FAIRMONT

Howard R. Green Company

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FAIRMONT WASTEWATER TREATMENT PLANT

2006

Howard R. Green Company

SPECIAL THANKS TO

PUBLIC UTILIES COMMISSION
Bill Supalla
Joe Kurtzman
Andy Noll
Jeff Ziemer
David Kuhl

CITY COUNCIL
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WASTEWATER TREATMENT PLANT STAFF
Butch Hybbert, Wastewater Plant Superintendent
Tom Fisch, Wastewater Operations Supervisor
Dave Schiltz, Plant Operator and Maintenance
Neal Becker, Collection System Maintenance
Russ Nelson, Plant Operator and Maintenance/Collection System Maintenance
Paul Moe, Plant Operator and Maintenance/Collection System Maintenance

ENGINEER: Howard R. Green Company

CONTRACTOR AND SUBCONTRACTORS:
Gridor Construction, Inc. – General Contractor
Schammel Electric
Tri-State Mechanical
Kahler Automation
Young Masonry, Inc.
Fairmont Concrete, Inc.
Patten Roofing
Miesen's Color Center Co., Inc.
Welp Construction

FAIRMONT WWTP DESIGN PARAMETERS

Flow

Annual Average Day, mgd	2.35
Maximum Day, mgd	7.57
Peak Hour, mgd	11.60

Loadings	Average Day	Max Day
Carbonaceous BOD lb/day	3,235	7,675
Total Suspended Solids, lbs/day	3,300	8,295
Nitrogen, Ammonia, lbs/day	276	552
Phosphorus (Total), lbs/day	82	246

Treatment Units

Item	Number	Detail
Flow Measurement	1	Parshall Flume 1'-6" wide
Mechanically Cleaned Bar Screens	2	3'-0" Wide, 1/4" Openings
Grit Removal	2	Vortex Grit Units, 7 mgd Each, Grit Concentrator, Dewatering Screens
Primary Clarifiers	2	70 ft. Diameter, Center Feed, Sludge Collector, Scum Removal
Aeration Tanks	3	135,000 cu. ft., Fine Bubble Diffused Aeration Equipment
Blowers	3	Positive Displacement, 125 Hp
Secondary Clarifier	4	Two New 75 ft Diameter, Center Feed, Sludge Collector, Scum Removal Two Existing 57 ft. Diameter Peripheral Feed, Sludge Collector, Scum Removal
UV Disinfection	1	Horizontal Bulb Arrangement in Channel
Return Activated Sludge Pumps	7	Three New Centrifugal Four Existing All w/ AFD's
Primary Sludge Pumps	3	Air Operated Diaphragm
Waste Activated Sludge Pumps	2	Existing Centrifugal
WAS Holding Tank	1	Retrofitted Gravity Thickener W/ Mixer
WAS Transfer Pumps	2	Centrifugal
WAS Thickening	1	100 gpm Rotary Drum w/ Polymer
Anaerobic Digesters	2	36 Ft. Dia. Fixed Cover w/External Draft Tube Mixers
Sludge Storage Tank	1	36 Ft. Dia. Floating Gas Holder Cover w/ Recirculation Mixing
Digester Feed Pumps	2	Progressing Cavity Pumps
Belt Filter Press	1	1 Meter High Solids BFP w/Polymer System
Belt Filter Press Feed Pumps	2	Progressing Cavity Pumps
Sludge Dryer	1	Class A Heat Dryer w/ Hopper and Discharge Conveyor
Dewatered Sludge Storage	1	180 Days of Dewatered or Dried Storage
Effluent Water System	1	Packaged PEW System w/ Pumps and Controls

LIQUID TREATMENT PROCESS

As the wastewater enters the Fairmont WWTP the first treatment step is screening. Two mechanically cleaned bar screens remove sticks, rags, large solids and other debris that may prove harmful to downstream plant equipment. Following screening, the influent flow is sampled for influent characteristics and measured thru a Parshall flume.

After the screening process the grit and sand is removed from the influent wastewater through two vortex grit removal units. The heavier grit particles settle out of the wastewater flow and are collected and pumped into a grit washer and dewatering units. The grit removed from the influent wastewater flow is deposited in containers for disposal at the landfill.

Two new 75-foot diameter primary clarifier tanks are used to settle the wastewater and separate the liquid from the solids by gravity settling of solid particles. The primary clarifiers also serve the main function of phosphorus removal. Ferric chloride is added to each of the primary clarifiers to chemically bind the phosphorus molecules and precipitate out the phosphorus as solids.

ANCILLARY FACILITIES AT THE WASEWATER TREATMENT PLANT

Backup power for the entire WWTP is provided through the use of a new stand-by engine generator. This stand-by engine generator gives the plant the capability to maintain its operation independently of emergency power outages or during normal peak power demand periods.

Automatic control of the treatment processes and various plant systems is accomplished through a Supervisory Control and Data Acquisition (SCADA) system. The computer based control and monitoring system consists of control stations and interfaces to multiple plant programmable logic controllers (PLCs).

The existing Control Building received a face lift as part of the WWTP improvements. The laboratory was relocated to a larger area, the locker room and restrooms were improved. The new laboratory is where the process control analysis is completed to ensure compliance with the plant's discharge permit is done.

A new Maintenance Garage was constructed on the WWTP site to provide vehicle, equipment and parts storage, and to provide area for WWTP maintenance procedures. The new building is a wood-framed metal building with several overhead doors.

FAIRMONT WWTP – NPDES EFFLUENT PERMIT LIMITATIONS

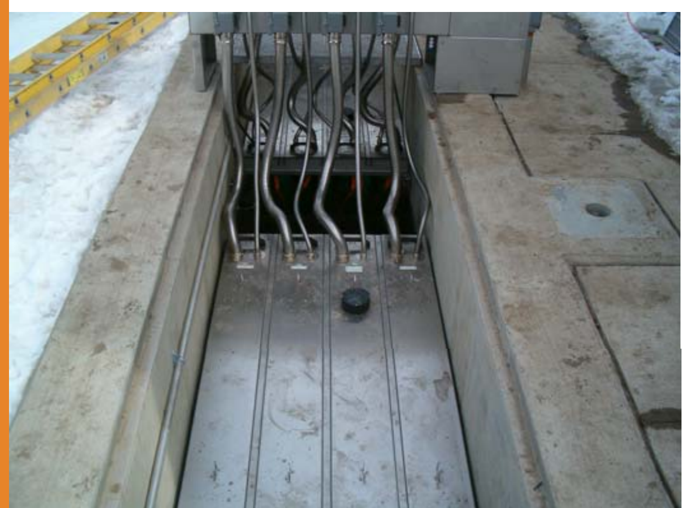
Parameter	Limit	Units	Limit Type
BOD	15	mg/l	Calendar Month Average
BOD	24	mg/l	Maximum Week Average
BOD (normal)	85	%	Minimum Calendar Month Average
TSS	30	mg/l	Calendar Month Average
TSS	45	mg/l	Maximum Week Average
TSS (removal)	85	%	Minimum Calendar Month Average
Nitrogen, Ammonia			
Dec. – March	5.0	mg/l	Calendar Month Average
April – May	5.3	mg/l	Calendar Month Average
June – Sept.	1.0	mg/l	Calendar Month Average
Oct. – Nov.	2.7	mg/l	Calendar Month Average
Fecal Coliform	200/100 ml	-	Calendar Month Geometric Mean
Oxygen Dissolved	5.0	mg/l	Calendar Month Minimum
Phosphorus, Total (as P)	1.0	mg/l	Calendar Month Average
pH	Not less than 6.0 nor greater than 9.0		

GENERAL

The wastewater flow comprised of domestic, commercial and industrial flow from Fairmont travels through the collection system to the Wastewater Treatment Plant (WWTP) located at 301 Margaret Street. The WWTP treats the influent wastewater through several process treatment units to remove the pollutants from the liquid and separate and treat the sludge. The WWTP effluent must meet stringent standards set by the Minnesota Pollution Control Agency (MPCA) to protect the water quality of the receiving stream. The Fairmont WWTP discharges the treated effluent to Center Creek. The average design flow for the wastewater treatment plant is 2.35 million gallons per day (mgd). The plant is designed to handle high flows up to 11.5 mgd safely.

The wastewater treatment plant improvements project made the best use of the existing facilities by incorporating several of the existing process units into the new plant processes. The new facilities and buildings closely match the existing architecture and design to provide a clean new look to the entire Fairmont Wastewater Treatment Plant. The design includes a mix of the most tried and true processes for wastewater treatment along with many latest technologies. The improvements project was completed within the construction budget and schedule. The completed WWTP facilities will provide the City of Fairmont's wastewater treatment infrastructure needs for many years to come.

Variable speed return activated sludge (RAS) pumps return the secondary clarifier sludge to the aeration flow splitter. This process re-populates the microorganisms in the aeration tanks so they can continue to metabolize the wastewater. Excess sludge is waste activated sludge (WAS) taken from the process and sent to the solids treatment processes.



The secondary clarifier effluent is sent to the ultraviolet (UV) disinfection system for final disinfection before final sampling and discharge to Center Creek. The low pressure, high intensity lamps inactivate any bacteria that would be discharged.

Plant effluent water is taken from the secondary clarifier effluent flow and pumped to several areas of the WWTP for general plant cleaning, belt filter press spray water and rotary drum filter spray water. The plant effluent water system pumps the reused water to its place of need. The reuse of plant effluent water eliminates the need to use costly City water for these uses.

SOLIDS TREATMENT PROCESSES

Primary sludge is collected in the primary clarifiers and pumped to the sludge blend tank to be mixed with thickened waste activated sludge prior to anaerobic digestion. Air-diaphragm primary sludge pumps pull the sludge from the sludge hopper and pump it to the sludge blend tank.

Waste activated sludge (WAS) is stored in the WAS holding tank ahead of thickening. The WAS holding tank was an existing gravity thickener in the previous plant process layout. The WAS holding tank has been retrofitted to provide at least five days of WAS storage so the thickening process can be flexible. A floating mixer is used to mix the contents of the tank.

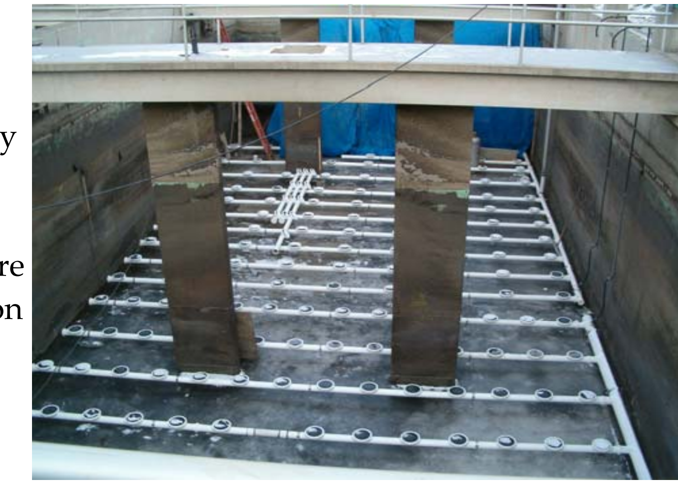
Anaerobic Digestion is the process used to stabilize and treat the co-blended primary and waste activated sludge. The plant includes two fixed cover concrete primary digesters and one floating gas-holding cover secondary sludge storage tank to store digested biosolids ahead of dewatering. The primary digesters heat and mix the sludge to maintain 95 F to complete the stabilization process. A by-product of the anaerobic digestion process is the generation of methane or digester gas. The digester gas is used in boilers to heat the primary digesters.

The sludge that has now been stabilized through the digestion process is called biosolids. The Fairmont WWTP uses a belt filter press to mechanically dewater the biosolids to approximately a 25 percent solids product. This dewatered biosolids (cake) can be directly land-applied as a Class B biosolids product. The particular belt filter press used is a high-solids belt filter press capable of yielding a low water content biosolids. This is important because the amount of on-site dewatered cake storage volume can be reduced.

The Fairmont WWTP also includes a Class A biosolids treatment option. A Fenton sludge dryer is used to further process the dewatered sludge by drying it to a 90+ percent solids product that meets the requirements for a Class A biosolids product. The Class A biosolids product is much less restrictive when land application is considered.

A covered biosolids storage area is adjacent to the Solids Processing Building. The storage area provides enough biosolids storage in one of two cells for a minimum of 180 days of biosolids storage. The metal canopy cover has been provided to keep any precipitation from mixing with the dried or dewatered biosolids products. Prior to spring planting or after fall harvest the stored biosolids will be removed and land applied to area farmland to use for its fertilizer value.

Following primary clarification, the wastewater is combined with the return activated sludge (RAS) from the secondary clarifiers into a flow splitter and equally distributed to three aeration tanks. The aeration tanks at the Fairmont WWTP were existing tanks retrofitted with new aeration equipment. The aeration tanks use fine bubble diffused aeration equipment and baffling to develop and maintain the optimum environments for the microorganisms to consume the organic material in the wastewater. The fine bubble diffused aeration system includes flexible membrane diffusers to efficiently transfer oxygen to the microorganisms.



The aeration air supplied to the aeration tanks is from three 125 Hp positive displacement blowers. The blowers are energy-efficiently controlled to supply a preset airflow to maintain a target dissolved oxygen level in the tanks. The new aeration blowers are enclosed units to reduce noise levels in the blower room. The new blowers are located in the existing WWTP blower room.

Flow from the aeration tanks dumps to a second flow splitter where the flow is equally distributed to three trains of secondary clarifiers. Two of the three trains are new 70-foot diameter clarifiers and the third train is two existing 57-foot diameter tanks. These clarifier tanks settle the heavier biological solids so they can be either returned back to the aeration process or wasted from the system. Each of the secondary clarifiers includes spiral sludge collectors, energy dissipating inlet, baffling, and scum skimming.