



PARCC Side Clean Water Plant



2015 Operations Report

Authority Board Members

Authority Members	Representative
Alpine Township	Alex Arends
Cannon Township	Steve Grimm
Courtland Township	Chuck Porter
Plainfield Charter Township	Jay Spencer
City of Rockford	Michael Young

Dedication

January 27, 2016, Rockford City Manager and North Kent Sewer Authority Board Chairman, Michael Young passed away at the early age of 48. Michael's love for his family and City of Rockford are well known, not as well-known was his dedication and leadership in getting the North Kent Sewer Authority formed and the building of PARCC Side CWP - a \$42 Million Dollar state of the art Wastewater Treatment Plant. Michael was passionate about the environment and extremely proud of this facility. He will be missed by our operations staff.

I. BACKGROUND

North Kent Sewer Authority (NKSA) was initially created in 1997 as a funding agency for the repair of sanitary sewer collection system infrastructure following the collapse of several large common use sewer mains. The five (5) governmental units below form the constituent municipalities of the Authority;

- Plainfield Charter Township
- Alpine Township
- Rockford, City of
- Cannon Township
- Courtland Township

Following formation of the Authority, wastewater collected from the communities continued to be discharged into the Grand Rapids sanitary collection system for treatment at the Grand Rapids wastewater treatment plant. As rate increases with Grand Rapids grew more threatening, NKSA studied a number of wastewater treatment options including construction of their own wastewater treatment facility.

In 2005, member communities approved funding for construction of the PARCC Side Clean Water Plant, named after the member communities and the site location next to Lamoreaux Park. Construction of PARCC Side Clean Water Plant began in 2007 with initial plant start-up October 30, 2008. Since December 1, 2008, all wastewater flow from the constituent municipalities has been treated at PARCC Side CWP.

North Kent Sewer Authority reached yet another milestone in 2012 as operational responsibility of the sanitary sewer collection system transitioned from Kent County Department of Public Works (KCDPW) to the Authority. From 1968 through September 30, 2012 KCDPW operated the North Kent Sewage Disposal System (NKSDS) under contract with the constituent communities with the exception of Rockford. Alpine, Plainfield and Cannon entered into service agreements with NKSA for operation of their respective Local sanitary sewer collection systems while Courtland entered into a contractual agreement with a private service provider. NKSA provides operation and maintenance service for the Joint and Shared Local components.

II. PARCC SIDE CLEAN WATER PLANT BUDGET

Funding for PARCC Side CWP operation and maintenance is based on contributing flows from member communities for the preceding year. As indicated in Figure 1, constituent municipality flows were derived from sewer flow data collected during 2015. In addition to flow, there is a provision in the cost sharing agreement that provides for rates to be adjusted for a municipality if a "qualified customer" discharges into their respective collection system. At this time, no industrial discharger meets the "qualified customer" criteria.

Sewer flow data that was collected during 2015 has been approved by the North Kent Sewer Authority board and is now the 2016 cost share percentage for each of the governmental units.

North Kent Sewer Authority's General Fund budget is comprised of the following departmental operating accounts for recording expenses at the PARCC Side Clean Water Plant:

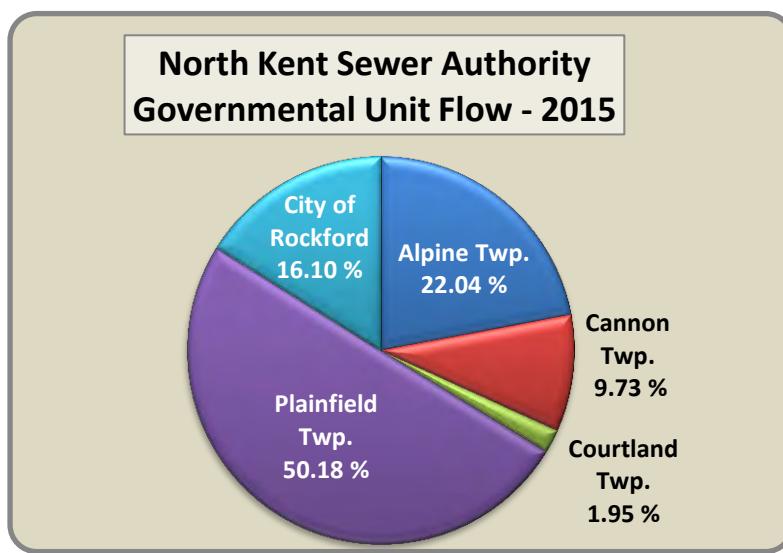


Figure 1 - Contribution Percentages

- **Department 172 - Administration.** Administration funding includes all PARCC Side CWP manpower cost, health care expenses, legal, engineering, specialized contractual services, insurance and other administrative activities.
- **Department 537 - Headworks.** This departmental budget relates to cost involved with initial wastewater pumping, grit removal and fine screen treatment for all flow into the facility. It includes landfill disposal of materials removed by the grit and screening processes.
- **Department 538 - Biological & Membranes Systems.** Includes Bio-reactors and GE membrane system operation. This encompasses membranes, aeration blowers (process and membrane), pumps and controls linked to those processes. Almost all of the wastewater treatment is accomplished within the biological and membrane systems.
- **Department 539 - Disinfection and Effluent Control.** Operational cost associated with UV disinfection and effluent discharge testing requirements.
- **Department 540 - Residuals Processing and Disposal.** Includes cost associated with Biosolids Holding Tanks, Inclined Screw Press operation and maintenance. Expenditures for landfill hauling and disposal are the major item within this departmental budget.
- **Department 541 - Building and Grounds.** Provide funds for maintenance of all the buildings, grounds and snow removal for the facility. Includes HVAC operation and janitorial maintenance cost.

- **Department 542 - Industrial Pretreatment.** To record cost related to operation of a MDEQ approved industrial monitoring, sampling and permitting program.
- **Capital Reserve Fund.** Capital Improvement Fund (Fund 403) to provide the required capital for replacement of treatment equipment and membranes. The NKSA Authority Board approved creation of a separate CIP fund in fiscal 2011. For 2016 NKSA's Board approved increasing CIP contributions to \$358,930 per year.

In November 2015, NKSA's Board approved the 2016 O&M Budget for PARCC Side CWP and Sanitary Collection System. PARCC Side's 2016 budget is summarized below.

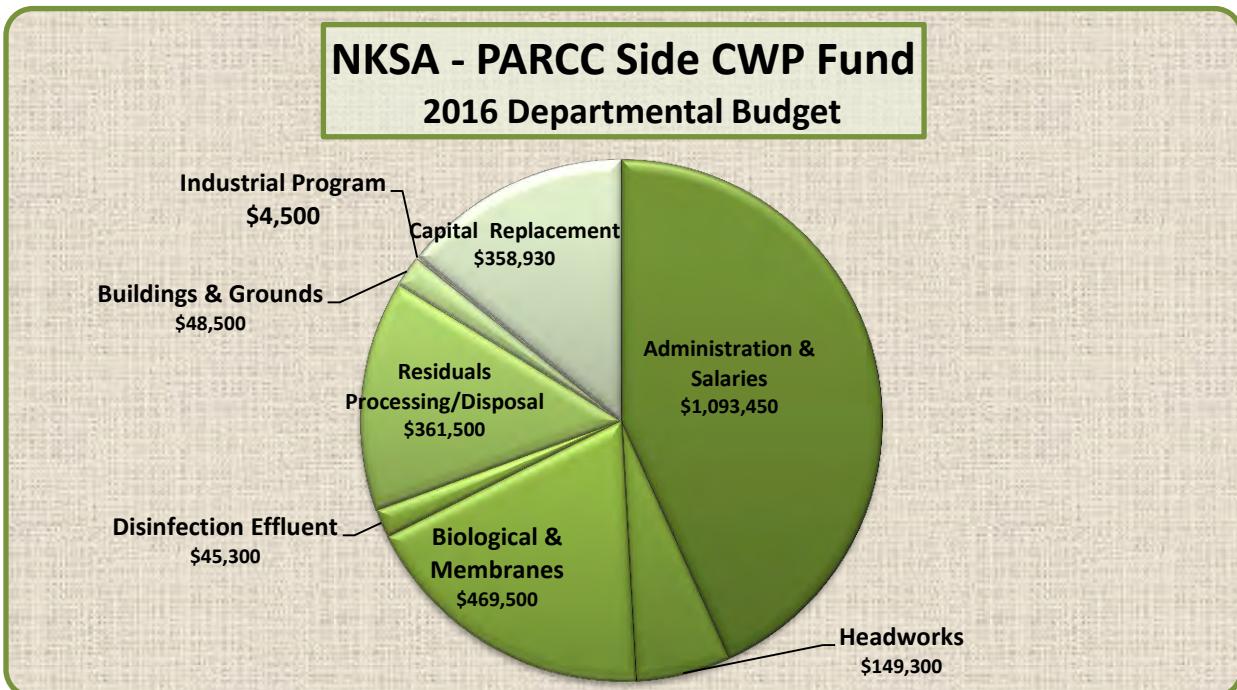


Figure 2 - Budget Centers

Pre-audit expenditures for operation and maintenance (O&M) of the PARCC Side CWP for fiscal 2015 were \$2,014,512. Figure 3, compares budgets and expenditures for the operational years of the clean water plant. The jump in 2016's budget is the result of funding for NKSA's SAW Grant expenditures. CIP funding increases the past two years are also evident. Maintenance and repair cost in 2015 were higher than 2014 as plant operators began rebuilding Huber

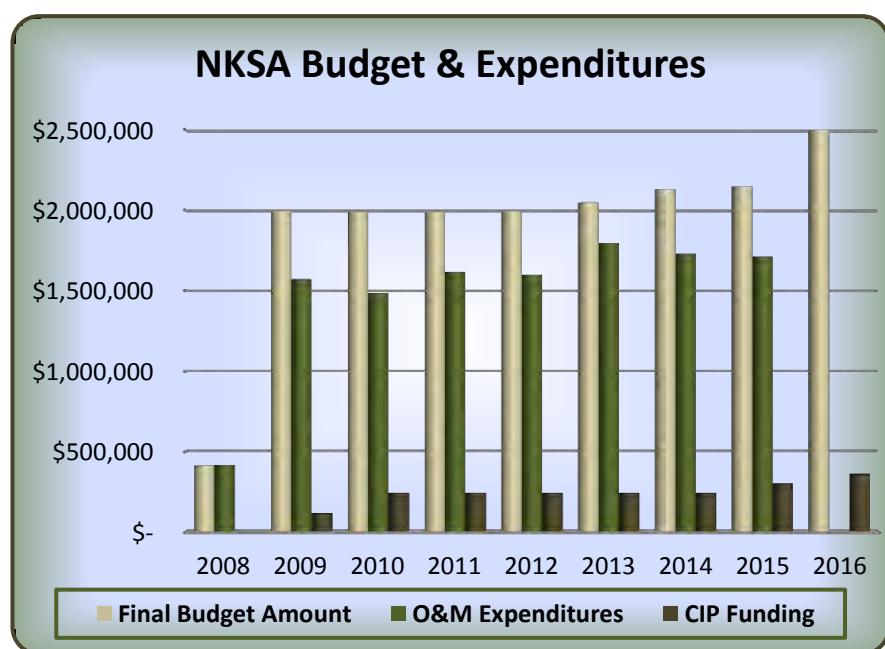


Figure 3 – Fiscal Year Budgets

sludge presses. Each ISP rebuild requires nearly \$6,000 in replacement parts and materials. In 2015, three presses were rebuilt. The remaining three presses are scheduled for rebuilding in 2016. Huber recommends rebuild at 8,000 - 9,000 hours, staff determined that with our less abrasive sludge we could get nearly 12,000 hours between rebuilds. In addition to the sludge ISP work, the Baycor gathering conveyor had to be replaced at a cost of nearly \$9,000 with funding coming from our Headworks OM&R budget.

III. NKSA SANITARY SEWER COLLECTION FUND BUDGET

North Kent Sewer Authority completed the third full year for operation and maintenance of the Sewer Disposal System in 2015. The "Sewer Collection Fund" was created in 2012 for the purpose of recording expenses related to NKSA Joint, Shared and Local sewer system cost.

NKSA Sewer Disposal System department accounts are listed below to describe the various expense centers that are operated by the Authority.

- **Department 545 – NKSA “Joint” System.** To record all expense related to operation of the Joint Sewer System. This includes the Four Mile Lift Station and Joint system sewers.
- **Department 550 – Plainfield Township “Local” System.** To record all expense related to operation of Plainfield Township’s locally owned Sewer System. This includes 14 Lift Stations with approximately 164 miles of sewer main.
- **Department 555 – Alpine Township “Local” System.** To record all expense related to operation of Alpine Township’s locally owned Sewer System. This includes 2 Lift Stations with approximately 45 miles of sewer main.
- **Department 560 – Cannon Township “Local” System.** To record all expense related to operation of Cannon Township’s locally owned Sewer System. This includes 12 Lift Stations with approximately 41 miles of sewer main.
- **Department 570 – Alpine/Plainfield Township “Shared” System.** To record all expense related to operation of Alpine Township and Plainfield Township’s shared Sewer System components.
- **Department 575 – Cannon/Courtland Township “Shared” System.** To record all expense related to operation of Cannon Township and Courtland Township’s shared Sewer System components. This includes Grass Lake Lift Station and related shared sewers.
- **Department 580 – Plainfield/Cannon/Courtland Township “Shared” System.** To record all expense related to operation of Plainfield Township, Cannon Township and Courtland Township’s shared Sewer System components. This includes Rogue River Lift Station and related shared sewers.

Figure 4 below indicates 2015 pre-audit expense for each department.

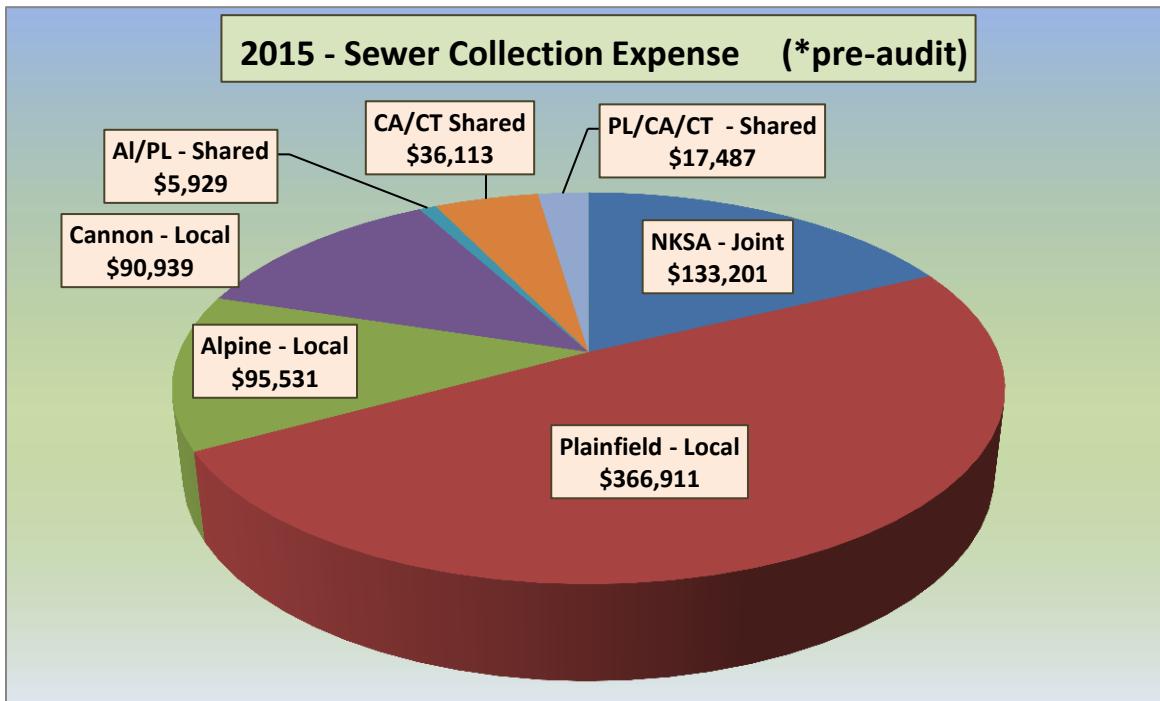


Figure 4 – 2014 Sewer O&M Expenses

In 2014, the Michigan Department of Environmental Quality initiated a new grant program designed to aid communities in developing Asset Management Plans for their respective infrastructure systems. This program, referred to by the acronym "SAW Grant" is funded through Clean Michigan Bond funds. Grants will provide 90% matching funds for DEQ approved communities with a three year grant timeline. The global goal for SAW Grant Programs are similar i.e. assess the overall condition of the collection systems, assess financial burden with funding ability and develop an MDEQ approvable asset management plan for the future.

Alpine Township, Plainfield Charter Township and City of Rockford were all selected for first round SAW Grant funding beginning in October 2013. Cannon Township was approved for second round funding which started October 2014. North Kent Sewer Authority and Courtland Township were approved for third year funding starting in October 2015. Prein&Newhof consulting engineers are grant administrators for all communities except Courtland Township who have contracted with Williams&Works.

Sewer condition assessment was the primary objective during the first year. Work involved sewer PACP pipe inspections, manhole condition assessment and sewer mapping. In 2015, grant work focused on defining system criticality and beginning the financial assessment process. The final year will be AM plan development. North Kent Sewer Authority's AM plan will be different as PARCC Side CWP becomes the focal point for assessment and defining critical operation equipment. Because of SAW, many of our sewer Work Plan activities were rescheduled. The state wide SAW grant program put a huge demand on contract sewer cleaning companies to the point we had problems scheduling normal sewer maintenance activities.

IV. PARCC Side CWP - OPERATIONAL DATA

From a treatment plant perspective, daily plant flow is the most important operational parameter. With a membrane plant it is even more crucial due to flow limitations of membrane systems. PARCC Side CWP has an average daily flow design of 6.3 million gallons per day (MGD). PARCC Side CWP is also rated with a design maximum day flow of 9.6 MGD and peak hour flow of 11.3 MGD.

For 2015, PARCC Side's average daily flow was 3.55 MGD. Although hard to see in Figure 5, 2015's daily average was only 0.14 MGD lower than 2014.

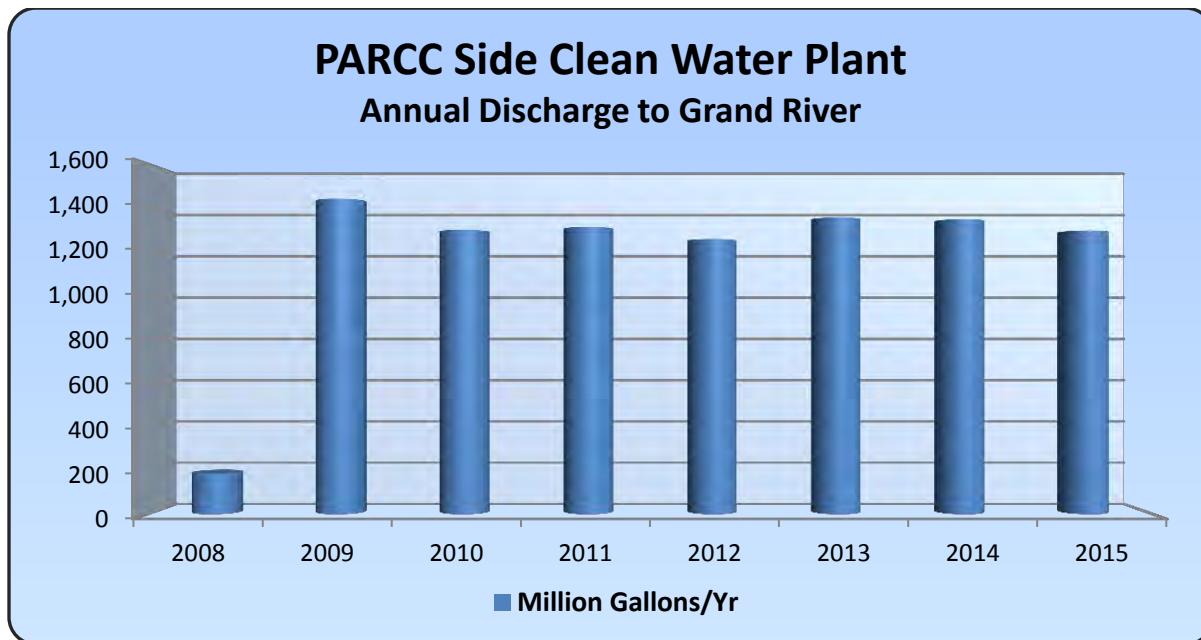


Figure 5 – Annual Discharge Flow

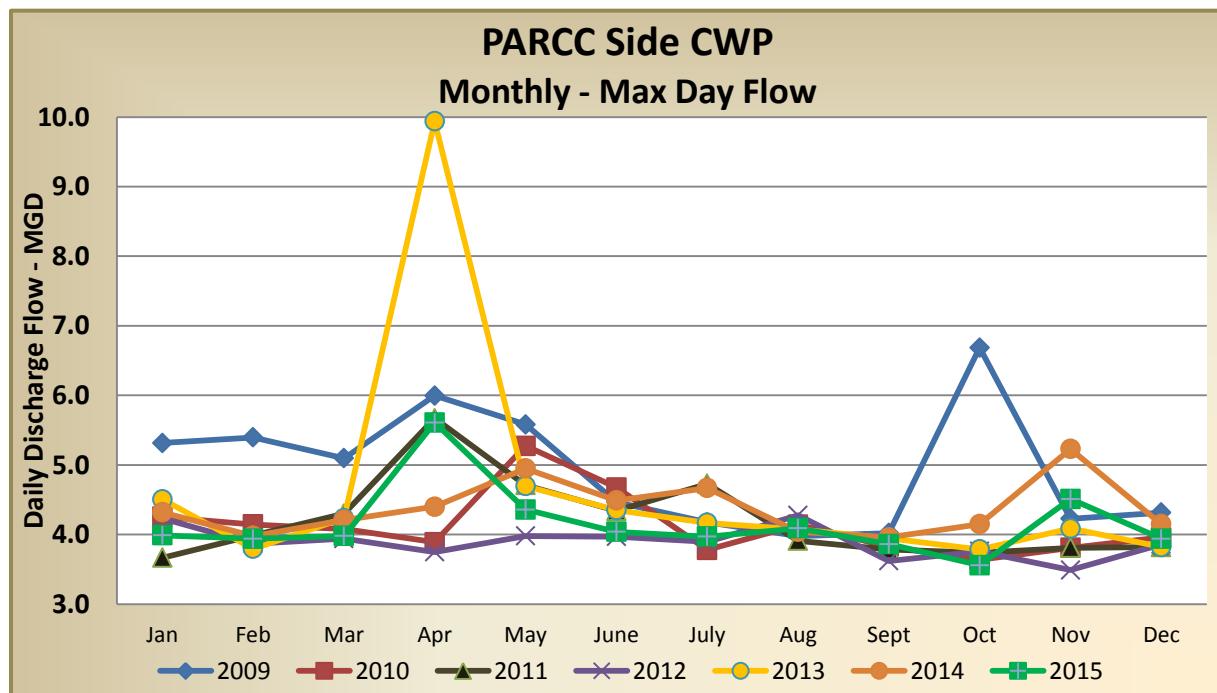


Figure 6 – Maximum Day Flow

It is important for readers to understand some basic treatment processes used at PARCC Side CWP as they are truly state-of-the-art technology. Treatment is accomplished using a proven biological system in conjunction with membrane filtration of the water. In the industry it is known as a Membrane Bio-Reactor (MBR) process that incorporates millions (6,300,000 at PARCC Side) of membrane fibers to provide a physical barrier for the removal of pollutants larger than 0.04 microns. For perspective, this pore size is 1,000 times smaller than the diameter of a human hair. Figure 7, represents how water passes through the membrane pores, yet pollutants are too large to pass through.

As a new technology, PARCC Side CWP has been drawn in the discussion about microbeads being discharged into the water environment. At the end of 2015, legislation was passed banning microbeads in products beginning in 2017. It should be pointed out that PARCC Side's membrane process doesn't allow microbeads to pass through the membrane therefore they are not discharged in our effluent to the Grand River. They are however captured in the plant's sludge and deposited in the landfill.

In addition to the biological treatment of pollutants, chemical addition is utilized for the removal of phosphorus. Phosphorous is a fertilizer that if not controlled can accelerate the aging of water bodies (eutrophication) by allowing excessive plant growth and resulting decay. At PARCC Side we feed a caustic solution of sodium aluminate to remove phosphorus. Aluminate was selected because it adds alkalinity to the bio-reactors to aid in ammonia removal. Sodium hypochlorite and citric acid are used for membrane cleaning procedures. Figure 8, reflects monthly chemical usage in the treatment plant for the last seven years.

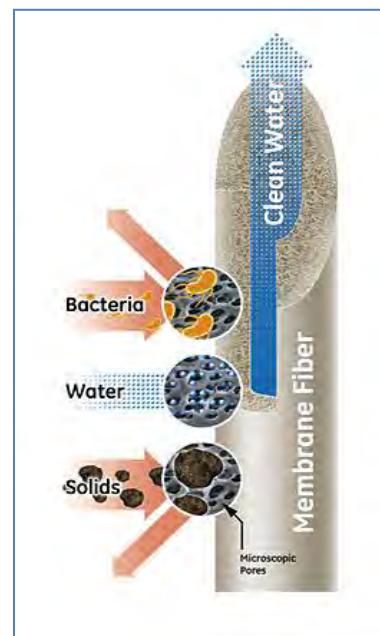


Figure 7 - Membrane Illustration

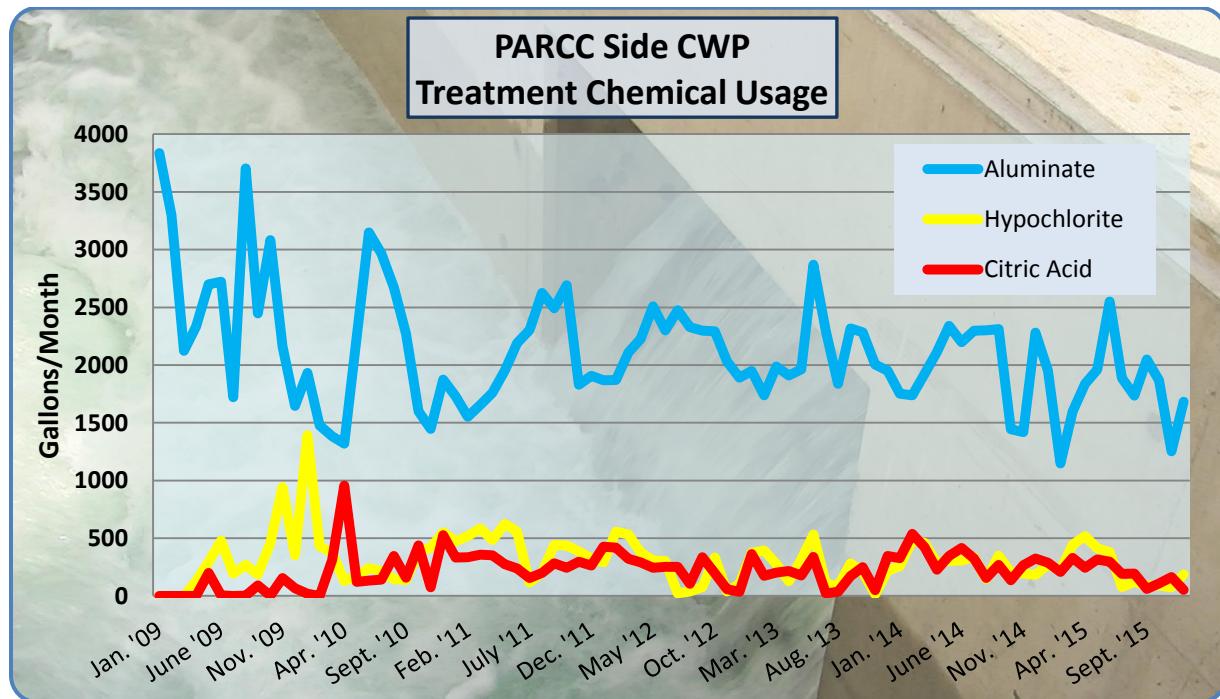


Figure 8 – Monthly Chemical Usage

Treatment of wastewater produces two very differing products; obviously the first is clean water for discharge into the environment and second, the often unseen product called biosolids. Biosolids are the treatment residual waste comprised of excess organisms used for biological treatment along with adsorbed chemicals such as phosphorus. PARCC Side CWP uses Huber Inclined Screw Press equipment for de-watering liquid biosolids. By reducing the liquid concentration a biosolids ‘cake’ is produced that is then hauled to North Central Landfill. This disposal practice provides the landfill with a good municipal solid waste fill material that increases decomposition and related methane production utilized for energy generation at the landfill.

Operators at the plant can also thicken the liquid portion of biosolids by allowing the holding tank solids to settle out and de-canting the clear liquid portion back into the plant influent flow. As indicated in Figure 9, during 2015 operators were able to reduce the volume of waste

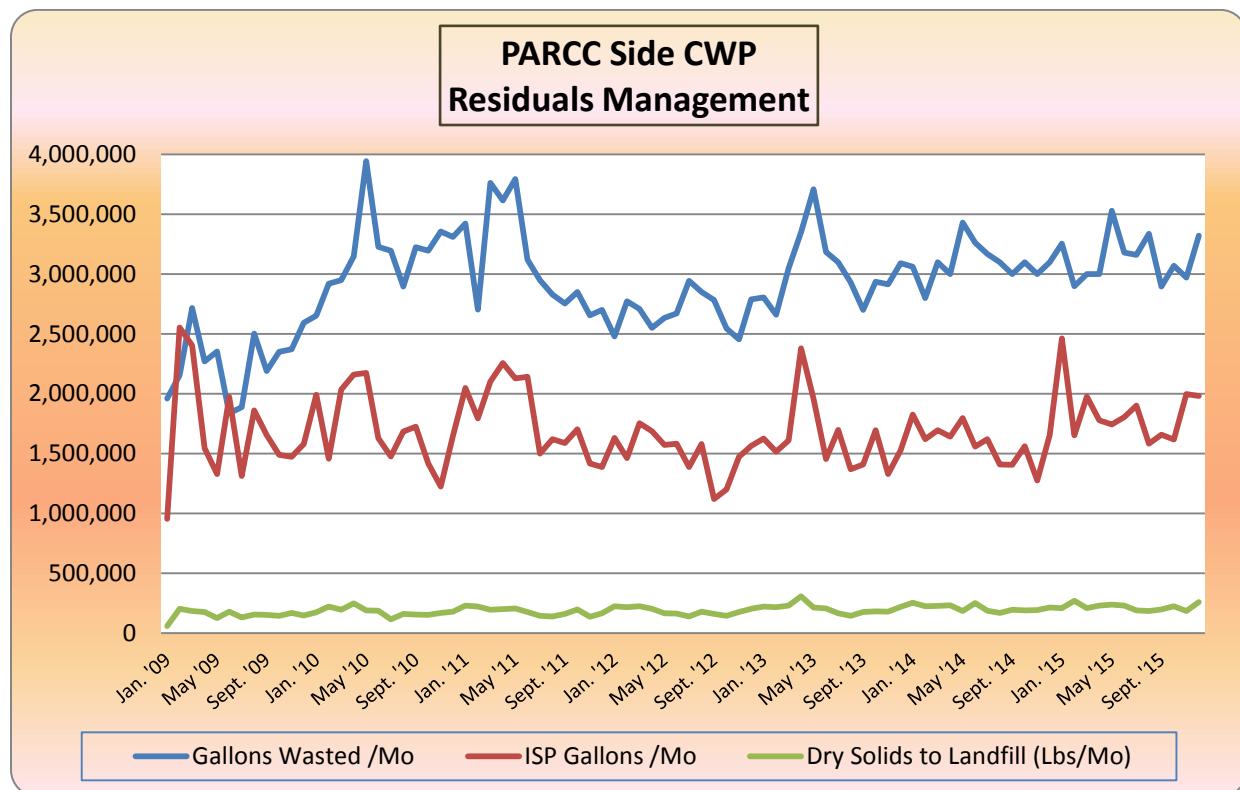


Figure 9 – Residual Management

mixed liquor to be pressed from the wasted amount of 3.13 MG/month to 1.85 MG/month, a 41% reduction in volume. This directly relates to a 41% savings in Inclined Screw Press operation. As indicated in Figure 10, the net tonnage of dry solids going to the landfill has increased the past few years. Because pounds of pollutants removed are a reflection of our population and industries served there are several possible reasons. Population growth along with less I&I as flows are consistent, possible ISP wear resulting in wetter sludge or increase in higher strength waste discharge from food/beverage facility discharges.

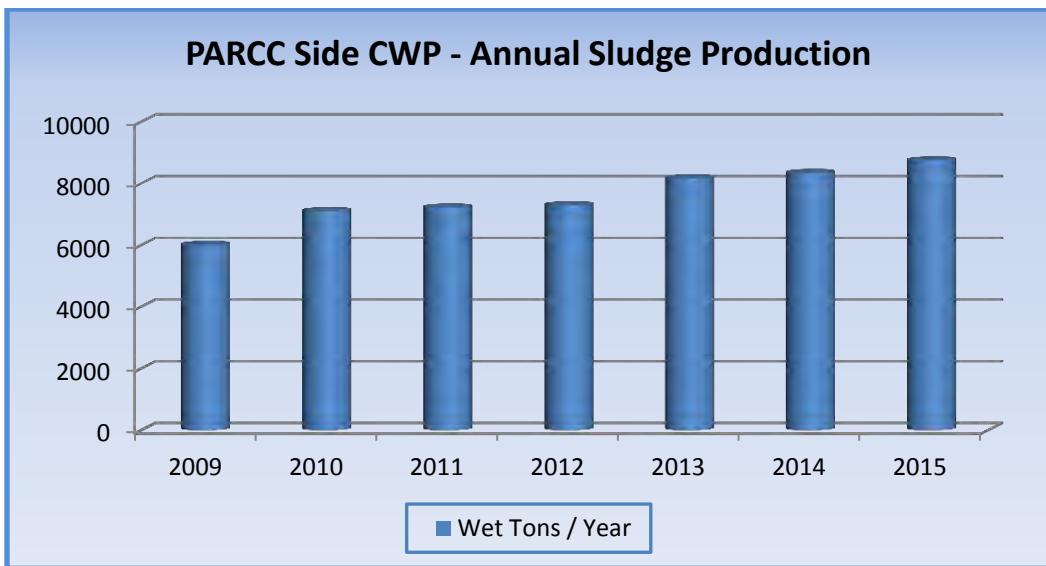


Figure 10 – Annual Sludge/Biosolids Production

Figure 11, below presents PARCC Side's annual electrical consumption and related annual electrical cost from plant start-up through 2015. This graph provides some very interesting information related to our effort to reduce energy consumption as well as rising electrical cost.

It can be seen that energy consumption was reduced in 2010 as plant processes were optimized. In 2014, a new style high RPM aeration blower was installed which allowed feed-back control of our dissolved oxygen levels in the aeration basin. Staff predicted \$90,000 in energy savings and after a full operational year in 2015, the actual savings were \$88,000. The Authority Board approved putting these savings into our CIP Fund to help fund future plant improvement projects thus hoping to stabilize future user fee increases.

It should be highlighted that but-for the efforts to reduce energy usage our current electrical cost would be approaching \$600,000/year instead of \$400,000/year due to increased electrical energy cost.

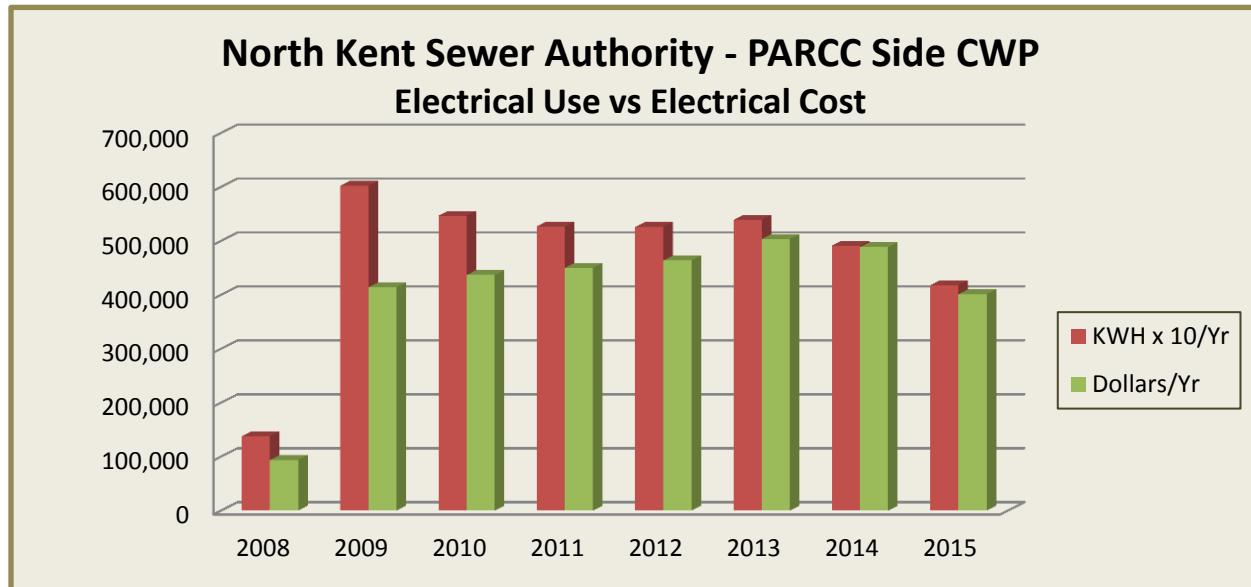


Figure 11 – Annual Electrical Consumption and Cost

V. DISCHARGE WATER QUALITY

PARCC Side CWP discharges treated effluent into the Grand River and as with any discharge of treated wastewater; it is regulated by the Michigan Department of Environmental Quality. MDEQ has the responsibility for controlling allowable levels of pollutants discharged into the environment through designation from the U.S. EPA as a permittee State. In later graphs you will see that PARCC Side's permit, as issued by MDEQ, contains specific water quality limits that are allowed to be discharged into the Grand River from our facility. PARCC Side CWP NPDES discharge permit was renewed in 2015 after expiring in 2013. The current permit will expire October 1, 2018.

To help understand PARCC Side CWP performance, it is important to understand a few basic water quality principles related to water treatment. As shown in Figure 12, one parameter tested for is Biochemical Oxygen Demand (BOD). BOD provides an indication of the oxygen demand a waste would have on the receiving stream. Another analyzed parameter is Total Suspended Solids (TSS). TSS results for our influent and effluent samples are shown in Figure 13, and represent solids captured on a laboratory filtration disc of specified size.

The plant again averaged removal rates greater than 99% for Biological Oxygen Demand and Total Suspended Solids during 2015 as in all previous years!

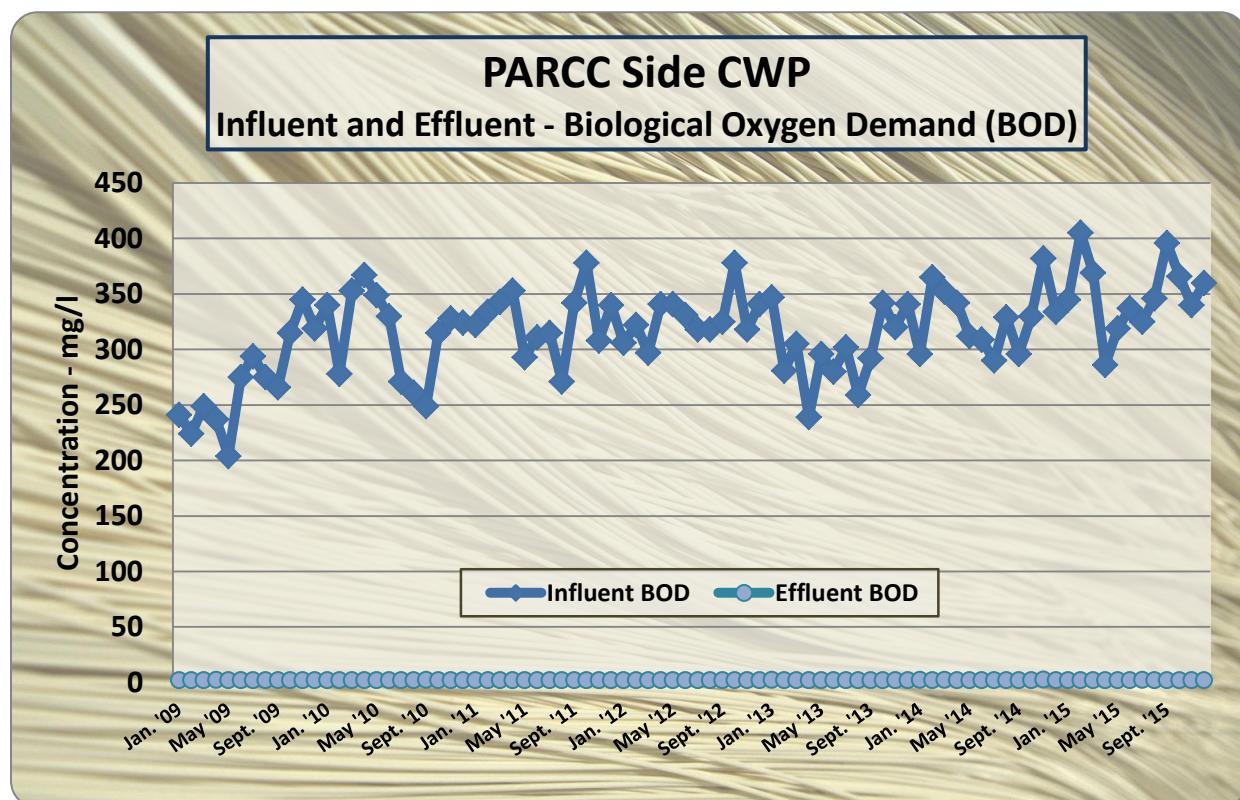


Figure 12- Influent and Effluent – BOD

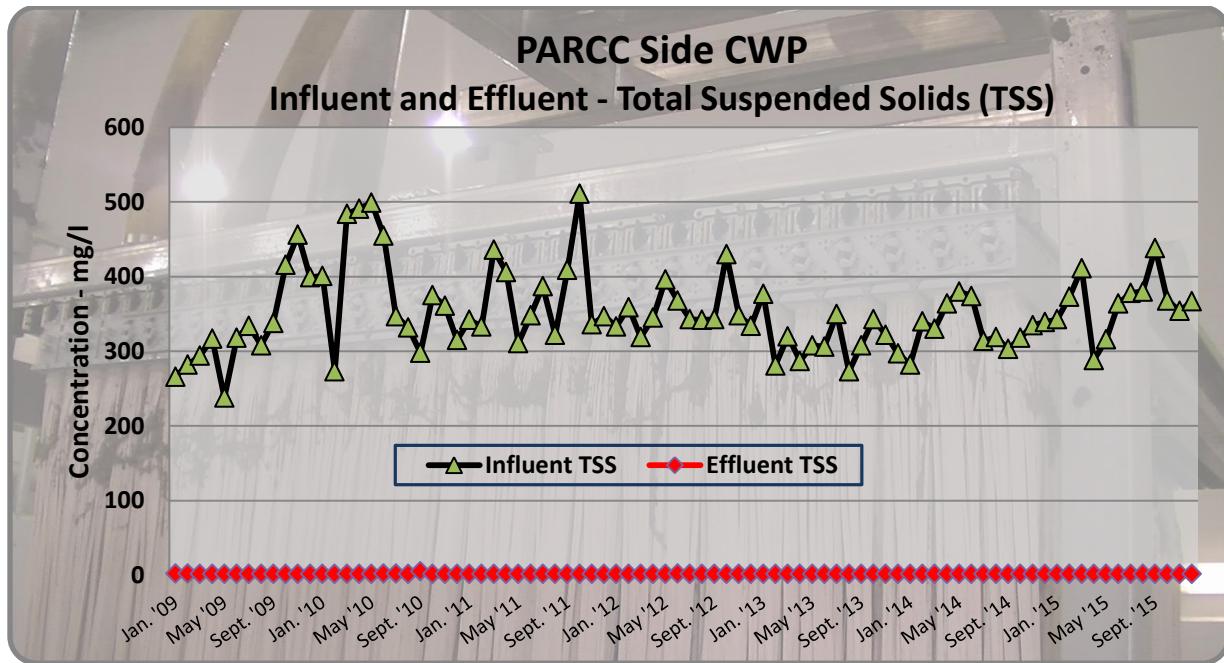


Figure 13 - Influent and Effluent - TSS

PARCC Side has discharge permit limits for the amount of BOD and TSS that can be discharged. Limits can also vary with the seasons to reflect river flows and usages. As indicated in Figure 14 below, PARCC Side has a BOD Monthly Average Limit and a BOD Daily Maximum Limit at differing times of the year. PARCC Side CWP's average of 2.0 mg/l was below permit limits. It should be pointed out that 2.0 mg/l is our quantification limit for BOD analysis, therefore our discharge is actually well below discharge limits.

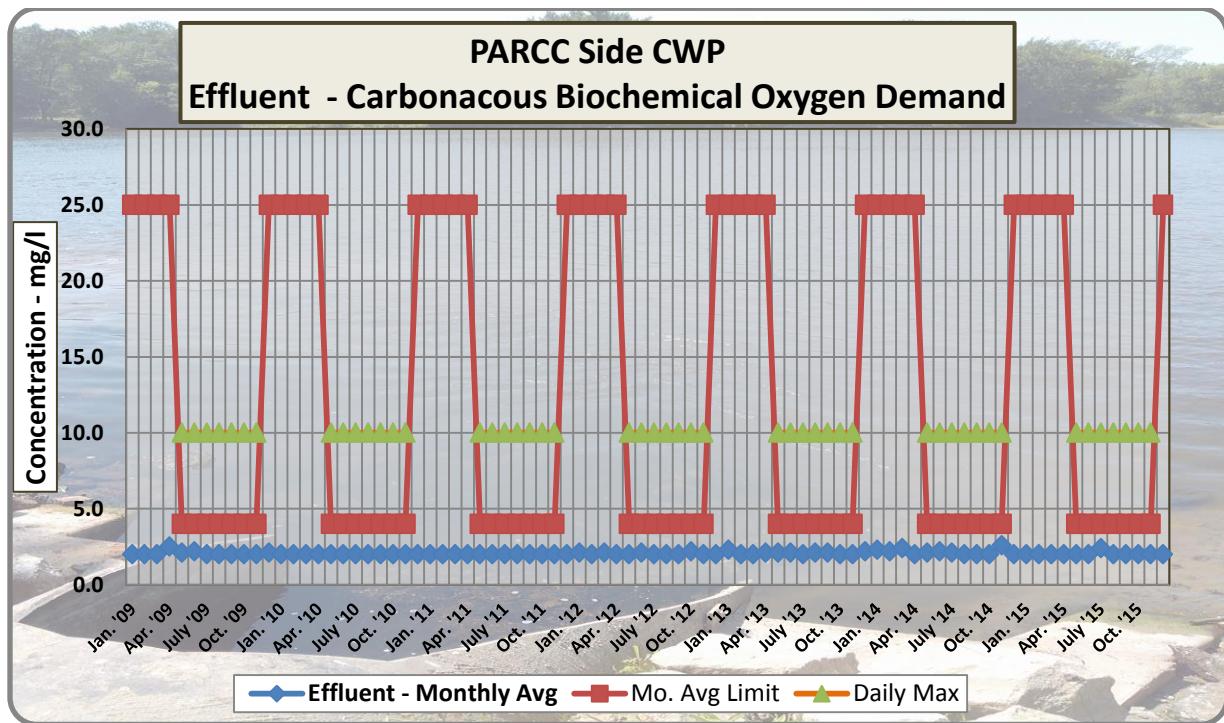


Figure 14 – Effluent CBOD vs Permit Discharge Limits

Figure 15, compares TSS levels in our effluent to permit limits. For the past six (7) years our yearly average for TSS was 2.0 mg/l, again our laboratory quantification limit. Discharge quality remained well below the Monthly Average Limits and 7-Day Average Limits. Note; there is no Daily Maximum Limit for TSS.

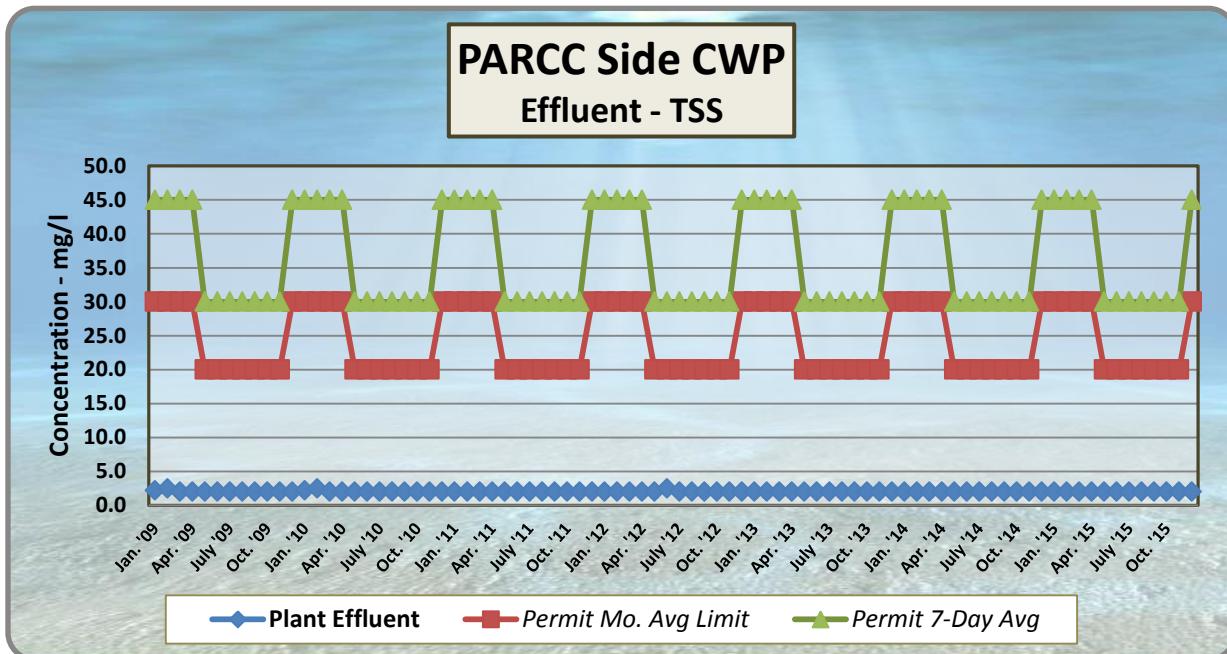


Figure 15 - Effluent TSS Concentration vs Permit Limits

In addition to BOD and TSS, PARCC Side CWP has limits on the amount of phosphorus and ammonia that can be discharged into the Grand River. Ammonia and phosphorus are both nutrients that can increase aquatic plant growth. Influent and effluent phosphorus concentrations are plotted in Figure 16.

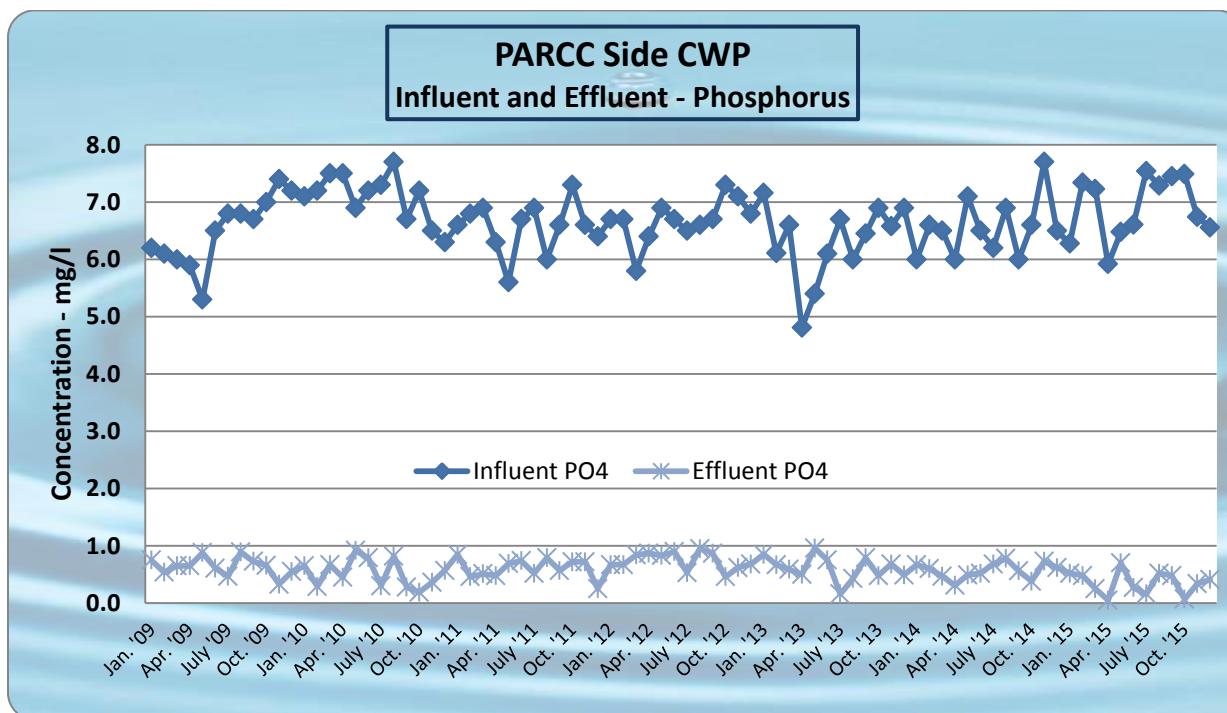


Figure 16 - Phosphorus Removal

Figure 17, summarizes the effluent phosphorus concentration related to our discharge permit limit of 1.0 mg/l, with no seasonal change. PARCC Side uses sodium aluminate for removal of

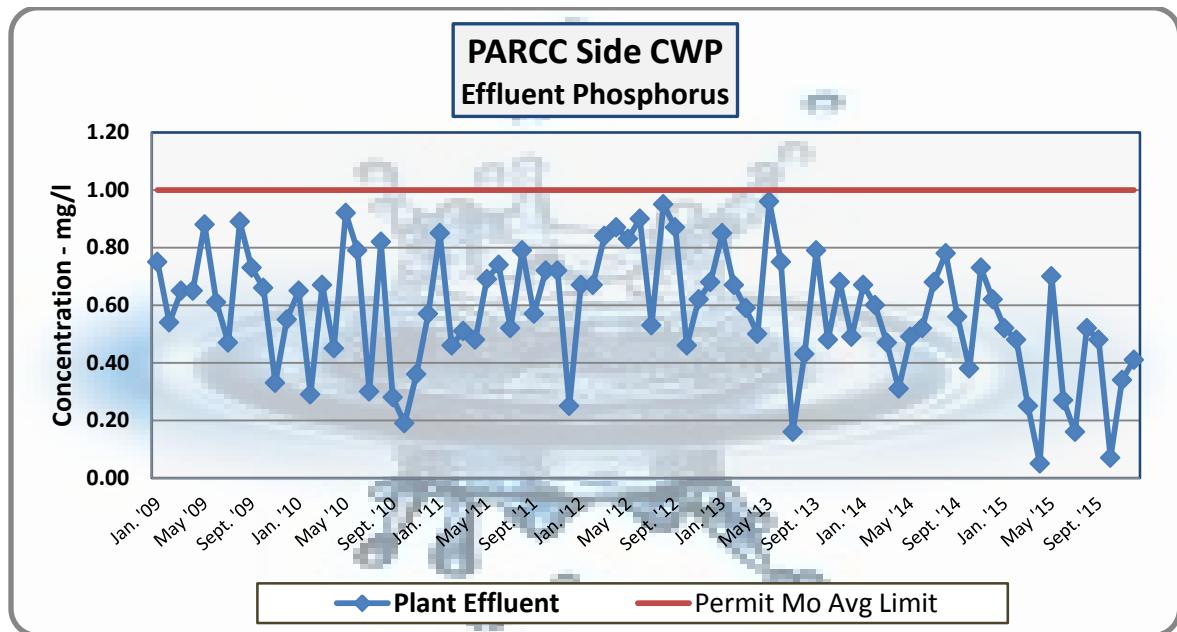


Figure 17 – Effluent Phosphorus Concentration vs Permit Limit

phosphorus by chemical precipitation. Biological removal of phosphorus occurs if certain conditions are favorable. This can be seen by the discharge fluctuation and from our chemical usage information that was presented in Figure 8.

Ammonia influent and effluent concentrations are shown in Figure 18 below. Virtually all of the ammonia is removed before discharge. Figure 19, compares our discharge to permit limits. It should be pointed out that during winter months there is no ammonia discharge limit, only

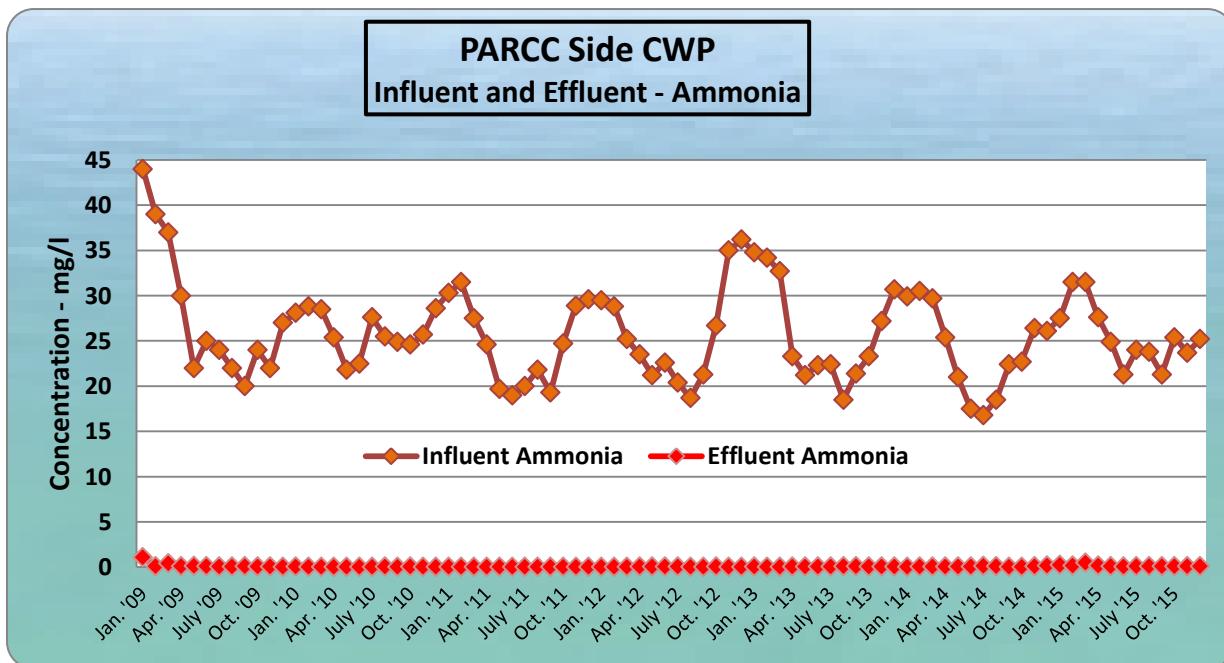


Figure 18 – Influent and Effluent Ammonia Concentrations

monitoring and reporting. Removal of ammonia is a biological process that normally will not take place in colder climates and cooler water temperatures. However, as indicated PARCC Side has been able to maintain nitrifying bacteria year-round because the MBR process uses a much larger bio-mass for wastewater treatment than conventional activated sludge plants. Figure 19, does indicate the cold water effect last winter's much longer and colder temperatures had on our nitrifying bacteria.

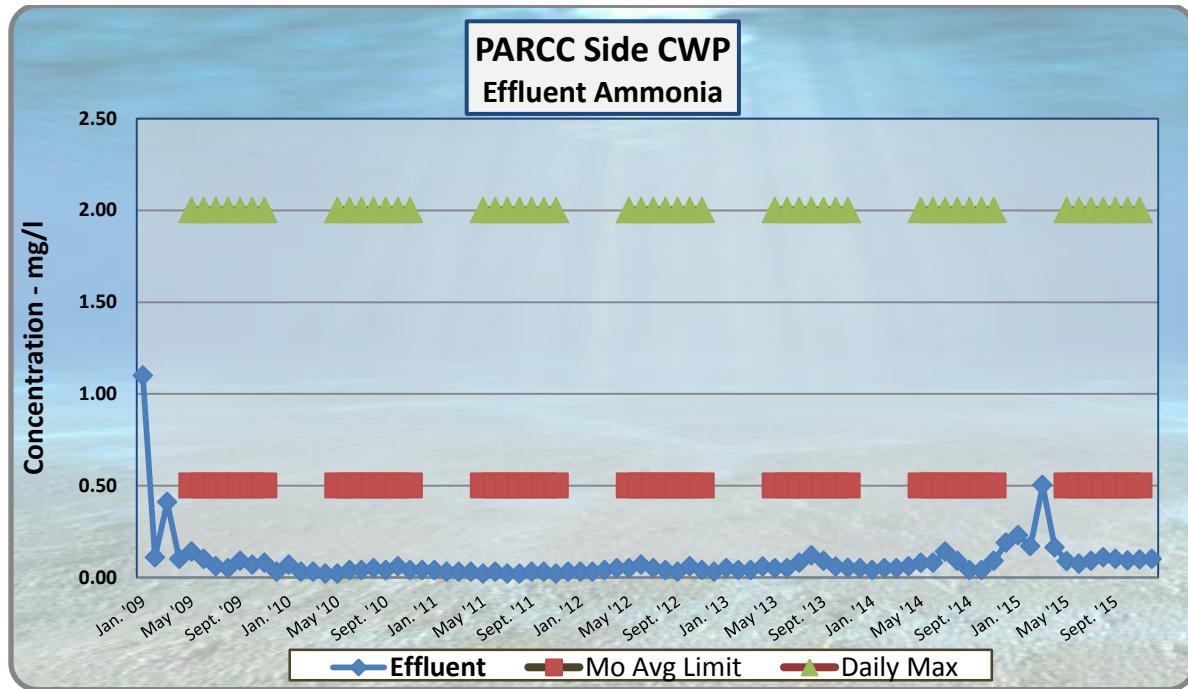


Figure 19 - Effluent Ammonia Concentration vs Permit Limit

VI. OPERATIONAL ACTIVITIES AND SUPPORT

The purpose of this report is to review NKSA's PARCC Side Clean Water Plant operation and performance for calendar year 2015. However, from an operational perspective it is important to include previous year results to showcase how consistent the effluent quality has been.

Operationally, PARCC Side CWP staff remained the same for most of 2015. The department is operated by a manager, a plant assistant superintendent, a sewer superintendent and five (5) operators. A new sewer lead operator position was created this past summer and Jeremy Pitsch was promoted to that position. With the increase in sewer connections, MISSDIG work and planned sewer projects underway it was time to increase staff. A new plant operator was hired in November 2015. NKSA operators are all cross-trained to rotate weekly through five positions at the plant and in the field. Operators also rotate being on-call to respond to after hour emergency calls.

PARCC Side maintains all of the plant equipment and lift station equipment utilizing a computerized maintenance management (CMM) program. During 2015, over 5,700 work orders were issued and completed. These work orders include both scheduled maintenance

and corrective (repair) work orders. Because our plant CMM doesn't handle spatial data (GIS) we will be adding a new sewer system CMM software package in 2016.

Laboratory control is one of the five operator rotational assignments. In 2015, operators performed over 8,300 water analysis for plant control and permit compliance. In addition, samples are often sent out for specialized testing such as metals and organics. Our new NPDES permit requires Whole Effluent Toxicity (WET) testing on a monthly basis which requires a specialized laboratory. If our WET testing results continue to indicate no effect, we can petition MDEQ for a reduction in testing frequency.

Besides the ISP rebuilding projects last year NKSA entered into contracts with Xylem and Northwest Kent Mechanical for replacement of PARCC Side CWP bio-reactor aeration diffuser system. This project was started in the fall and will be completed in the spring of 2016.

As stated above, sanitary sewer operations were very busy with a host of new developments and sewer connections. Supervisors and operators did an excellent job working with engineers and contractors on SAW Grant task in addition to their normal job demands. With sewer projects planned this year at Forest Ridge lift station, Rogue River siphon replacement in Plainfield Township and Silver Lake sewer replacement project in Cannon Township it will be a very interesting construction year.

NKSA Board members were unchanged during 2015. Sanitary sewer and Infrastructure committees are now in place for each of the Local sewer systems NKSA operates. These committees provide direction for local collection system work objectives along with required SAW Grant activity communication.

Hopefully, NKSA sewer customers will realize that their wastewater continues to receive exceptional treatment and that water quality in the Grand River has been improved by this facility. Readers of this report that are not familiar with the North Kent Sewer Authority or PARCC Side CWP are encouraged to visit our website; www.nksa.us or better yet, call for a tour of the facility.

Finally, in December of last year, the Board appointed Mr. James 'Scott' Schoolcraft as NKSA's new Director effective February 1, 2016. I've had the rare opportunity to be NKSA's first employee, commissioning PARCC Side CWP and helping operate the plant for over 7 years. I am very grateful to my co-workers and all who have helped in this endeavor.

Thank you,

Larry H. Campbell, Director
North Kent Sewer Authority