LIFT Scholarship Exchange Experience for Innovation & Technology (SEE IT)
Sponsored by: WE&RF, WEF and NACWA

TRIP REPORT

SCHOLARSHIP UTILITY: Trinity River Authority of Texas, Arlington, Texas

SCHOLARSHIP UTILITY CONTACT: Matthew Jalbert, P.E.; Engineering Manager; jalbertm@trinityra.org

ATTENDEES: Matthew Jalbert, Mike Young, Bill Tatum

TRIP DATES: May 16th - May 18th, 2017

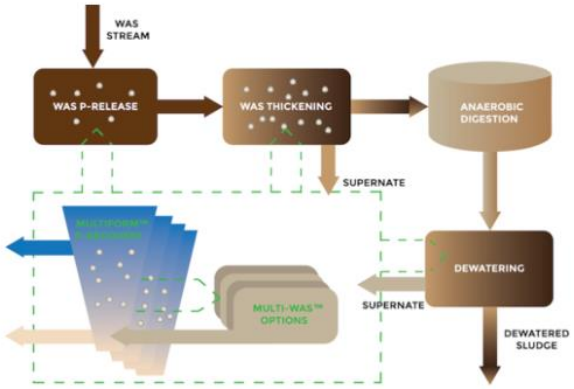
UTILITIES/SITES VISITED:

1. Madison Metropolitan Sewerage District
   Nine Springs Wastewater Treatment Plant
   1610 Moorland Road
   Madison, WI 53713
   (608) 222-1201

2. City of Fond du Lac
   Regional Wastewater Treatment and Resource Recovery Facility
   700 Doty Street
   Fond du Lac, WI 54935
   (920) 322-3663

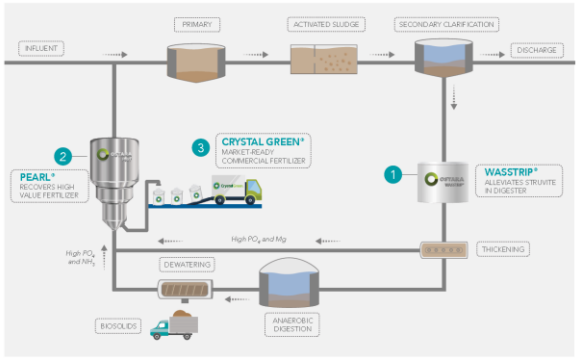
3. Green Bay Metropolitan Sewerage District
   NEW Water Green Bay Facility
   2231 N Quincy St.
   Green Bay, WI 54302
   (920) 432-4893

TECHNOLOGIES/INNOVATIONS SEEN: The technologies seen included struvite harvesting facility (Ostara Pearl) at Madison, Wisconsin and Multiform™ Systems at Green Bay, Wisconsin. Hydrogen sulfide gas conditioning system (Biorem) biological scrubber at Fond du Lac, Wisconsin.



MULTI-WAS™

(Source: http://www.multiformharvest.com/multi-was)



Ostara's Pearl® and WASSTRIP

(Source: http://ostara.com/nutrient-management-solutions/

BIOREM H_2S Gas Conditioning System

(Source: http://www.biorem.biz/?portfolio=1498)

TRIP BACKGROUND and RATIONALE (250 WORDS): *What technology did you select to visit? What is the problem you are trying to address? How did you envision the LIFT SEE IT scholarship trip helping your utility?*

In 2016, the Authority conducted a Masterplan for the CRWS Treatment Plant and part of this effort included evaluation of the current and future nutrient loadings as it relates to the ongoing solids processing improvements. The overall solids processing improvements that are on-going include new gravity thickeners for primary sludge thickening, rehabilitation of the existing gravity thickeners, new primary sludge pumping, screening and building, removal of the existing dissolved air floatation thickeners, installation of gravity belt thickeners for waste activated sludge thickening, rehabilitation of the two existing digesters and buildings, installation of thermal hydrolysis and new anaerobic digesters. It is anticipated that a significant amount of ammonium and phosphorous will be recycled back to the main liquids stream. The phosphorus loading will

have a great impact on the main liquid stream and it is anticipated that the Authority will have to remove this soluble phosphorus with either ferric chloride addition or a process such as struvite harvesting. Struvite harvesting implementation is a newer technology to North America and there are currently two types of technologies available: Airprex and Ostara. Staff selected to visit the Ostara Pearl® facility at Madison Metropolitan Sewerage District since it is similar to the unit recommended in our facility Masterplan. In addition, we were able to visit two other types of technologies, one was related to our on-going solids improvement. We are in the process of constructing a gas conditioning system for hydrogen sulfide removal from the digester gas. The Regional Wastewater Treatment and Resource Recovery Facility allowed us to stop by and look at their current system and ask questions regarding performance and maintenance. In addition, NEW Water at Green Bay allowed us to tour their wastewater treatment facility and we were able to also look at another form of struvite harvesting technology called Multiform Harvest. The facility was not in operation, but was currently under construction. The LIFT SEE IT scholarship trip helped us gain a perspective on the size of the struvite harvesting facilities and also the operations and maintenance involved with operating these facilities. The tours allowed us to interact with plant staff and ask questions as we walked through the facility.

TRIP SUMMARY (1 page max. Please include 10 photos and a 1-2 minute video montage from the trip. The video does not need to be professional, however if you have the means to create a professional video feel free to do so)

<u>Madison Metropolitan Sewerage District Struvite Harvesting Facility (Ostara Pearl®) Report</u>

The Madison Metropolitan Sewerage District (MMSD) Nine Springs Wastewater Treatment Plant is located in Madison, Wisconsin. The Authority selected this specific utility and technology because the Ostara Pearl® struvite harvesting system was identified as a potential technology in the Masterplan for the Central Regional Wastewater System Treatment Plant. The Nine Springs Wastewater Treatment plant is a 40 million gallons per day (MGD) conventional activated sludge (A/O and modified UCT without internal nitrate recycle) with enhanced biological phosphorous removal and has a Biological Oxygen Demand (BOD) limit of 7 mg/l, total suspended solids (TSS) limit of 10 mg/L and a phosphorous limit of 1.5 mg/L. The phosphorous limit would actually be expected to drop to 0.075 mg/L next permit cycle, but by using adaptive management, the anticipated permit will be 0.6 mg/L. The anaerobic digestion facility consists of anaerobic and acid phase digesters. They can store approximately 20.5 million gallons (MG) of digester Class B liquid biosolids during the winter months. The biosolids are used primarily for land application. For their solids processing facility, the primary sludge is sent to their primary gravity thickeners and to the acid digester. The waste activated sludge (WAS) is processed through both their p-release tank (hydraulic retention time of 10-13 hours) and acid digester approximately 12 gallons per minute (gpm) of acid phase sludge into 500 gpm WAS. Following the acid digester, the sludge is then sent to their anaerobic digester and then processed through their biosolids digestion and thickening process. Following the p-release tank (pH of 6.9), the thickened WAS is sent to their gravity belt thickener's (GBT's) and the filtrate (pH of 7.2) from both of the GBT's and digested sludge GBT's are sent to the struvite harvest reactor (Ostara Pearl®). The facility hasn't been able to completely eliminate the ferric chloride; they have to feed it at the gravity belt thickener's filtrate pumps. This helps control potential struvite formation in this section of pumps and piping. They were having problems historically with struvite production in the pipes and it began in 1998 when they implemented enhanced biological phosphorus removal. The worked with the University of

Wisconsin at Madison to determine if there was a way to release the phosphorus prior to digestion, but then other companies begin developing commercially available technology to remove struvite in the mid-2000's. When the struvite started getting out of control, the facility would add ferric chloride at various points in order to keep maintenance and repair costs down in the interim.

Ostara Process:
When you are doing struvite harvesting downstream, the controls for chemical dosing is flow proportioning. The Ostara reactors are not fully redundant and they were designed for a 2030 design loading. The effluent ("Ostarate") from the Ostara reactor are routed back to the head of the plant and if not controlled properly can overload the main liquid process. For maintenance of the Ostara reactors, the have to take one offline and conduct an acid wash on a regular basis, approximately quarterly. The indication for conducting an acid wash is based on the Ostara recycle pumps (pump health) performance. If staff notices build up on the recycle pump, then they will prepare the reactor for its acid wash. The staff will drain the reactor down for initial inspection and then initiate the acid wash this maintenance activity is conducted quarterly. This can all depend on how much you are loading it. When they get down to a certain amount of product bed, they will reduce feed and load and then shut the feed completely off and go to pull down. The vendor provided programmable logic controllers (PLC's) are Square D Siemens. The MMSD staff conducted in-house dewaterability testing on the WAS before process design because it was expected that the acid phase sludge addition would negatively impact dewatering of the WAS; staff have seen an increase in WAS polymer usage by 30%-50% due to the addition of acid phase sludge to the WAS that triggers p-release.

Procurement Process:
MMSD staff evaluated three vendors and they piloted two of the three vendors (Ostara and Procorp Enterprises). At the time, they did not pilot the Multiform reactor due to being new to the struvite harvesting market in 2010, and the performance of the Ostara and ProCorp pilots were similar. Procorp Enterprises had most of their experience in industrial applications. In May 2010, MMSD conducted a pre-procurement of the struvite harvesting equipment. They received three proposals from the three vendors and ended up selecting Ostara. Following the pre-selection, the design of the struvite harvesting facility was included in their 11th Addition expansion and this project was bid in November 2011. It took over two years to complete the entire project and they had the struvite harvesting facility operational by the end of 2013. MMSD and Ostara developed a 10-year takeoff agreement, which meant that MMSD would provide the capital funding to construct the struvite harvesting facility and Ostara would purchase the product from MMSD at price per ton for the struvite product. Each year, an annual adjustment would be conduct on the product based on the consumer price index (CPI). The takeoff agreement started in 2010 and will expire in 2020. The facility is currently producing 450 to 500 dry tons per year of the Ostara Pearl® product. For staffing of the facility, in the end MMSD did not add additional staff, but it did add about 15 hours per week on average operator time for struvite harvesting. The facility operates 24-hours a day, 7-days a week. MMSD staff did mention that it would have been nice to have a docking bay for the product loading station.

This trip was very useful to the Authority because it gave us an idea on what to expect when we implement a struvite harvesting facility in the future. We were able to gain insight on the

procurement process and how the whole Ostara process fits into a wastewater treatment facility. We were also able to obtain lessons learned and ways that the facility can be optimized.

NEW Water Green Bay Solids Improvements and Struvite Harvesting Facility (Multiform) Report

The NEW Water Green Bay facility is currently constructing a struvite harvesting facility (Multiform). Other solids dewatering improvements consists of a new dryer, centrifuges for their primary sludge, new digesters and a fluidize bed incinerator. This facility has a design of 40-MGD between their north and south plant. NEW Water selected Multiform due to the particle size requirements. The Ostara process requires a certain particle size and the Multiform does not have a requirement for the particle size, their interest is in the product that is produced. Their operations staff operates both the liquids and solids processes. Since the facility is getting a new solids dewatering process and multiform struvite harvesting, they plan on operating 24-hours a day for 5-days a week and they have hired four temporary operators to help free up operator time for training on the new solids process. They started training back in May 2016 and the new facility should be started up around January 2018. For their operator training program, a full-time training operator trains an operator intern for approximately 3-4 months. The training operator also spends 20-25 hours a week working with crews and reviewing operation and maintenance manuals. The trainer is responsible for training all the shifts as well as the O&M manuals and developing the standard operating procedures (SOP's). For example, an Operator starts out as an operator-in-training for three years. All operators are required to go through this training process.

Startup of the New Solids processes
As the new digesters and the multiform struvite harvesting equipment are brought online, New Water will switch to their 24-hours a day, 5-days a week schedule. New Water has assigned operators to four different sections of the new solids processing area and have also identified a primary and secondary person from each crew. Eventually all of the operations staff will be responsible to know every section.

The site visit to NEW Water Green Bay was very beneficial in being able to walk around a facility that is undergoing major improvements to their solids dewatering facility and also gain insight of how they plan to start-up the facility and also train their operations staff.

Fond du Lac Regional Wastewater Treatment and Resource Recovery Facility Report

The Authority is in the process of constructing a gas conditioning system for hydrogen sulfide removal from the digester gas. The Fond du Lac Regional Wastewater Treatment and Resource Recovery Facility allowed us to stop by and look at their current system and ask questions regarding performance and maintenance. Their gas conditioning system has been in service since 2013. They only have one bioscrubber unit, which was designed to treat gas for their boilers and gas engines. Since the system has been in operation, they are only scrubbing the gas engines due to the current bioscrubber treatment capacity. The staff pointed out that the elemental sulfur will build up on the bottom of the tanks (approximately 600 – 700 gallons of sulfur). They built a custom tool, which would allow them to clean the units more effectively. For this type of bioscrubber, they are required to add oxygen and nutrients to the system. They currently do not recommend sending the elemental sulfur back the head of the plant. They are currently looking at other methods for settling out the sulfur and having it hauled off-site.