City of Richland Center
2015 Wastewater Facilities

Cover Page:

Project History:

The City of Richland Center's original wastewater treatment facility was located between State Highway 14 and the Pine River, near the downtown. This facility dated back to the 1970's with improvements in 1992, 1993, and 2001. After this last upgrade the wastewater facility included preliminary treatment with screening and grit removal, primary treatment by a high rate dissolved air flotation device, activated sludge secondary treatment, anaerobic digestion, and liquid sludge storage.

In 2004 the City began planning for this most recent upgrade. The existing facility had reached its design capacity with much of the equipment and structures reaching the end of their useful life. The planning process considered upgrading infrastructure on the existing site close to the City center and relocating the facility to a remote site more than six miles to the east of the City. The resulting plan recommended relocating the facility which would provide the Richland Center Utilities more room for future expansion and better able to serve nearby communities and rural residents should they wish to contract with the City's Utilities, which would offset operational costs.

Project Description:

Construction of the new wastewater treatment facility began in 2014 and was substantially completed in the winter of 2015. It's been designed and constructed to produce a high-quality effluent for discharge to the Pine River, and to maximize

operational flexibility and energy conservation. The new facility is located off of Country Highway TB straddling the townships of Buena Vista and Orion.

Facility treatment processes include wastewater transmission through a seven mile long force-main, preliminary treatment including fine screening and grit removal, primary settling, secondary biological treatment including enhanced biological phosphorus removal, ultraviolet (UV) disinfection, anaerobic digestion, and biosolids dewatering and natural drying to produce a spreadable fertilizer/soil additive.

Influent Pumping and Force-main:

The new main pumping station is located on the site of the original Richland Center wastewater treatment facility and includes five (5) submersible pumps equipped with variable frequency drives used to regulate flow to the new wastewater treatment facility. Influent pumps direct raw wastewater from the City through the seven mile long pipeline terminating at the new site.

Influent Pumping

In order to reduce fouling of the pipeline and reduce odor issues associated with the long detention time, the pumping system is provided with flushing and “pigging” capabilities. Periodic flushing is achieved through automatic controls which allow the wet well to surcharge and then activating multiple pumps to develop high flows and velocities in the pipeline. “Pigging” involves the insertion of an 18-inch diameter foam swab, or “pig”, into the pipeline to aid in scouring the inside of the pipe. The pig is retrieved at the Hauled Waste Receiving station at the new WWTF site.

Pump Piping with Pig Launcher

Liquid Treatment:

Preliminary Treatment

Preliminary treatment is a mechanical process that removes plastics and rags by means of screening, and sand through use of a grit separator and washer. This process protects downstream equipment from unnecessary wear and damage and reduces the buildup of heavy deposits in tanks. Preliminary treatment is located in the Headworks building and includes a mechanical fine screen using a stair-style bar screen, and grit removal using a vortex grit chamber and conical grit washer.

Influent Stair Screen

Grit Washer

Influent flow metering and sampling are also accomplished at the Headworks building. Wastewater samples are tested in the on-site laboratory to determine the amount of pollutants flowing to the facility.

Odor issues were expected at the Headworks building due to the length of the pipeline extending to the site and discharging at this structure. To combat odors and corrosion

in the Headworks building an odor control system was installed to evacuate and treat process air from the influent channels.

Odor Control System

Hauled Waste Receiving

A receiving station was constructed at the new site to accept hauled wastes from the surrounding rural community as well as local industries. The station includes a rock trap for large debris, flow meter, discrete sampler, and mechanical screen. Two underground tanks are provided to allow for temporary storage and segregation of liquid wastes. The facility's SCADA (Supervisory Control and Data Acquisition) system allows for logging of haulers' information and generates billing information for resulting fees.

Hauled Waste Receiving Building

Hauled Waste Receiving Screen

Primary Clarification

Primary treatment is performed with two activated primary clarifiers that provide settling of heavier organic material and inert solids in the raw wastewater prior to secondary treatment. This heavier organic material and solids settle to the floor of the clarifiers and are drawn to a center sump in the bottom of the tank. From the sump the solids are pumped by double disk pumps to the anaerobic digestion process to become stabilized.

Primary Clarifier

Primary Sludge Pumping

Allowing heavy organic matter to sit in the clarifiers without oxygen and to be recycled around the clarifiers promote a fermentation process in which volatile fatty acids are produce to aid in the removal of phosphorus in the secondary treatment process.

Secondary Treatment

The secondary treatment process consists of selector basins, aeration basins and final clarifiers and provides biological treatment of wastewater where most of the BOD (biochemical oxygen demand) is removed, ammonia is converted to a less toxic nitrate form, and phosphorus is taken up biologically.

The liquid discharge from the primary clarifiers blends with the return activated sludge (RAS) in the ***selector basins***. The selector basins are operated to maintain anoxic and anaerobic conditions that promote an environment to remove the phosphorus biologically rather than via chemical addition.

Selector Basins

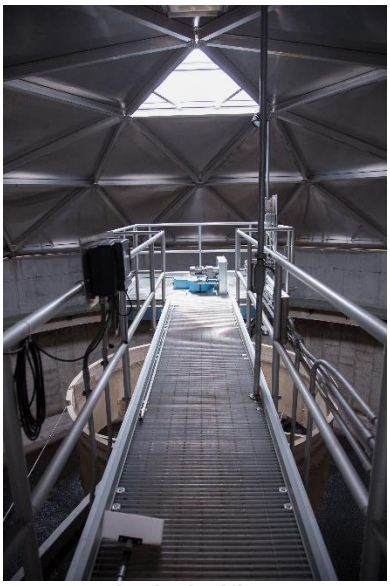
The ***aeration basins*** receive flow from the selector basins and are used to reduce BOD, convert ammonia to nitrate, and further promote biological phosphorus uptake. Two basins are provided with fine bubble diffusers to provide air to promote the growth of aerobic microbes to consume the biological waste. Instrumentation is provided to monitor the dissolved oxygen concentration in the basins and to provide a means to automatically control air flow to the basins.

Aeration Basin

Aeration Blowers

High efficiency blowers, located in the Process Control Building, are automatically controlled to maintain an adequate air flow to the basins. Control is achieved through the facility's SCADA system using "most open valve" control strategy. This provides an adequate balance of air between the basins and helps to maintain an adequate dissolved oxygen concentration in the aeration basins.

Effluent from the aeration basins flows to the ***final clarifiers*** which provide the final settling of solids and treatment microbiology. Microbial floc or activated sludge settles to the bottom of the clarifier and the clear liquid is allowed to overflow the perimeter weirs to continue on to the disinfection process. The settled sludge is pumped back to the selector basin as RAS, since this material contains the aerobic microbes that are used in the secondary treatment process. A smaller portion of this sludge is wasted by pumping it to the waste activated sludge (WAS) thickener and eventually on to the anaerobic digester for final stabilization.



Final Clarifier

RAS Pumps and Piping

Ultraviolet Disinfection

Clear water from the final clarifiers then flows to the ultraviolet disinfection process where UV light is used to reduce the disease causing bacteria, or pathogens, in the water discharged to the Pine River. The effluent wastewater is again sampled to verify that adequate treatment is being provided and meets the limits established by the WDNR and EPA before being discharged to the river.

UV Disinfection

Biosolids Treatment:

Waste Activated Sludge Thickening

Waste activated sludge from the final clarifiers is pumped to the rotary drum thickener (RDT), located in the Sludge Processing Building where polymer is added to improve thickening characteristics. Sludge thickening increases the sludge concentration to between 4% and 5% solids before being pumped to the anaerobic digester.

Sludge Thickener

Anaerobic Digestion

Following thickening, waste activated sludge is combined with primary sludge from the activated primary clarifiers, which typically has a solids concentration between 3.5% and 4.5%. Combined primary sludge and thickened WAS are fed to the anaerobic digester, where the sludge is held for up to 40 days at 98°F and in the absence of oxygen. The anaerobic digestion process stabilizes the sludge and produces methane gas. Digester temperature is maintained by recirculating sludge through a combination boiler/heat exchanger. Methane gas from the anaerobic digestion process is used as a fuel in the boiler system to provide heat for the process and could be used to supply building heat in the future.

Combination Boiler/Heat Exchanger

Anaerobic Digester and Flare

Sludge Dewatering

After digestion, liquid biosolids are y pumped to a sludge dewatering centrifuge where it is combined with polymer and dewatered to a solids concentration of near 20%. The product is then called biosolids cake. Cake solids are further concentrated by natural drying on an asphalt pad, and then stored inside of the covered Cake Solids Storage Building until they are able to be land applied on surrounding farm fields in the spring and fall. Land application of biosolids provides a soil supplement that is rich in organic matter and nutrients.

Biosolids Dewatering Centrifuge

Biosolids Cake Storage Building

SCADA Controls

Need write up

Administration and Maintenance Facilities

Existing Administration Building

The construction project included renovations to the City's existing administration building to remove process equipment and expand garage facilities. This building now provides a home base for the City's collection system maintenance fleet.

Existing Administration Building

New Administration Building and Maintenance Facility

The new facility was constructed with many new features that improved the work environment for the utility staff. A new administration building and maintenance building was constructed which includes offices, process control space, conference room and a state of the art laboratory. The laboratory is used to analyze influent and effluent samples as well as samples from other facilities and industries.

New Administration Building and Maintenance Facility

Laboratory

Conference Room

The maintenance garage provides increased storage for vehicles and equipment, work bay area for maintenance and equipment repairs and a vehicle wash bay. The improved work space areas provide a significant improvement to the tools available to the operators to maintain and fix equipment.

Maintenance Bay

Project Funding:

The project was broken up into two separate construction contracts; one for the force-main and the second for the wastewater treatment plant. The total budget for the two contracts was $32 million. The project was funded by the City of Richland Center, USDA Rural Development, Wisconsin DNR's Clean Water Fund, and the Wisconsin DOA's Community Development Block Grants and included approximately $7 million of grants.

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