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IMPROVEMENTS TO SCREENING AND GRIT REMOVAL SYSTEMS AT THE PARSIPPANY-TROY HILLS WASTEWATER TREATMENT PLANT

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INTRODUCTION

The Township of Parsippany-Troy Hills operates a wastewater treatment plant with a capacity of 16 million gallon per day. The facility service area also includes Mountain Lakes, East Hanover, Montville and a portion of Denville. Septic tank waste is also accepted. Effluent is discharged to the Whippany River near where it meets the Rockaway River.

Parsippany-Troy Hills Grit Building

The existing Blower and Pump Building, where the screening equipment is located, and the grit removal tanks were placed into service in the mid-1970's. Screening and grit removal equipment were past their design life. Grit and debris passing through the preliminary treatment processes caused increased maintenance on downstream equipment. In 2016, the Township began a capital project to improve the screening and grit removal systems.

Prior to the design phase, H2M Associates, Inc. prepared an Engineering Report that evaluated the existing screening and grit removal facilities based on the applicable design standards in New Jersey Administrative Code Subchapter 23 (NJAC 7:14A-23.15 and .16).

SCREENING IMPROVEMENTS

The Blower and Pump building is a one-story building with 2 basement levels subdivided for different uses. Housed in the building is mechanical equipment such as the screens, influent pumps and motors, and the motor control center (MCCs). When initially placed into service, the building also housed the aeration tank blowers. Blowers are currently located closer to the aeration tanks. Consequently, with the change in blower location, the air filter that was connected to the blower intake piping was no longer in service.

Wastewater from the 72-inch interceptor sewer enters a 6-foot wide influent channel with a manually cleaned coarse bar rack. After passing through the coarse rack, flow is distributed to four channels on a 45-degree angle from the influent channel. A slide gate, with manual operator, allows each branch channel to be isolated. The first and third channels are 4 feet wide. The second and fourth channels are 4.5 feet wide. One channel had a mechanical bar screen, two channels had a manually cleaned bar rack, and one channel had an out of service comminutor. While the facility was constructed with a fifth channel, an 8-inch wide masonry bulkhead keeps this channel out of service. Septic tank waste is discharged directly into the pump station influent channel downstream of the one mechanical screen and would pass through a manually cleaned rack.

An MCC Room was located on the grade floor above the first two channels. An adjacent room that housed the blower intake dust collector was on the grade floor above the third and fourth channels. The design challenge was to layout the new screening and washer compacting equipment within the constraints of the existing building.

During preparation of the Engineering Report, a survey was sent to five screen manufacturers that included the design parameters and building constraints. During the screening equipment survey, manufacturers of washer compactors advised that due to the distance

Screen Compactor Panels

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Location for Screen Placement

and elevation change it was not possible to convey screening from the lower level up to an at grade screening container. Since the blower air intake filter was no longer utilized, this area could be utilized for the upper portion of the new screens to reduce the distance for conveying the compacted screenings. Consequently, the manufacturer representatives were advised to submit information on a screen that would extend up from the channels to the air filter floor level. Following evaluation of the responses, screens from two manufacturers were selected for further consideration.

During the report preparation phase, Revit software was used to create a building information model that was used to establish the layout of two new screens and the associated washer / compactor and troughs for the compacted screenings in the available space. In addition to items noted above, layout considerations included:

- Top of Channel Floor in Screen Room Approximately 20 feet below Grade.
- The floor in the area with the dust collected was 2.5 feet lower than the MCC room floor.
- Screenings to discharge into existing roll-off container with compactor beyond downstream end of channel.
- Original preliminary treatment process was designed to hydraulically accommodate an average daily flow of 12 MGD. Permitted average daily flow for the facility is currently 16 MGD following a BNR (biological nutrient removal) upgrade completed in the early 2010's. Based on flow during a hurricane, 28 MGD was the design flow for each screen.

Design selections for the new screen included:

- Screen Angle from Vertical 10 degrees
- Clear Opening 0.75-inch
- Average Flow Rate 6 MGD
- Maximum Flow rate 28 MGD
- Head Differential 1 foot.
- Full penetration scrappers
- Operation by timer and submersible pressure transducer upstream of screen
- Washer compactor needed to move screenings up 9 feet to discharge chute
- Screen and washer compactor drives not subject to flooding.

From the model, the depth below grade and building dimensions would not allow the fifth channel to be utilized for installation of a mechanical screen so this channel would remain out of service. The separate screen for wastewater from Montville would remain in service and was not part of the screening system improvement.

The model determined new screens could be installed in the third and fourth channel with the upper portion of the 33-foot long screens in a new room created after removal of the out-of-service blower intake air filter. An interior masonry partition wall was installed to create the upper-level room that would meet NFPA requirements. An exterior door was installed for personnel access and an exterior roll-up door was installed to allow installation of the screens and washer compactors. Stainless steel framing was installed on the underside of the floor slab where openings were cut. Manually cleaned racks

Duperon Screens

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Grit Classifiers

with 1 ½ inch clear openings were provided in the first and second channel. Under normal operation, both mechanical screens are used and the gates upstream of the manually cleaned racks are closed.

GRIT REMOVAL IMPROVEMENTS

Two 19-foot by 19-foot by 16-foot deep aerated grit chambers are located downstream of the influent pump station and upstream of the primary settling tanks. The grit screws in each tank were no longer operable. Consequently, the Township would periodically take each tank out of service to manually remove the accumulated grit. This method was labor intensive. Grit at one time was conveyed to classifiers more than 200 feet away before on-site incineration. To reduce the length to transport the grit, a reinforced concrete slab was designed adjacent to one of the grit chambers. This provided an elevated platform for a new fiberglass reinforced plastic (FRP) building to house two grit classifiers. Dual cyclones were provided on each classifier.

The elevated platform provided a covered area for the grit to be deposited from each classifier into a roll-off container positioned below. The container is located adjacent to the dewatered sludge container. The classifier overflow is returned to the adjacent grit chamber.

A new 12-inch diameter grit screw and fiberglass baffle wall was installed within each grit chamber. Instead of an in-kind replacement of the above deck drive and chain, the new grit screws have a through wall direct drive in the pipe tunnel. The two horizontal, dry pit vortex non-clog grit pumps for each chamber and the plug and swing check valve on the pump discharge piping were replaced. Under normal operation, one grit pump for each chamber conveys flow to a dedicated classifier. To provide operating flexibility, piping and valves were added that allows the grit pumps to utilize either classifier.

PRIMARY SETTLING TANK IMPROVEMENTS

The treatment plant has six 20-foot wide by 100-foot long primary settling tanks. Installation of stainless-steel scum troughs and replacement of the sludge cross collectors was also included in the project

SEQUENCE OF CONSTRUCTION

The Contract documents provided a specified sequence of construction of improvements that was from upstream to downstream, not when equipment was available. The construction sequence was:

- Create screen room
- Install screens and washer compactors
- Construct concrete platform for new grit classifiers.
- Install cyclone grit classifiers and FRP building
- Replace grit pumps and valves.
- Remove grit piping no longer in service.
- Place screens in operation
- Take grit tanks out of service one at a time to replace grit conveyors. Place first rehabilitated grit tank into service before starting on second tank.
- Place second rehabilitated grit tank into service before starting primary settling tank improvements.
- Take 1 of 6 primary settling tanks out of service at a time to replace settling tank screw cross collector and scum trough.

The new screening and grit removal equipment has eliminated manual labor formerly needed to remove grit and screenings and improved operating reliability of downstream processes.

SCHEDULE AND COSTS

- Bids were received October 26, 2017
- 5 bids were received. The low bid was for $2,880,044
- Contractor: MBE Mark III Electric, Inc., Madison, New Jersey
- Notice to Proceed: December 27, 2017
- 400-day contract period
- Screen Start-up January 2019
- First Grit Chamber Start-up February 2019
- Second Grit Chamber Start-up March 2019

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