City of Biscay Wastewater Treatment Upgrades

Introduction

The City of Biscay (City) is located approximately five miles southeast of Hutchinson along State Highway 22 in McLeod County, Minnesota. The population is 113 (2010 US Census). Historically, wastewater infrastructure consisted of septic tanks at each connection that discharged settled wastewater to a common sewer within City right of way. Untreated wastewater would flow via gravity within the sewer and ultimately straight-pipe to the South Fork Crow River; a tributary of the Mississippi River. A handful of properties within the community were served by individual subsurface sewage treatment systems (ISTS).

Straight-pipe Discharge of Sewage

The City was aware of the pollution created by their wastewater infrastructure and in 2010, Wenck was retained to assist in finding a solution. The City worked for five years with the MPCA, McLeod County, Midwest Assistance Program (MAP), Minnesota Public Facilities Authority (PFA) and Wenck to evaluate potential improvements and procure funding for the project. System design occurred in the spring and summer of 2014 and construction soon followed.

Construction of a community midsized subsurface sewage treatment system (MSTS) occurred in fall 2014. The MSTS consists of a combination conventional gravity and grinder pump pressure collection system conveying raw sewage to a lift station. The lift station conveys wastewater to the treatment site approximately 2/3-mile northeast of Biscay. The treatment system consists of septic tanks, a dose tank, and a multi-celled mound soil dispersal system. The MSTS is designed to treat 9,600 gallons per day and serves 29 properties within the City. The remaining properties, not connected to the MSTS, are served by conforming individual septic systems.

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Background Investigation

Prior to implementing a solution, an assessment of the preexisting wastewater infrastructure was required for potential future funding. A community assessment report (CAR) was prepared by Wenck in 2010 to determine the condition and probable compliance status of preexisting individual subsurface sewage treatment systems (ISTS). The CAR was made possible through the Small Community Wastewater Technical Assistance Grant from the PFA. These grants are available to unsewered communities to examine possible solutions to wastewater infrastructure problems associated with noncomplying ISTS. A field assessment was completed and ISTS were inspected on 51 parcels. Wenck found 75% of the preexisting ISTS to be an imminent threat to public health or safety or failing to protect groundwater.

Also within the CAR, Wenck analyzed three wastewater treatment solutions including ISTS replacement on each lot, a communal system to serve select service areas, and regionalization to the City of Hutchinson. The analysis was based off monetary and nonmonetary factors and helped aid the City's decision. The City selected to pursue a communal collection and treatment system to serve select parcels within the service area. Parcels not connected to the community system were upgraded with compliant ISTS.

Collection System

The collection system is a conventional gravity sewer in combination with low pressure grinder pump stations. A 10-inch diameter mainline was installed and homes directly adjacent the mainline were connected. Homes not adjacent to the mainline, where gravity sewer was unfeasible, are served by individual grinder pump stations.

Residential Grinder Pump Station

Wastewater flows within the main sewer line to a lift station located at the northern edge of town. The new 6-foot diameter lift station is 18-foot deep and consists of duplex 3-inch solids handling pumps, guiderails, and a valve vault basin. The structure interior is coated to prevent concrete deterioration. The lift station conveys wastewater to the treatment system north of town.

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Lift Station Wet Well

Lift Station Valve Vault

Wastewater Treatment System

Wenck and the City evaluated several options for sites of the new treatment system. Field investigations were conducted to determine the adequacy for soil dispersal systems. The site that was ultimately selected showed favorable soil characteristics to accommodate the treatment system. Field investigations were conducted by Wenck soil scientists and consisted of soil test pits, hand augered borings, and hydraulic conductivity testing. In addition, piezometers were installed to determine the physical depth to static groundwater and groundwater flow direction. The site was concluded to be favorable and was approved by the MPCA and McLeod County.

Four(4) 12,000 gallon Septic Tanks in Series

The treatment system serving the City is an MSTS. Following MN Rules, four days of detention time is required of septic tank volume. To accomplish this, four 12,000 gallon precast concrete tanks were installed in series. All tanks are insulated, contain an inlet baffle, outlet baffle, and access risers brought to grade. The last tank outlet is equipped with an effluent screen that prevents suspended solids greater than 1/16-inch from exiting the tank. In addition, the exterior walls and base are coated with a waterproofing membrane.

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Incoming wastewater flow fluctuation occurs throughout the day as people use water. To accommodate for these peaks, the dose tank was sized as an equalization tank. The tank is large enough to attenuate or store the surge flows that occur throughout the day. The tank is insulated and equipped with eight submersible dose pumps on guiderails and timed dosing float switches. Forcemain from each pump is installed with positive slope to allow complete drainback and pipe evacuation through a weep hole within the tank to prevent freezing.

Mound Cell Construction

Mound Dispersal Bed Construction

Final effluent dispersal to the soil is accomplished by an 8-celled mound soil dispersal system totaling over 900 feet. Each cell contains a 10-foot wide bed containing rock, a manifold, and three distribution laterals. Lateral ends are equipped with flushing boxes to allow the operator access for periodic flushing. Each mound cell is dosed an equal volume of effluent two to three times per day. During a normal dosing event, one pump is engaged and doses a cell. After the pump has timed out and ceased dosing, the system alternates and the next mound cell in sequence is ready to dose. This cycle repeats itself throughout the day as water is generated by the City and conveyed to the treatment site.

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Treatment Site After Construction

Acknowledgments

Many thanks to past and current members of the Biscay City Council and staff, MN Public Facilities Authority, Midwest Assistance Program, McLeod County, Board of Water and Soil Resources, MPCA, Hjerpe Contracting, and all the subcontractors and equipment suppliers that were involved in the project. For questions about the project, contact Peter Daniels, Wenck, at 763-479-4284.