mean of fecal coliform densities measured in the sludge from 2004 to 2010 was in the range of 72,000 to 230,000 colony-forming units per gram of total solids (cfu/gTS). These are below the WAC Chapter NR 204 limit of 2,000,000 cfu/gTS for a Class B sludge.

According to 2008 to 2009 meter readings, the digesters produce between 6,400 to 23,200 cf/day digester gas daily. All gas is flared.

SECTION 4
FLOW AND WASTELOAD FORECASTS

In this section, wastewater flow and loading projections are developed for evaluating future treatment plant capacity and needs. Data from current conditions have been used together with population forecasts and development trends to project design flows and loads for the Whitewater WWTP through the year 2032.

4.01 SEWER SERVICE AREA

The current sewer service area for the Whitewater WWTP was described in Figure 1.02-1 of this report. It is anticipated the overall area served by the Whitewater WWTP will remain as identified, but there may be boundary changes that could modify the overall boundaries of the sewer service area depending on how development occurs in the area.

4.02 POPULATION AND GROWTH PROJECTIONS

Population projections for the Whitewater WWTP are presented in Table 4.02-1 and Figure 4.02-1. Different projections were developed by the Wisconsin Department of Administration (DOA) and a Market Profile firm Retail Coach.

Year	Census	Estimated Population[1]	DOA Projections[2, 4]	City Projections[3, 4]
1980	11,520			
1990	12,636			
2000	13,437			
2004		13,855		
2005	13,937			
2006		14,044		
2007		14,139		
2008		14,234		
2009		14,329		
2010			14,296	14,597
2015			14,773	15,289
2020			15,249	16,013
2025			15,664	16,772
2030			15,981	17,566
2032			16,110	17,894

[1] Population estimated by linearly extrapolating the 1980 to 2005 census data.
[2] Wisconsin Department of Administration Web site 2010.
[3] Based on a 0.93 percent annual growth rate provided by the City of Whitewater.
[4] 2032 Projection based on extrapolation from 2025-2030 projections.

Table 4.02-1 City of Whitewater Population Projections

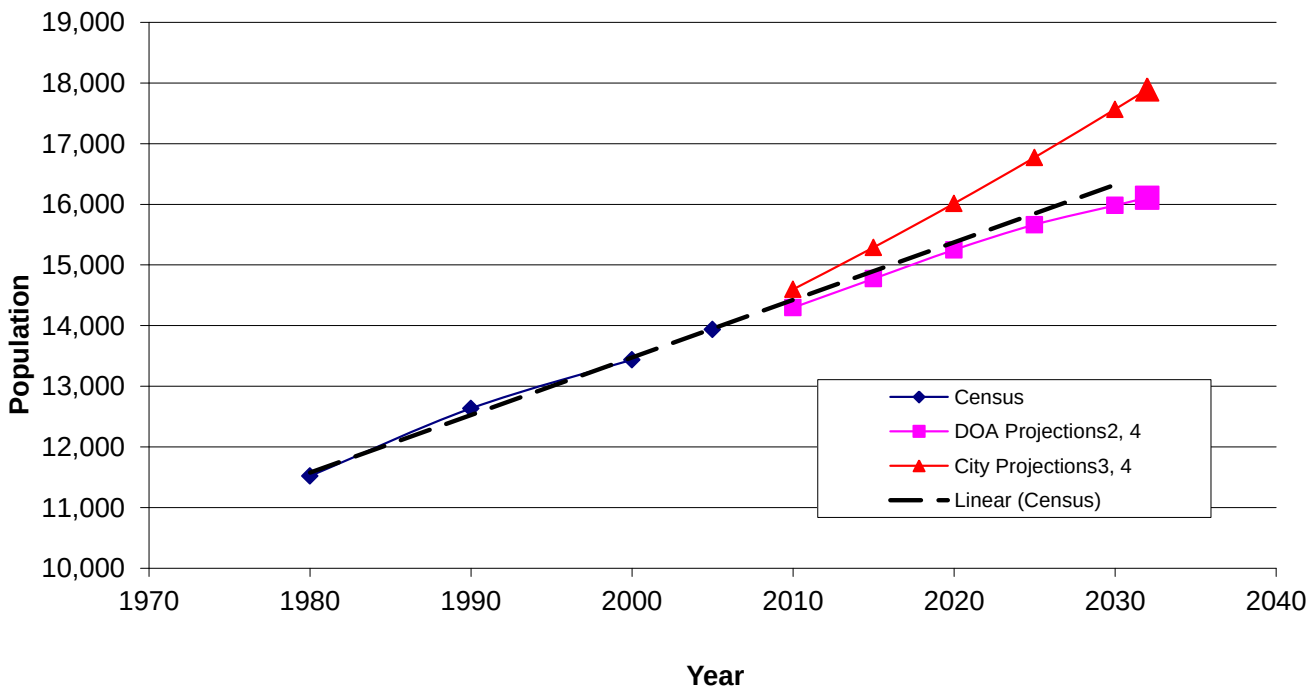

Figure 4.02-1 City of Whitewater Population Projections

The population of the City of Whitewater has steadily increased for several decades. However, the City is anticipating significant growth through the year 2032. The census population for the City was 13,437 in 2000 and population was estimated to be approximately 13,937 in the year 2005. The Market Profile indicated a growth rate of 0.93 percent annually for 2008 to 2013, and the City has adopted this growth rate for planning purposes. Based on this, the year 2032 population is projected to be 17,894, which is a 0.93 percent annual growth and a 28 percent increase over the 27-year period from 2005 through 2032.

4.03 INDUSTRIAL SURVEY SUMMARY

A questionnaire was sent to approximately 12 industries in the City of Whitewater primarily to gauge their plans for future expansion. The questionnaire also requested information about use of phosphorus, chlorides, and other chemicals, and interest in sending high strength waste to the anaerobic digesters or accepted treated WWTP for cooling or other purposes.

Based on water use records and other information, only two Whitewater industries are significant in terms of flow and one of these responded to the survey. The survey responses indicate that no Whitewater industries are planning to expand or change in the foreseeable future. Most industries use commercial or residential water softeners with sodium chloride salt. Only one industry reported use of phosphorus-containing compounds. The amount reported to be discharged to the sewer system increases the influent phosphorus loading to the WWTP by about 5 percent, based on 2007 WWTP influent phosphorus data. None of the industries reported needing treatment or digestion of high

strength wastes. One industry expressed some interest in treated WWTP effluent to replace approximately 3,200 gpd of makeup process water.

4.04 FLOW PROJECTIONS

Projecting future wastewater flow requires identification of residential/commercial and industrial wastewater flow, peaking factors, and anticipated residential/commercial and industrial growth in areas tributary to the Whitewater WWTP. The data presented in this report includes wastewater sales and daily flow measurements from the plant's magnetic influent flow meter from 2004 through 2009. Where more conservative for future projections, the more recent period of 2007 through 2009 has been used.

A. Annual Average Flow

The annual average flow currently treated at the Whitewater WWTP is approximately 1.68 mgd based on data from 2004 to 2009, with an average of 1.83 mgd from 2007 through 2009. Table 4.04-1 presents an analysis of the components included in the annual average daily flow. Estimates of the residential, commercial, industrial, and public authority flows were obtained from City of Whitewater Water Utility water sales records for the indicated time period. The estimate of the annual I/I was obtained by subtracting the indicated flows from the annual daily average flow metered at the WWTP.

Wastewater Contribution (mil gal)						
Class	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**
Residential	132.6	138.1	137.5	134.3	132.1	112.3
Commercial	102.8	99.7	94.2	91.3	80.0	70.8
Industrial	13.1	19.4	13.1	11.5	21.6	15.1
Public Authority	78.5	99.5	81.7	82.5	68.3	54.2
Total Annual Flow (mil gal)	327.0	356.6	326.5	319.5	302.0	252.4
Daily Average Flow (mgd)	0.90	0.98	0.89	0.88	0.83	0.69
Daily Average Wastewater Flow at WWTP (mgd)	1.59	1.35	1.67	1.85	1.88	1.76
Annual Average Infiltration/Inflow (mgd)	0.70	0.37	0.78	0.97	1.05	1.07
Infiltration/Inflow as % Wastewater Flow at WWTP	44%	27%	46%	53%	56%	61%

[1] Flow by customer class is based on City of Whitewater water sales (billing) data.
[2] Based on flow metered at the WWTP minus water sales. This number is approximate because it also includes hauled waste flows and WWTP recycle streams and does not account for lawn watering and metering errors.

Table 4.04-1 Flows by Customer Class

B. Per Capita Flows

The City of Whitewater includes several significant dischargers in the commercial, industrial, and public authority classifications. To determine flow for each user classification, the user class wastewater contribution as measured by the water sales was divided by the total annual flow as measured by water sales and then multiplied by the daily average flow measured at the WWTP. The calculated flow was divided by the estimated population for that year. The per capita flow was calculated in this manner for each year and averaged to determine the per capita flow for the period 2004 to 2009 as shown in Table 4.04-2. The average per capita flow for the 2007 through 2009 period was calculated to be approximately 128 gcd.

User Classification	Per Capita Contributions (gallons/day)						
	2004	2005	2006	2007	2008	2009	2007-2009 Average
Residential	26	27	27	26	25	21	24
Commercial	20	20	18	18	15	14	16
Public Authority	3	4	3	2	4	3	3
Industrial	16	20	16	16	13	10	13
Infiltration/Inflow	50	26	55	69	74	75	72
Total Per Capita[1]	115	97	119	131	132	123	128

[1] Populations used in analysis are shown on Table 4.02-1.

Table 4.04-2 Per Capita Flows

C. Design Flow Projections

Table 4.04-3 shows the projected WWTP flows in 2032. The average flow was determined by multiplying the projected 2032 population of 17,894 times the 2007-2009 average per capita flow of 128 gcd. The year 2032 design average flow includes an additional 5 percent allowance for unplanned commercial, industrial, or institutional flow as allowed by NR 110. Maximum daily flow, maximum weekly flow, and maximum monthly flow were developed by applying peaking factors described in Section 3.03.

Design Flow[1]	2032 (mgd)
Annual Average	2.4
Maximum Monthly Average	3.5
Maximum Weekly Average	5.0
Maximum Daily Average	7.6
Peak Hourly Flow	11

[1] Design flow using 0.93 percent rate and 5 percent unplanned industrial growth allowance.

Table 4.04-3 Design Flows

The 2032 design PHF was calculated as follows. First, the population growth between the City-projected 2010 value of 14,597 and the projected 2032 value of 17,894 was determined to be 3,297. Next this population growth was multiplied by the current per capita wastewater flow and a peaking factor PF of 2.7 from the *Recommended Standards for Wastewater Facilities* (Ten State Standards, 1997) to identify a project increase in PHF of 1.14 mgd. Then this value was added to

the current PHF of 9.8 mgd, to identify a PHF of 10.94, or approximately 11.0 mgd as identified in the 2009 report. Therefore, 11.0 mgd has been used as the design PHF.

4.05 PROJECTED LOADINGS

The per capita and future design BOD_5 and TSS loadings for the City of Whitewater were developed using an analysis similar to that employed for the flow projections. The first step is to determine per capita loadings for BOD_5 and TSS and then develop future projections using the population projections and per capita loadings plus separate industrial loading estimates.

A. Per Capita Loadings

The per capita WWTP loading estimates for BOD_5 and TSS are based on data collected from 2004 to 2009.

Estimates of the per capita loadings are presented in Table 4.05-1 for BOD_5 and TSS. For 2007 through 2009, the average per capita BOD_5 load was calculated as 0.16 lbs per capita per day (pcd), which is below the typical range of 0.17 to 0.22 pcd. The average per capita TSS load of 0.17 pcd is also lower than the normal range for TSS of 0.20 to 0.25 pcd. Year 2032 BOD_5 and TSS loads are based on the current loadings for the existing population plus the projected population increase and NR 110 average per capita loadings of 0.22 pcd for BOD_5 and 0.25 pcd for TSS. Both per capita values are within the range commonly used for planning. In addition, the new per capita loadings better match the anticipated loadings from new residential development, which usually includes garbage grinders resulting in higher loadings.

Year	Population	Loading (lb/day)		Per Capita Loading (pcd)	
		BOD	TSS	BOD	TSS
2004	13,855	2,176	2,597	0.16	0.19
2005	13,937	2,116	2,540	0.15	0.18
2006	14,044	2,159	2,571	0.15	0.18
2007	14,139	2,034	2,361	0.14	0.17
2008	14,234	2,214	2,409	0.16	0.17
2009	14,329	2,384	2,322	0.17	0.16
Annual Averages					
2004-2007		2,121	2,517	0.15	0.18
2007-2009		2,212	2,470	0.16	0.17
2004-2009		2,181	2,467	0.15	0.18

Table 4.05-1 Per Capita BOD and TSS Loading Calculations

For the purposes of developing design loadings for future population growth, the following per capita loadings are used in these analyses:

BOD_5	0.22 pcd (see discussion above)
TSS	0.25 pcd (see discussion above)
TKN	0.038 pcd (based on typical reference loadings)
phosphorus	0.006 pcd (based on typical reference loadings)

B. Projected Design Loadings

Table 4.05-2 summarizes the annual average design loads for the year 2032 based on the per capita values listed above and the population projections presented in Table 4.02-1.

Design Parameter	2007 to 2009 Annual Average Loading (lbs/day)	Population Growth Loading (lbs/day)	Future Industrial Loading (lbs/day)	2032 Design Average Loading (lbs/day)	2032 Design Max Month Loading (lbs/day)	2032 Design Max Week Loading (lbs/day)
BOD_5	2,227	805	303	3,335	4,103	4,458
TSS	2,384	915	330	3,629	6,664	7,354
Estimated TKN	541	139	68	748	920	1,000
Estimated phosphorus	72	22	9	104	127	139

Table 4.05-2 Design Loadings

The projected average design loadings for BOD_5 and TSS were developed by adding the loadings resulting from the population growth to the 2007 to 2009 annual average loadings. A 10 percent loading allowance for unforeseen commercial, industrial, or institutional growth was also added to develop future total design loadings. The maximum design loadings were developed based on analyses of the variability of influent BOD_5 and TSS loadings at the WWTP from 2007 through 2009 using peaking factors described in Section 3.03. The peaking factors were applied to the year 2032 average loading projections to develop the maximum design loadings in 2032.

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SECTION 5
EXISTING WASTEWATER TREATMENT PLANT EVALUATION

This section evaluates the ability of the existing facilities to treat planned future flows and loadings and compliance of the current facilities with NR 110 of the WAC and other applicable design criteria. The review focuses on the rated capacity, age, reliability, and other factors related to operating and maintaining the existing facilities. Where applicable, treatment alternatives are identified for more detailed evaluation and consideration in Section 7.

5.01 UNIT PROCESS EVALUATION

A. Site Utilities and Emergency Power

The WWTP has a well on-site to provide potable water. A small water purification system provides treated water for laboratory use. The high mineral content of the well water has made the water unsuitable for WWTP staff to drink; therefore, the staff drink bottled water at the plant. The City would like to evaluate the extension of City water service to the WWTP.

The original plant effluent nonpotable water (NPW) system did not function well. This included NPW pumps and hydrants. This replacement was included in the 2010 construction project.

The emergency power to the plant is provided by two dual-fuel generators. The generators were installed in 2007 and can burn natural gas or diesel. A single generator has the capacity to power the entire plant. A single power feed serves the plant. The transformer and switchgear are at the end of their design lives and should be replaced.

B. Septage and Hauled Wastes Receiving Facilities

The current septage receiving facilities are located inside the WWTP fenced area immediately next to an air intake for the Administration Building. When haulers unload, the Administration Building receives a strong dose of odors. Relocating the septage receiving outside the WWTP fence would allow haulers to discharge outside the hours when the gate is open, potentially improving Whitewater's ability to attract septage and holding waste haulers and increase revenue from hauling fees. Relocating the septage receiving facilities would also significantly reduce nuisance odors at the Administration Building. A key or card access sliding gate could be installed outside the current gate to continue hauler access to the septage receiving facilities. Other options that may be considered include moving the air intake, constructing a separate building for administration and laboratory services away from influent pumping and septage receiving, or moving septage receiving to the anaerobic digesters. Acceptance of septage directly to the digesters was evaluated in 2010 and does not appear beneficial.

The holding tank facilities allow the WWTP staff to slowly add high strength industrial wastes into the influent wet well. The current facilities adequately serve this function, although there is no flow monitoring downstream of the throttling valve, so it is difficult for staff to know the rate at which the wastes enter the influent wet well. A submersible grinder- or chopper-style pump with magmeter could be considered for the future.

Acceptance of high strength industrial waste directly to the digesters was evaluated in 2010 and may be beneficial, particularly if the generated biogas can be captured and used for heating the digester or

other purposes. The WWTP staff will test this after a new boiler/heat exchanger is installed as planned in 2011. Testing of high strength waste acceptance to the digester will likely take place in 2012.

C. Influent Pumping

Influent wastewater enters the influent pumping wet well through a 48-inch sewer. Solids settle in the influent sewer and wet well during low flows. Raw wastewater passes through a manual bar screen that prevents large objects from damaging the influent pumps. Replacement of this screen should be considered. A new basket screen could also be considered and is presented in Section 8. Filter backwash is pumped from the clearwell to the plant sewer where it combines with digester supernatant. These recycle flows are returned to the influent pumping wet well, and flow metering has been added to these two streams as part of the 2010 construction project. Septage receiving and other plant recycle loads are not metered or sampled separately from the influent flow.

The three vertically mounted overhung-impeller Fairbanks Morse pumps were each rated for a pumping rate of 3,225 gpm at 49 feet total dynamic head (TDH), with a firm capacity of 6,450 gpm (9.3 mgd). As part of the 2010 construction project, the pumps have been replaced with four dry pit submersible pumps having a firm capacity of 11.0 mgd.

A magnetic flow meter measures influent flow downstream of the pumps. The meter was replaced in 2005. The magnetic flow meter manufacturer recommends that the meter be installed at least two pipe diameters downstream of a bend in the pipeline and five pipe diameters upstream of a bend in a pipeline to achieve the rated accuracy of the unit of ±0.5 percent of actual flow. The meter has an elbow immediately downstream. According to the meter manufacturer, this is a nonideal installation that could result in lower accuracy. During high flow events in June 2008, peak flows exceeded 10 mgd, but the SCADA only recorded to 10 mgd. The flow meter can be rescaled to record these higher peak events. The current 12-inch-diameter meter has the capacity to measure the peak hourly flow of 11.0 mgd, though the accuracy is likely less than at the rated accuracy of ±0.5 percent of actual flow because of the downstream elbow. Because there is effluent metering available at the plant as well, the somewhat lower accuracy should not be a primary concern.

D. Screening and Grit Removal

A 30-inch force main conveys raw wastewater to the preliminary treatment building. Solids tend to settle in this force main during low flows, and are then resuspended during peak flow, causing high grit and screenings loadings to downstream equipment. A new access to allow jetting or automatic flushing could minimize accumulation of solids in the influent force main.

Raw wastewater flows to the Preliminary Treatment Building that was constructed in 1996. An Infilco Degremont mechanical screen removes rags and debris that cannot pass through the 3/8-inch opening in the screen. The existing screen is rated for a capacity of 10.0 mgd according to the operation and maintenance manual; however, depending on upstream hydraulics, it likely has the capacity to handle the future peak flow of 11.0 mgd. During high flow events, grit accumulates in the offset downstream of the screenings screw compactor and plugs the discharge chute. Grit resuspended during peak flows contributes to problems with screen operation and the screenings screw capacity. A higher capacity compactor that also washes screenings has been installed as part of the 2010 construction project. A

mechanical fine screen with 1/8-inch openings will be presented in Section 8. A screen with smaller openings could also improve rag, grit, and debris removal and could be considered for a future phase of construction.

A vortex grit unit, installed in 1996, has a nominal capacity of approximately 12 mgd, which is greater than the future peak hourly flow. Grit settles to the bottom of the basin and is pumped to a grit classifier by a recessed impeller vortex grit pump. During peak flow events, the grit pump will need to run continuously. Grit is dewatered in the classifier and discharged to a dumpster for landfilling along with screenings.

The aluminum stop plates in the screening channels seize up and are difficult to open. These will be replaced with stainless steel stop plates as part of the 2010 construction project.

E. Primary Sedimentation and Cothickening

Wastewater flows by gravity from the grit chamber to two 70-foot-diameter primary clarifiers. The clarifier drives and mechanisms were installed in 1982. The clarifier drives were replaced in 1999 and continue to perform well because of routine preventive maintenance. The clarifier mechanisms and bearings have been replaced as part of the 2010 construction project.

The clarifiers have a total surface area of 7,700 square feet, which provides a surface overflow rate (SOR) of 950 gpd/ft^2 at the current design maximum flow rate of 7.3 mgd. WAC NR 110.18 sets the maximum hourly surface settling rate at 1,500 gpd/ft^2. The rated peak capacity of the clarifiers is 11.5 mgd at a SOR of 1,500 gpd/ft^2. Therefore, the primary clarifiers have adequate capacity to handle future peak hourly flows of 11.0 mgd.

Primary and secondary sludge is cothickened in the primary clarifier and pumped to the anaerobic digesters using Marlow piston pumps, which were installed in the 1980s. These pumps have exceeded their expected life and have been replaced with rotary lobe pumps as part of the 2010 construction project. Scum handling has been a difficult manual operation. A baffle with piping and valve modifications were added as part of the 2010 project to improve performance.

F. Rotating Biological Contactors

The RBC facilities were installed in 1982. All but one of the RBC shafts are original and are operating beyond the expected life of such equipment. The existing facilities continue to serve the plant well, even with only two of the three trains operating. The 1995 *Wastewater Treatment Facilities Evaluation* determined the RBC capacity to remove BOD_5 and to nitrify to meet permit limits. The 1995 evaluation concluded the RBCs were capable of meeting the same 10 mg/L summer and 20 mg/L winter weekly average BOD_5 effluent limit that the plant has to meet currently as well as the more stringent 4.4 mg/L NH_3-N winter monthly average limits. The BOD_5 loading used in the 1995 evaluation is approximately equivalent to the current BOD_5 loading. For example, the 1993 annual average BOD_5 loading of 2,137 lb/day is within 4 percent of the 2007 to 2009 annual average of 2,227 lb/day. At that time the RBCs were calculated to be at 77 percent capacity based on winter operating limits.

The RBC facilities were evaluated briefly to assess their capacity to treat future design loadings. The peak weekly average soluble BOD_5 ($SBOD_5$) and TKN loadings were determined based on past data to estimate the additional RBC capacity available to meet weekly effluent limits. The maximum BOD_5 weekly peaking factor (weekly average/annual average) determined from average weekly data from 2007-2009 was 1.35. The BOD_5 removal in the primary clarifier was assumed to be similar to the performance during the January 1993 to March 1994 period. During this period, BOD_5 removal in the primary clarifiers was 43 percent. The projected 2032 influent BOD_5 average loading is 3,335 lb/day. At 43 percent BOD_5 removal, the primary effluent is projected to contain 1,900 lb/day BOD_5. Assuming a similar $SBOD_5$ to total BOD_5 ratio in the primary effluent as the 1993 to 1994 data, the primary effluent would contain 1,245 lb/day $SBOD_5$.

The 2032 weekly peak $SBOD_5$ loading rate is projected to be 1,668 lb/day (1,245 x 1.34). To meet weekly NH_3-N effluent limits, nitrification must occur in the RBC units. In order for nitrification to proceed rapidly, the $SBOD_5$ concentration must first be reduced to below 10 to 15 mg/L (WEF, MOP 8, 1992).

The nitrification area requirements for RBC media at a given flow rate were determined on the basis of the area required to reduce the RBC influent NH_3-N level to the winter weekly average effluent requirements of 10 mg/L.

Generally, nitrification designs should use TKN as the basis for sizing RBCs because TKN is converted to NH_3-N in the RBCs. The 2032 design influent maximum week TKN loading is 1,000 lb/day. Conservatively assuming 10 percent removal of TKN in the primary clarifiers, the 2032 weekly peak TKN influent RBC loading rate is projected to be 900 lb/day.

When ammonia nitrogen concentration in the wastewater exceeds 4 to 5 mg/L, design data published by WEF, MOP 8, indicate that 0.3 lb of TKN could be oxidized per 1,000 square feet (sq ft) of media at 55ºC.

During the winter, wastewater temperatures can drop to around 45ºF. Consequently, the nitrification rate was adjusted by a temperature correction factor of 0.57, resulting in a nitrification rate of 0.17 lb TKN/1,000 sq ft at 45ºF. Using these conditions for sizing requirements, it was determined that 4,118,000 sq ft of media would be required to remove weekly peak TKN influent RBC loading of 900 lb/day down to the winter weekly average NH_3-N effluent limit of 10 mg/L (200 lb/day).

The remaining effective media area is assumed to be utilized for BOD_5 removal. With 6,240,000 sq ft of total media area, this would correspond to 2,122,000 sq ft available BOD_5 capacity. To determine the area requirement for the removal of $SBOD_5$ down to 20 mg/L (400 lb/day), an allowable soluble organic loading rate (SOLR) of 1.54 lb/day/1,000 sq ft of media area would be necessary. This is based on the USEPA study *Review of Current RBC Performance and Design Procedures*, with an adjustment for a winter wastewater temperature of 45ºF. The media requirement would be 823,000 sq ft based on a 2032 $SBOD_5$ peak week loading rate of 1,668 lb/day to the RBCs and the SOLR of 1.54 lb/day/1,000 sq ft.

The total media area requirement to meet the winter NH_3-N effluent standard of 10 mg/L at peak weekly 2032 conditions is estimated to be 4,941,000 sq ft. This is 79 percent of the current RBC surface area of 6,240,000 sq ft.

It should be noted that BOD_5 removal in the primary clarifiers may decrease as flows and loads increase. It appears the RBCs will have adequate capacity as long as the primary clarifiers remove at least 41 percent of the 2030 influent BOD_5 load.

The WWTP staff replaced one failed RBC shaft several years ago at the cost of $10,000. Two additional shafts broke recently and have not yet been replaced. The WWTP staff typically replaces six bearings a year at a cost of $18,000 a year.

The RBCs are housed inside buildings to maintain a higher temperature to improve biological treatment. Sheltering the RBCs in buildings also gives operators the ability to more comfortably and easily maintain the units during inclement weather. The condition of the buildings was evaluated. The high humidity environment has degraded the buildings' heating, ventilating, and air-conditioning (HVAC) systems. The HVAC system requires significant modifications. The evaluation can be found in Appendix E. Exhaust fans associated with the RBC FRP enclosures will be replaced as part of the 2010 construction project, and this should provide a negative pressure under the RBC enclosures and reduce humidity in the buildings.

Apparent roof leakage has caused failure of a roof support beam in RBC building No. 3. A new column has been added to provide support of the beam and roof, and some HVAC equipment has been removed from all three buildings and openings capped to eliminate a possible route of precipitation entry. During this work, the roofing was inspected by a contractor and the insulation below the roofing was found to be saturated with moisture in several areas. A portion of the roofing no longer slopes properly to roof drains. If the City elects to keep the RBCs for future biological treatment, the building roofing and, potentially, a portion of the roofing support system should be replaced. Alternatively, the buildings that enclose the RBCs could be removed. However, the impact of this building removal on winter temperatures and treatment efficiencies should be evaluated before this alternative is selected.

Snails feed and accumulate on the RBC biomass. Currently, operators manually remove the snails in a difficult and time-consuming process. An extension of the access road to the north side of the RBCs would allow easier Vactor truck access and reduce the time required to perform this routine maintenance item.

G. Secondary Clarification

The two 70-foot-diameter secondary clarifiers have a total surface area of 7,700 square feet, which provides an SOR of 950 gpd/ft^2 at the current design maximum flow rate of 7.3 mgd. The WAC NR 110.18 sets the maximum hourly surface overflow rate at 1,200 gpd/ft^2, which gives the clarifiers a rated peak capacity of 9.2 mgd. The future design peak hourly flow of 11.0 mgd is greater than the rated capacity; however, the WPDES permit allows bypassing a portion of the peak flow around the secondary calrifiers during wet weather. At the design peak hourly flow of 11.0 mgd without any bypassing, the surface overflow rate would be 1,400 gpd/ft^2. The final clarifier scum beaches have submerged at peak flows unless the bypass line is opened. The secondary clarifiers have a shallow side water depth of 10 feet. Algae tends to grow and accumulate on the clarifier troughs.

The clarifier drives were replaced in 1999 and continue to perform well. The clarifier mechanisms have exceeded their expected life and have been replaced as part of the 2010 construction project along with

the drive bearings. Density current baffles were also installed in 2010 to reduce the chance for solids washout at peak flows. Scum beach elevations were adjusted.

Secondary sludge is pumped to the primary clarifier. It can also be pumped directly to the digesters, though some of the valves used for this purpose appear no longer operational. The sludge piston pumps have exceeded their expected life and have been replaced with rotary lobe pumps as part of the 2010 construction project.

Additional potential modifications required to the secondary clarifiers are discussed in Section 7.

H. Phosphorus Removal

Chemical phosphorus removal facilities were installed in 1996. The plant has consistently met effluent limits using the existing phosphorus removal system. The existing facilities have adequate capacity to meet current effluent limits through the planning period. If phosphorus limits become more stringent as expected, however, additional measures will be required and are evaluated in Section 7.

I. Effluent Filtration

At the future peak hourly design flow of 11.0 mgd, the effluent gravity filter would be loaded at a rate of 5.8 gpm/sf with one filter out of service. At the future maximum day flow of 7.6 mgd, the loading rate would be 4.0 gpm/sf with one filter out of service. These rates are within the typical range of 2 to 6 gpm/sf gravity filters. According to WAC NR 110, filtration rate may not exceed 5 gpm/ft^2 with one filter out of service at maximum flow. In July 2010 revisions were made to NR 110 that define the maximum flow as maximum hourly flow (i.e., PHF). The 5.8 gpm/sf value is above this. Therefore, the filters are not quite adequate for the future design flows, although the WPDES permit allows bypassing a portion of the flow around the filters during wet weather. The WAC also requires that backwash reservoirs be provided with the filters. The total backwash storage should equal or exceed the volume required for two complete backwash cycles. The storage volume required is 127,000 gallons. The existing facilities are provided with 150,000 gallons of storage underneath the filters. WAC NR 110 also requires that spent backwash water should be returned to the head of the treatment facility at a rate no greater than 15 percent of the average design flow rate. At the future design average flow rate of 2.4 mgd, 250 gpm can be returned to meet this requirement. The new submersible backwash pumps that are being provided as part of the 2010 project will meet this capacity.

Prior to the 2010 project, the filter media had not been replaced since it was originally installed, and much of it had been lost. Piping and valves in the filter building showed signs of corrosion because of the humid environment. At that time the filters were a hydraulic bottleneck during high flows. This bottleneck was caused by a combination of factors, including the higher solids loading rate at high flows, current manual operation practices, and the relatively slow rate at which backwash was returned to the head of the plant. Because of this, during high flows that exceeded 5 mgd, the filters were bypassed.

The *Wastewater Treatment Plant Equipment Replacement and Rehabilitation* engineering report (2009) included an evaluation of various alternatives for filtration to meet 2030 design conditions. The report recommended rehabilitation of the existing filters. The 2010 construction project included

replacement of the anthracite media, nozzles, valves, and other worn components in the existing filters. Controls will be provided to allow automatic timed or head loss-based backwashing of the filters. Backwash pumps will be turned off when there is adequate forward flow available for backwashing, thereby improving the overall hydraulics through the filters. The backwash wastewater pumps will also be replaced. Bypassing will still be available for extreme peak flows. These modifications should improve the hydraulic capacity and performance of the filters. Additional improvements may be required as a result of future more stringent phosphorus limits; these are considered in Section 7.

J. Effluent Disinfection, Postaeration, and Outfall

Chlorine gas solution is injected into carrier water and added to the flow upstream of the chlorine contact tanks. Approximately 7 pounds of chlorine gas are used per average day to disinfect the effluent. Dechlorination is provided by addition of sulfur dioxide immediately downstream of the chlorine contact tank. Both the chlorine and sulfur dioxide gas injection systems were replaced in 2007 and the maximum chlorination rate is 50 lb/day. A higher rate would be needed for the future peak hourly flow rate of 11.0 mgd. Current fire code requires automatic sprinklers be installed in rooms that contain more than 500 pounds of hazardous chemicals such as chlorine or sulfur dioxide. Plant staff should monitor how many cylinders are stored in each room to comply with this requirement.

The chlorine contact tank is difficult to clean and maintain and algae grows in it; a catwalk or cover would be beneficial. The chlorine contact tank will have a 21-minute hydraulic retention time (HRT) at the design of PHF of 11.0 mgd. This is less than the WAC requirement of 30 minutes, but this may be acceptable if an adequate chlorine dose and dechlorination are provided.

The *Wastewater Treatment Plant Equipment Replacement and Rehabilitation* engineering report (2009) included an evaluation of various alternatives for disinfection to meet 2030 design conditions. Based on cost and nonmonetary factors, ultraviolet (UV) disinfection was selected and will be constructed as part of the 2010 project. The former chlorine contact tank will be covered to reduce the growth of algae (affecting filter backwash quality and cleaning frequency). The existing chlorination system will be maintained in case it is needed to reduce biomass growth in the filters or needed for future return activated sludge chlorination.

The effluent flow is metered in an 18-inch Parshall flume that discharges to an outfall pipe to Whitewater Creek. The flume is large enough to measure the future peak hourly flow, though the flume and the short section of pipe upstream of it may cause a surcharge condition to the weir in the postaeration tank. This pipe was replaced with a higher capacity channel during the 2010 construction project.

The effluent outfall sewer is a 24-inch-diameter followed by 48-inch-diameter. This sewer submerges at the 100-year flood elevation of 799.00 in Whitewater Creek. Assuming this condition of full flow, it appears the sewer has an approximate capacity of 7 to 8 mgd without losing effluent metering accuracy. The influent flow meter could be utilized during flood conditions. In any case, the capacity and condition of the outfall sewer should be evaluated further, and the City should budget for rehabilitation or replacement of this outfall sewer, perhaps in conjunction with a future construction project.

K. Biosolids Stabilization–Anaerobic Digestion

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 ft^3 of volume per day in the primary anaerobic digesters. At the minimum detention time, the rated primary digestion total capacity is 78,000 gallons a day with a VS loading of 12,600 lbs VS/day. In 2007, a single primary digester treated approximately 2,030 lb/day of suspended solids with an average flow rate of 6,100 gal/day. The VS concentration was approximately 72 percent, so the VS loading was approximately 1,470 lbs VS/day. This loading effectively used only 12 percent of the primary digester capacity.

Between 2007 and 2009, an average of 1.5 million gallons of digested biosolids were hauled to farmlands each year, or 4,100 gal/day. Supernatant is decanted from the secondary digester. At current biosolids production and supernating practices, there are 284 days of storage in the existing secondary digester or 158 percent of the required 180 days of storage. Since only one primary digester is required to digest the biosolids generated, the second primary digester could be converted to storage, providing an additional 140 days of storage. The City is also considering treating industrial or agricultural waste in the second primary digester; this was the subject of a separate study as discussed previously.

According to 2007 plant data, digested sludge hauled to farmland had a total solids concentration of 4.4 percent, with approximately 45 percent VS content. The VS reduction through the digester was determined by the percent VS of the digester feed sludge (72 percent) and the digested sludge hauled to farmland (45 percent). This data indicates a VS reduction of about 70 percent through the digesters and through loss in the supernatant. There was approximately 1,000 lbs VSS destroyed or lost per day. Total gas production is usually quantified from the amount of VS destroyed. Typical values range from 12 to 18 ft^3/lb of VSS destroyed. Gas production in 2007 ranged from 7,800 to 19,000 ft^3/day, which corresponds to a gas production rate of 8 to 19 ft^3/lb VSS destroyed. According to WWTP data, gas production from 2008 to 2009 ranged from 6,400 to 23,300 ft^3/day.

Prior to the 2010 project, the gas mixing system for primary digesters was inoperable. Only a single recirculation pump mixed digester contents. Additional VS destruction and methane gas production could have been generated if the primary digester tank contents were completely mixed. The gas handling piping did not have flame traps or accumulators. Condensate could have clogged gas piping, reducing pipe capacity. The absence of flame traps on gas piping presented a safety concern. The waste gas burner automatic ignition system was inoperable. The WAC NR 110 code requires that all gas burners be equipped with automatic ignition systems.

The portion of the covers on the primary digester in contact with the digested sludge had not been painted since their original construction. The secondary digester cover was a floating cover and was in poor condition. A floating cover is not required since little methane gas should be stored in this tank. The secondary digester mixing consisted of only one 15 hp submersible mixer. The supernatant pump was not easy to use.

Only one heat exchanger was operational and connected to the boiler system. This single heat exchanger adequately served the current loading, and it appeared additional existing heat exchangers could be reconnected if needed. The boiler system is close to its expected useful life and replacement is recommended with a boiler that can utilize biogas.

The existing digester gas compressor and gas storage sphere are inoperable. Some form of gas storage may need to be provided if biogas is to be utilized rather than just flared.

The current digestion facilities have adequate capacity to handle projected future growth. As part of the 2010 construction project, the digester gas safety equipment and waste gas burner have been replaced, the primary digester covers have been repainted, the sludge storage tank cover has been removed and replaced with a new aluminum dome-style cover, the supernatant pump has been replaced and supernatant flow metering added, new pumped mixing systems have been provided for Primary Digester No. 1 and the sludge storage tank, a new recirculation pump has been provided for Primary Digester No. 1, and the Primary Digester No. 2 recirculation pump has been re-installed. As part of a planned 2011 project, a biogas combination boiler and heat exchanger will be added to utilize biogas or blended biogas and natural gas to heat Primary Digester No. 1.

L. Sampling

Previously, the effluent sampler often became clogged with algae; this is anticipated to improve after the chlorine contact tank cover is added as part of the 2010 project. The influent sampler monitors internal recycle flows mixed with raw wastewater. Internal recycle flows are not currently measured. A tap to sample internal recycle flows can be installed where the recycle line discharges to the influent wet well. This location includes filtrate and digester supernatant but not hauled wastes. Alternatively, these later streams could be sampled at their source and will be metered separately after the 2010 construction project. Hauled wastes to be monitored separately and hauled volumes recorded.

M. Bypass Flow Metering

The WDNR has requested the City have a reasonable means of estimating bypass flows. The City is able to use existing weirs to estimate flows at various points in the treatment train. Accuracy is questionable at the secondary clarifier splitter structure, however, because of flow surging. This issue should be addressed as part of any future biological treatment process. Another option would be to install a flow meter in the bypass piping.

N. Administration Offices, Maintenance Operations, and Laboratory Space

The administration building houses staff offices, the laboratory, locker rooms, storage areas, meeting rooms, and related spaces. In general, only minor upgrades have been implemented for these facilities since the 1980s, and the existing space is in need of significant refurbishment and potential expansion. This is evaluated in additional detail in Appendix E. As part of the 2010 project, equipment bases for former emergency generators and belt filter presses were removed along with the former cooling tower in the Main Building. This provided additional space that may be used for storage or other purposes.

O. Sewer Cleaning Debris Pad

Currently, sewer cleaning crews use the WWTP site to store sewer cleaning/jetting debris. To improve dewatering and handling of such material, a drained concrete pad should be included in a future project budget. The location of this pad is dependent on the hauled waste receiving alternative selection.

P. Site Roadways

The site roadways are deteriorating. Paving contractors have indicated that the driveways should be rebuilt rather than just resealed. When this is done, additional driveway access should be added to the north side of the RBC buildings as discussed previously as well as the UV area. Waste hauler access to new or relocated receiving facilities and to the digesters should also be considered.

Q. Flood Protection and Stormwater Management

A WWTP has been operating on the existing site since the 1980s. The current treatment facility, as constructed, satisfies code requirements for flood protection. All existing units are above the 100-year flood elevation for Whitewater Creek.

Stormwater regulations require erosion control during construction. A permit will need to be obtained by the City and a site-specific erosion control and stormwater management plan will need to be prepared prior to construction. Stormwater detention or infiltration measures will need to be provided as part of the final design if impervious area is added to the WWTP site.

5.02 SUMMARY OF REQUIRED UNIT PROCESS MODIFICATIONS

Table 5.02-1 presents a summary of the required or recommended unit process modifications.

TABLE 5.02-1

SUMMARY OF PROCESS REQUIREMENTS

Unit Process/Item	Design Requirements	Existing Capacity or Condition	Year 2032 Capacity or Recommendations	Priority[1]
Emergency Electrical Power	Standby generator or connection to two power grids.	Two 300 kW standby generators provided.	Adequate capacity for emergency power requirements. Replace transformer and switchgear in future.	3
Potable Water	Provide potable water for drinking, laboratory, and other uses and for standby to the nonpotable water system.	A potable well is provided but has a high mineral content. The pump and hydropneumatic tank are at the end of their expected life.	City water can be extended from the nearby LS Power/Cogentrix facility to the WWTP.	3
Septage and Hauled Waste Receiving Facilities	Provide facilities for handling of septage and holding tank waste.	Poor location; unable to slowly feed septage.	Relocate septage receiving station to reduce odors and increase ability to attract haulers.	2
Influent Pumping Station	Capacity to pump peak flow with one pump out of service.	Firm capacity = 11.0 mgd with new pumps.	Pumps were replaced with the 2010 construction project. Replace manual bar rack, consider a new basket style screen, and repaint dry well area.	3
Influent Flow Metering	Flow monitoring required per WPDES permit.	Maximum meter capacity of 11.5 mgd.	Adequate capacity. Increase span as part of the 2010 or future construction project.	3
Screening and Grit Removal	Provide protection for pumps and other downstream equipment.	Screen capacity = 10.0 mgd or possibly higher; evaluate hydraulics. Screenings washer was added in 2010. Manual bar rack used when mechanical screen is out of service. Grit removal capacity = 12 mgd.	Utilize bypass bar screen as needed during peak flow events. Consider new fine mechanical screening as replacement or in addition to existing screen.	3
Primary Sedimentation and Cothickening	Surface overflow rate of 1,500 gpm/ft	Existing surface area = 7,700 ft^2. Maximum hourly flow = 11.5 mgd.	Adequate capacity. Worn equipment was replaced with the 2010 construction project.	3
Rotating Biological Contactors	Minimum hydraulic retention time of 100 minutes at peak flow.	At 77 percent of capacity at current loadings. Maximum hourly flow = 10.5 mgd at	Will be at approximately 80 percent of capacity at design BOD and TKN loadings. Inadequate hydraulic capacity; consider bypass at flows	1

Unit Process/Item	Design Requirements	Existing Capacity or Condition	Year 2032 Capacity or Recommendations	Priority[1]
	Refer to Section 5.01 for a discussion on RBC capacity.	100-minute hydraulic retention time. Near end of expected design life. Two shafts have recently failed and buildings are in poor condition.	exceeding 10.5 mgd. Consider complete replacement of this system before shaft failure becomes widespread.	
Secondary Clarification	Surface overflow rate maximum 1,200 gpd/ft^2.	Existing surface area = 7,700 ft^2. Maximum hourly flow = 9.2 mgd.	Inadequate capacity for future peak flows; however, WPDES permit allows bypassing a portion of the peak flow during wet weather. Stamford baffles were provided with the 2010 project to help treat projected peak flow. Consider bypass at flows exceeding 9.2 mgd. Consider a third final clarifier if required to meet more stringent phosphorus or TSS limits in the future.	2
Chemical Phosphorus Removal System	Meet WPDES permit limit for effluent total phosphorus.	25 gph firm metering pump capacity.	Adequate capacity for current limits. May need to increase capacity, add biological phosphorus removal and/or use additional chemical application points depending on future limits.	2
Total Nitrogen Removal	Meet future WPDES permit for total nitrogen, if imposed; reduce nitrogen loadings to the Gulf of Mexico.	No facilities currently.	Facilities may be required to meet future permit limits.	2
Effluent Filtration	Loading rate = 5 gpm/ ft^2 with one filter out of service.	Maximum capacity = 9.5 mgd per code.	Inadequate capacity for future peak flows; however, WPDES permit allows bypassing a portion of the peak flow during wet weather. Rehabilitation included in the 2010 construction project. Consider bypass at flows exceeding about 7.9 mgd. Consider the addition of a parallel or series process if required to meet future phosphorus, total nitrogen, or TSS limits.	2
Effluent Flow Metering	Flow monitoring required per WPDES permit.	Parshall flume maximum capacity = 15.9 mgd. Becomes submerged at 11.0 mgd and 100-year flood.	Improve hydraulic capacity up and downstream of Parshall flume. Upstream capacity being addressed in the 2010 construction project.	3

Unit Process/Item	Design Requirements	Existing Capacity or Condition	Year 2032 Capacity or Recommendations	Priority[1]
Postaeration	Meet WPDES permit limit for effluent DO concentration.	Adequate capacity in postaeration.	Hydraulic limitation at peak hourly flow is being addressed in the 2010 construction project.	3
Disinfection	Meet WPDES permit limits for effluent fecal coliform and chlorine residual.	New UV equipment will be adequate for 11.0 mgd PHF.	UV disinfection included in the 2010 construction project. Chlorination/dechlorination system will be maintained as needed to chlorinate filter, NPW, or future RAS.	3
Anaerobic Digestion	Minimum detention time = 15 days. Loading rate = 80 lbs VSS/ ft^3.	Adequate capacity for 2032 conditions and beyond with one primary digester out of service.	Rehabilitation was included in the 2010 construction project. Biogas utilization in a new boiler/heat exchanger for digester heating is being planned for 2011. High strength liquid industrial wastes may be accepted in 2012 as part of a full-scale pilot project.	2
Biosolids Storage	Provide 180 days of storage.	Adequate capacity in Sludge Storage Tank for 2032 conditions and beyond. Anaerobic Digester No. 2 is also available for storage.	New cover over storage tank, better supernating, and more effective mixing were added as part of the 2010 construction project.	3
Bypass Flow Estimation	Provide means of estimating bypass flows in accordance with the WPDES permit.	Head measurements over weirs are used to estimate flows; accuracy at the secondary clarifier splitter structure is questionable because of surging.	Correct the surging at the secondary clarifier splitter structure or install bypass flow meter as part of a future biological treatment project .	1

[1] Ranking is approximate and is as follows:

1 = should be addressed as soon as possible based on poor condition and/or inadequate capacity.
2 = consider addressing prior to rerating WWTP for higher design flows or based on future changes in regulations and WPDES permit limits.
3 = consider addressing in the future as needed based on condition, capacity, or changed regulation or as part of a larger construction project.

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SECTION 6
CURRENT AND POTENTIAL REGULATORY ISSUES

This section will provide a discussion of the impact of current and future regulations on the Whitewater WWTP.

6.01 PENDING SANITARY SEWER OVERFLOW RULES (USEPA AND WDNR)

The Clean Water Act (CWA) contains a strict prohibition against sanitary sewer overflows (SSO). In January 2001, the USEPA Administrator signed a new SSO Rule. However, it was never published in the Federal Register and is still under debate.

The proposed SSO Rule resulted from extensive dialogue with the regulated community through the Federal Advisory Committee Act (FACA). The proposed SSO Rule contains provisions that would cause the Whitewater WWTP to develop a Capacity Assurance program including:

1. A Capacity, Management, Operation, and Maintenance (CMOM) program.
2. An SSO monitoring and reporting scheme.

The Capacity Assurance program would require:

1. Estimates of peak flows (including flows from SSOs that escape the system) associated with conditions similar to those causing overflow events.
2. Capacity of key system components.
3. Identification of hydraulic deficiencies.
4. Identification of the major sources that contribute to the peak flows associated with overflow events.

The Capacity Assurance program would require the establishment of both short- and long-term actions to address each hydraulic deficiency including prioritization, alternatives, analysis, and schedule.

The WDNR's focus on collection system maintenance and SSOs has increased in recent years. New requirements include issuing separate WPDES permits for owners of collection systems and reporting of SSOs and CMOM activities in the Compliance Maintenance Annual Reports (CMARs). The CMARs assign letter grades to communities based on their SSOs and collection system rehabilitation activities. The WDNR formed a technical advisory committee (TAC) and started an administrative rule process for collection system operation and maintenance (O&M) programs and has issued working drafts of new and changed code language to the TAC and other interested parties. The most recent draft rule revisions were issued in December 2010. The draft rules indicate that basement sewage backups will not be considered SSOs; however, repeated basement backups may lead to the WDNR requiring collection system capacity evaluations and corrective actions. The draft rules require implementation of a CMOM program. A system evaluation and capacity assurance plan (SECAP) may be required by WDNR in some cases such as frequent basement backups. Existing rule language would be revised to prohibit "bypassing" with some exceptions; one of the exceptions is when allowed by the WPDES permit (as is the case in Whitewater) during wet weather. Bypassing may need to be justified with each permit reissuance.

For the purpose of the Facilities Plan for the Whitewater WWTP, sufficient hydraulic capacity needs to be provided to allow the collection system to function without overflows and system backups. Based on the information presented in Section 4, the alternatives evaluated in Section 7 will include hydraulic capacity to convey a minimum of 11.0 mgd (estimated 2032 peak hourly flow). This facilities plan also assumes bypassing will continue to be allowed during peak wet weather events as it is described in Whitewater's WPDES permit.

6.02 TOTAL MAXIMUM DAILY LOAD (TMDL) IMPACT

The Whitewater WWTP discharges into Whitewater Creek in the Lower Rock River Basin. Whitewater Creek flows into the Bark River in Jefferson County. The Bark River flows to the Rock River upstream of Lake Koshkonong.

The CWA provides special authority for restoring polluted waters. For water bodies that appear on the list of impaired waters [CWA Section 303(d)], the CWA mandates development of a TMDL, which is the maximum amount of a specific pollutant that a water body can receive and still meet water quality standards. A TMDL also allocates the maximum amount of each identified pollutant of concern that can be contributed from National Pollutant Discharge Elimination System (NPDES) permitted discharges and nonpoint (surface runoff or atmospheric deposition) sources into the water body.

Figure 6.02-1 shows the water bodies in the Rock River Basin that are on the 2010 impaired waters list. The 2010 303(d) list includes the Rock River and Lake Koshkonong, downstream of Whitewater's WWTP discharge, as impaired waters with impairments including degraded habitat, low dissolved oxygen, and excess algae. The pollutants of concern are listed as sediment and phosphorus. The 303(d) list information for downstream waterbodies is shown in Table 6.02-1.

While Whitewater Creek is not specifically listed as an impaired water body, the WDNR State of the Basin report for the Lower Rock River Basin indicates Whitewater Creek only partially meets its warm water sport fishery use. Furthermore, the WDNR has indicated that all the municipal wastewater treatment plants in the basin will be included in the Rock River Basin TMDL because they are a source of phosphorus potentially causing downstream impairments. The WDNR considers total phosphorus a "conservative" pollutant, meaning it will travel from the point of discharge downstream within a reasonable period of time without being transformed significantly or removed from the system.

The USEPA and WDNR have begun phosphorus and sediment TMDL development efforts for the Rock River Basin. A public meeting on the TMDL was held by the WDNR on December 12, 2006, for communities and other interested parties. The City of Whitewater has joined a group of concerned municipalities, the Rock River TMDL Group ("Group"). The Group has been involved in the TMDL Technical Advisory Team and other efforts to guide the process, with the goal of having a scientifically sound and fiscally responsible TMDL. As a member of the Group, Whitewater is informed of potential impacts of the TMDL on its stormwater and wastewater management programs. The USEPA and WDNR released a draft version of the Rock River TMDL report in December 2010 and comments are due January 21, 2011. It is anticipated that a final report (including any public comments and responses) will be submitted to the USEPA in 2011.

According to the draft TMDL report, the Whitewater WWTP could have both monthly and daily waste load allocations (WLAs) for effluent phosphorus and TSS. The WLAs vary by month. The WLAs from the draft report for the most stringent months are presented in Table 6.02-2 along with the calculated effluent concentrations that would result from the WLAs at various wastewater flow rates. This table indicates the TMDL-based monthly average effluent limit for phosphorus could be as low as 0.24 mg/L at the current design average flow of 3.65 mgd.

WDNR has also begun formation of committees for development of a companion implementation plan for the TMDL, and we recommend Whitewater's involvement in that effort. The WDNR intends that the implementation committees will meet quarterly in 2011 and 2012.

Phosphorus effluent limits may also be effected by the national or state nutrient strategies, as discussed below.

TABLE 6.02-1

2010 303(d) LIST

WBIC	Impaired Water ID	Waterbody Name	Counties	Start Mile	End Mile or Acres	Pollutants of Concern	Impairments	Impaired Water Category	Impaired Water Status	Impaired Water Priority	WDNR Regions
788800	401	Rock River	Rock	171.08	183.45	Mercury, PCBs, Sediment, Total Phosphorus	Contaminated Fish Tissue, Degraded Habitat, Low DO	Contam. Sediment, PS/NPS Blend	TMDL Development, Water Delisted for mercury and PCBs	High Priority	South Central Region
788800	400	Rock River	Rock	183.45	193.11	PCBs, Sediment, Total Phosphorus	Contaminated Fish Tissue, Degraded Habitat, Low DO	Contam. Sediment, PS/NPS Blend	TMDL Development, Water Delisted for PCBs	High Priority	South Central Region
788800	399	Rock River	Rock	193.11	201.29	PCBs, Sediment, Total Phosphorus	Contaminated Fish Tissue, Degraded Habitat, Low DO	Contam. Sediment, PS/NPS Blend	TMDL Development, Water Delisted for PCBs	High Priority	South Central Region
808700	610	Lake Koshkonong	Dane, Jefferson, Rock	0	10595.62	Sediment, Total Phosphorus	Degraded Habitat, Excess Algal(Plant)Growth, Low DO, Sediment	PS/NPS Blend	TMDL Development	High Priority	South Central Region
788800	609	Rock River	Dodge, Jefferson	213.62	249.13	Total Phosphorus	Excess Algal(Plant)Growth, Low DO	PS/NPS Blend	TMDL Development	High Priority	South Central Region

TABLE 6.02-2

SUMMARY OF POTENTIAL IMPACT AT VARIOUS FLOW RATES

	Phosphorus					TSS				
Effluent Flow (mgd)	Lowest Month Pounds	Lowest Monthly "Limit" mg/L	Lowest Daily Pounds	Lowest Daily "Limit" mg/L	Lowest Month	Lowest Month Tons	Lowest Monthly "Limit" mg/L	Lowest Daily Tons	Lowest Daily "Limit" mg/L	Lowest Month
1.8	219.87	0.49	17.52	1.17	Sept	11.47	49	0.37	49	July
2.4	219.87	0.37	17.52	0.88	Sept	11.47	37	0.37	37	July
3.65	219.87	0.24	17.52	0.58	Sept	11.47	24	0.37	24	July

Note regarding use of the word "limit": this is the concentration calculated from the load and the design average flow (mgd) shown. This "limit" may or may not be used as the effluent limit (i.e., it may be used in lieu of a WQBEL per recent revisions to NR 217).

Source: http://www.dnr.state.wi.us/org/water/wqs/303d/RockRiverTMDL

Figure 6.02-1 Impaired Waters of the Rock River Basin

6.03 NATIONAL NUTRIENT STRATEGY

In December 2000, the USEPA published recommended regional water quality criteria with the goal of reducing the impact of excess nutrient discharge to water bodies. The USEPA intended to work with the states to adopt regionally specific and locally appropriate water quality criteria for nutrients in 17 defined ecoregions. States were expected to adopt or revise water quality standards by 2004. This marks the first time the USEPA has issued regional-specific criteria for lakes, reservoirs, rivers, streams, and wetlands.

The USEPA originally expected the states to use the ecoregional nutrient criteria as a starting point for identifying more precise nutrient levels that will ensure that nutrient water quality standards are met. The nutrient criteria are intended to serve as a baseline to describe surface water conditions that are minimally impacted by human activity in an effort to protect surface waters from eutrophication caused by nutrient overenrichment. The parameters represent both causal criteria [total phosphorus (TP) and total nitrogen (TN)] and physical/biological responses (chlorophyll *a* and turbidity).

The Whitewater WWTP discharge is located in Aggregate Ecoregion VII, in Level III Ecoregion, Southeastern Wisconsin Till Plains, as defined by the USEPA and shown in Figure 6.03-1. The USEPA's baseline water quality criteria for rivers and streams in this ecoregion are presented in Table 6.03-1. The states are allowed to either adopt the USEPA's recommended water quality criteria as published or develop their own based on scientific methods approved by the USEPA.

Parameter	Potential Nutrient Criteria
Total Phosphorus	80 μg/L
Total Nitrogen	1.3 to 1.59 mg/L
Chlorophyll *a*	3.52 μg/L
Turbidity	2.74 FTU

Table 6.03-1 USEPA Recommended Nutrient Criteria for Rivers and Streams in Southeastern Wisconsin Till Plains

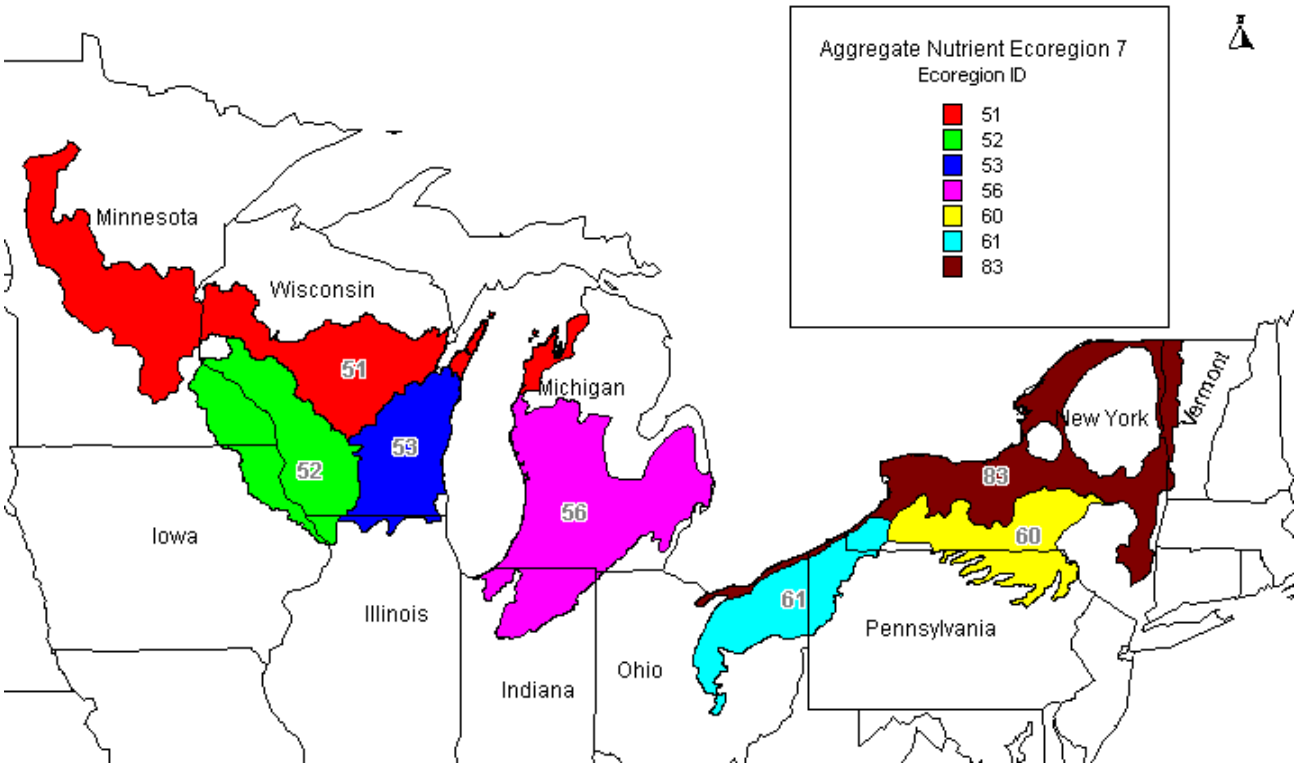

Figure 6.03-1 Ecoregion VII with Level III Ecoregions Shown

Note that a criterion is the allowable concentration of a substance in the waterbody. Permit limits are often higher than a criterion because consideration can be given to dilution of the effluent with the receiving water body. In the case where the receiving water body's background water quality is higher than the criterion, or if the receiving stream has a very low dry weather flow, the permit limit may be set at the criterion.

Concern over Gulf of Mexico hypoxia could impact nutrient limits as well. In 2008, the USEPA along with other agencies submitted an action plan to Congress that outlined a strategy to reduce the size of the hypoxic zone (or "dead zone") in the Gulf. According to the USEPA, the size of the hypoxic zone off the coast of Louisiana averaged approximately 9,000 mi^2 in 2009. Nutrients from the Mississippi River Basin are identified as one of the causes of hypoxia in the northern Gulf of Mexico. Hypoxia refers to a condition where DO concentrations in the water drop to a level that does not support fish and other aquatic species. The action plan depends on incentive- and voluntary-based approaches to reduce agricultural runoff and restoration of wetlands to decrease the size of the hypoxic zone. Additionally, permitting authorities within the Mississippi Basin may require wastewater treatment facilities to remove nutrients to reduce loadings (*Mississippi River/Gulf of Mexico Watershed Nutrient Task Force, 2008 Action Plan for Reducing, Mitigating, and Controlling Hypoxia in the Northern Gulf of Mexico*, Washington, D.C.).

The USEPA is beginning a nutrient TMDL for the entire Mississippi River Basin and northern Gulf of Mexico. Representatives expect the Mississippi River Basin TMDL to focus primarily on nitrogen.

Targets for nitrogen may be more difficult to set, since, at least in Wisconsin, there is not a clear breakpoint in the data that would indicate the concentration of TN below which the impacts on aquatic life are minimized. Therefore, targets may be set based on Gulf of Mexico hypoxia rather than local conditions. Eventually this TMDL could lead to TN limits at the Whitewater WWTP; however it appears this TMDL effort will take several years to complete.

6.04 WISCONSIN NUTRIENT STRATEGY

Wisconsin, along with other states in USEPA Region 5, elected to develop its own nutrient criteria rather than using the USEPA's ecoregional criteria. Over the past several years, the WDNR has contracted the USGS to monitor various sizes of streams to determine the impact of nutrients on algal growth and aquatic life. Phosphorus criteria were developed based on these studies. Wisconsin's final phosphorus criteria were adopted by the Natural Resources Board in 2010 and went into effect on December 1, 2010. The following new water quality criteria from revised WAC Chapter NR 102 apply to Whitewater's discharge:

Rivers (e.g., Bark and Rock Rivers):	100 micrograms per liter (µg/L)
Streams (e.g., Whitewater Creek):	75 µg/L

It appears downstream Lake Koshkonong is not considered a reservoir and so will have a criterion of 100 µg/L, as well. Revisions to NR 217 provide a method for calculating water quality-based effluent limits (WQBELs) from the NR 102 criteria. This calculation allows for dilution with the receiving stream. However, if the receiving stream has growing season concentrations of phosphorus above the NR 102 criterion, the WQBEL would be set at the criterion. In Whitewater's case, this would result in a WQBEL of 0.075 mg/L.

Revisions to NR 217 also allow use of a TMDL limit in lieu of a WQBEL if appropriate, for example, if agricultural contributions to phosphorus are significant in the watershed as they are in the Rock River Basin. NR 217 contains other options for compliance with the new criteria, but for Whitewater it appears the TMDL limit option would be most favorable.

In summary, it is likely the Whitewater WWTP will have a revised monthly average phosphorus limit in the range of 0.075 mg/L to approximately 0.25 mg/L in their next WPDES permit due to be reissued on January 1, 2014. Daily and monthly mass limits for phosphorus will also be included. If the limit is revised, the permit should contain a compliance schedule for meeting these limits. The compliance schedule could be as long as seven to nine years depending on the technology selected to meet the limit and how much time is required to arrange for funding, planning, design, construction, and related issues. Depending on the final phosphorus limitations, additional chemical use and, potentially, additional tertiary treatment technologies may be required. Any WWTP modifications made for phosphorus should allow for future potential TN removal, as well.

Water quality trading is also an option for Whitewater whether the plant has a WQBEL based on the new criterion or a TMDL-based effluent limit. Trading partners would most likely need to be identified upstream of the treatment plant. The WDNR has formed advisory groups for the purpose of developing a framework for water quality trading in Wisconsin, as directed by the Natural Resources Board in 2010. A progress report on water quality trading is expected by mid-2011.

6.05 EFFLUENT MERCURY LIMITATIONS

Mercury is a persistent and bioaccumulative pollutant. Found naturally, it can also be released from energy production and man-made products to cause health and environmental problems. Once released into the environment, mercury cycles and converts to the toxic form, methyl mercury, and can be difficult to remove.

The WDNR has adopted effluent mercury standards in NR 105 and NR 106. Quarterly effluent mercury sampling is required in Whitewater's recently reissued permit. The WDNR added an alternative effluent mercury limit of 3.89 nanograms per liter (ng/L) daily maximum into the reissued permit that is effective January 1, 2009. Through the Green Tier program, Whitewater voluntarily pledged to go beyond regulatory environmental compliance and implement a mercury pollutant minimization program, thereby being eligible for the higher alternative mercury limit instead of the default water quality-based effluent limit of 1.3 ng/L. The reissued permit requires mercury PMP annual reports be submitted in February of each year. Whitewater is working to keep mercury out of the environment through recycling and promoting mercury-free alternatives. The existing nonpotable water system control panel at the WWTP contains mercury pressure switches. Mercury-containing switches at the WWTP are recommended to be replaced with mercury-free alternatives.

It should be noted the current Whitewater biosolids mercury concentrations are significantly less than 17 milligrams per kilogram (mg/kg) stipulated for high quality sludges in NR 204 of the WAC.

6.06 CHLORIDE REGULATIONS IMPACT REVIEW

The WDNR has adopted effluent chloride standards in NR 105 and NR 106. These regulations should not affect the Whitewater WWTP because the chloride concentrations in samples collected during the previous WPDES permit cycle were below calculated acute and chronic limits. Monthly chloride sampling is required only in year 2012 according to the 2009 permit. Whitewater should remain aware of the sources of chlorides (for example, water softeners, deicing chemicals in I/I, and some industrial sources) and review any industrial or other proposed changes in the water supply or collection system that may affect chlorides.

6.07 COPPER REGULATIONS IMPACT REVIEW

The WDNR has adopted effluent copper standards in NR 105 and NR 106. These regulations may not affect the Whitewater WWTP because the copper concentrations in samples collected during the previous WPDES permit cycle were below calculated acute and chronic limits. Monthly copper sampling is required only in year 2012 according to the 2009 permit. Whitewater should be aware of the sources of copper (for example, water supply piping and some industrial sources) and review any industrial or other proposed changes in the water supply or collection system that may affect copper.

6.08 EFFLUENT CYANIDE LIMITATION

The Whitewater WWTP is scheduled to have an amenable cyanide effluent limitation effective January 1, 2012. According to the 2009 permit, Whitewater may request that the WDNR make a determination for the need for a limit after providing four or more representative results for cyanide to

the WDNR. We recommend that sampling be performed according to WDNR requirements to potentially reopen the permit and remove the cyanide effluent limit.

6.09 NEW THERMAL STANDARDS

The WDNR issued draft rules for thermal standards in December 2007 and accepted public comments in February 2008. Final revisions to NR 102 that include thermal standards became effective October 1, 2010. Revisions to NR 106 contain implementation guidelines and methods for determining WQBELs. The revised rules indicate that existing POTWs will have WQBELs calculated as part of permit reissuance in many cases. A draft guidance document and effluent limits calculation spreadsheet is posted on the WDNR's Web site at http://dnr.wi.gov/org/water/wm/wqs/thermalrulesrevisions.htm. It is likely that Whitewater will have temperature limits calculated when the WPDES permit is reissued in 2014. Whether limits will be placed in the permit will depend on effluent temperatures, receiving stream dilution, and the health of the aquatic life in the stream. The nearby Cogentrix/LS Power discharge may also be a factor. We recommend Whitewater monitor effluent temperature in accordance with the WDNR's draft guidance document. The data should be entered into the spreadsheet and reviewed after the first year to determine whether Whitewater will be subject to WQBELs during any month(s) of the year. If WQBELs appear likely, Whitewater should consider conducting a dissipative cooling study during the month(s) in question. This should be done in 2012 and the results submitted with the permit application in 2013 along with the effluent temperature data.

6.10 DISINFECTION AND THE USE OF CHLORINE

The Whitewater WWTP currently disinfects with liquefied chlorine gas followed by dechlorination. In 1996, the USEPA promulgated 40 CFR 68 112(r) to the Clean Air Act that requires facilities storing certain process chemicals above threshold quantities to develop very detailed plans to reduce the risk of chemical release accidents or off-site consequences should such accidents occur. The USEPA threshold quantity for chlorine is 2,500 pounds. The threshold quantity of OSHA 1910.119 (Process Safety Management) is 1,500 pounds of chlorine for public facilities. Whitewater presently utilizes 150-pound cylinders of chlorine to stay below the threshold values. Therefore, the current mode of operation appears to cost-effectively abide by the regulations while minimizing paperwork. Because of the safety concerns associated with chlorine storage and use, Whitewater is considering other alternatives such as ultraviolet (UV) disinfection.

6.11 EMERGING NATIONAL ISSUES

According to the Water Environment Federation (WEF) Government Affairs Committee, three of the main issues emerging at the national level are sustainability, financing, and microconstituents.

The WEF is supporting sustainability measures, particularly with respect to stormwater management or "green infrastructure" measures and energy conservation measures. In Wisconsin, funding is available for certain stormwater management projects through various programs including the state revolving fund. Funding is available from Focus on Energy and some power and gas companies for studying and implementing energy conservation measures. This funding could be available to Whitewater for projects that increase energy efficiency (lighting, insulation, replacement of low-efficiency motors or equipment,

installation of VFDs, automation and optimization of systems) or projects that more fully utilize digester biogas.

Approximately $10 billion in funding for wastewater projects were included in the economic stimulus legislation in 2007, and Whitewater's 2010 construction project utilized a 50 percent grant from this program. For the upcoming 2011 construction project, Whitewater is also being considered for a 10 percent Principle Forgiveness grant. The funding flows through the existing the Wisconsin Clean Water Fund. It is possible that additional grant funding would be available in future years. Whitewater should submit appropriate paperwork (i.e., intent to apply forms) to the state so its wastewater and other imminent public works projects are on any future funding lists.

Microconstituents are also known as "compounds of emerging concern." They include pharmaceuticals, personal care products, and other compounds that are presently not specifically regulated in wastewater. The WDNR currently has the ability to regulate microconstituents from WWTPs only if a specific problem such as a directly-linked adverse impact on aquatic life is demonstrated. Eventually, advanced oxidation processes or membrane treatment may be required to treat microconstituents. Some communities have taken a pollution prevention approach and have implemented drug take-back programs to help reduce the concentrations of pharmaceuticals in wastewater. Successful drug take-back programs have been implemented in Marshfield, Madison, and several other Wisconsin communities. Whitewater could consider sponsoring a program such as this at the city or county level.

6.12 BIOSOLIDS DISPOSAL AND BENEFICIAL REUSE

Biosolids disposal at the Whitewater WWTP follows the requirements of WAC Chapter NR 204, Domestic Sewage Sludge Management. The biosolids data from 2004 through 2009 show low metal content and therefore satisfy one of the requirements for "high quality" sludge. The quantity of sludge hauled from 2004 through 2007 is presented in Table 3.06-1, and the quality of the sludge hauled for the same period is presented in Table 3.06-2. The Whitewater WWTP generates Class B biosolids based on the fecal coliform level in the solids being land spread.

Class B biosolids by definition have a higher level of pathogenic bacteria than Class A biosolids. Local farmers have accepted the Class B sludge for disposal on agricultural land. The majority of POTWs in Wisconsin produce Class B sludge.

Producing Class A sludge would provide the following advantages over Class B sludge.

1. The sludge would contain a lower level of pathogenic bacteria. Class A biosolids must have a fecal coliform concentration of less than 1,000 most probable number (MPN) per gram total solids.

2. Land application site evaluation reports would not be required and bulk sludge land application reports would not need to be filed with the WDNR.

3. Whitewater would not need to receive approval from the WDNR prior to applying sludge.

4. More sites would potentially be available to apply the sludge.

5. Since Class A biosolids have lower levels of pathogens, there is a lower threat to human health, and therefore, fewer measures are required to minimize human contact with the sludge.

To be considered "exceptional quality sludge" or Class A, the sludge must receive prescribed treatment to reduce pathogens and vector attraction. The prescribed treatment options available include lime stabilization, composting, heat drying, thermophilic aerobic digestion, temperature phased anaerobic digestion, heat treatment, pasteurization, or an equivalent process to further reduce pathogens.

Based on the current acceptance of Class B biosolids for beneficial reuse and the increased costs necessary to comply with Class A biosolids regulations, it is assumed the Whitewater WWTP will continue to use the current methods of biosolids stabilization and disposal for the foreseeable future.

6.13 INDICATOR BACTERIA FOR DISINFECTION

The WDNR previously formed a TAC to investigate applicability of the USEPA's proposal to use an indicator organism other than fecal coliform bacteria to determine compliance with water quality objectives. The most likely organism is *Escherichia coli* (*E. coli*), and the USEPA has already promulgated rules that use this organism as a standard for the Great Lakes. The Wisconsin Section of Central States Water Environment Association had a representative on the TAC who developed a white paper on this topic. The full paper can be viewed at http://www.cswea.org/wisconsin/governmentaffairs/. This white paper indicates that if chlorination is used for disinfection and the facility uses the IDEXX® testing methods for effluent indicator organisms, the E. coli results may have a high bias making it more difficult to comply with any new *E. coli* limits. This problem was not found with UV disinfection. The WDNR's rules related to indicator organisms are presently on hold.

6.14 IMPACT OF FUTURE REGULATIONS ON THE WHITEWATER WWTP

As indicated, the regulations summarized above may affect the Whitewater WWTP in the future. They will be addressed in this current facilities plan by providing sufficient areas on the existing site to allow for additional tertiary treatment for potentially lower phosphorus and TN effluent limits or by selecting treatment technologies that can be operated or expanded to meet the potential future limits.

Based on the review of current and proposed regulations, the effluent limits that will be used for alternative evaluations in this Facilities Plan for the Whitewater WWTP will be equal to the existing WPDES permit effluent limitations summarized in Table 3.02-1. Whitewater may decide to reduce its WWTP design flow as a result of this facilities plan (i.e., to 2.4 mgd). If that is the case, additional dilution with Whitewater Creek will be available. This would result in a lower (less stringent) instream waste concentration (IWC) to use for whole effluent toxicity testing. Higher dilution rates would also be considered in future calculations for potential water quality-based effluent limits. These could potentially include phosphorus, nitrogen, temperature, chlorides, metals, or other parameters. There is also the potential that permit limits for ammonia would be recalculated with the higher dilution resulting in slightly less stringent limits; however, federal antibacksliding rules may prevent such relaxation of existing limits.

SECTION 7
SCREENING OF ALTERNATIVES

Section 5 reviewed the existing facilities. Section 6 identified regulatory issues that will likely affect the WPDES permit and therefore the WWTP. This section reviews potential alternatives for WWTP upgrades.

7.01 INTRODUCTION

Alternative screening is an initial evaluation through which the more feasible options available for wastewater treatment and biosolids thickening are designated for detailed analysis. Alternative screening eliminates less attractive alternatives from consideration and allows a review of costs and nonmonetary benefits of the remaining alternatives.

The City of Whitewater has an existing WWTP constituting an investment on the part of the City that should not be ignored in facilities planning. Most of the facility was placed in operation in 1982 and has served the community well. Given this investment, overall community acceptance of the current location of the Whitewater WWTP, and the availability of land at the current site both for present needs and future expansion, all alternatives evaluated in this report will assume continued use of the existing site and discharge of treated effluent to Whitewater Creek.

7.02 BIOLOGICAL TREATMENT ALTERNATIVES

Though the existing RBCs appear to have capacity to treat wastewater to the current effluent limitations at future loadings through 2032, the RBCs have been in operation since 1982 and shaft failure may soon become an issue. In addition, future effluent limits will likely be more stringent. The biological treatment alternatives that will be evaluated include continued use of the RBCs (following shaft replacement) or conversion to a different biological treatment system. The biological treatment alternatives will include provisions for nutrient removal for both total nitrogen (TN) and total phosphorus (TP). The biological treatment alternatives will include anaerobic digestion of biosolids if the primary clarifiers are retained. If the primary clarifiers are not retained, the anaerobic digestion facilities would be eliminated since digestion is not required for extended aeration processes like oxidation ditches.

The biological treatment alternatives are identified as follows:

- B1a: RBCs with primary clarification with anoxic zone upstream of RBCs.
- B1b: RBCs with primary clarification with Biostyr™ filter and methanol addition.
- B2a: Diffused air activated sludge with primary clarification and biological nutrient removal [BNR–including biological phosphorus removal (BPR)] plus CPR backup.
- B2b: Diffused air activated sludge with TN removal, primary clarification, and CPR.
- B3a: Oxidation ditch with primary clarification and BNR plus CPR back up.
- B3b: Oxidation ditch with primary clarification, TN removal, and CPR.
- B4: BNR extended air oxidation ditch.
- B5: BNR vertical loop reactor (VLR).
- B6: Sequencing Batch Reactors (SBR) with equalization.
- B7: Membrane Bioreactor (MBR).

Process sizing for the biological treatment alternatives will be based on the design loads and flows summarized in Section 4. To be conservative, approximately 30 percent BOD_5 removal is assumed in the primary clarifiers upstream of new biological treatment facilities.

- *Alternative B1a–RBCS with Primary Clarification with Anoxic Zone Upstream of RBCs*

This alternative includes phased replacement of the aging RBCs shafts, construction of an anoxic tank upstream of the RBCs to promote TN removal, additional rehabilitation of the HVAC system in the three RBC buildings, cothickening of primary and secondary sludge in the primary clarifiers, and CPR. The anoxic zone upstream of the RBCs could allow the plant to meet potential future nitrogen removal limits of around 8 mg/L.

- *Alternative B1b–RBCs with Primary Clarification with Biostyr™ and Methanol Addition*

This alternative is similar to Alternative B1a above, except the effluent gravity filter would be replaced with a Biostyr™ filter to meet a future TN effluent limit of around 3 mg/L. To achieve this level of TN removal, an additional carbon source would be required. Methanol addition is assumed in this evaluation. A Biostyr™ incorporates a polystyrene media in an upflow fixed film treatment process. Nitrogen removal (denitrifying) microbes grow on the media and convert nitrate to nitrogen gas while consuming the added methanol. Wastewater passes upward through aerated cells in which the buoyant media is kept submerged by an overlying grid. The media also acts as a filter, reducing effluent solids concentrations. The media is backwashed at intervals of 24 hours or more, with the backwash water being recycled to the primary clarifiers. Required components for this treatment alternative would be a structure similar to a granular media filtration facility; the Biostyr™ media and equipment including pumps, backwash nozzles, and aeration blowers; and a large backwash water storage tank. The WWTP operators are not familiar with this process, and there are no known installations in Wisconsin. It appears the cost and complexity of this alternative make it less favorable than other biological treatment alternatives. Furthermore, Whitewater may not be required to meet a TN limit as low as 3 mg/L; the value of any TN effluent limit may not be known for many years. *Therefore, Alternative B1b will be eliminated from further consideration.*

- *Alternative B2a–Diffused Air-Activated Sludge with BNR Plus CPR Backup*

This alternative includes replacing the RBCs with approximately 1.4 million gallons of BNR and aeration tanks that have 20-foot side water depth. Diffused air activated sludge consists of primary clarification followed by one or more aeration tanks operated in series or parallel providing biological treatment of influent wastewater. Oxygen is normally supplied by blowers and submerged diffusers. Anaerobic and anoxic BNR zones would be provided for removing TP and TN, respectively. This would allow removal of TN to about 8 mg/L. The anaerobic digestion facilities would be maintained. New blowers and return activated sludge (RAS) pumps would be installed in a new building. BPR combined with CPR backup will be used as a part of this analysis. BPR with CPR backup may require separate waste activated sludge (WAS) thickening, since the process of cothickening of primary and secondary sludge in the primary clarifiers could reduce BPR effectiveness. Therefore, a separate WAS thickening process is assumed with this alternative. It is assumed the rehabilitated secondary clarifiers with Stamford baffles installed in the 2010 project will be adequate for treating future flows. The existing secondary treatment bypass pipe would be maintained and would be used for wet weather flows exceeding about 9.5 mgd to prevent washout of biological solids from the aeration tanks and final clarifiers. A third final clarifier could also be considered, depending on future TP limits and future WPDES permit language related to bypassing.

- *Alternative B2b–Diffused Air-Activated Sludge with TN Removal and CPR*

This alternative is similar to Alternative B2a, except that BPR would not be used. Use of only CPR would allow continued use of cothickening primary sludge and WAS in the primary clarifiers. A volume of 1.4 million gallons is assumed for the BNR anoxic zone plus aeration tanks for this alternative.

- *Alternative B3a–Oxidation Ditch with Primary Clarification and BNR with CPR Backup*

This alternative is similar to Alternative B2a except that surface aeration would provide oxygen to the activated sludge rather than diffused aeration, and the configuration would be different. An oxidation ditch is commonly a circular or oblong basin that operates like a racetrack. Wastewater enters at one end, and oxygen is provided by mechanical aerators that operate at one or both ends of the ditch, causing continuous circulation in the system. The overall volume of the oxidation ditch would be similar to a diffused air activated sludge system (1.4 million gallons). A blower building would not be required, but a RAS pumping building would be.

- *Alternative B3b–Oxidation Ditch with Primary Clarification and CPR*

This alternative is similar to Alternative B3a, except that BPR would not be used. Use of only CPR would allow continued use of cothickening primary sludge and WAS in the primary clarifiers. A volume of 1.4 million gallons is assumed for the BNR anoxic tanks plus aeration tanks for this alternative.

- *Alternative B4–BNR Extended Air Oxidation Ditch*

This alternative consists of replacing the primary clarifiers and the RBCs with oxidation ditches having a total volume of approximately 2.4 million gallons. An average design hydraulic retention time of 24 hours was used to develop the required basin volume for this alternative, as recommended for extended aeration processes. The ditch would include both anaerobic and anoxic zones for BNR removal of phosphorus and nitrogen. The anaerobic digestion facilities would be converted to biosolids storage. Eliminating the primary clarifiers would increase the size and cost of the extended air oxidation ditch while simultaneously eliminating the need for and potential benefits of anaerobic digestion. Anaerobic digestion produces biogas that can produce heat for WWTP buildings and treatment processes or can be potentially used to generate “green” power. Furthermore, the City of Whitewater has recently invested in rehabilitation of anaerobic digester No. 1 and biogas handling equipment. On the other hand, a WWTP having oxidation ditches and no digestion facilities is very simple to operate, and labor costs would likely be lower with this type of plant.

- *Alternative B5–VLR System*

A VLR is a relatively recent activated sludge configuration that is similar to an oxidation ditch turned on its side. A horizontal baffle is installed at mid-depth to separate the aeration zones. Diffused aeration is provided in the deeper portion of the tank and mechanical surface aeration is provided in the shallow portion, and the mixed liquor circulates vertically. BNR zones can be added upstream of the VLR. Primary clarifiers are not required, particularly when the VLR is designed as an extended

aeration process. Some designers use less than a 24-hour HRT for VLR systems without primary clarification; however, there is not an established track record of VLR nitrification performance at shorter HRTs. Also, separate aerobic sludge digestion would likely be required by the WDNR if HRTs were shorter than 24 hours. The VLR system is considered more energy efficient than other configurations because mixing and aeration energy can be optimized by having the two separate aeration zones. They are deeper than most oxidation ditches, thereby providing a smaller footprint. The depth will make construction more complicated at Whitewater because of groundwater and dewatering issues. VLRs are more complex and require more equipment than an oxidation ditch because of the two aeration systems. Operations staff is not familiar with the process and would require significant training, and there are only a few installations being planned in Wisconsin. VLRs are also more complicated to construct with the horizontal baffle. The manufacturer has stated that VLRs are more cost-competitive on a life-cycle basis for WWTPs that have design average flows greater than about 5 mgd. *Because of the higher cost and complexity for a WWTP the size of Whitewater's, the VLR system will not be considered further.*

- *Alternative B6–SBR System*

This alternative consists of replacing the RBCs and final clarifiers with a fill and draw activated sludge system. Aeration and clarification would be carried out in a single basin. Three basins would be provided to allow continuous filling (by alternating tanks), flexibility, and redundancy. The SBR is filled with influent raw wastewater. After filling, diffusers at the bottom of the tank or jet aeration provide mixing and aeration during the reaction stage of treatment. After a specified reaction time, the aerators are turned off, and the solids are allowed to settle. Clarified effluent is then decanted off the top of the basin. Anaerobic and anoxic cycles can be incorporated into the control sequence for BNR. The advantage of the system is that solids remain in the reactor, so the mixed liquor does not need to be pumped back to the system. This system typically has a smaller required land area than other activated sludge systems. While oxidation ditches operate in continuous fashion, SBRs operate in batches, so process equipment runs intermittently, making operation somewhat more complex than other activated sludge systems. Because the decant period occurs in shorter batches rather than in a continuous mode, equalization would be recommended upstream of the effluent filters. Also, diffuser fouling and growth of filaments may make system operation more problematic than other activated sludge systems. There are very few SBRs in Wisconsin, which may create difficulties gaining WDNR approval and peer support for such a system. The anaerobic digestion facilities would be maintained and rehabilitated. Alternatively, the primary clarifiers could be eliminated and anaerobic digestion converted to sludge storage. The WWTP operators are unfamiliar with the SBR process and would require significant training. This alternative would not allow reuse of many of the existing WWTP facilities. *For these reasons as well as the capital cost and operating concerns with the SBR system, it will not be considered further.*

- *Alternative B7-MBR System*

This alternative consists of replacing the primary clarifiers, RBCs, final clarifiers, and filters with a membrane bioreactor. An MBR combines microfiltration or ultrafiltration membranes with activated sludge. The membranes' ability to filter solids allows the elimination of both the final clarifiers and the effluent filter, though peak flow storage will be required upstream of the MBR. Sludge digestion would not be required because the MBR system maintains a high solids retention time similar to an

extended aeration process, creating a stabilized waste sludge. The anaerobic digestion facilities would be converted to sludge storage tanks. The existing influent screen would need to be replaced with 2 mm fine screens to protect the membranes. Membranes would need to be replaced every 3 to 5 years. In addition to aeration blowers, permeate pumps are required. In northern climates, membranes are typically protected from winter weather, so a new building would be required to house the membranes. BPR adds more complexity to MBR systems, so CPR is often the primary phosphorus removal method particularly for very low effluent phosphorus limits (below about 0.1 mg/L). Alternatively, a tertiary flocculation-sedimentation process for CPR may be required following the MBR, or the membranes would potentially be located in separate tanks from the mixed liquor aeration. Based on a study completed by our firm for the Wisconsin Municipal Environmental Group, it is assumed an MBR WWTP capable of treating 2.4 mgd dry weather flow and 11.0 mgd peak hourly flow would have capital costs on the order of $25 million. O&M costs would also be higher than other alternatives. The MBR technology is ideally suited for land-locked sites where space is a premium, for WWTPs that have low peak to average flow ratios, and when effluent reuse is desired. MBR is the most complex process to operate of the biological treatment alternatives evaluated. The WWTP operators are unfamiliar with the MBR process and would require significant training, and there are no known installations in Wisconsin. This alternative would not allow reuse of many of the existing WWTP facilities. *For these reasons as well as the high capital and operating cost of the MBR system, it will not be considered further.*

7.03 EFFLUENT FILTRATION/TERTIARY TREATMENT

The current method of removing suspended solids to meet permit limits is by using gravity filters filled with an anthracite media. The filters have been rehabilitated as part of the 2010 construction project. Other alternatives were evaluated in detail in the 2009 report titled *Wastewater Treatment Plant Equipment Replacement and Rehabilitation.* Since the 2009 report was issued, Chapter NR 110 of the Wisconsin Administrative Code has been updated to require filtration to be sized based on peak hourly flow rather than maximum day flow. However, since Whitewater's WPDES permit allows bypassing of peak flows around filtration if needed during wet weather, the existing effluent filtration system may still be adequate from a design flow standpoint. If additional tertiary treatment capacity is required in the future, for example to meet very stringent future phosphorus limits, a series or parallel process could be added at the WWTP. Possibilities include a new flocculation-sedimentation step downstream of the existing secondary clarifiers and upstream of the existing filters or a parallel filtration process housed in a building addition adjacent to the existing filters.

For budgeting purposes, a phosphorus effluent target of 0.1 to 0.2 mg/L is assumed, along with a flow of 6 mgd through a new parallel filtration process. This would allow treatment of most dry and wet weather flows by the new process, while maintaining the existing filters for additional peak flow treatment.

- *Alternative F1–Membrane Filtration*

Membrane filtration of secondary effluent may be applied to remove very small suspended solids. When "ultrafiltration" follows flocculant addition and coagulation, solids down to 3 nanometers (nm) can be removed from the effluent, making it very effective at removing

phosphorus bound within the flocs. (Note: membranes cannot remove dissolved phosphorus, which is smaller than 3 nm, so the flocculation step is needed.) The membrane filtration process includes a rectangular tank containing racks of multiple membrane modules resembling cylinders with thin tubular-shaped membranes from end to end, fixed at both ends. Plates are sometimes used in lieu of cylinders. Because there is significant head loss through the membranes, pumping on the downstream side to draw the effluent through the membranes is usually required. Membrane installations in wastewater plants are currently rare and operator experience with them is very limited; however, membrane installations have become more prevalent in recent years, especially in water treatment. As anticipated low phosphorus limits are implemented, it is expected to be increasingly prevalent.

- *Alternative F2–Blue PRO® Filtration*

Blue PRO®, a product of Blue Water Technologies, uses reactive filtration to reduce phosphorus to low levels. Reactive filtration features continuous regeneration of reactive filter media within a moving bed filter. A hydrous ferric oxide (HFO) coating is formed on the media surface, abraded away within the filter, and continuously regenerated. Waste particulates, including the iron and phosphorus, are continuously separated from the process flow. HFO's adsorption of phosphorus is what allows it to achieve such low TP levels. Single-pass systems may meet TP regulations as low as 0.1 mg/L, depending on the influent concentration. Lower limits are achieved with two-pass systems and reject recycle. Reject recycle refers to the return of process residuals to an earlier point in a wastewater plant. Blue PRO® reject particulates contain significant adsorptive capacity. With this recycle process, the manufacturer has indicated that full-scale installations have reached effluent levels below 0.010 mg/L. The filters can be installed as free-standing fiberglass units or within concrete tanks. This system can be retrofit for biological nitrogen removal.

7.04 EFFLUENT DISINFECTION SUMMARY

Disinfection alternatives were evaluated in detail in the 2009 report titled *Wastewater Treatment Plant Equipment Replacement and Rehabilitation*, and UV was selected and constructed as part of the 2010 project. This process will be adequate for the 2032 design peak hourly flow.

7.05 BIOSOLIDS THICKENING

Most of the biological treatment alternatives listed above require either cothickening of secondary sludge with primary sludge or thickening of WAS prior to pumping the WAS to the anaerobic digesters. The cost for separate thickening of WAS will be included in the BPR alternatives, because it is not known whether the BPR process will operate well if cothickening is used. No thickening would be required for the extended air BNR oxidation ditch alternative. The alternative thickening processes to be considered in this analysis are as follows:

T1: No Thickening
T2: Continued use of Cothickening
T3: Gravity Belt Thickener
T4: Centrifuge
T5: Rotary Drum Thickener
T6: Dissolved Air Flotation Thickener

For alternatives T3 through T6, it is assumed only one unit will be required because cothickening could be used as a backup process should the thickener be out of service. It is assumed the thickener would be housed in a new building along with RAS pumps and, if applicable, aeration blowers.

- *Alternative T3–Gravity Belt Thickener*

Gravity belt thickening employs gravity drainage through a filter belt to thicken polymer-conditioned solids. Dilute solids are introduced at the feed end of a horizontal filter belt. As the slurry makes its way down the moving belt, free water drains through the porous belt. The solids are continuously turned, which enhances the drainage of more water. GBTs can generally thicken sludge from 1 to 2 percent solids to 5 to 7 percent solids with the use of polymers. Odors can be generated by thickening biosolids using a GBT, although this is typically not a concern when thickening WAS.

- *Alternative T4–Centrifuge*

Centrifuge thickening is accomplished with a rotating assembly that uses centrifugal force to separate solids from liquids. The materials fed into the centrifuge each have different specific gravities that allow them to “settle” concentrically at different levels in the rotating assembly of the centrifuge. The material with the higher specific gravity (solids) will settle on the inside wall of the rotating assembly, while the lighter material (liquids) remain toward the core of the rotating assembly. The internal conveyor (scroll) that rotates at a slightly different speed moves the settled material up the ‘beach’ toward the discharge ports. Solids are thickened by the centrifugal force and released through these ports. Separated liquids from the process are released at the opposite end of the machine through adjustable weir plates.

Polymer use is generally less than required for other mechanical thickening technologies. Centrifuges are closed to their operating environment. This reduces potential odor concerns.

- *Alternative T5–Rotary Drum Thickener*

A rotary drum thickening system is composed of polymer injection, floc development tank, rotary drum system, and thickened solids hopper. The rotary drum system is composed of a multizone drum cylinder. The zones have different size mesh media to augment capture efficiency as the sludge moves along the length of the cylinder. Rings with adjustable ports control detention time in each zone. The unit is cleaned with a spray bar that runs the entire length of the cylinder. Over the last decade, this technology has been used more frequently, although most of the installations have been at relatively small treatment plants. The system is relatively simple, and the closed drum lends itself to the control of odors.

- *Alternative T6–Dissolved Air Flotation Thickener*

A dissolved air flotation thickener injects compressed air into the WAS in a tank. Thickened sludge floats to the top of the tank where it is removed, generally using a collector arm. A small amount of sludge settles to the bottom of the tank where it can periodically be removed. Polymer can be used to enhance the thickening. The systems can be run continuously or intermittently. They are relatively simple particularly when run continuously, when they can be fully automated.

7.06 BIOSOLIDS MANAGEMENT

Section 5 determined that the capacity of the existing biosolids management system was adequate and that equipment replacement and rehabilitation of structural components would be adequate. These issues were addressed as part of the 2010 project. For the upcoming 2011 construction project, the City intends to install a boiler to utilize the biogas that is currently flared.

7.07 PRESENT VALUE DETERMINATION FOR REMAINING ALTERNATIVES

This section presents the cost evaluation for the remaining alternatives from the screening process. Tables 7.07-1 through -4 summarize the alternatives, comparing them on a total present worth basis for a 20-year planning period. The detailed evaluation of present value costs appears in the Appendix B.

A. Biological Treatment

For the biological treatment alternatives, the cost analyses show that Alternative B3a (oxidation ditch with BPR plus CPR backup) is the lowest cost in terms of present value, Alternatives B2a (activated sludge with BNR and CPR backup) and B3b (oxidation ditch with CPR) are within 10 percent. For facilities planning, alternatives that have costs within 10 percent of each other are considered essentially equal, and nonmonetary factors may dictate final selection. Alternative B2b (activated sludge with CPR only) is slightly beyond the 10 percent threshold. Alternatives B1a (RBC with anoxic zones) and B4 (extended air oxidation ditch) are over twice the cost of Alternative B3a. However, the selection of a biological alternative will also depend on the thickening alternative required and the nonmonetary evaluation.

Summary of Present Value Costs	B1a RBCs with CPR	B2a Diffused Air Activated Sludge with BPR plus CPR Backup	B2b Diffused Air Activated Sludge with CPR	B3a Oxidation Ditch with BPR plus CPR Backup	B3b Oxidation Ditch with CPR	B4 BPR Extended Air Oxidation Ditch
Capital	$15,050,000	$5,771,000	$5,308,000	$5,322,000	$4,859,000	$12,606,000
O&M	$3,683,000	$2,567,000	$3,817,000	$2,540,000	$3,790,000	$2,890,000
Replacement	$19,000	$141,000	$141,000	$251,000	$290,000	$345,000
- Salvage	$817,000	$151,000	$145,000	$214,000	$233,000	$379,000
Present Value	**$17,935,000**	**$8,328,000**	**$9,121,000**	**$7,899,000**	**$8,706,000**	**$15,462,000**
Percent Above Lowest Cost Alternative	**127%**	**5%**	**15%**	**0%**	**10%**	**96%**

Table 7.07-1 Biological Treatment Cost Comparison

B. Effluent Filtration

Review of the filtration alternative costs in Table 7.07-2 shows that Blue PRO® is significantly less costly than membrane filtration, which is 55 percent more costly. Therefore, it is recommended that the Blue PRO® costs be assumed at this time for budgeting purposes. Prior to final selection of an effluent filtration process, the final WPDES phosphorus limit should be obtained from the WDNR and the existing deep bed filtration system "stress tested" to determine its performance capabilities using multipoint chemical feed and higher chemical dosages. If a new parallel process such as Blue PRO® is needed, pilot testing of the proposed process may be warranted.

Summary of Present Value Costs	F1 Membrane Filtration	F2 Blue PRO® Filtration
Capital	$8,964,000	$5,549,000
O&M	$4,072,000	$2,611,000
Replacement	$98,000	$548,000
- Salvage	$114,000	$328,000
Present Value	**$13,020,000**	**$8,380,000**
Percent Above Lowest Cost Alternative	**55%**	**0%**

Table 7.07-2 Effluent Filtration Cost Comparison

C. WAS Thickening

Table 7.07-3 shows that Alternatives T3 (gravity belt thickeners) and T5 (rotary drum thickeners) are nearly equivalent in cost, while Alternatives T4 (centrifuges) and T6 (dissolved air flotation) are significantly higher in cost. Based on this, Alternatives T4 and T6 will not be considered further. Note that Alternatives T1 (no thickening) and T2 (continued use of cothickening) listed above have no capital cost associated with them; however, Alternative T1 (no thickening) could have a higher O&M cost than T2 because of the negative impact on anaerobic digestion and sludge storage supernating operations. Alternative T1 will not be considered further.

Summary of Present Value Costs	T3 Gravity Belt Thickener	T4 Centrifuge	T5 Rotary Drum Thickener	T6 Dissolved Air Flotation
Capital	$544,000	$1,192,000	$539,000	$1,184,000
O&M	$551,000	$685,000	$538,000	$282,000
Replacement	$9,000	$9,000	$9,000	$0
- Salvage	$15,000	$27,000	$15,000	$21,000
Present Value	**$1,089,000**	**$1,859,000**	**$1,071,000**	**$1,445,000**
Percent Above Lowest Cost Alternative	**2%**	**74%**	**0%**	**35%**

Table 7.07-3 WAS Thickening Cost Comparison

D. Biological Treatment and WAS Thickening Combination

If the City chooses, the current practice of cothickening may be continued for the biological alternatives that do not include BPR. Alternatively, the City may elect to discontinue cothickening. However, Since the current practice of cothickening may be impractical with the BPR process alternative, costs for WAS thickening alternatives would have to be included to determine the lowest cost. Table 7.07-4 shows that the costs for the required combinations for all of the activated sludge (not including extended aeration) alternatives are within the 10 percent threshold. Therefore, these four will be considered in the nonmonetary analysis.

Summary of Present Value Costs	B1a + T2	B2a + T3 or T5	B2b + T2	B3a + T3 or T5	B3b + T2	B4 + T3 or T5
Biological Treatment	$17,935,000	$8,328,000	$9,121,000	$7,899,000	$8,706,000	$15,462,000
WAS Thickening	$0	$1,071,000	$0	$1,071,000	$0	$1,071,000
TOTAL	**$17,935,000**	**$9,399,000**	**$9,121,000**	**$8,970,000**	**$8,706,000**	**$16,533,000**
Percent Above Lowest Cost Alternative	106%	8%	5%	3%	0%	90%

Table 7.07-4 Combination Cost Comparison

7.08 NONMONETARY EVALUATION OF ALTERNATIVES

For those alternatives considered equivalent in cost (i.e., within 10 percent on a total present worth basis), the decision will be made based on other nonmonetary factors. Tables 7.08-1 through 7.08-4 show this evaluation. Eight criteria were applied to evaluate nonmonetary costs, with a point range of -3 to +3.

1. Operator familiarity
2. Ease of Maintenance
3. Operational Reliability
4. WDNR Support/Wisconsin Experience
5. Positive Environmental Impact
6. Impact of Future Options
7. Aesthetic Impact
8. Construction Impacts (Temporary)

A. Biological and WAS Thickening

Tables 7.08-1 and 7.08-2 show the nonmonetary evaluation for Biological Treatment and WAS Thickening. Alternative B3b scored the highest among the lowest cost alternatives, and Alternatives B2a, B2b, and B3b scored 1 to 2 points lower. Alternative T2 scored considerably higher than any of the other WAS thickening alternatives.

Table 7.08-3 shows both the present value and the nonmonetary costs for the combination of biological treatment and WAS thickening. The alternatives that appear to have the best value in this respect are B3b and B2a, plus T2–in other words, CPR-based activated sludge (either via diffused air or an oxidation ditch with no change in thickening). For the purposes of this report, alternative B3b with T2 will be assumed, an oxidation ditch with CPR and continued cothickening.

To reduce capital costs of the BPR options, Whitewater could also consider jar or pilot testing of cothickening and BPR or discontinuation of thickening altogether. However, discontinuing thickening will reduce anaerobic digestion capacity and the ability to accept liquid industrial wastes and will increase the amount of supernating required in the sludge storage tank.

Nonmonetary Cost Component	B1a RBCs With CPR	B2a Diffused Air Activated Sludge with BPR plus CPR Backup	B2b Diffused Air Activated Sludge with CPR	B3a Oxidation Ditch with BPR plus CPR Backup	B3b Oxidation Ditch with CPR	B4 BPR Extended Air Oxidation Ditch
Operator Familiarity	+2	-1	+0	-1	+0	-1
Ease of Maintenance	-1	+1	+1	+2	+2	+3
Operational Reliability	-1	+1	+2	+1	+2	+2
WDNR Support/ Wisconsin Installations	+1	+2	+2	+2	+2	+2
Positive Environmental Impact	+1	+2	+1	+2	+1	+2
Impact on Future Options	+0	+2	+2	+2	+2	+1
Aesthetic Impact	-1	+0	+0	+0	+0	+0
Construction Impacts (Temporary)	-1	-2	-2	-2	-2	-3
TOTALS	**0**	**5**	**6**	**6**	**7**	**6**

Table 7.08-1 Biological Treatment Nonmonetary Comparison

Nonmonetary Cost Component	T2 Continue with Cothickening	T3 Gravity Belt Thickener	T4 Centrifuge	T5 Rotary Drum Thickener	T6 Dissolved Air Flotation
Operator Familiarity	+3	+0	+0	+0	+0
Ease of Maintenance	+2	-1	-1	-1	+0
Operational Reliability	+2	+0	+0	+0	+0
WDNR Support/Wisconsin Installations	+1	+1	+1	+1	+1
Positive Environmental Impact	+1	+0	+0	+0	+0
Impact on Future Options	+2	+1	+0	+0	+0
Aesthetic Impact	+2	-1	+0	-1	-2
Construction Impacts (Temporary)	+2	-1	-1	-1	-1
TOTALS	**15**	**-1**	**-1**	**-2**	**-2**

Table 7.08-2 WAS Thickening Nonmonetary Comparison

Nonmonetary Cost Component	B1a + T1 or T2	B2a + T3 or T5	B2b + T1 or T2	B3a + T3 or T5	B3b + T1 or T2	B4 + T3 or T5
Biological Treatment	0	5	6	6	7	6
WAS Thickening	15	-1	15	-2	15	0
TOTAL	**15**	**4**	**21**	**4**	**22**	**6**
PRESENT VALUE	**$17,935,000**	**$9,399,000**	**$9,121,000**	**$8,970,000**	**$8,706,000**	**$16,533,000**

Table 7.08-3 Combination Nonmonetary Comparison

B. Filtration

Table 7.08-4 shows the nonmonetary evaluation for the filtration alternative, suggesting that, as with the costs, Blue PRO® filtration would be the preferable alternative.

Nonmonetary Cost Component	F1 Membrane Filtration	F2 Blue PRO® Filtration
Operator Familiarity	-2	-1
Ease of Maintenance	-2	+0
Operational Reliability	+0	+0
WDNR Support/Wisconsin Installations	+0	+0
Positive Environmental Impact	+2	+2
Impact on Future Options	-1	+1
Aesthetic Impact	+0	+0
Construction Impacts (Temporary)	-1	-1
TOTALS	**-4**	**1**

Table 7.08-4 Filtration Nonmonetary Comparison

C. Summary

Section 8 will outline the recommended alternatives and discuss further recommended operational or capital improvements for which a comparison evaluation has not been necessary.

DRAFT

SECTION 8
RECOMMENDED ALTERNATIVES

8.01 BIOLOGICAL TREATMENT

A. Selected Alternative

As determined in Section 7, the recommended alternatives include an activated sludge oxidation ditch with biological nitrogen removal, continuing with cothickening and chemical phosphorus removal, and, depending on final phosphorus effluent limits and pilot testing, a Blue PRO® Filtration process in parallel with the existing filters. The costs associated with the recommended alternatives are shown in Table 8.01-1. This alternative represents the lowest cost of all the alternatives evaluated and has the highest nonmonetary score, compared with the competing alternatives.

Process	Alt Number	Description	Capital Cost	O&M Cost
Activated Sludge	B3b	Oxidation Ditch with CPR	$4,859,000	$226,000
WAS Thickening	T2	Continue with Cothickening	$0	unchanged
Filtration	F2	Blue PRO® Filtration	$5,549,000	$156,000
TOTAL			**$10,408,000**	**$382,000**

Table 8.01-1 Recommended Alternative

As noted in Section 7, several of the alternatives were within 10 percent of the low cost alternative on a present worth basis. Therefore, the City would have the option of selecting aeration tanks with blowers and diffused aeration instead of the oxidation ditch with mechanical aeration. The City could also consider adding BPR with or without separate WAS thickening. The final decisions could be made in a few years as discussed in Section 8.04.

B. Design Criteria

Table 8.01-2 provides the proposed preliminary design criteria for the recommended improvements in the same form that Table 3.02-2 was presented.

TABLE 8.01-2

WHITEWATER WWTP PRELIMINARY DESIGN CRITERIA FOR PROPOSED IMPROVEMENTS

C. Secondary Treatment

Oxidation Ditches	
Number of Basins	2
Volume, Total (Oxic and Anoxic)	1.4 mil gal
Aerators per Basin	2
Type	Vertical Turbine
BHP, each	30 hp
RAS Pumping	
Number	3
Type	Centrifugal, variable speed
Capacity, firm	1,680 gpm
Capacity, each	840 gpm
Operating range[1], each	130 to 840 gpm

D. Advanced Secondary

Dry Weather Filtration	
Type	Continuous backwash upflow filter
Capacity	6 mgd

E. Sludge Handling

WAS Pumping (Existing Secondary Sludge Pumps)	
Number	2
Type	Rotary Lobe, Variable Speed
Capacity, each	50 gpm

[1] Based on a required capacity range of 25 to 100 percent average daily flow.

8.02 CAPITAL IMPROVEMENTS PLAN

In addition to the projects identified from the alternatives evaluation, several potential capital and operational improvements to the WWTP are recommended, as shown in Table 8.02-1.

Item	Opinion of Capital Cost	Approximate Year of Implementation	Comments
Influent wet well basket screen	$105,000	2016	Add during biological treatment project.
Replace existing mechanical screen with one or two new fine screens	$600,000 to $1,050,000	2016	Add during biological treatment project.
Bypass flow metering	$80,000	2016	Add during biological treatment project if required.
Remodel Main Building	$500,000 to $1,000,000	2016	Consider doing during biological treatment project
Replace doors throughout plant	$2,000 to $2,500 each	2011–2012	Replace as needed.
Rebuild site roadways	$300,000 to $400,000	2011–2012	Could include new drives at UV and Digestion.

Note: Costs shown are in fourth quarter 2010 dollars. See wastewater utility replacement fund schedule for equipment replacements.

Table 8.02-1 Capital Improvements

8.03 USER CHARGE IMPACTS

The total project capital cost is approximately $10.4 million, depending on the final selected alternative, between diffused air and oxidation ditch activated sludge. This project cost assumes inclusion of the Blue PRO® phosphorus removal system; costs could be significantly lower if effluent phosphorus limits are higher than the 0.1 to 0.2 mg/L range assumed in this report or if water quality trading is used for a portion of the required phosphorus. The major portion of the capital costs is anticipated to be funded through the Clean Water Fund (CWF) loan program.

User charges are anticipated to increase with the project. As of the preliminary user charge system (UCS) performed in November 2010, the currently proposed UCS would result in a typical residential user charge of $28.57 per month. Implementation of this project in 2012 would increase this rate by approximately $16.5 per month, for an increase of about 58 percent.[2] The total rate would be approximately $45 per month; this represents about 1.3 percent of the estimated 2010 median household income (MHI) of $41,600. This value is considered by USEPA to represent a medium impact for residential users.

[2] This rate was based on the following assumptions: 1. An interest rate of 2.5 percent over a 19-year period, 2. Debt coverage ratio of 110 percent, 3. Number of residential customers of 3,300, 4. Residential share of wastewater revenue of 50 percent, based on current preliminary UCS.

However, if the project is implemented in 2017 when a significant amount of debt would retire (which has a $365,000 per year payment), the resulting increase would be $11.25, suggesting a sewer user charge of $39.80 (in year 2010 dollars). This represents a typical residential user increase of 40 percent and 1.15 percent of the MHI.

8.04 OTHER IMPLEMENTATION CONSIDERATIONS

The City of Whitewater has expressed interest in implementing this project by 2017 to coincide with retirement of debt and elimination of a $365,000 annual payment. Determination of a final schedule for the biological treatment and additional phosphorus removal project will depend on several factors, potentially including the following:

1. Ability to maintain the existing RBCs and RBC buildings for reliable treatment.
2. Implementation schedule for the Rock River Basin TMDL.
3. Implementation schedule for any revised phosphorus or other limits in the WPDES permit (scheduled to be reissued around January 1, 2014).
4. Availability of funding.

The following key actions by the City are recommended for biological treatment and nutrient removal project implementation. Additional recommendations are included in Section 5 with respect to other regulatory initiatives.

1. Continue to maintain and/or replace aging equipment using the wastewater utility replacement fund.

2. Continue to submit intent to apply (ITA) and priority evaluation and ranking forms (PERF) to the WDNR Clean Water Fund by December 31 of each calendar year to maintain the proposed project(s) on the funding list. Monitor potential sources of grant funding.

3. Consider annual UCS rate increases to assure availability of funds for the proposed project(s).

4. Continue to track the Rock River Basin TMDL development to determine whether TMDL-based phosphorus and TSS effluent limits will be applied to the WWTP and what magnitude and form (e.g., seasonal average and maximum day versus monthly average and maximum day) the limits will take.

5. In mid-2012 (approximately one-and-a-half years prior to WPDES permit expiration), perform a feasibility study to explore compliance options and schedules for potential new phosphorus, nitrogen, and TSS limits, whether they are WQBELs or TMDL-based limits. This could include, for example, jar testing to evaluate the feasibility of cothickening combined with BPR; determining the maximum capabilities of the existing effluent filters for phosphorus removal; and exploring water quality trading as an alternative to new nutrient removal facilities at the WWTP.

6. Complete the WPDES permit renewal application in mid-2013 according to the feasibility study recommendations. For example, a long compliance schedule, TMDL-based effluent limits and/or water quality trading may need to be requested with the permit application.

7. In mid-to-late 2013 (approximately two years prior to commencing biological treatment project construction), update the costs in this report, make final alternatives selections, and complete an Environmental Information Document (EID) as report Section 9. Submit the report with EID to the WDNR for preliminary approval and hold a public hearing. The report with the EID and public hearing record will constitute a complete facilities plan that can then be submitted to the WDNR for final approval.

8. Following WDNR approval of the facilities plan, begin design of biological treatment improvements and apply for funding as appropriate. Depending on City preferences and permit compliance schedules, design of additional nutrient removal facilities may also begin at this time.

9. Complete construction of new biological treatment facilities so that principal and interest payments will not need to be made until 2017 when other City debt is retired. If the Clean Water Fund is used, this suggests construction may begin around mid-2015 with completion in late 2016 or early 2017.

APPENDIX A
INFILTRATION/INFLOW ANALYSIS

TABLE A-1

INFILTRATION ANALYSIS

Year	Estimated Population	Industrial Flow [1] (mgd)	Commercial Flow [2] (mgd)	Metered Annual Average Flow (mgd)	Adjusted Annual Average Flow[3] (mgd)	Estimated Annual Average Per Capita Flow (gpd)
2004	13,855	0.04	0.28	1.59	1.27	92
2005	13,937	0.05	0.27	1.35	1.02	73
2006	14,044	0.04	0.26	1.67	1.38	98
2007	14,139	0.03	0.25	1.85	1.56	111
2008	14,234	0.06	0.22	1.88	1.60	113
2009	14,329	0.04	0.19	1.76	1.52	106
Annual Averages						
2004-2007		0.04	0.27	1.61	1.31	93
2007-2009		0.04	0.22	1.83	1.56	110
2004-2009		0.04	0.25	1.68	1.39	99

Notes:
(1) Industrial Flow based upon City of Whitewater water sales data.
(2) Commercial Flow based upon City of Whitewater water sales data.
(3) Metered Annual Average Flow minus Industrial and Commercial Flows.

TABLE A-2

INFLOW ANALYSIS

Year	Estimated Population	Industrial Flow [1] (mgd)	Commercial Flow [2] (mgd)	Metered Maximum Weekly Flow[3] (mgd)	Adjusted Maximum Weekly Flow[4] (mgd)	Estimated Maximum Week Per Capita Flow (gpd)
2004	13,855	0.04	0.28	4.47	4.15	300
2005	13,937	0.05	0.27	1.84	1.51	109
2006	14,044	0.04	0.26	2.7	2.41	171
2007	14,139	0.03	0.25	4.84	4.56	322
2008	14,234	0.06	0.22	5.64	5.36	377
2009	14,329	0.04	0.19	3.4	3.16	221
Annual Averages						
2004-2007		0.04	0.27	3.46	3.16	226
2007-2009		0.04	0.22	4.63	4.36	307
2004-2009		0.04	0.25	3.82	3.53	250

Notes:
(1) Industrial Flow based upon City of Whitewater water sales data.
(2) Commercial Flow based upon City of Whitewater water sales data.
(3) Maximum weekly flow measured at the WWTP during the entire calendar year. Includes residential, public, and maximum I/I.
(4) Metered Maximum Weekly Flow minus Industrial and Commercial Flows.

APPENDIX B
ALTERNATIVES COSTS

Whitewater Facilities Planning
Alternative B1a
RBCs with CPR

ITEM	Percentage	2010 Capital Cost	Replacement Cost	Replacement Interval (Yr)	Replacement P.W.	Service Life	20-yr Salvage Value	Salvage Value (P.W.)
RBC Equipment - Building No. 1 - Year 0		$2,402,000	$0	20	$0	20	$0	$0
RBC Equipment - Building No. 2 - Year 5		$2,276,000	$0	20	$0	20	$485,000	$216,000
RBC Equipment - Building No. 3 - Year 10		$2,155,000	$0	20	$0	20	$918,000	$409,000
Anoxic Tank		$211,000						
Anoxic Tank Mixers		$60,000						
Submersible Recycle Pump Station		$65,000						
CPR Pumps		$0	$28,000	10	$19,000	10	$0	$0
Stamford Baffles and Coatings on Final Clarifiers		$0						
Subtotal-Equipment and Structures		$7,169,000						
Piping/Mechanical	18%	$1,290,000				30	$430,000	$192,000
Electrical	15%	$1,075,000				20	$0	$0
HVAC	5%	$358,000				20	$0	$0
Sitework (Driveway), Roofing, and Doors	6%	$430,000				20	$0	$0
Subtotal		$10,322,000						
Contractor's General Conditions	8%	$826,000						
Total Construction Costs		$11,148,000						
Contingencies, Legal & Engineering Services	35%	$3,902,000						
Total Capital Costs		**$15,050,000**	$28,000		$19,000		$1,833,000	$817,000
Present Worth		**$15,050,000**			**$19,000**			**$817,000**

Estimated Annual O&M Costs	
Labor	$46,400
Power	$70,000
Chemicals:	
Alum Dose (mg/L Alum)	40
Alum Cost	$123,000
Maintenance and Supplies	$35,000
Biosolids Disposal Cost ($/year)	$58,800
Total	$274,000
Present Worth of O&M	$3,683,000

Summary of Present Worth Costs	
Capital Cost	$15,050,000
Replacement	$19,000
O&M Cost	$3,683,000
Salvage Value	($817,000)
TOTAL PRESENT WORTH	**$17,935,000**

Notes:
All costs are fourth quarter 2010 dollars.
Present worth is calculated on a 20-year basis at discount rate shown.

Unit cost assumptions:			
Labor	$37	per hour	
Power	$0.08	per kwh	
Alum	$403	per ton	From Hydrite and Oconomowoc (Bulk)
Maintenance and Supplies - equipment	2%	percent of equipment capital cost	
Maintenance and Supplies - shafts	0.5%	percent of RBC shaft costs	
Biosolids Disposal Cost	$0.03	per gal	
Process Constants for Calcs.			
DAF	2.4	mgd	
PHF	11	mgd	

Whitewater Facilities Planning

Alternative B2a

Diffused Air Activated Sludge with BPR plus CPR Backup

ITEM	Percentage	2010 Capital Cost	Replacement Cost	Replacement Interval (Yr)	Replacement P.W.	Service Life	20-yr Salvage Value	Salvage Value (P.W.)
Aeration Tanks with Anoxic Zones		$1,439,000	$0	20	$0	20	$0	$0
Aeration Equipment with Anoxic Zone Mixers		$261,000	$222,000	15	$121,000	15	$174,000	$78,000
BPR Tanks		$166,000						
BPR Mixers		$51,000	$0	20	$0	20	$0	$0
Blowers		$376,000	$0	20	$0	20	$0	$0
RAS/WAS Pumping		$85,000						
Blower and RAS Building		$250,000						
CPR Pumps		$0	$30,000	10	$20,000	10	$0	$0
Demolish RBCs		$83,000						
Stamford Baffles and Coatings on Final Clarifiers		$0						
Subtotal-Equipment and Structures		$2,711,000						
Piping/Mechanical	18%	$488,000				30	$163,000	$73,000
Electrical	15%	$407,000				20	$0	$0
HVAC	3%	$81,000				20	$0	$0
Sitework	10%	$271,000				20	$0	$0
Subtotal		$3,958,000						
Contractor's General Conditions	8%	$317,000						
Total Construction Costs		$4,275,000						
Contingencies, Legal & Engineering Services	35%	$1,496,000						
Total Capital Costs		**$5,771,000**	$252,000		$141,000		$337,000	$151,000
Present Worth		**$5,771,000**			**$141,000**			**$151,000**

Estimated Annual O&M Costs	
Labor	$46,400
Power	$40,300
Chemicals:	
Alum Dose (mg/L Alum)	12.0
Alum Cost	$36,800
Maintenance and Supplies	$15,000
Biosolids Disposal Cost ($/year)	$52,200
Total	$191,000
Present Worth of O&M	$2,567,000

Summary of Present Worth Costs	
Capital Cost	$5,771,000
Replacement	$141,000
O&M Cost	$2,567,000
Salvage Value	($151,000)
TOTAL PRESENT WORTH	**$8,328,000**

Notes:

All costs are fourth quarter 2010 dollars.

Present worth is calculated on a 20-year basis at discount rate shown.

Unit cost assumptions:

Labor	$37	per hour	
Power	$0.08	per kwh	
Alum	$403	per ton	From Hydrite and Oconomowoc (Bulk)
Maintenance and Supplies	2%	percent of equipment capital cost	
Biosolids Disposal Cost	$0.03	per gal	

Process Constants for Calcs.

DAF	2.4	mgd
PHF	11	mgd

Whitewater Facilities Planning
Alternative B2b
Diffused Air Activated Sludge with CPR

ITEM	Percentage	2010 Capital Cost	Replacement Cost	Replacement Interval (Yr)	Replacement P.W.	Service Life	20-yr Salvage Value	Salvage Value (P.W.)
Aeration Tanks with Anoxic Zones		$1,439,000	$0	20	$0	20	$0	$0
Aeration Equipment with Anoxic Zone Mixers		$261,000	$222,000	15	$121,000	15	$174,000	$78,000
Blowers		$376,000						
RAS/WAS Pumping		$85,000						
Blower and RAS Building		$250,000						
CPR Pumps		$0	$30,000	10	$20,000	10	$0	$0
Demolish RBCs		$83,000						
Stamford Baffles and Coatings on Final Clarifiers		$0						
Subtotal-Equipment and Structures		$2,494,000						
Piping/Mechanical	18%	$449,000				30	$150,000	$67,000
Electrical	15%	$374,000				20	$0	$0
HVAC	3%	$75,000				20	$0	$0
Sitework	10%	$249,000				20	$0	$0
Subtotal		$3,641,000						
Contractor's General Conditions	8%	$291,000						
Total Construction Costs		$3,932,000						
Contingencies, Legal & Engineering Services	35%	$1,376,000						
Total Capital Costs		**$5,308,000**	$252,000		$141,000		$324,000	$145,000
Present Worth		**$5,308,000**			**$141,000**			**$145,000**

Estimated Annual O&M Costs	
Labor	$46,400
Power	$41,400
Chemicals:	
Alum Dose (mg/L Alum)	40
Alum Cost	$123,000
Maintenance and Supplies	$14,000
Biosolids Disposal Cost ($/year)	$58,800
Total	$284,000
Present Worth of O&M	$3,817,000

Summary of Present Worth Costs	
Capital Cost	$5,308,000
Replacement	$141,000
O&M Cost	$3,817,000
Salvage Value	($145,000)
TOTAL PRESENT WORTH	**$9,121,000**

Notes:
All costs are fourth quarter 2010 dollars.
Present worth is calculated on a 20-year basis at discount rate shown.

Unit cost assumptions:			
Labor	$37	per hour	
Power	$0.08	per kwh	
Alum	$403	per ton	From Hydrite and Oconomowoc (Bulk)
Maintenance and Supplies	2%	percent of equipment capital cost	
Biosolids Disposal Cost	$0.03	per gal	
Process Constants for Calcs.			
DAF	2.4	mgd	
PHF	11	mgd	

Whitewater Facilities Planning
Alternative B3a
Oxidation Ditch with BPR plus CPR Backup

ITEM	Percentage	2010 Capital Cost	Replacement Cost	Replacement Interval (Yr)	Replacement P.W.	Service Life	20-yr Salvage Value	Salvage Value (P.W.)
Aeration Tanks with Anoxic Zones		$1,439,000	$0	20	$0	20	$0	$0
Aeration Equipment with Anoxic Zone Mixers		$496,000	$423,000	15	$231,000	15	$331,000	$147,000
BPR Tanks		$166,000						
BPR Mixers		$51,000	$0	20	$0	20	$0	$0
Blowers		$0						
RAS/WAS Pumping		$85,000						
CPR Pumps		$0	$30,000	10	$20,000	10	$0	$0
Demolish RBCs		$83,000						
Stamford Baffles on Final Clarifiers		$0						
RAS/WAS Pump Building		$180,000						
Subtotal-Equipment and Structures		$2,500,000						
Piping/Mechanical	18%	$450,000				30	$150,000	$67,000
Electrical	15%	$375,000				20	$0	$0
HVAC	3%	$75,000				20	$0	$0
Sitework	10%	$250,000				20	$0	$0
Subtotal		$3,650,000						
Contractor's General Conditions	8%	$292,000						
Total Construction Costs		$3,942,000						
Contingencies, Legal & Engineering Services	35%	$1,380,000						
Total Capital Costs		**$5,322,000**	$453,000		$251,000		$481,000	$214,000
Present Worth		**$5,322,000**			**$251,000**			**$214,000**

Estimated Annual O&M Costs	
Labor	$46,400
Power	$40,300
Chemicals:	
Alum Dose (mg/L Alum)	12.0
Alum Cost	$36,800
Maintenance and Supplies	$13,000
Biosolids Disposal Cost ($/year)	$52,200
Total	$189,000
Present Worth of O&M	$2,540,000

Summary of Present Worth Costs	
Capital Cost	$5,322,000
Replacement	$251,000
O&M Cost	$2,540,000
Salvage Value	($214,000)
TOTAL PRESENT WORTH	**$7,899,000**

Notes:
All costs are fourth quarter 2010 dollars.
Present worth is calculated on a 20-year basis at discount rate shown.

Unit cost assumptions:			
Labor	$37	per hour	
Power	$0.08	per kwh	
Alum	$403	per ton	From Hydrite and Oconomowoc (Bulk)
Maintenance and Supplies	2%	percent of equipment capital cost	
Biosolids Disposal Cost	$0.03	per gal	
Process Constants for Calcs.			
DAF	2.4	mgd	
PHF	11	mgd	

Whitewater Facilities Planning
Alternative B3b
Oxidation Ditch with CPR

ITEM	Percentage	2010 Capital Cost	Replacement Cost	Replacement Interval (Yr)	Replacement P.W.	Service Life	20-yr Salvage Value	Salvage Value (P.W.)
Aeration Tanks with Anoxic Zones		$1,439,000	$0	20	$0	20	$0	$0
Aeration Equipment with Anoxic Zone Mixers		$496,000	$423,000	15	$231,000	15	$331,000	$147,000
BPR Tanks		$0						
BPR Mixers		$0	$0	15	$0	15	$0	$0
Blowers		$0	$0	15	$0	15	$0	$0
RAS/WAS Pumping		$85,000	$72,000	15	$39,000	15	$57,000	$25,000
CPR Pumps		$0	$30,000	10	$20,000	10	$0	$0
Demolish RBCs		$83,000						
Stamford Baffles and Coatings on Final Clarifiers		$0						
RAS/WAS Pump Building		$180,000						
Subtotal-Equipment and Structures		$2,283,000						
Piping/Mechanical	18%	$411,000				30	$137,000	$61,000
Electrical	15%	$342,000				20	$0	$0
HVAC	3%	$68,000				20	$0	$0
Sitework	10%	$228,000				20	$0	$0
Subtotal		$3,332,000						
Contractor's General Conditions	8%	$267,000						
Total Construction Costs		$3,599,000						
Contingencies, Legal & Engineering Services	35%	$1,260,000						
Total Capital Costs		**$4,859,000**	$525,000		$290,000		$525,000	$233,000
Present Worth		**$4,859,000**			**$290,000**			**$233,000**

Estimated Annual O&M Costs	
Labor	$46,400
Power	$41,400
Chemicals:	
Alum Dose (mg/L Alum)	40
Alum Cost	$123,000
Maintenance and Supplies	$12,000
Biosolids Disposal Cost ($/year)	$58,800
Total	$282,000
Present Worth of O&M	$3,790,000

Summary of Present Worth Costs	
Capital Cost	$4,859,000
Replacement	$290,000
O&M Cost	$3,790,000
Salvage Value	($233,000)
TOTAL PRESENT WORTH	**$8,706,000**

Notes:
All costs are fourth quarter 2010 dollars.
Present worth is calculated on a 20-year basis at discount rate shown.

Unit cost assumptions:			
Labor	$37	per hour	
Power	$0.08	per kwh	
Alum	$403	per ton	From Hydrite and Oconomowoc (Bulk)
Maintenance and Supplies	2%	percent of equipment capital cost	
Biosolids Disposal Cost	$0.03	per gal	
Process Constants for Calcs.			
DAF	2.4	mgd	
PHF	11	mgd	

Whitewater Facilities Planning
Alternative B4
BPR Extended Air Oxidation Ditch

ITEM	Percentage	2010 Capital Cost	Replacement Cost	Replacement Interval (Yr)	Replacement P.W.	Service Life	20-yr Salvage Value	Salvage Value (P.W.)
Aeration Tanks, BNR Tanks and Splitter Structure		$3,596,000	$0	20	$0	20	$0	$0
Aeration Equipment and BNR Mixers		$742,000	$632,000	15	$345,000	15	$495,000	$221,000
Demolish Primary Clarifiers		$60,000						
Blowers for Activated Sludge Treatment			$0	15	$0	15	$0	$0
RAS/WAS Pumping		$85,000	$0	20	$0	20	$0	$0
RAS/WAS Pump Building		$256,000						
Demolish RBCs		$83,000						
Stamford Baffles on Final Clarifiers		$0						
Final Clarifier No. 3		$1,100,000						
Subtotal-Equipment and Structures		$5,922,000						
Piping/Mechanical	18%	$1,066,000				30	$355,000	$158,000
Electrical	15%	$888,000				20	$0	$0
HVAC	3%	$178,000				20	$0	$0
Sitework	10%	$592,000				20	$0	$0
Subtotal		$8,646,000						
Contractor's General Conditions	8%	$692,000						
Total Construction Costs		$9,338,000						
Contingencies, Legal & Engineering Services	35%	$3,268,000						
Total Capital Costs		**$12,606,000**	$632,000		$345,000		$850,000	$379,000
Present Worth		**$12,606,000**			**$345,000**			**$379,000**

Estimated Annual O&M Costs	
Labor	$46,400
Power	$57,300
Chemicals:	
Alum Dose (mg/L Alum)	12.0
Alum Cost	$36,800
Maintenance and Supplies	$22,000
Biosolids Disposal Cost ($/year)	$52,200
Total	$215,000
Present Worth of O&M	$2,890,000

Summary of Present Worth Costs	
Capital Cost	$12,606,000
Replacement	$345,000
O&M Cost	$2,890,000
Salvage Value	($379,000)
TOTAL PRESENT WORTH	**$15,462,000**

Notes:
All costs are fourth quarter 2010 dollars.
Present worth is calculated on a 20-year basis at discount rate shown.

Unit cost assumptions:		
Labor	$37 per hour	
Power	$0.08 per kwh	
Alum	$403 per ton	From Hydrite and Oconomowoc (Bulk)
Maintenance and Supplies	2% percent of equipment capital cost	
Biosolids Disposal Cost	$0.03 per gal	
Process Constants for Calcs.		
DAF	2.4 mgd	
PHF	11 mgd	

Whitewater Facilities Planning
Alternative T3
Gravity Belt Thickener

ITEM	Percentage	2010 Capital Cost	Replacement Cost	Replacement Interval (Yr)	Replacement P.W.	Service Life	20-yr Salvage Value	Salvage Value (P.W.)
Gravity Belt Thickener		$166,000	$0	20	$0	20	$0	$0
Polymer Feed System		$20,000	$17,000	15	$9,000	15	$13,000	$6,000
WAS Pumps		$40,000	$0	20	$0	20	$0	$0
Thickened WAS Pumps		$31,000	$0	20	$0	20	$0	$0
Subtotal-Equipment and Structures		$257,000						
Piping/Mechanical	25%	$64,000				30	$21,000	$9,000
Electrical	15%	$39,000				20	$0	$0
HVAC	3%	$8,000				20	$0	$0
Sitework	2%	$5,000				20	$0	$0
Subtotal		$373,000						
Contractor's General Conditions	8%	$30,000						
Total Construction Costs		$403,000						
Contingencies, Legal & Engineering Services	35%	$141,000						
Total Capital Costs		**$544,000**	$17,000		$9,000		$34,000	$15,000
Present Worth		**$544,000**			**$9,000**			**$15,000**

Estimated Annual O&M Costs	
Labor	$23,100
Power	$2,100
Chemicals:	
Polymer (12 lb/ton @ $1.75/lb)	$10,300
Maintenance and Supplies	$5,100
Total	$41,000
Present Worth of O&M	$551,000

Summary of Present Worth Costs	
Capital Cost	$544,000
Replacement	$9,000
O&M Cost	$551,000
Salvage Value	($15,000)
TOTAL PRESENT WORTH	**$1,089,000**

Notes:
All costs are fourth quarter 2010 dollars.
Present worth is calculated on a 20-year basis at discount rate shown.

Unit cost assumptions:

Labor	$37	per hour	
Power	$0.08	per kwh	
Polymer	$3,713	per ton	From Kruger
Chlorine Gas (Cl2)	$160	per 150 lb cylinder	From Tim Reel
Sulfur Dioxide (SO2)	$160	per 150 lb cylinder	Assumed
Additional Sludge percent solids	2%		
Additional Sludge cost for land application	$0.05	per gallon	
Sludge Storage Cost	$1.60	per gallon	
Maintenance and Supplies	2%	percent of equipment capital cost	

Process Constants for Calcs.

DAF	2.4	mgd
PHF	11	mgd

[1] Based on dosage of 2 mg/L

Whitewater Facilities Planning
Alternative T4
Centrifuge

ITEM	Percentage	2010 Capital Cost	Replacement Cost	Replacement Interval (Yr)	Replacement P.W.	Service Life	20-yr Salvage Value	Salvage Value (P.W.)
Centrifuge Equipment		$473,000	$0	20	$0	20	$0	$0
Polymer Feed System		$20,000	$17,000	15	$9,000	15	$13,000	$6,000
WAS Pumps		$40,000	$0	20	$0	20	$0	$0
Thickened WAS Pumps		$31,000	$0	20	$0	20	$0	$0
Subtotal-Equipment and Structures		$564,000						
Piping/Mechanical	25%	$141,000				30	$47,000	$21,000
Electrical	15%	$85,000				20	$0	$0
HVAC	3%	$17,000				20	$0	$0
Sitework	2%	$11,000				20	$0	$0
Subtotal		$818,000						
Contractor's General Conditions	8%	$65,000						
Total Construction Costs		$883,000						
Contingencies, Legal & Engineering Services	35%	$309,000						
Total Capital Costs		**$1,192,000**	$17,000		$9,000		$60,000	$27,000
Present Worth		**$1,192,000**			**$9,000**			**$27,000**

Estimated Annual O&M Costs	
Labor	$23,100
Power	$15,900
Chemicals:	
Polymer (2 lb/ton @ $1.75/lb)	$1,150
Maintenance and Supplies	$11,000
Total	$51,000
Present Worth of O&M	$685,000

Summary of Present Worth Costs	
Capital Cost	$1,192,000
Replacement	$9,000
O&M Cost	$685,000
Salvage Value	($27,000)
TOTAL PRESENT WORTH	**$1,859,000**

Notes:
All costs are fourth quarter 2010 dollars.
Present worth is calculated on a 20-year basis at discount rate shown.

Unit cost assumptions:

Labor	$37	per hour	
Power	$0.08	per kwh	
Polymer	$3,700	per ton	From Kruger
Chlorine Gas (Cl2)	$160	per 150 lb cylinder	From Tim Reel
Sulfur Dioxide (SO2)	$160	per 150 lb cylinder	Assumed
Additional Sludge percent solids	2%		
Additional Sludge cost for land application	$0.05	per gallon	
Sludge Storage Cost	$1.60	per gallon	
Maintenance and Supplies	2%	percent of equipment capital cost	

Process Constants for Calcs.

DAF	2.4	mgd
PHF	11	mgd

[1] Based on dosage of 2 mg/L

Whitewater Facilities Planning
Alternative T5
Rotary Drum Thickener

ITEM	Percentage	2010 Capital Cost	Replacement Cost	Replacement Interval (Yr)	Replacement P.W.	Service Life	20-yr Salvage Value	Salvage Value (P.W.)
Rotary Drum Thickener Equipment		$163,000	$0	20	$0	20	$0	$0
Polymer Feed System		$20,000	$17,000	15	$9,000	15	$13,000	$6,000
WAS Pumps		$40,000	$0	20	$0	20	$0	$0
Thickened WAS Pumps		$31,000	$0	20	$0	20	$0	$0
Subtotal-Equipment and Structures		$254,000						
Piping/Mechanical	25%	$64,000				30	$21,000	$9,000
Electrical	15%	$38,000				20	$0	$0
HVAC	3%	$8,000				20	$0	$0
Sitework	2%	$5,000				20	$0	$0
Subtotal		$369,000						
Contractor's General Conditions	8%	$30,000						
Total Construction Costs		$399,000						
Contingencies, Legal & Engineering Services	35%	$140,000						
Total Capital Costs		**$539,000**	$17,000		$9,000		$34,000	$15,000
Present Worth		**$539,000**			**$9,000**			**$15,000**

Estimated Annual O&M Costs	
Labor	$23,100
Power	$1,100
Chemicals:	
Polymer (12 lb/ton @ $1.75/lb)	$10,300
Maintenance and Supplies	$5,000
Total	$40,000
Present Worth of O&M	$538,000

Summary of Present Worth Costs	
Capital Cost	$539,000
Replacement	$9,000
O&M Cost	$538,000
Salvage Value	($15,000)
TOTAL PRESENT WORTH	**$1,071,000**

Notes:
All costs are fourth quarter 2010 dollars.
Present worth is calculated on a 20-year basis at discount rate shown.

Unit cost assumptions:

Labor	$37	per hour	
Power	$0.08	per kwh	
Polymer	$3,713	per ton	From Kruger
Chlorine Gas (Cl2)	$160	per 150 lb cylinder	From Tim Reel
Sulfur Dioxide (SO2)	$160	per 150 lb cylinder	Assumed
Additional Sludge percent solids	2%		
Additional Sludge cost for land application	$0.05	per gallon	
Sludge Storage Cost	$1.60	per gallon	
Maintenance and Supplies	2%	percent of equipment capital cost	

Process Constants for Calcs.

DAF	2.4	mgd
PHF	11	mgd

[1] Based on dosage of 2 mg/L

Whitewater Facilities Planning
Alternative T6
Dissolved Air Flotation

ITEM	Percentage	2010 Capital Cost	Replacement Cost	Replacement Interval (Yr)	Replacement P.W.	Service Life	20-yr Salvage Value	Salvage Value (P.W.)
Dissolved Air Flotation Equipment		$78,000	$0	20	$0	20	$0	$0
Building Addition and Concrete Tank for DAF		$366,000	$0	20	$0	20	$0	$0
Recirculation Pumps		$45,000	$0	20	$0	20	$0	$0
WAS Pumps		$40,000	$0	20	$0	20	$0	$0
Thickened WAS Pumps		$31,000	$0	20	$0	20	$0	$0
Subtotal-Equipment and Structures		$560,000						
Piping/Mechanical	25%	$140,000				30	$47,000	$21,000
Electrical	15%	$84,000				20	$0	$0
HVAC	3%	$17,000				20	$0	$0
Sitework	2%	$11,000				20	$0	$0
Subtotal		$812,000						
Contractor's General Conditions	8%	$65,000						
Total Construction Costs		$877,000						
Contingencies, Legal & Engineering Services	35%	$307,000						
Total Capital Costs		**$1,184,000**	$0		$0		$47,000	$21,000
Present Worth		**$1,184,000**			**$0**			**$21,000**

Estimated Annual O&M Costs

Labor	$11,600	Labor	
Power	$5,300		
Chemicals:			
Polymer (12 lb/ton @ $1.75/lb)	$0	Does DAF not need polymer?	1000
Maintenance and Supplies	$3,900		
Total	$21,000		
Present Worth of O&M	$282,000		

Summary of Present Worth Costs

Capital Cost	$1,184,000
Replacement	$0
O&M Cost	$282,000
Salvage Value	($21,000)
TOTAL PRESENT WORTH	**$1,445,000**

Notes:
All costs are fourth quarter 2010 dollars.
Present worth is calculated on a 20-year basis at discount rate shown.

Unit cost assumptions:

Labor	$37	per hour	
Power	$0.08	per kwh	
Polymer	$3,713	per ton	From Kruger
Chlorine Gas (Cl2)	$160	per 150 lb cylinder	From Tim Reel
Sulfur Dioxide (SO2)	$160	per 150 lb cylinder	Assumed
Additional Sludge percent solids	2%		
Additional Sludge cost for land application	$0.05	per gallon	
Maintenance and Supplies	2%	percent of equipment capital cost	

Process Constants for Calcs.

DAF	2.4	mgd
PHF	11	mgd

[1] Based on dosage of 2 mg/L

Whitewater Facilities Planning
Alternative F1
Membrane Filtration

ITEM		2010 Capital Cost	Replacement Cost	Replacement Interval (Yr)	Replacement P.W.	Service Life	20-yr Salvage Value	Salvage Value (P.W.)
Effluent Pumping Structural		$220,000				40	$110,000	$49,000
Effluent Pumping Equipment		$175,000	$149,000	15	$81,000	15	$117,000	$52,000
Membrane Structural		$997,000				40	$499,000	$222,000
Membrane Equipment and Controls		$4,160,000	$55,460	1	$53,000	20	$0	$0
Chemical Feed, Rapid Mix, and Flocculation Tanks/Equip.		$105,000	$68,000	10	$45,000	10	$0	$0
Subtotal-Equipment and Structures		$4,265,000						
Piping/Mechanical	18%	$768,000				30	$256,000	$114,000
Electrical	15%	$640,000				20	$0	$0
HVAC	3%	$128,000				20	$0	$0
Sitework	5%	$213,000				20	$0	$0
Subtotal		$6,014,000						
Contractor's General Conditions	8%	$481,000						
Total Construction Costs		$6,495,000						
Contingencies, Legal & Engineering Services	38%	$2,468,000						
Total Capital Costs		**$8,964,000**	$123,000		$98,000		$256,000	$114,000
Present Worth		**$8,964,000**			**$98,000**			**$114,000**

Estimated Annual O&M Costs	
Labor	$79,295
Power	$28,563
Chemicals:	
Alum Dose (mg/L)	24
Alum Cost	$80,136
Cleaning Chemical Cost	$6,520
Maintenance and Supplies	$52,583
Additional Sludge (lb/year)	$96,752
Additional 180 Day Sludge Storage, Amoritized	$28,184
Additional Sludge Handling and Disposal	$27,133
Total	$302,000
Present Worth of O&M	$4,072,000

Summary of Present Worth Costs	
Capital Cost	$8,964,000
Replacement	$98,000
O&M Cost	$4,072,000
Salvage Value	($114,000)
TOTAL PRESENT WORTH	**$13,020,000**

Notes:
The above costs assume an existing activated sludge plant with BPR or CPR currently averaging 0.2 mg/L effluent phosphorus on an annual average basis.
The membrane costs assume peak flows greater than 5 mgd will be diverted to membranes.
All costs are fourth quarter 2010 dollars.
Present worth is calculated on a 20-year basis at discount rate shown.
Contingencies, Legal & Engineering Services (38%) includes 3% for jar testing of chemicals and pilot testing of equipment
Alum is assumed for phosphorus removal; aluminum chlorohydrate could also be used and would be preferred.
The above costs do not include continuous pH monitoring or adjustment; however, this may be required to meet low phosphorus limits in some locations.

Unit cost assumptions:			
Labor	$37	per hour	
Power	$0.08	per kwh	
Polymer	$3,626	per ton	From Kruger x CCI Factor
Coagulant (Alum)	$403	per ton	From Hydrite (Bulk)
Additional Sludge percent solids	2%		
Additional Sludge cost for land application	$0.05	per gallon	
Sludge Storage Cost	$1.30	per gallon	
Maintenance and Supplies	1%	percent of equipment capital cost	

Process Constants for Calcs.		
DAF	2.1	mgd
PHF	11	mgd

Whitewater Facilities Planning
Alternative F2
Blue PRO Filtration

ITEM		2010 Capital Cost	Replacement Cost	Replacement Interval (Yr)	Replacement P.W.	Service Life	20-yr Salvage Value	Salvage Value (P.W.)
Effluent Pumping Structural		$188,000			$0	40	$71,000	$31,600
Effluent Pumping Equipment		$149,000	$149,000	15	$81,000	15	$75,000	$33,000
Process Structural		$1,006,000			$0	40	$377,000	$168,000
Process Equipment and Controls		$1,061,000	$33,000	1	$444,000	20	$0	$0
Add'l Chemical Feed, Mix, and Flocculation Tanks/Equip.		$164,000	$35,000	10	$23,000	10	$0	$0
Subtotal-Equipment and Structures		$2,568,000						
Piping/Mechanical	25%	$642,000				30	$214,000	$95,000
Electrical	15%	$385,000				20	$0	$0
HVAC	3%	$77,000				20	$0	$0
Sitework	2%	$51,000				20	$0	$0
Subtotal		$3,723,000						
Contractor's General Conditions	8%	$298,000						
Total Construction Costs		$4,021,000						
Contingencies, Legal & Engineering Services	38%	$1,528,000						
Total Capital Costs		**$5,549,000**	$217,000		$548,000		$737,000	$328,000
Present Worth		**$5,549,000**			**$548,000**			**$328,000**

Estimated Annual O&M Costs	
Labor	$21,500
Power	$15,000
Chemicals:	$0
Ferric Dose	$83,600
Sand Cost	$200
Maintenance and Supplies	$9,500
Additional Sludge (lb/year)	$114,300
Additional 180 Day Sludge Storage, Amoritized	$32,600
Additional Sludge Handling and Disposal	$31,900
Total	$194,000
Present Worth of O&M	$2,611,000

Summary of Present Worth Costs	
Capital Cost	$5,549,000
Replacement	$548,000
O&M Cost	$2,611,000
Salvage Value	($328,000)
TOTAL PRESENT WORTH	**$8,380,000**

Capital cost per gpd
PW cost per gpd
Annualized PW
Annualized per lb incremental P removed
Annualized per lb total P removed (assumes 6 mg/L in)
Annualized per gpd
Annualized O,M,R,&S

Notes:
The above costs assume an existing activated sludge plant with BPR or CPR currently averaging 0.2 mg/L effluent phosphorus on an annual average basis.
The membrane costs assume peak flows greater than 5 mgd will be diverted to Blue PRO filters.
All costs are fourth quarter 2010 dollars.
Present worth is calculated on a 20-year basis at discount rate shown.
Contingencies, Legal & Engineering Services (38%) includes 3% for jar testing of chemicals and pilot testing of equipment
Alum is assumed for phosphorus removal; aluminum chlorohydrate could also be used and would be preferred.
The above costs do not include continuous pH monitoring or adjustment; however, this may be required to meet low phosphorus limits in some locations.

Unit cost assumptions:

Labor	$37	per hour	
Power	$0	per kwh	
Polymer	$3,626	per ton	From Kruger x CCI Factor
Coagulant (Alum)	$403	per ton	From Marshfield (Bulk)
Additional Sludge percent solids	2%		
Additional Sludge cost for land application	$0.05	per gallon	
Sludge Storage Cost	$1.30	per gallon	
Maintenance and Supplies	1%	percent of equipment capital cost	

Process Constants for Calcs.

DAF	2.4	mgd
PHF	11.0	mgd

APPENDIX C
WPDES PERMIT

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

Jim Doyle, Governor
Matthew J. Frank, Secretary
Gloria L. McCutcheon, Regional Director

Waukesha Service Center
141 NW Barstow St., Room 180
Waukesha, WI 53188
Telephone (262) 574-2100
FAX (262) 574-2117
TTY Access via relay - 711

December 16, 2008

FID #: 265004520

Mr. Kevin Brunner, Manager
City of Whitewater
312 W. Whitewater St.
P.O. Box 178
Whitewater, WI 53190

SUBJECT: WPDES Permit Reissuance No. WI-0020001-08-0
Whitewater Wastewater Treatment Facility, 109 County Hwy U, Whitewater, WI 53190

Dear Mr. Brunner:

Your Wisconsin Pollutant Discharge Elimination System (WPDES) Permit is enclosed. The conditions of the enclosed permit reissuance were determined using the permit application, information from your WPDES permit file, other information available to the Department, comments received during the public notice period, and applicable Wisconsin Administrative Codes. All discharges from this facility and actions or reports relating thereto shall be in accordance with the terms and conditions of the enclosed permit.

This enclosed permit requires you to submit monitoring results to the Department on a periodic basis. Blank copies of the appropriate monitoring forms and instructions for completing them will be mailed to you under separate cover.
The WPDES permit program has been approved by the Administrator of the U.S. Environmental Protection Agency pursuant to Section 402(b) of the Federal Water Pollution Control Act Amendments of 1972 (33 U.S.C. Section 1342 (b)). The terms and conditions of the enclosed permit are accordingly subject to enforcement under ss. 283.89 and 283.91, Stats., and Section 309 of the Federal Act (33 U.S.C. Section 1319).

The Department has the authority under chs. 160 and 283, Stats., to establish effluent limitations, monitoring requirements, and other permit conditions for discharges to groundwater and surface waters of the State. The Department also has the authority to issue, reissue, modify, suspend, or revoke WPDES permits under ch. 283, Stats.
The enclosed permit contains water quality-based effluent limitations that are necessary to ensure the water quality standards for Whitewater Creek, a tributary to the Bark River in Jefferson County are met. You may apply for a variance from the water quality standard used to derive the limitations pursuant to s. 283.15, Stats., by submitting an application to the Director of the Bureau of Watershed Management,

P.O. Box 7921, Madison, Wisconsin 53707 within 60 days of the date the permit was issued (see "Date Permit Signed/Issued" after the signature on the front page of the enclosed permit). Subchapter III of ch. NR 200, Wis. Adm. Code, specifies the procedures that must be followed and the information that must be included when submitting an application for a variance.

To challenge the reasonableness of or necessity for any term or condition of the enclosed permit, s. 283.63, Stats., and ch. NR 203, Wis. Adm. Code, require that you file a verified petition for review with the Secretary of the Department of Natural Resources within 60 days of the date the permit was issued (see "Date Permit Signed/Issued" after the signature on the front page of the enclosed permit). For permit-related decisions that are not reviewable pursuant to s. 283.63, Stats., it may be possible for permittees or other persons to obtain an administrative review pursuant to s. 227.42, Stats., and s. NR 2.05(5), Wis. Adm. Code, or a judicial review pursuant to s. 227.52, Stats. If you choose to pursue one of these options, you should know that Wisconsin Statutes and Administrative Code establish time periods within which requests to review Department decisions must be filed.

Sincerely,

Timothy Thompson
SER Basin Engineer

Dated: 12/16/2008

cc: Permit Files: Region & Central
U.S. Fish and Wildlife Service (Electronic Copy via Email)
EPA – Region V (Electronic Copy via Email)
SEWRPC
Tim Reel, WWTP Superintendent.

WPDES PERMIT

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

PERMIT TO DISCHARGE UNDER THE WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM

Whitewater Wastewater Treatment Plant

is permitted, under the authority of Chapter 283, Wisconsin Statutes, to discharge from a facility located at
109 County Hwy U, Whitewater, WI 53190
to

Whitewater Creek, a tributary to the Bark River in Jefferson County

in accordance with the effluent limitations, monitoring requirements and other conditions set forth in this permit.

The permittee shall not discharge after the date of expiration. If the permittee wishes to continue to discharge after this expiration date an application shall be filed for reissuance of this permit, according to Chapter NR 200, Wis. Adm. Code, at least 180 days prior to the expiration date given below.

State of Wisconsin Department of Natural Resources
For the Secretary

By _____
Timothy Thompson
Basin Engineer

12/16/2008
Date Permit Signed/Issued

PERMIT TERM: EFFECTIVE DATE - January 01, 2009 **EXPIRATION DATE - December 31, 2013**

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7 SUMMARY OF REPORTS DUE **23**

1 Influent Requirements

1.1 Sampling Point(s)

Sampling Point Designation	
Sampling Point Number	**Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)**
701	Influent: 24-hour flow proportional composite sampler intake located in the influent wet well - includes sidestream flows (sludge decant and filter backwash).

1.2 Monitoring Requirements

The permittee shall comply with the following monitoring requirements.

1.2.1 Sampling Point 701 - INFLUENT PLANT

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Continuous	
BOD_5, Total		mg/L	3/Week	24-Hr Flow Prop Comp	
Suspended Solids, Total		mg/L	3/Week	24-Hr Flow Prop Comp	
Mercury, Total Recoverable		ng/L	Quarterly	24-Hr Flow Prop Comp	See 1.2.1.1

1.2.1.1 Mercury Monitoring

The permittee shall collect and analyze all mercury samples according to the data quality requirements of ss. NR 106.145(9) and (10), Wisconsin Administrative Code. The limit of quantitation (LOQ) used for the effluent and field blank shall be less than 1.3 ng/L, unless the samples are quantified at levels above 1.3 ng/L. The permittee shall collect at least one mercury field blank for each set of mercury samples (a set of samples may include combinations of intake, influent, effluent or other samples all collected on the same day). The permittee shall report results of samples and field blanks to the Department on Discharge Monitoring Reports.

2 In-Plant Requirements

2.1 Sampling Point(s)

Sampling Point Designation	
Sampling Point Number	**Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)**
102	Mercury field blanks shall be collected using standard sample handling procedures
103	Flow from the primary clarifiers that bypasses the RBC, the secondary clarifiers and the filters

2.2 Monitoring Requirements and Limitations

The permittee shall comply with the following monitoring requirements and limitations.

2.2.1 Sampling Point 102 - Mercury Field Blanks

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Mercury, Total Recoverable		ng/L	Quarterly	Grab	See 3.2.1.4

2.2.2 Sampling Point 103 - In plant diversion

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Per Occurrence	Continuous	See 2.2.2.1

2.2.2.1 In-Plant Diversion Requirements

During wet weather flow conditions, when necessary to maintain the proper function of the wastewater treatment facility, the permittee may operate in-plant diversion and blending subject to the following conditions and monitoring:

- All flows shall receive treatment equivalent to primary treatment. Disinfection shall also be applied to all flows whenever in-plant diversion is carried out during the disinfection season.
- The flow rate of diverted flows shall be measured and reported on the monthly Discharge Monitoring Report (DMR) forms whenever in-plant diversion is carried out. Flow chart recordings of influent flows shall also be submitted.
- Final effluent monitoring and sampling shall include the portion of flows that is diverted and permit requirements and limitations contained in 3.2.1 shall remain in full force and effect during periods when in-plant diversion and blending occur.
- In-plant diversion and blending shall only be carried out during wet weather when peak flows at the treatment facility are in excess of secondary treatment capacity.

3 Surface Water Requirements

3.1 Sampling Point(s)

Sampling Point Designation	
Sampling Point Number	**Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)**
001	Effluent: 24-hour flow proportional composite sampler intake located in the post aeration tank. Grab sample also collected at the same location.

3.2 Monitoring Requirements and Effluent Limitations

The permittee shall comply with the following monitoring requirements and limitations.

3.2.1 Sampling Point (Outfall) 001 - EFFLUENT

Monitoring Requirements and Effluent Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Continuous	
BOD_5, Total	Weekly Avg	10 mg/L	3/Week	24-Hr Flow Prop Comp	May-Oct
BOD_5, Total	Weekly Avg	20 mg/L	3/Week	24-Hr Flow Prop Comp	Nov-Apr
BOD_5, Total	Monthly Avg	10 mg/L	3/Week	24-Hr Flow Prop Comp	May-Oct
BOD_5, Total	Monthly Avg	20 mg/L	3/Week	24-Hr Flow Prop Comp	Nov-Apr
BOD_5, Total	Weekly Avg	304 lbs/day	3/Week	24-Hr Flow Prop Comp	May-Oct
BOD_5, Total	Weekly Avg	609 lbs/day	3/Week	24-Hr Flow Prop Comp	Nov-Apr
Suspended Solids, Total	Weekly Avg	10 mg/L	3/Week	24-Hr Flow Prop Comp	May-Oct
Suspended Solids, Total	Weekly Avg	20 mg/L	3/Week	24-Hr Flow Prop Comp	Nov-Apr
Suspended Solids, Total	Monthly Avg	10 mg/L	3/Week	24-Hr Flow Prop Comp	May-Oct
Suspended Solids, Total	Monthly Avg	20 mg/L	3/Week	24-Hr Flow Prop Comp	Nov-Apr
Suspended Solids, Total	Weekly Avg	304 lbs/day	3/Week	24-Hr Flow Prop Comp	May-Oct
Suspended Solids, Total	Weekly Avg	609 lbs/day	3/Week	24-Hr Flow Prop Comp	Nov-Apr
Nitrogen, Ammonia (NH_3-N) Total	Daily Max	16.8 mg/L	3/Week	24-Hr Flow Prop Comp	Year round

Monitoring Requirements and Effluent Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Nitrogen, Ammonia (NH_3-N) Total	Weekly Avg	10.5 mg/L	3/Week	24-Hr Flow Prop Comp	Jan
Nitrogen, Ammonia (NH_3-N) Total	Weekly Avg	10.6 mg/L	3/Week	24-Hr Flow Prop Comp	Feb
Nitrogen, Ammonia (NH_3-N) Total	Weekly Avg	11.3 mg/L	3/Week	24-Hr Flow Prop Comp	Mar
Nitrogen, Ammonia (NH_3-N) Total	Weekly Avg	9.8 mg/L	3/Week	24-Hr Flow Prop Comp	Apr
Nitrogen, Ammonia (NH_3-N) Total	Weekly Avg	9.2 mg/L	3/Week	24-Hr Flow Prop Comp	May
Nitrogen, Ammonia (NH_3-N) Total	Weekly Avg	6.3 mg/L	3/Week	24-Hr Flow Prop Comp	Jun-Sep
Nitrogen, Ammonia (NH_3-N) Total	Weekly Avg	9.6 mg/L	3/Week	24-Hr Flow Prop Comp	Oct
Nitrogen, Ammonia (NH_3-N) Total	Weekly Avg	10.7 mg/L	3/Week	24-Hr Flow Prop Comp	Nov
Nitrogen, Ammonia (NH_3-N) Total	Monthly Avg	4.4 mg/L	3/Week	24-Hr Flow Prop Comp	Jan, Feb, Dec
Nitrogen, Ammonia (NH_3-N) Total	Monthly Avg	4.8 mg/L	3/Week	24-Hr Flow Prop Comp	Mar
Nitrogen, Ammonia (NH_3-N) Total	Monthly Avg	4.3 mg/L	3/Week	24-Hr Flow Prop Comp	Apr
Nitrogen, Ammonia (NH_3-N) Total	Monthly Avg	4.0 mg/L	3/Week	24-Hr Flow Prop Comp	May
Nitrogen, Ammonia (NH_3-N) Total	Monthly Avg	3.2 mg/L	3/Week	24-Hr Flow Prop Comp	Jun
Nitrogen, Ammonia (NH_3-N) Total	Monthly Avg	3.0 mg/L	3/Week	24-Hr Flow Prop Comp	Jul-Sep
Nitrogen, Ammonia (NH_3-N) Total	Monthly Avg	4.1 mg/L	3/Week	24-Hr Flow Prop Comp	Oct
Nitrogen, Ammonia (NH_3-N) Total	Monthly Avg	4.5 mg/L	3/Week	24-Hr Flow Prop Comp	Nov
pH Field	Daily Max	9.0 su	Daily	Grab	
pH Field	Daily Min	6.0 su	Daily	Grab	
Dissolved Oxygen	Daily Min	6.0 mg/L	Daily	Grab	
Chlorine, Total Residual	Daily Max	38 µg/L	Daily	Grab	May-Sept and whenever chlorinating. See 3.2.1.2
Chlorine, Total Residual	Weekly Avg	11 µg/L	Daily	Grab	May-Sept and whenever chlorinating. See 3.2.1.2
Fecal Coliform	Geometric Mean	400 #/100 ml	2/Week	Grab	May-Sept only
Phosphorus, Total	Monthly Avg	1.0 mg/L	2/Week	24-Hr Flow Prop Comp	
Copper, Total Recoverable		mg/L	Monthly	24-Hr Flow Prop Comp	2012 only

Monitoring Requirements and Effluent Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Chloride		mg/L	Monthly	24-Hr Flow Prop Comp	2012 only
Mercury, Total Recoverable	Daily Max	3.89 ng/L	Quarterly	Grab	See 3.2.1.4
Acute WET		TU_a	Quarterly	24-Hr Flow Prop Comp	Annual in rotating quarters. See 3.2.1.6
Chronic WET		rTU_c	Quarterly	24-Hr Flow Prop Comp	Annual in rotating quarters. See 3.2.1.6
Cyanide, Amenable	Weekly Avg	17 µg/L	Quarterly	24-Hr Flow Prop Comp	See 3.2.1.3, 3.2.1.5 and Compliance Schedule in 5.3
Cyanide, Amenable	Weekly Avg	0.53 lbs/day	Quarterly	24-Hr Flow Prop Comp	See 3.2.1.3, 3.2.1.5 and Compliance Schedule in 5.3

3.2.1.1 Sample Analyses

Samples shall be analyzed using a method which provides adequate sensitivity so that results can be quantified, unless not possible using the most sensitive approved method.

3.2.1.2 Applicable Mass Limits for Total Residual Chlorine

The applicable mass limits for Total Residual Chlorine are **2.9 pounds per day (daily maximum), 0.33 pounds per day (non-wet weather weekly average)**, and **0.61 pounds per day (wet weather weekly average)**. See Standard Requirements for "Applicability of Alternative Wet Weather Limitations".

3.2.1.3 Potential Removal of Effluent Limitation(s)

The effluent limitations for Cyanide Amenable become effective on January 1, 2012 as specified in the Schedules of Compliance Section. Quarterly monitoring is required upon permit reissuance.

However, when 4 or more representative results for cyanide have been provided to the Department, the permittee may request that the Department make a determination of the need for a limit under section NR 106.05, Wisconsin Administrative Code. For this request, the samples shall be evenly spaced over the period or periods of discharge during at least 12 months time and must be tested according to the "Sampling and Testing Procedures" in the Standard Requirements section in this permit. Within 60 days of such request, the Department shall make that determination. If the Department determines that effluent limitations are unnecessary based on the procedures in NR 106.05, the Department shall notify the permittee that the limitations will not become effective, pursuant to NR106.04(4). The monitoring requirements and the compliance schedule for cyanide shall be discontinued at that time. This action shall take place without public notice thereof.

If, after reviewing the data, the Department determines that effluent limitations for cyanide are necessary based on the procedures in NR 106.05, the requirement to meet the effluent limitations according to the Schedules of Compliance will not be removed nor will the monitoring frequency be reduced.

3.2.1.4 Mercury Monitoring

The permittee shall collect and analyze all mercury samples according to the data quality requirements of ss. NR 106.145(9) and (10), Wisconsin Administrative Code. The limit of quantitation (LOQ) used for the effluent and field blank shall be less than 1.3 ng/L, unless the samples are quantified at levels above 1.3 ng/L. The permittee shall collect at least one mercury field blank for each set of mercury samples (a set of samples may include combinations of

intake, influent, effluent or other samples all collected on the same day). The permittee shall report results of samples and field blanks to the Department on Discharge Monitoring Reports.

3.2.1.5 Non-Wet Weather and Alternative Wet Weather Mass Limit

This parameter (Cyanide Amenable) has a mass limit based on weather conditions. The applicable non-wet weather mass limit is 0.53 pounds/day. The applicable wet weather mass limit is 1.0 pounds/day. Report the applicable mass limit on the Discharge Monitoring Report form in the variable limit column. See Standard Requirements for "Applicability of Alternative Wet Weather Mass Limitations" and "Appropriate Formulas for Effluent Calculations".

Note: 1000 ug/l = 1 mg/L (divide ug/L by 1000 to convert to mg/L).

3.2.1.6 Whole Effluent Toxicity (WET) Testing

Primary Control Water: Whitewater Creek, upstream of the effluent and any other discharges

Instream Waste Concentration (IWC): 66%

Dilution series: At least five effluent concentrations and dual controls must be included in each test.

- **Acute:** 100, 50, 25, 12.5, 6.25% and any additional selected by the permittee.
- **Chronic:** 100, 75, 50, 25, 12.5% and any additional selected by the permittee.

WET Testing Frequency: Tests are required during the following quarters.

- **Acute:** Apr-Jun 2009; Jan-Mar 2010; July-Sept 2011; Oct-Dec 2012; Apr-Jun 2013
- **Chronic:** Apr-Jun 2009; Jan-Mar 2010; July-Sept 2011; Oct-Dec 2012; Apr-Jun 2013

Reporting: The permittee shall report test results on the Discharge Monitoring Report form, and also complete the "Whole Effluent Toxicity Test Report Form" (Section 6, "*State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition*"), for each test. The original, complete, signed version of the Whole Effluent Toxicity Test Report Form shall be sent to the Biomonitoring Coordinator, Bureau of Watershed Management, 101 S. Webster St., P.O. Box 7921, Madison, WI 53707-7921, within 45 days of test completion. The original Discharge Monitoring Report (DMR) form and one copy shall be sent to the contact and location provided on the DMR by the required deadline.

Determination of Positive Results: An acute toxicity test shall be considered positive if the Toxic Unit - Acute (TU_a) is greater than 1.0 for either species. The TU_a shall be calculated as follows: If $LC_{50} \geq 100$, then $TU_a = 1.0$. If LC_{50} is < 100, then $TU_a = 100 \div LC_{50}$. A chronic toxicity test shall be considered positive if the Relative Toxic Unit - Chronic (rTU_c) is greater than 1.0 for either species. The rTU_c shall be calculated as follows: If $IC_{25} \geq IWC$, then $rTU_c = 1.0$. If $IC_{25} < IWC$, then $rTU_c = IWC \div IC_{25}$.

Additional Testing Requirements: Within 90 days of a test which showed positive results, the permittee shall submit the results of at least 2 retests to the Biomonitoring Coordinator on "Whole Effluent Toxicity Test Report Forms". The retests shall be completed using the same species and test methods specified for the original test (see the Standard Requirements section herein).

4 Land Application Requirements

4.1 Sampling Point(s)

The discharge(s) shall be limited to land application of the waste type(s) designated for the listed sampling point(s) on Department approved land spreading sites or by hauling to another facility.

Sampling Point Designation	
Sampling Point Number	**Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)**
002	Anaerobic Liquid Sludge, sampled from the secondary digester (sludge storage tank), after mixing.

4.2 Monitoring Requirements and Limitations

The permittee shall comply with the following monitoring requirements and limitations.

4.2.1 Sampling Point (Outfall) 002 - Liquid Sludge

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Arsenic Dry Wt	Ceiling	75 mg/kg	Annual	Grab Comp	
Arsenic Dry Wt	High Quality	41 mg/kg	Annual	Grab Comp	
Cadmium Dry Wt	Ceiling	85 mg/kg	Annual	Grab Comp	
Cadmium Dry Wt	High Quality	39 mg/kg	Annual	Grab Comp	
Copper Dry Wt	Ceiling	4,300 mg/kg	Annual	Grab Comp	
Copper Dry Wt	High Quality	1,500 mg/kg	Annual	Grab Comp	
Lead Dry Wt	Ceiling	840 mg/kg	Annual	Grab Comp	
Lead Dry Wt	High Quality	300 mg/kg	Annual	Grab Comp	
Mercury Dry Wt	Ceiling	57 mg/kg	Annual	Grab Comp	
Mercury Dry Wt	High Quality	17 mg/kg	Annual	Grab Comp	
Molybdenum Dry Wt	Ceiling	75 mg/kg	Annual	Grab Comp	
Nickel Dry Wt	Ceiling	420 mg/kg	Annual	Grab Comp	
Nickel Dry Wt	High Quality	420 mg/kg	Annual	Grab Comp	
Nitrogen, Ammonium (NH_4-N) Total		Percent	Annual	Grab Comp	
Nitrogen, Total Kjeldahl		Percent	Annual	Grab Comp	
Phosphorus, Total		Percent	Annual	Grab Comp	
Phosphorus, Water Extractable		Percent	Annual	Grab Comp	
Potassium, Total Recoverable		Percent	Annual	Grab Comp	
PCB Total Dry Wt	Ceiling	50 mg/kg	Once	Grab Comp	See 4.2.1.5
PCB Total Dry Wt	High Quality	10 mg/kg	Once	Grab Comp	See 4.2.1.5
Selenium Dry Wt	Ceiling	100 mg/kg	Annual	Grab Comp	
Selenium Dry Wt	High Quality	100 mg/kg	Annual	Grab Comp	

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Solids, Total		Percent	Annual	Grab Comp	
Zinc Dry Wt	Ceiling	7,500 mg/kg	Annual	Grab Comp	
Zinc Dry Wt	High Quality	2,800 mg/kg	Annual	Grab Comp	
Radium 226 Dry Wt		pCi/g	Annual	Grab Comp	

Other Sludge Requirements	
Sludge Requirements	**Sample Frequency**
List 3 Requirements – Pathogen Control: The requirements in List 3 shall be met prior to land application of sludge.	**Annual**
List 4 Requirements – Vector Attraction Reduction: The vector attraction reduction shall be satisfied prior to, or at the time of land application as specified in List 4.	**Annual**

4.2.1.1 List 2 Analysis

If the monitoring frequency for List 2 parameters is more frequent than "Annual" then the sludge may be analyzed for the List 2 parameters just prior to each land application season rather than at the more frequent interval specified.

4.2.1.2 Changes in Feed Sludge Characteristics

If a change in feed sludge characteristics, treatment process, or operational procedures occurs which may result in a significant shift in sludge characteristics, the permittee shall reanalyze the sludge for List 1, 2, 3 and 4 parameters each time such change occurs.

4.2.1.3 Multiple Sludge Sample Points (Outfalls)

If there are multiple sludge sample points (outfalls), but the sludges are not subject to different sludge treatment processes, then a separate List 2 analysis shall be conducted for each sludge type which is land applied, just prior to land application, and the application rate shall be calculated for each sludge type. In this case, List 1, 3, and 4 and PCBs need only be analyzed on a single sludge type, at the specified frequency. If there are multiple sludge sample points (outfalls), due to multiple treatment processes, List 1, 2, 3 and 4 and PCBs shall be analyzed for each sludge type at the specified frequency.

4.2.1.4 Sludge Which Exceeds the High Quality Limit

Cumulative pollutant loading records shall be kept for all bulk land application of sludge which does not meet the high quality limit for any parameter. This requirement applies for the entire calendar year in which any exceedance of Table 3 of s. NR 204.07(5)(c), is experienced. Such loading records shall be kept for all List 1 parameters for each site land applied in that calendar year. The formula to be used for calculating cumulative loading is as follows:

[(Pollutant concentration (mg/kg) x dry tons applied/ac) ÷ 500] + previous loading (lbs/acre) = cumulative lbs pollutant per acre

When a site reaches 90% of the allowable cumulative loading for any metal established in Table 2 of s. NR 204.07(5)(b), the Department shall be so notified through letter or in the comment section of the annual land application report (3400-55).

4.2.1.5 Sludge Analysis for PCBs

The permittee shall analyze the sludge for Total PCBs one time during **2010**. The results shall be reported as "PCB Total Dry Wt". Either congener-specific analysis or Aroclor analysis shall be used to determine the PCB concentration. The permittee may determine whether Aroclor or congener specific analysis is performed. Analyses shall be performed in accordance with Table EM in s. NR 219.04, Wis. Adm. Code and the conditions specified in Standard Requirements of this permit. PCB results shall be submitted by January 31, following the specified year of analysis.

4.2.1.6 Lists 1, 2, 3, and 4

List 1 **TOTAL SOLIDS AND METALS** See the Monitoring Requirements and Limitations table above for monitoring frequency and limitations for the List 1 parameters
Solids, Total (percent)
Arsenic, mg/kg (dry weight)
Cadmium, mg/kg (dry weight)
Copper, mg/kg (dry weight)
Lead, mg/kg (dry weight)
Mercury, mg/kg (dry weight)
Molybdenum, mg/kg (dry weight)
Nickel, mg/kg (dry weight)
Selenium, mg/kg (dry weight)
Zinc, mg/kg (dry weight)

List 2 **NUTRIENTS** See the Monitoring Requirements and Limitations table above for monitoring frequency for the List 2 parameters
Solids, Total (percent)
Nitrogen Total Kjeldahl (percent)
Nitrogen Ammonium (NH4-N) Total (percent)
Phosphorus Total as P (percent)
Phosphorus, Water Extractable (as percent of Total P)
Potassium Total Recoverable (percent)

List 3
PATHOGEN CONTROL FOR CLASS B SLUDGE

The permittee shall implement pathogen control as listed in List 3. The Department shall be notified of the pathogen control utilized and shall be notified when the permittee decides to utilize alternative pathogen control.

The following requirements shall be met prior to land application of sludge.

Parameter	Unit	Limit
Fecal Coliform*	MPN/gTS or CFU/gTS	2,000,000
OR, ONE OF THE FOLLOWING PROCESS OPTIONS		
Aerobic Digestion	Air Drying	
Anaerobic Digestion	Composting	
Alkaline Stabilization	PSRP Equivalent Process	

* The Fecal Coliform limit shall be reported as the geometric mean of 7 discrete samples on a dry weight basis.

List 4
VECTOR ATTRACTION REDUCTION

The permittee shall implement any one of the vector attraction reduction options specified in List 4. The Department shall be notified of the option utilized and shall be notified when the permittee decides to utilize an alternative option.

One of the following shall be satisfied prior to, or at the time of land application as specified in List 4.

Option	Limit	Where/When it Shall be Met
Volatile Solids Reduction	≥38%	Across the process
Specific Oxygen Uptake Rate	≤1.5 mg O_2/hr/g TS	On aerobic stabilized sludge
Anaerobic bench-scale test	<17 % VS reduction	On anaerobic digested sludge
Aerobic bench-scale test	<15 % VS reduction	On aerobic digested sludge
Aerobic Process	>14 days, Temp >40°C and Avg. Temp > 45°C	On composted sludge
pH adjustment	>12 S.U. (for 2 hours) and >11.5 (for an additional 22 hours)	During the process
Drying without primary solids	>75 % TS	When applied or bagged
Drying with primary solids	>90 % TS	When applied or bagged
Equivalent Process	Approved by the Department	Varies with process
Injection	-	When applied
Incorporation	-	Within 6 hours of application

4.2.1.7 Daily Land Application Log

Daily Land Application Log		
Discharge Monitoring Requirements and Limitations		
The permittee shall maintain a daily land application log for biosolids land applied each day when land application occurs. The following minimum records must be kept, in addition to all analytical results for the biosolids land applied. The log book records shall form the basis for the annual land application report requirements.		
Parameters	**Units**	**Sample Frequency**
DNR Site Number(s)	Number	Daily as used
Outfall number applied	Number	Daily as used
Acres applied	Acres	Daily as used
Amount applied	As appropriate * /day	Daily as used
Application rate per acre	unit */acre	Daily as used
Nitrogen applied per acre	lb/acre	Daily as used
Method of Application	Injection, Incorporation, or surface applied	Daily as used

*gallons, cubic yards, dry US Tons or dry Metric Tons

5 Schedules of Compliance

5.1 Mercury Pollutant Minimization Program

An alternative mercury effluent limitation of 3.89 ng/L is included in this permit pursuant to NR 106.145(6), Wis. Adm. Code. Therefore, the permittee shall implement a pollutant minimization program as outlined below.

Required Action	Date Due
Implement the Mercury Pollutant Minimization Program (PMP) Plan:: The permittee shall continue to implement the mercury PMP plan as amended by agreement of the permittee and the Department.	
Annual Report #1: The permittee shall submit to the Department an annual status report on the progress of the PMP as required by s. NR 106.145(7), Wis. Adm. Code. Submittal of the first annual status report is required by the Date Due.	02/15/2009
Annual Report #2: Submit the second annual report	02/15/2010
Annual Report #3: Submit the third annual report	02/15/2011
Annual Report #4: Submit the fourth annual report	02/15/2012
Submit Final Report: Submit the final progress report. Note: If the permittee wishes to apply for an alternative mercury effluent limitation, that application is due with the application for permit reissuance, six months prior to permit expiration. The permittee should submit or reference the PMP plan as updated by the Annual Status Report or more recent developments as part of that application.	02/15/2013

5.2 Chemical Specific Toxic Pollutants - Cyanide, Amenable

Cyanide, Amenable limits, effective after Compliance Schedule: 17 ug/L and the Applicable Mass Limit.

Required Action	Date Due
Report on Effluent Discharges: Submit a report on effluent discharges of Cyanide, Amenable with conclusions regarding compliance. If the Department determines, based on the additional effluent data, that the effluet limitations are unnecessary based on the procedures in section NR 106.05, Wis Admin Code, the Department shall notify the permittee that the limits will no longer become effective. The monitoring requirement shall also be discontinued. But if after reviewing the data, the Department determines that effluent limitations are necessary, the requirement to meet the effluent limitations according to the Compliance Schedule is not removed	12/31/2009
Action Plan: Submit an action plan for complying with the effluent limitation. If construction is required, include plans and specifications with the submittal.	06/30/2010
Initiate Actions: Initiate actions identified in the plan.	09/30/2010
Complete Actions: Complete actions necessary to achieve compliance with the effluent limitations.	12/31/2011

6 Standard Requirements

NR 205, Wisconsin Administrative Code: The conditions in ss. NR 205.07(1) and NR 205.07(2), Wis. Adm. Code, are included by reference in this permit. The permittee shall comply with all of these requirements. Some of these requirements are outlined in the Standard Requirements section of this permit. Requirements not specifically outlined in the Standard Requirement section of this permit can be found in ss. NR 205.07(1) and NR 205.07(2).

6.1 Reporting and Monitoring Requirements

6.1.1 Monitoring Results

Monitoring results obtained during the previous month shall be summarized and reported on a Department Wastewater Discharge Monitoring Report. The report may require reporting of any or all of the information specified below under 'Recording of Results'. This report is to be returned to the Department no later than the date indicated on the form. When submitting a paper Discharge Monitoring Report form, the original and one copy of the Wastewater Discharge Monitoring Report Form shall be submitted to the return address printed on the form. A copy of the Wastewater Discharge Monitoring Report Form or an electronic file of the report shall be retained by the permittee.

All Wastewater Discharge Monitoring Reports submitted to the Department should be submitted using the electronic Discharge Monitoring Report system. Permittees who may be unable to submit Wastewater Discharge Monitoring Reports electronically may request approval to submit paper DMRs upon demonstration that electronic reporting is not feasible or practicable.

If the permittee monitors any pollutant more frequently than required by this permit, the results of such monitoring shall be included on the Wastewater Discharge Monitoring Report.

The permittee shall comply with all limits for each parameter regardless of monitoring frequency. For example, monthly, weekly, and/or daily limits shall be met even with monthly monitoring. The permittee may monitor more frequently than required for any parameter.

An Electronic Discharge Monitoring Report Certification sheet shall be signed and submitted with each electronic Discharge Monitoring Report submittal. This certification sheet, which is not part of the electronic report form, shall be signed by a principal executive officer, a ranking elected official or other duly authorized representative and shall be mailed to the Department at the time of submittal of the electronic Discharge Monitoring Report. The certification sheet certifies that the electronic report form is true, accurate and complete. Paper reports shall be signed by a principal executive officer, a ranking elected official, or other duly authorized representative.

6.1.2 Sampling and Testing Procedures

Sampling and laboratory testing procedures shall be performed in accordance with Chapters NR 218 and NR 219, Wis. Adm. Code and shall be performed by a laboratory certified or registered in accordance with the requirements of ch. NR 149, Wis. Adm. Code. Groundwater sample collection and analysis shall be performed in accordance with ch. NR 140, Wis. Adm. Code. The analytical methodologies used shall enable the laboratory to quantitate all substances for which monitoring is required at levels below the effluent limitation. If the required level cannot be met by any of the methods available in NR 219, Wis. Adm. Code, then the method with the lowest limit of detection shall be selected. Additional test procedures may be specified in this permit.

6.1.3 Recording of Results

The permittee shall maintain records which provide the following information for each effluent measurement or sample taken:

- the date, exact place, method and time of sampling or measurements;

- the individual who performed the sampling or measurements;
- the date the analysis was performed;
- the individual who performed the analysis;
- the analytical techniques or methods used; and
- the results of the analysis.

6.1.4 Reporting of Monitoring Results

The permittee shall use the following conventions when reporting effluent monitoring results:

- Pollutant concentrations less than the limit of detection shall be reported as < (less than) the value of the limit of detection. For example, if a substance is not detected at a detection limit of 0.1 mg/L, report the pollutant concentration as < 0.1 mg/L.

- Pollutant concentrations equal to or greater than the limit of detection, but less than the limit of quantitation, shall be reported and the limit of quantitation shall be specified.

- For the purposes of reporting a calculated result, average or a mass discharge value, the permittee may substitute a 0 (zero) for any pollutant concentration that is less than the limit of detection. However, if the effluent limitation is less than the limit of detection, the department may substitute a value other than zero for results less than the limit of detection, after considering the number of monitoring results that are greater than the limit of detection and if warranted when applying appropriate statistical techniques.

6.1.5 Compliance Maintenance Annual Reports

Compliance Maintenance Annual Reports (CMAR) shall be completed using information obtained over each calendar year regarding the wastewater conveyance and treatment system. The CMAR shall be submitted by the permittee in accordance with ch. NR 208, Wis. Adm. Code, by June 30, each year on an electronic report form provided by the Department.

In the case of a publicly owned treatment works, a resolution shall be passed by the governing body and submitted as part of the CMAR, verifying its review of the report and providing responses as required. Private owners of wastewater treatment works are not required to pass a resolution; but they must provide an Owner Statement and responses as required, as part of the CMAR submittal.

A separate CMAR certification document, that is not part of the electronic report form, shall be mailed to the Department at the time of electronic submittal of the CMAR. The CMAR certification shall be signed and submitted by an authorized representative of the permittee. The certification shall be submitted by mail. The certification shall verify the electronic report is complete, accurate and contains information from the owner's treatment works.

6.1.6 Records Retention

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by the permit, and records of all data used to complete the application for the permit for a period of at least 3 years from the date of the sample, measurement, report or application. All pertinent sludge information, including permit application information and other documents specified in this permit or s. NR 204.06(9), Wis. Adm. Code shall be retained for a minimum of 5 years.

6.1.7 Other Information

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or correct information to the Department.

6.2 System Operating Requirements

6.2.1 Noncompliance Notification

- The permittee shall report the following types of noncompliance by a telephone call to the Department's regional office within 24 hours after becoming aware of the noncompliance:
  - any noncompliance which may endanger health or the environment;
  - any violation of an effluent limitation resulting from an unanticipated bypass;
  - any violation of an effluent limitation resulting from an upset; and
  - any violation of a maximum discharge limitation for any of the pollutants listed by the Department in the permit, either for effluent or sludge.

- A written report describing the noncompliance shall also be submitted to the Department's regional office within 5 days after the permittee becomes aware of the noncompliance. On a case-by-case basis, the Department may waive the requirement for submittal of a written report within 5 days and instruct the permittee to submit the written report with the next regularly scheduled monitoring report. In either case, the written report shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times; the steps taken or planned to reduce, eliminate and prevent reoccurrence of the noncompliance; and if the noncompliance has not been corrected, the length of time it is expected to continue.

NOTE: Section 292.11(2)(a), Wisconsin Statutes, requires any person who possesses or controls a hazardous substance or who causes the discharge of a hazardous substance to notify the Department of Natural Resources **immediately** of any discharge not authorized by the permit. The discharge of a hazardous substance that is not authorized by this permit or that violates this permit may be a hazardous substance spill. To report a hazardous substance spill, call DNR's 24-hour HOTLINE at **1-800-943-0003**

6.2.2 Flow Meters

Flow meters shall be calibrated annually, as per s. NR 218.06, Wis. Adm. Code.

6.2.3 Raw Grit and Screenings

All raw grit and screenings shall be disposed of at a properly licensed solid waste facility or picked up by a licensed waste hauler. If the facility or hauler are located in Wisconsin, then they shall be licensed under chs. NR 500-536, Wis. Adm. Code.

6.2.4 Sludge Management

All sludge management activities shall be conducted in compliance with ch. NR 204 "Domestic Sewage Sludge Management", Wis. Adm. Code.

6.2.5 Prohibited Wastes

Under no circumstances may the introduction of wastes prohibited by s. NR 211.10, Wis. Adm. Code, be allowed into the waste treatment system. Prohibited wastes include those:

- which create a fire or explosion hazard in the treatment work;
- which will cause corrosive structural damage to the treatment work;
- solid or viscous substances in amounts which cause obstructions to the flow in sewers or interference with the proper operation of the treatment work;
- wastewaters at a flow rate or pollutant loading which are excessive over relatively short time periods so as to cause a loss of treatment efficiency; and
- changes in discharge volume or composition from contributing industries which overload the treatment works or cause a loss of treatment efficiency.

6.2.6 Unscheduled Bypassing

Any unscheduled bypass or overflow of wastewater at the treatment works or from the collection system is prohibited, and the Department may take enforcement action against a permittee for such occurrences under s. 283.89, Wis. Stats., unless:

- The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
- There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
- The permittee notified the Department as required in this Section.

Whenever there is an unscheduled bypass or overflow occurrence at the treatment works or from the collection system, the permittee shall notify the Department <u>within 24 hours</u> of initiation of the bypass or overflow occurrence by telephoning the wastewater staff in the regional office as soon as reasonably possible (FAX, email or voice mail, if staff are unavailable).

In addition, the permittee shall <u>within 5 days</u> of conclusion of the bypass or overflow occurrence report the following information to the Department in writing:

- Reason the bypass or overflow occurred, or explanation of other contributing circumstances that resulted in the overflow event. If the overflow or bypass is associated with wet weather, provide data on the amount and duration of the rainfall or snow melt for each separate event.
- Date the bypass or overflow occurred.
- Location where the bypass or overflow occurred.
- Duration of the bypass or overflow and estimated wastewater volume discharged.
- Steps taken or the proposed corrective action planned to prevent similar future occurrences.
- Any other information the permittee believes is relevant.

6.2.7 Scheduled Bypassing

Any construction or normal maintenance which results in a bypass of wastewater from a treatment system is prohibited unless authorized by the Department in writing. If the Department determines that there is significant public interest in the proposed action, the Department may schedule a public hearing or notice a proposal to approve the bypass. Each request shall specify the following minimum information:

- proposed date of bypass;
- estimated duration of the bypass;

- estimated volume of the bypass;
- alternatives to bypassing; and
- measures to mitigate environmental harm caused by the bypass.

6.2.8 Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control which are installed or used by the permittee to achieve compliance with the conditions of this permit. The wastewater treatment facility shall be under the direct supervision of a state certified operator as required in s. NR 108.06(2), Wis. Adm. Code. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training as required in ch. NR 114, Wis. Adm. Code, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the permit.

6.3 Surface Water Requirements

6.3.1 Permittee-Determined Limit of Quantitation Incorporated into this Permit

For pollutants with water quality-based effluent limits below the Limit of Quantitation (LOQ) in this permit, the LOQ calculated by the permittee and reported on the Discharge Monitoring Reports (DMRs) is incorporated by reference into this permit. The LOQ shall be reported on the DMRs, shall be the lowest quantifiable level practicable, and shall be no greater than the minimum level (ML) specified in or approved under 40 CFR Part 136 for the pollutant at the time this permit was issued, unless this permit specifies a higher LOQ.

6.3.2 Appropriate Formulas for Effluent Calculations

The permittee shall use the following formulas for calculating effluent results to determine compliance with average limits and mass limits:

Weekly/Monthly average concentration = the sum of all daily results for that week/month, divided by the number of results during that time period.

Weekly Average Mass Discharge (lbs/day): Daily mass = daily concentration (mg/L) x daily flow (MGD) x 8.34, then average the daily mass values for the week.

Monthly Average Mass Discharge (lbs/day): Daily mass = daily concentration (mg/L) x daily flow (MGD) x 8.34, then average the daily mass values for the month.

6.3.3 Visible Foam or Floating Solids

There shall be no discharge of floating solids or visible foam in other than trace amounts.

6.3.4 Percent Removal

During any 30 consecutive days, the average effluent concentrations of BOD_5 and of total suspended solids shall not exceed 15% of the average influent concentrations, respectively. This requirement does not apply to removal of total suspended solids if the permittee operates a lagoon system and has received a variance for suspended solids granted under NR 210.07(2), Wis. Adm. Code.

6.3.5 Fecal Coliforms

The limit for fecal coliforms shall be expressed as a monthly geometric mean.

6.3.6 Seasonal Disinfection

Disinfection shall be provided from May 1 through September 30 of each year. Monitoring requirements and the limitation for fecal coliforms apply only during the period in which disinfection is required. Whenever chlorine is used for disinfection or other uses, the limitations and monitoring requirements for residual chlorine shall apply. A dechlorination process shall be in operation whenever chlorine is used.

6.3.7 Applicability of Alternative Wet Weather Mass Limitations

- An alternative wet weather mass limitation applies when:
  - The applicable mass limitation (based on annual average design flow) is exceeded; and
  - The permittee demonstrates to the satisfaction of the Department that the discharge exceedance is caused by and occurs during a wet weather event. For the purposes of this demonstration, a wet weather event occurs during and immediately following periods of precipitation or snowmelt, including but not limited to rain, sleet, snow, hail or melting snow during which water from the precipitation, snowmelt or elevated groundwater enters the sewerage system through infiltration or inflow, or both. The permittee shall present demonstrations to the Department by attaching them to the Wastewater Discharge Monitoring Report Form(s).

Note: In making this demonstration, the permittee may want to consider presenting a discussion of normal effluent flow rates, the effluent flow rates that resulted in the exceedance and identification of the event, including intensity and duration, which caused the high flow rates. A graph of effluent flow over time may also be helpful.

6.3.8 Total Residual Chlorine Requirements (When De-Chlorinating Effluent)

Test methods for total residual chlorine, approved in ch. NR 219 - Table B, Wis. Adm. Code, normally achieve a limit of detection of about 20 to 50 micrograms per liter and a limit of quantitation of about 100 micrograms per liter. Reporting of test results and compliance with effluent limitations for chlorine residual and total residual halogens shall be as follows:

- Sample results which show no detectable levels are in compliance with the limit. These test results shall be reported on Wastewater Discharge Monitoring Report Forms as "< 100 µg/L". (Note: 0.1 mg/L converts to 100 µg/L)

- Samples showing detectable traces of chlorine are in compliance if measured at less than 100 µg/L, unless there is a consistent pattern of detectable values in this range. These values shall also be reported on Wastewater Discharge Monitoring Report Forms as "<100 µg/L." The facility operating staff shall record actual readings on logs maintained at the plant, shall take action to determine the reliability of detected results (such as re-sampling and/or calculating dosages), and shall adjust the chemical feed system if necessary to reduce the chances of detects.

- Samples showing detectable levels greater than 100 µg/L shall be considered as exceedances, and shall be reported as measured.

- To calculate average or mass discharge values, a "0" (zero) may be substituted for any test result less than 100 µg/L. Calculated values shall then be compared directly to the average or mass limitations to determine compliance.

6.3.9 Whole Effluent Toxicity (WET) Monitoring Requirements

In order to determine the potential impact of the discharge on aquatic organisms, static-renewal toxicity tests shall be performed on the effluent in accordance with the procedures specified in the *"State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition" (PUB-WT-797*, November 2004) as required by NR 219.04, Table A, Wis. Adm. Code). All of the WET tests required in this permit, including any required retests, shall be conducted on the *Ceriodaphnia dubia* and fathead minnow species. Receiving water samples shall not be collected from any point in contact with the permittee's mixing zone and every attempt shall be made to avoid contact with any other discharge's mixing zone.

6.3.10 Whole Effluent Toxicity (WET) Identification and Reduction

Within 60 days of a retest which showed positive results, the permittee shall submit a written report to the Biomonitoring Coordinator, Bureau of Watershed Management, 101 S. Webster St., PO Box 7921, Madison, WI 53707-7921, which details the following:

- A description of actions the permittee has taken or will take to remove toxicity and to prevent the recurrence of toxicity;

- A description of toxicity reduction evaluation (TRE) investigations that have been or will be done to identify potential sources of toxicity, including some or all of the following actions:

  (a) Evaluate the performance of the treatment system to identify deficiencies contributing to effluent toxicity (e.g., operational problems, chemical additives, incomplete treatment)
  (b) Identify the compound(s) causing toxicity
  (c) Trace the compound(s) causing toxicity to their sources (e.g., industrial, commercial, domestic)
  (d) Evaluate, select, and implement methods or technologies to control effluent toxicity (e.g., in-plant or pretreatment controls, source reduction or removal)

- Where corrective actions including a TRE have not been completed, an expeditious schedule under which corrective actions will be implemented;

- If no actions have been taken, the reason for not taking action.

The permittee may also request approval from the Department to postpone additional retests in order to investigate the source(s) of toxicity. Postponed retests must be completed after toxicity is believed to have been removed.

6.4 Land Application Requirements

6.4.1 Sludge Management Program Standards And Requirements Based Upon Federally Promulgated Regulations

In the event that new federal sludge standards or regulations are promulgated, the permittee shall comply with the new sludge requirements by the dates established in the regulations, if required by federal law, even if the permit has not yet been modified to incorporate the new federal regulations.

6.4.2 General Sludge Management Information

The General Sludge Management Form 3400-48 shall be completed and submitted prior to any significant sludge management changes.

6.4.3 Sludge Samples

All sludge samples shall be collected at a point and in a manner which will yield sample results which are representative of the sludge being tested, and collected at the time which is appropriate for the specific test.

6.4.4 Land Application Characteristic Report

Each report shall consist of a Characteristic Form 3400-49 and Lab Report, unless approval for not submitting the lab reports has been given. Both reports shall be submitted by January 31 following each year of analysis.

The permittee shall use the following convention when reporting sludge monitoring results: Pollutant concentrations less than the limit of detection shall be reported as < (less than) the value of the limit of detection. For example, if a substance is not detected at a detection limit of 1.0 mg/kg, report the pollutant concentration as < 1.0 mg/kg .

All results shall be reported on a dry weight basis.

6.4.5 Monitoring and Calculating PCB Concentrations in Sludge

When sludge analysis for "PCB, Total Dry Wt" is required by this permit, the PCB concentration in the sludge shall be determined as follows.

Either congener-specific analysis or Aroclor analysis shall be used to determine the PCB concentration. The permittee may determine whether Aroclor or congener specific analysis is performed. Analyses shall be performed in accordance with the following provisions and Table EM in s. NR 219.04, Wis. Adm. Code.

- EPA Method 1668 may be used to test for all PCB congeners. If this method is employed, all PCB congeners shall be delineated. Non-detects shall be treated as zero. The values that are between the limit of detection and the limit of quantitation shall be used when calculating the total value of all congeners. All results shall be added together and the total PCB concentration by dry weight reported. **Note**: It is recognized that a number of the congeners will co-elute with others, so there will not be 209 results to sum.
- EPA Method 8082A shall be used for PCB-Aroclor analysis and may be used for congener specific analysis as well. If congener specific analysis is performed using Method 8082A, the list of congeners tested shall include at least congener numbers 5, 18, 31, 44, 52, 66, 87, 101, 110, 138, 141, 151, 153, 170, 180, 183, 187, and 206 plus any other additional congeners which might be reasonably expected to occur in the particular sample. For either type of analysis, the sample shall be extracted using the Soxhlet extraction (EPA Method 3540C) (or the Soxhlet Dean-Stark modification) or the pressurized fluid extraction (EPA Method 3545A). If Aroclor analysis is performed using Method 8082A, clean up steps of the extract shall be performed as necessary to remove interference and to achieve as close to a limit of detection of 0.11 mg/kg as possible. Reporting protocol, consistent with s. NR 106.07(6)(e), should be as follows: If all Aroclors are less than the LOD, then the Total PCB Dry Wt result should be reported as less than the highest LOD. If a single Aroclor is detected then that is what should be reported for the Total PCB result. If multiple Aroclors are detected, they should be summed and reported as Total PCBs. If congener specific analysis is done using Method 8082A, clean up steps of the extract shall be performed as necessary to remove interference and to achieve as close to a limit of detection of 0.003 mg/kg as possible for each congener. If the aforementioned limits of detection cannot be achieved after using the appropriate clean up techniques, a reporting limit that is achievable for the Aroclors or each congener for the sample shall be determined. This reporting limit shall be reported and qualified indicating the presence of an interference. The lab conducting the analysis shall perform as many of the following methods as necessary to remove interference:

3620C – Florisil	3611B - Alumina
3640A - Gel Permeation	3660B - Sulfur Clean Up (using copper shot instead of powder)
3630C - Silica Gel	3665A - Sulfuric Acid Clean Up

6.4.6 Land Application Report

Land Application Report Form 3400-55 shall be submitted by January 31, following each year non-exceptional quality sludge is land applied. Non-exceptional quality sludge is defined in s. NR 204.07(4), Wis. Adm. Code.

6.4.7 Other Methods of Disposal or Distribution Report

The permittee shall submit Report Form 3400-52 by January 31, following each year sludge is hauled, landfilled, incinerated, or when exceptional quality sludge is distributed or land applied.

6.4.8 Approval to Land Apply

Bulk non-exceptional quality sludge as defined in s. NR 204.07(4), Wis. Adm. Code, may not be applied to land without a written approval letter or Form 3400-122 from the Department unless the Permittee has obtained permission from the Department to self approve sites in accordance with s. NR 204.06 (6), Wis. Adm. Code. Analysis of sludge characteristics is required prior to land application. Application on frozen or snow covered ground is restricted to the extent specified in s. NR 204.07(3) (l), Wis. Adm. Code.

6.4.9 Soil Analysis Requirements

Each site requested for approval for land application must have the soil tested prior to use. Each approved site used for land application must subsequently be soil tested such that there is at least one valid soil test in the four years prior to land application. All soil sampling and submittal of information to the testing laboratory shall be done in accordance with UW Extension Bulletin A-2100. The testing shall be done by the UW Soils Lab in Madison or Marshfield, WI or at a lab approved by UW. The test results including the crop recommendations shall be submitted to the DNR contact listed for this permit, as they are available. Application rates shall be determined based on the crop nitrogen recommendations and with consideration for other sources of nitrogen applied to the site.

6.4.10 Land Application Site Evaluation

For non-exceptional quality sludge, as defined in s. NR 204.07(4), Wis. Adm. Code, a Land Application Site Request Form 3400-053 shall be submitted to the Department for the proposed land application site. The Department will evaluate the proposed site for acceptability and will either approve or deny use of the proposed site. The permittee may obtain permission to approve their own sites in accordance with s. NR 204.06(6), Wis. Adm. Code.

6.4.11 Class B Sludge: Fecal Coliform Limitation

Compliance with the fecal coliform limitation for Class B sludge shall be demonstrated by calculating the geometric mean of at least 7 separate samples. (Note that a Total Solids analysis must be done on each sample). The geometric mean shall be less than 2,000,000 MPN or CFU/g TS. Calculation of the geometric mean can be done using one of the following 2 methods.

Method 1:

Geometric Mean = $(X_1 \times X_2 \times X_3 \ldots \times X_n)^{1/n}$

Where X = Coliform Density value of the sludge sample, and where n = number of samples (at least 7)

Method 2:

Geometric Mean = $\text{antilog}[(X_1 + X_2 + X_3 \ldots + X_n) \div n]$

Where X = $\log_{10}$ of Coliform Density value of the sludge sample, and where n = number of samples (at least 7)

Example for Method 2

Sample Number	Coliform Density of Sludge Sample	$\log_{10}$
1	6.0×10^5	5.78
2	4.2×10^6	6.62
3	1.6×10^6	6.20

4	9.0×10^5	5.95
5	4.0×10^5	5.60
6	1.0×10^6	6.00
7	5.1×10^5	5.71

The geometric mean for the seven samples is determined by averaging the $\log_{10}$ values of the coliform density and taking the antilog of that value.

$(5.78 + 6.62 + 6.20 + 5.95 + 5.60 + 6.00 + 5.71) \div 7 = 5.98$

The antilog of $5.98 = 9.5 \times 10^5$

6.4.12 Vector Control: Volatile Solids Reduction

The mass of volatile solids in the sludge shall be reduced by a minimum of 38% between the time the sludge enters the digestion process and the time it either exits the digester or a storage facility. For calculation of volatile solids reduction, the permittee shall use the Van Kleeck equation or one of the other methods described in "Determination of Volatile Solids Reduction in Digestion" by J.B. Farrell, which is Appendix C of EPA's *Control of Pathogens in Municipal Wastewater Sludge* (EPA/625/R-92/013). The Van Kleeck equation is:

$$VSR\% = \frac{VS_{IN} - VS_{OUT}}{VS_{IN} - (VS_{OUT} \times VS_{IN})} \times 100$$

Where: VS_{IN} = Volatile Solids in Feed Sludge (g VS/g TS)

VS_{OUT} = Volatile Solids in Final Sludge (g VS/g TS)

VSR% = Volatile Solids Reduction, (Percent)

6.4.13 Class B Sludge - Vector Control: Injection

No significant amount of the sewage sludge shall be present on the land surface within one hour after the sludge is injected.

6.4.14 Land Application of Sludge Which Contains Elevated Levels of Radium-226

When contributory water supplies exceed 2 pci per liter of Radium 226, monitoring for Radium 226 in sludge is required. Sludge containing Radium 226 shall be land applied in accordance with the requirements in s. NR 204.07(3)(n), Wis. Adm. Code.

7 Summary of Reports Due

FOR INFORMATIONAL PURPOSES ONLY

Description	Date	Page
Mercury Pollutant Minimization Program -Implement the Mercury Pollutant Minimization Program (PMP) Plan	See Permit	12
Mercury Pollutant Minimization Program -Annual Report #1	February 15, 2009	12
Mercury Pollutant Minimization Program -Annual Report #2	February 15, 2010	12
Mercury Pollutant Minimization Program -Annual Report #3	February 15, 2011	12
Mercury Pollutant Minimization Program -Annual Report #4	February 15, 2012	12
Mercury Pollutant Minimization Program -Submit Final Report	February 15, 2013	12
Chemical Specific Toxic Pollutants - Cyanide, Amenable -Report on Effluent Discharges	December 31, 2009	12
Chemical Specific Toxic Pollutants - Cyanide, Amenable -Action Plan	June 30, 2010	12
Chemical Specific Toxic Pollutants - Cyanide, Amenable -Initiate Actions	September 30, 2010	12
Chemical Specific Toxic Pollutants - Cyanide, Amenable -Complete Actions	December 31, 2011	12
Compliance Maintenance Annual Reports (CMAR)	by June 30, each year	14
General Sludge Management Form 3400-48	prior to any significant sludge management changes	19
Characteristic Form 3400-49 and Lab Report	by January 31 following each year of analysis	20
Land Application Report Form 3400-55	by January 31, following each year non-exceptional quality sludge is land applied	21
Report Form 3400-52	by January 31, following each year sludge is hauled, landfilled, incinerated, or when exceptional quality sludge is distributed or land applied	21
Wastewater Discharge Monitoring Report	no later than the date indicated on the form	13

Report forms shall be submitted to the address printed on the report form. Any facility plans or plans and specifications for municipal, industrial, industrial pretreatment and non industrial wastewater systems shall be

submitted to the Bureau of Watershed Management, P.O. Box 7921, Madison, WI 53707-7921. All other submittals required by this permit shall be submitted to:
Southeast Region - Waukesha, 141 NW Barstow St., Room 180, Waukesha, WI 53188

APPENDIX D
WWTP DATA

TABLE D-1

EFFLUENT BOD_5 (mg/L)[1]

Month	2004	2005	2006	2007	2008	2009	2010
January	2.6	2.2	2.0	2.0	2.5	2.0	4.5
February	2.4	2.1	2.0	2.0	2.4	2.0	5.1
March	2.2	2.0	2.4	3.0	2.8	2.1	5.8
April	2.0	2.3	2.4	3.1	3.2	2.1	3.8
May	2.4	2.0	2.0	2.0	2.0	2.6	3.2
June	2.0	2.1	2.0	2.0	3.2	2.9	3.0
July	2.0	2.3	2.0	2.0	2.1	3.2	4.0
August	2.0	2.1	2.0	3.9	2.0	2.3	4.6
September	2.4	2.2	2.0	2.0	2.0	3.5	6.1
October	2.2	2.1	2.0	2.3	2.1	5.3	
November	2.9	2.1	2.2	2.5	2.0	6.6	
December	2.8	2.0	2.0	2.3	2.1	5.3	
Annual Average [2]	**2.3**	**2.1**	**2.1**	**2.4**	**2.4**	**3.3**	**4.5**

[1] Effluent values taken from Discharge Monitoring Reports 2004-2010.
[2] Annual average values are based on the average of the monthly average daily effluent.

TABLE D-2

EFFLUENT TSS (mg/L)[1]

Month	2004	2005	2006	2007	2008	2009	2010
January	5.0	3.0	1.8	2.7	3.4	1.4	5.2
February	5.0	3.0	1.7	2.0	3.6	2.2	6.9
March	4.0	3.0	2.1	3.9	4.9	1.8	8.4
April	3.0	4.0	2.3	6.6	4.6	1.7	2.9
May	4.0	3.0	2.7	2.0	1.8	1.7	3.2
June	1.0	3.0	1.1	0.7	4.0	2.0	3.2
July	2.0	3.0	1.2	1.0	2.0	3.4	3.0
August	3.0	2.0	1.1	5.6	1.0	1.8	3.5
September	3.0	1.0	1.2	1.7	1.3	3.5	8.0
October	3.0	2.0	2.3	3.4	1.4	5.4	
November	5.0	2.0	2.7	1.8	1.3	6.9	
December	5.0	1.0	2.5	3.4	2.2	4.7	
Annual Average [2]	**3.6**	**2.5**	**1.9**	**2.9**	**2.6**	**3.0**	**4.9**

[1] Effluent values taken from Discharge Monitoring Reports 2004-2010.
[2] Annual average values are based on the average of the monthly average daily effluent.

TABLE D-3

EFFLUENT AMMONIA NITROGEN (mg/L) [1]

Month	2004	2005	2006	2007	2008	2009	2010
January	0.1	0.1	0.1	0.1	0.1	0.1	0.1
February	0.1	0.1	0.1	0.1	0.1	0.5	0.1
March	0.1	0.1	0.2	0.2	1.3	0.1	1.2
April	0.1	1.1	0.1	0.2	0.3	0.1	0.1
May	0.1	0.1	0.1	0.1	0.1	0.1	0.1
June	0.1	0.1	0.1	0.1	0.2	0.1	0.1
July	0.1	0.1	0.1	0.1	0.1	0.1	0.1
August	0.1	0.1	0.1	0.2	0.1	0.1	0.1
September	0.1	0.1	0.1	0.3	0.2	2.3	0.2
October	0.1	0.1	0.1	0.4	0.3	0.7	
November	0.1	0.1	0.3	0.1	0.2	1.0	
December	0.4	0.1	1.0	0.1	0.2	0.9	
Annual Average [2]	**0.1**	**0.2**	**0.2**	**0.2**	**0.3**	**0.5**	**0.2**

[1] Effluent values taken from Discharge Monitoring Reports 2004-2010.
[2] Annual average values are based on the average of the monthly average daily effluent.

TABLE D-4

EFFLUENT PHOSPHORUS (mg/L)[1]

Month	2004	2005	2006	2007	2008	2009	2010
January	0.7	0.4	0.4	0.5	0.4	0.3	0.3
February	0.9	0.4	0.5	0.6	0.6	0.8	0.6
March	0.8	0.5	0.5	0.7	0.5	0.4	0.8
April	0.5	0.6	0.5	0.6	0.4	0.4	0.5
May	0.6	0.5	0.4	0.6	0.6	0.6	0.5
June	0.5	0.9	0.5	0.7	0.6	0.6	0.3
July	0.3	0.7	0.6	0.7	0.4	0.5	0.4
August	0.9	0.8	0.8	0.5	0.6	0.5	0.6
September	0.9	0.9	0.6	1.0	0.7	0.9	0.9
October	0.9	0.9	0.5	0.6	0.8	0.8	
November	0.7	0.6	0.3	0.5	0.5	0.7	
December	0.7	0.5	0.4	0.7	0.4	0.7	
Annual Average [2]	**0.7**	**0.6**	**0.5**	**0.6**	**0.5**	**0.6**	**0.5**

[1] Effluent values taken from Discharge Monitoring Reports 2004-2010.
[2] Annual average values are based on the average of the monthly average daily effluent.

TABLE D-5

EFFLUENT FECAL COLIFORM (Geometric Mean)[1]

Month	2004	2005	2006	2007	2008	2009	2010
January to April	NA	NA	NA	NA	NA	NA	NA
May	27	81	18	157	11	28	12
June	55	55	37	14	53	82	29
July	100	94	74	12	37	163	25
August	51	26	44	29	23	43	270
September	18	4	96	20	91	9	90
October to December	NA	NA	NA	NA	NA	NA	NA
Annual Average [2]	**50**	**52**	**54**	**46**	**43**	**65**	**85**

[1] Effluent values taken from Discharge Monitoring Reports 2004-2010.
[2] Annual average values are based on the average of the monthly geometric means.

APPENDIX E
STRUCTURAL, MECHANICAL, AND ELECTRICAL SYSTEM EVALUATION

These observations were made during a site visit in 2008. Some of these inadequacies have been addressed as part of the 2010 project as discussed in Section 5.

E.01 GENERAL/MISCELLANEOUS

Site

1. Many yard hydrants leak and are inoperable. Yard hydrant replacement is recommended.
2. Well water used for potable water at the plant contains high levels of minerals including iron. Bottled water is used by plant staff. Consider bringing City water to the WWTP.
3. Consider providing access to plant effluent to allow vactor truck to fill tank. Alternatively, a plant effluent hydrant could be installed to fill tanks. Potentially could use plant effluent for yard hydrants, though existing pumps would need to be evaluated for capacity.

Structural

1. The majority of the buildings' exterior doors and windows are failing or nonoperational. Replacement is recommended.
2. Overall exterior and interior masonry is in an acceptable condition; minor cracking, and mortar joint repair (RBC Building) is recommended as required.
3. Storage for and drive through capabilities for plant vehicles may be able to be accomplished within the existing facilities depending on the dispensation of some of the existing buildings.
4. Storage of lubricants and similar materials needs to be addressed throughout the WWTP, according to WWTP staff.

HVAC

1. All equipment installed in the original plant construction (Administration Building, Tunnel, Digester Control Building, Filtration Building, Primary and Secondary Pump Building, and RBC Buildings) are past or near their expected useful life. Replacement is recommended.
2. Fine mesh stainless steel screens were missing throughout the plant on natural gas pressure regulator vents. This may have an adverse effect on the operation of the regulators.
3. Review need for fall protection measures on heating, ventilating, and air-conditioning (HVAC) equipment that is within 10 feet of the roof edge.
4. All natural gas valves in the plant are designed in a manner that they cannot be rebuilt once they start to leak and have to be replaced. As valves start to leak, recommend replacement with valves that can be rebuilt in the field.

Electrical

1. Grounding for all buildings is poor. It appears the only ground for each of the buildings (besides the Administration Building) may be from the ground conductors run with the power feeds to each of the buildings. Recommend three ground rods and associated ground conductor be installed for each Motor Control Center (MCC) in each building. Also recommend testing the grounding system for each MCC once the new ground rods are installed.
2. All MCCs in the plant are from the original construction in 1982. The typical life expectancy for this type of equipment is 20 years and therefore this equipment is near the end of its useful life.

3. All the lights around the plant are currently on individual photocells. As an energy-saving measure, contactors could be added to the programmable logic controllers (PLC) panels around the plant and the lights controlled from the Supervisory Control and Data Acquisition (SCADA) System. This would allow the operators to select several options for control of the lights such as PHOTOCELL ON AND OFF, PHOTOCELL ON–TIME CLOCK OFF, or TIME CLOCK ON AND OFF.
4. The enclosures for the high torque alarm/shutdown control panels on the primary and secondary clarifiers are in very poor condition. Recommend removing these control panels and installing these control features within the associated MCCs.
5. It was noted that the existing hardware alarm dialer is cumbersome to program when the call list needs to be changed. A software alarm dialer could be added to the SCADA computer that would make these changes easier and provide more flexibility for alarm call-outs. If a software dialer is utilized, it is recommended that the existing hardware dialer be used as a backup in case of a computer failure.
6. Plant staff has indicated there are numerous broken conduits throughout the plant. Recommend that these be documented to the extent possible and repaired as part of the next plant upgrade.
7. The existing PLCs throughout the plant are currently interconnected using three conductor's shielded cable. Recommend replacing this wiring with fiber-optic cable and setting up a self-healing ring-type configuration for communication between the PLCs. Fiber-optic cable is not susceptible to lightning strikes and electrical noise, which can damage the PLC or cause operational issues. The self-healing ring provides redundancy in the fiber-optic communication loop such that if a fiber is damaged, the system automatically switches to a second pair of fibers to keep the communications functional.
8. There are existing power factor correction capacitors located throughout the plant. Currently the plant is not penalized for low power factor. Recommend asking the Utility Company to provide information regarding the power factor for the plant. With this information, a decision can be made regarding the need for these. It appears these capacitors are free of polychlorinated biphenyls (PCBs).
9. The SCADA System currently monitors the power usage of the plant. From the trend screens of this data, the operators can determine, to a certain extent, what causes high power demands within the plant. Recommend using this data to reduce Demand charges from the Utility Company by avoiding starting equipment during on-peak electrical times if the equipment is not absolutely necessary. Modifying operating procedures where practical based on this information could also save energy and associated electrical costs.
10. Based on discussions with plant staff, it does not appear the SCADA System is utilized to its full capacity. Recommend detailed discussion regarding process controls that are currently done through the SCADA System and those that are not. Potential exists for additional energy savings as well as increased operational efficiency.

E.02 ADMINISTRATION BUILDING

Structural

1. Current staff, including seasonal employees, equals 12. The following space needs are developed based on the current staff.
   a. Current clerical/reception area is not separated from the building entry, providing limited security for records stored in this area. Partitioning of space is recommended with an additional 200 square feet of secure storage space recommended.

b. Existing laboratory and lab storage sizes are sufficient for current operations. Laboratory records storage may increase over time, current storage is sufficient. Laboratory and laboratory records storage remodeling may be required to address any inefficiencies in the current layout and operation.

c. Existing office space is limited; the addition of one office to provide workspace and records storage for two employees is recommended. Total additional square footage equals 250 square feet. In addition, conversion of the existing first floor SCADA room to an office is also recommended; see breakroom description below for additional conference room space.

d. SCADA room is sufficiently sized for SCADA operation; the addition of one Map/CMOM Room is recommended at a total of 300 square feet. This room will replace the existing room above the existing breakroom adjacent to the shop, see note 2 below.

e. Existing breakroom was built into space originally designated as a welding booth; it is not adequately sized for current staff. Recommend creating new break/training room with square footage equal to 600 square feet. Existing space will be returned to the shop to provide additional shop space.

f. Currently there is not a female locker room; recommend addition of space to accommodate locker and shower facilities totaling 400 square feet.

g. Existing plant-wide vehicle storage is not sufficient. Recommend additional space for storage of current vehicles with drive through capacity.

h. Existing material storage is limited and inadequate. The plant has built a mezzanine for pipe storage in the existing vehicle storage bays. Recommend additional storage space to be planned for; additional mezzanine space should be considered.

2. Stair between breakroom and map room may not meet current code because of 7 1/2-inch rise and 9-inch tread and headroom requirements. We recommend removal of break and map room and turning the space back into shop space.
3. Chemicals and oil are stored under stair to old belt filter press (BFP) room. This may not comply with current code and should be reviewed. Additional storage space may be required to meet current code.
4. Second exit may be required in upstairs MCC room to comply with current code, or it may be possible to remove this MCC.
5. Main switchgear room doors may be required by building code to swing outward.
6. Stairwells to the second floor may need to be enclosed in a rated shaft enclosure.
7. Barrier-free access to the second floor may be required. This requirement is contingent upon the use and occupancy of the second floor level and the total value of the improvements undertaken within the building.
8. Additional shop storage/small inventory space may be accommodated for in room currently occupied by the water well treatment system and hydropneumatic storage tank if the plant abandons the well and tank and used City water.
9. Existing restrooms and locker room are not accessible/barrier-free. Redesign to meet current code requirements and/or new facilities located within the building will be required. Women's facilities (locker room and showers) must also be provided to meet the current building code.
10. Existing boiler appears to meet the current building code requirements for fire wall separation and/or sprinkler protection.

HVAC

1. Cooling tower is no longer needed. Pipe has been arbitrarily cut off. Remove all work associated with the cooling tower.
2. The pneumatic controls were rebuilt in 2000. They appear old but are in good working condition. Could upgrade to direct digital controls (DDC). Recommend this for central monitoring, control, etc.
3. To assist in plant maintenance, operators routinely weld in their shop. A welding hood may be required as well as a thorough code review for the space.
4. Old BFP Room axial fan and associated gravity roof ventilator should be removed.
5. No heat is provided in the old BFP Room. An opening to the first floor below is kept open and heat rises.
6. Outside air intake louver is located right next to the septage receiving station.
7. There are two existing Clever Brooks Model 4 boilers. CB M4W-4500 Series 200 MG. Serial No. G-12981-M4. 4,500 Thousand British Thermal Units Per Hour (MBH) input, 3,600 MBH output. Oil usage is 32.7 GPH. These boilers may need to be in a rated room.
8. One of the expansion tanks is not operational. The expansion tanks in general have been experiencing pinholes and should be replaced. According to plant staff, a corrosion inhibitor has not been added in a long time. This is recommended to prevent degradation of the piping interior. We recommend a maintenance plan to monitor and install inhibitor as needed.
9. A duct is located above the MCC in the influent lift station. This does not meet the National Electric Code (NEC).
10. The switch to activate the ventilation in the wet well is currently located in the room adjacent to the wet well. Recommend this switch be relocated to the stairs entering the wet well to help minimize staff entering the wet well without activating the ventilation system. Further review is required to eliminate the confined space requirement.
11. The breakroom is not ventilated. A window air conditioner is installed.
12. Standby power engines are dual fuel natural gas and diesel. They work fine on diesel, but the engines trip out on overtemp on natural gas. Engines are not ducted to the exterior, which may lead to high temperatures in the space. Intake louver sizes appear to be too small to accommodate generator operation.
13. Switchgear room may need mechanical cooling. Currently it is just ventilated.
14. The boiler circulating pump control panel is powered from a different circuit than the associated boilers. If power is lost to the circulating pump control panel, the pumps shut down but the boilers do not. An alarm can be generated at SCADA to indicate boiler circulation pump fail.
15. According to plant staff, the boilers are oversized and constantly cycle on and off when in the Auto mode because they come up to temperature so fast. Because of this, the boilers are operated in the Manual mode, which makes their operation less efficient.

Electrical

1. The raw sewage pumps are currently controlled from an old Consolidated Electric D620 controller. There is a PLC in the panel adjacent to the panel with this controller that can be utilized to control the pumps in lieu of the D620. Recommend removing the D620 controller and adding the raw sewage pump controls to the existing PLC and SCADA System.
2. There have been instances in the past where water has accumulated in the wireway pit below the main switchgear. It appears possible to core a hole out the north end of this pit and run a drain pipe down to the sump pit in this stairwell on the lower level.

3. There have been two instances where the plant main breaker tripped before the feeder breaker associated with the fault tripped. Recommend that all feeder and main breaker settings in the main switchgear be reviewed for proper coordination. May also want to have the trip units on each of these breakers tested to make sure they are functioning properly.
4. There was a problem with the standby generators where the generators tripped out on over-temperature when running on natural gas and the units had to be run on diesel. A service technician replaced a temperature sensor after this event, so this may have alleviated the problem.
5. MCC-3 located in the Generator/Boiler room has not been tied into the SCADA system yet.
6. According to plant staff, the lightning protection system was compromised when the building was reroofed. Staff intends to fix this.

E.03 PRELIMINARY TREATMENT BUILDING

Structural

Exterior door(s) are not functioning properly. Consider replacement.

HVAC

1. Equipment in this building was installed in 1996 and is in fair working order.
2. Screens missing on inlets of exhaust fan ducts down to the floor.
3. Rooftop unit has had issues in the past with freezing up, but this has been addressed by plant staff.

E.04 RBC BUILDINGS

Structural

1. Buildings structurally sound with timber roof framing and steel columns.
2. The brick course is 13 feet 4 inches high from floor to bottom of beam and 14 feet 8 inches on the endwall. A 12-foot-high overhead door could potentially be installed in the buildings.
3. Minor cracked block in room between RBC buildings.
4. Lubricant stored in room between RBC buildings. This may not comply with current code.
5. No secondary containment for lubricant at RBCs. Lubricant could leak into wastewater flow below.

HVAC

1. Mold is present, according to WWTP staff.
2. Review cost to replace HVAC prior to proceeding.
3. Louvers are styrofoamed over and manually removed.
4. Ductwork is galvanized and rusting because of high humidity environment.
5. Vortex inline fans draw 300 cfm off two contactors. Fan is plug-in type, 120 volt. Cost is around $250 to replace fan.
6. Gas-fired air handling units (AHUs) were removed in two of the three RBC buildings. The one remaining operates, but access doors were open, actuators do not work, and so on.
7. Gas heaters are installed in the buildings where the AHUs were removed.

8. Would recommend increasing ventilation to the spaces and increase negative pressure ventilation on the RBC.

Electrical

1. The existing lighting around the perimeter of each of the RBC buildings is High Pressure Sodium (HPS), which was recently installed. This lighting takes several minutes to come up to full brightness and the lighting levels are poor. Recommend replacing four fixtures per building with fluorescent lighting. The lighting down the center of each building and between buildings is fluorescent with T12 lamps. Recommend replacing these fixtures with fluorescent lighting with T8 lamps.
2. All signals to/from the RBC buildings are currently hard-wired to the Administration Building. Recommend providing PLC(s) in this area and tying them into the other PLCs within the plant.
3. Recommend NEMA 4X environment classification because of high humidity.

E.05 PRIMARY AND SECONDARY PUMP BUILDINGS

HVAC

1. Both buildings are the same. Electric heater for heat, intake louver and exhaust fan for cooling.
2. Keep the same setup, barring any process or electrical changes to the building.

Electrical

The existing lighting in these buildings is incandescent and lighting levels are poor. Recommend replacing this lighting with fluorescent lighting that will save energy and increase the light levels.

E.06 FILTER BUILDING

Structural

1. If chlorine is to remain, consider dividing existing chlorine room into two spaces, one for chlorine storage and one for storage of plant equipment.
2. Concrete has spalled where the handrail is bolted to the top of wall of the chlorine contact tank.
3. Monorail may require repainting.

HVAC

1. Natural gas unit heaters are installed in the filter room and chlorine room. Both are considered NEMA 4X areas. We recommend corrosion-resistant electric unit heaters for equipment longevity. Units should be sized to accommodate winter ventilation.
2. Gas unit heater in the chlorine room was new. Replacement is recommended, even though equipment is new. See notes above.
3. Chemical storage volumes should be considered for fire protection triggers (five ~150-pound chlorine cylinders).
4. MCC room may require mechanical cooling. Currently, it pulls air into the room through the filter room.

Electrical

1. The existing lighting in the filter room is HPS and lighting levels are poor. Recommend replacing existing lighting with fluorescent lighting.
2. The existing NPW system control panel contains mercury pressure switches. Recommend replacement of these pressure switches with nonmercury type.
3. The filters are currently backwashed manually. This control could be added to the existing SCADA System while maintaining the ability to manually backwash the filters if the need arises.
4. The existing lighting in the blower room is fluorescent with T12 lamps. Recommend replacing these fixtures with fluorescent lighting with T8 lamps.
5. The existing lighting in the chlorine and sodium bisulfite rooms is incandescent and lighting levels are poor. Recommend replacing this lighting with fluorescent lighting that will save energy and increase the light levels.
6. According to plant staff, the lightning protection system was compromised when the building was reroofed. Recommend this system be repaired so that it is in proper operating order.
7. There are junction boxes and control stations in the filter backwash wet well manhole located just outside the filter building. The junction boxes are completely corroded away and need to be replaced. We also recommend that the control stations be removed from this location. Plant staff has indicated these modifications are already in the works.

E.07 TUNNEL TO THE DIGESTER CONTROL BUILDING

Structural

1. Current building code requires a 2-hour separation between the tunneled walkway and the building to which it is connected. Since neither building on either end of the tunnel is anticipated to be changing, use of the current tunnel will most likely be acceptable. Consider the potential separation and Control Building stair redesign as a life safety issue.

HVAC

Tunnel is not ventilated. The tunnel should be rated Class 1 Division 2 or ventilation provided.

Electrical

The light level in the tunnel is poor even though there are numerous incandescent fixtures. Recommend replacing lighting with new fluorescent fixtures that will save energy and increase the light levels.

E.08 DIGESTER CONTROL BUILDING

General

1. Only one heat exchanger is operational and connected to the boiler system.
2. Digester gas equipment is not operational. The accumulators are not connected to flame traps. The flame traps were removed to allow the accumulators to drain.
3. Perth gas mixing system in two primary digesters is not operational. The two primary digesters are currently only mixed by their dedicated recirculation pump.

4. Tires are being stored in heat exchanger room.
5. An access point in the exterior wall of digesters would allow tanks to be drained, cleaned, and maintained more efficiently.

Structural

1. The roofs of the digester covers are in good shape. The metal portion of the covers in contact with the tank contents appears to be corroded. We recommend repainting the digester covers.
2. The wooden stairs and platforms to the digester covers have been exposed to the elements for 28 years and are showing signs of age. Replacement of wooden access catwalk with aluminum or other suitable material should be evaluated.

Electrical

1. The lighting level in the digester basement is poor and utilizes incandescent fixtures. Recommend replacing lighting with new fluorescent fixtures that will save energy and increase the light levels.
2. There is fluorescent lighting with T12 lamps on the first floor. Recommend replacing this with fluorescent lighting with T8 lamps.
3. A new methane gas leak detector needs to be provided for the basement. According to plant staff, occasionally a drip trap is left open inadvertently and the building fills up with methane. Installation of automatic drip traps would also help alleviate this situation.
4. Occasionally the digester heat exchangers get left in the “Hand” mode, which causes an over-temperature condition. Recommend that a safety interlock be added in the Hand mode to prevent this condition.
5. Plant staff have indicated they would like to add a timer next to the transfer valve in the basement. The timer would be set when the valve is open and would cause an alarm at the SCADA System if someone forgets to come back and close the valve and disable the timer. Another option for this would be to install an automatic valve that is controlled from the SCADA System.
6. According to plant staff, the lightning protection system was compromised when the building was reroofed. Recommend this system be repaired so that it is in proper operating order.

E.09 WASTE GAS SPHERE AND COMPRESSOR

Gas sphere has not been operational for over 10 years. Interior of tank should be evaluated prior to placing sphere back in service. Condition of all appurtenances suggests the gas sphere and compressor may be past operational life.

E.10 WASTE GAS BURNER

Automatic starter on waste gas burner does not function. Recommend complete flare replacement.