Sustainability

2019 Annual Report

Madison Metropolitan Sewerage District

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INTRODUCTION

Stewardship is core to the mission of Madison Metropolitan Sewerage District. This ethic allows us to make sound decisions to protect public health and the environment by forging our planning and priorities in ways that are meaningful and responsive to our customers and natural resources.

Stewardship was woven into much of the District's work in 2019. This work not only sets us on a path for long-term stability, but it strengthens our partnerships, locks in good financial management strategies, solidifies our commitment to transparency and to our communities, extends our mission to protect public health and environment, and allows the District to set itself as a leader among clean water utilities. Some highlights of our commitment to stewardship in 2019 include:

Customer community outreach: The District organized three meetings with its customer communities where participants learned about District work and received feedback on issues participants were most interested in learning about. Through these meetings, we established an inflow and infiltration technical advisory committee that is now active. The meetings also set the course for our 2020 schedule, as a call for greater insight into the District's budget and financial strategy was top among participant feedback.

Asset management and reliability-centered maintenance: In 2019, District staff completed an asset management plan for assets at the treatment plant and continued developing reliability-centered maintenance (RCM) best practices; these actions help lower the life-cycle cost of assets, manage risk, maintain service levels, and better plan and execute work. Next steps include deeper implementation of RCM, supporting the design and implementation of a new computerized maintenance management system, and continued work to update the collection system facilities plan, including asset management issues.

Emerging contaminants: The District takes customer and community issues seriously, including public concerns regarding the transport, fate and effects of per- and polyfluoroalkyl substances (PFAS). While wastewater treatment plants are not original sources of PFAS and do not add or have the capability to remove these chemicals during the treatment processes, the District committed significant time and resources in 2019 to better understand PFAS. This included a comprehensive sampling and analysis plan to fill sizeable gaps in the science of PFAS in wastewater and biosolids and establish a baseline, through standardized testing, to help the District better monitor PFAS.

Unfortunately, in 2019 the District also lost a strong advocate for our work with the passing of Commission Secretary James L. Martin. Along with his fellow commissioners, Commissioner Martin set a vision for the District based on equity, reliability and being good partners, and during his tenure he was a strong advocate for African Americans being represented in all parts of life. Secretary Martin advanced major improvements in the collection system, all while insisting on fiscal accountability. We thank Commissioner Martin for his professional and personal dedication to the Madison Metropolitan Sewerage District.

And we thank you for your support. I welcome your comments and feedback on this annual report.

Sincerely,

Michael Mucha, P.E., ENV-SP

Chief Engineer and Director | Madison Metropolitan Sewerage District

About the District

WHO WE ARE

The District Defined

Madison Metropolitan Sewerage District (the "District") is a body corporate with the powers of a municipal corporation for the purpose of carrying out the provisions of Sections 200.01 to 200.15 of the State of Wisconsin Statutes. These provisions allow for the creation of "metropolitan sewerage districts" governed by a commission to manage wastewater collection and treatment in metropolitan areas in Wisconsin. As part of the 2015 budget bill, 2015 Wisconsin Act 118, the legislature revised the makeup of such commissions in areas including Dane County.

Our Mission

PROTECT PUBLIC HEALTH AND THE ENVIRONMENT

We are a passionate and experienced resource recovery team focused on protecting public health and the environment. Every time we clean and return wastewater safely back to nature or apply Metrogro to help farmers grow more food, we are taking steps to create a cleaner and better world. We are known for our innovative engineering, conservation leadership and expertise with resource recovery. We are also cost-conscious ratepayers, just like you.

Our Vision

ENRICH LIFE THROUGH CLEAN WATER AND RESOURCE RECOVERY

Our vision is to enrich the community by improving living conditions for people, plants and animals while seeking partnerships with others to better conserve our shared resources. Water is finite; we can't create more of it. By changing the way we think about and use water, together we have the power to enhance the quality of life on our planet. By making small changes and respecting every drop of water we have today, we can set the tone for a resource-conscious and sustainable community tomorrow.

Commission

The District is governed by a nine-member commission appointed for staggered three-year terms. The mayor of Madison appoints five individuals as members of the Commission. An executive council composed of the elected executive officers of each city and village that is wholly or partly within the boundaries of the District, except Madison, appoints three members of the Commission by a majority vote of the members of the executive council. An executive council composed of the elected executive officers of each town that is wholly or partly within the boundaries of the District appoints one member of the Commission by a majority vote of the members of the executive council.

- Thomas D. Hovel, President (term ending June 30, 2020)
- Ezra Meyer, Vice President (term ending June 30, 2019)
- Ken Clark (term ending June 30, 2019)
- Sara Eskrich (term ending June 30, 2020)
- Grant Foster (term ending June 30, 2020)
- Brad Murphy (term ending June 30, 2021)
- Mary Swanson (term ending June 30, 2021)
- Tom Wilson (term ending June 30, 2021)
- TBD

Note: D. Michael Mucha serves as the Chief Engineer and Director of the District. Dave Gawenda, the Treasurer of the City of Madison, serves as Treasurer of the District. Paul Kent, Stafford Rosenbaum, LLP is legal counsel for the District.

TIME AND PLACE OF MEETINGS

The Commissioners of the District meet one to two times each month, at the Maintenance Facility Training Center at 1610 Moorland Road, Madison, WI 53713. Special meetings are held upon call of any member of the Commission.

Executive Team

The Executive Team consists of five directors, a human resources manager, a communications and public affairs manager, the chief engineer and director and the District's legal counsel. The team meets Wednesdays in the Operations Building.

The directors oversee the following departments:

- District Leadership and Support
- Ecosystem Services
- Engineering
- Finance
- Operations and Maintenance
- Planning and Strategy

DISTRICT LEADERSHIP & SUPPORT

The purpose of the District Leadership and Support team is to provide human resources, Commission and communication services to the organization so that the District develops and invests in coworkers, advances a policy-driven strategic approach to governance and deepens relationships with customers and the public.

ECOSYSTEM SERVICES

The purpose of the Ecosystem Services department is to advance initiatives and provide support services so that treatment plant operating systems can be optimized, demand for traditional wastewater treatment infrastructure and collection services can be reduced, resources can be recovered and environmental quality can be enhanced.

ENGINEERING

The Engineering team provides design and construction administration services to other departments and advisory services to District teams so that safe, reliable and cost-effective infrastructure is built.

FINANCE

This department provides financial services – procurement, accounting and financial process improvement – to internal and external customers so that the District can achieve its mission of protecting public health and the environment.

OPERATIONS AND MAINTENANCE

This department protects human health and the environment by ensuring that all wastewater generated in the District's service area is safely conveyed to the Nine Springs Wastewater Treatment Plant. They then recover the resources of clean water, biosolids, biogas and phosphorus fertilizer.

PLANNING AND STRATEGY

Planning and Strategy monitors, evaluates and reports on the overall health of District infrastructure in support of long-term planning and financial sustainability. The department uses analytical tools and data, which it develops in cooperation with other departments, including asset management, information technology, the computerized maintenance management system (CMMS) and the geographic information system (GIS), among others.

Personnel

In 2019, the District employed 104.5 full-time employees (FTE). Table 1 represents the District's overall staffing from 2018-2019.

Table 1 – FTE Employees

DEPARTMENT	2018 FTE COUNT	2019 FTE COUNT
Administration	7	0*
District Leadership and Support	7	15
Ecosystem Services	17	16
Engineering	7	8.5
Operations and Maintenance	51	51
Planning and Strategy	13	14
TOTALS	102	104.5

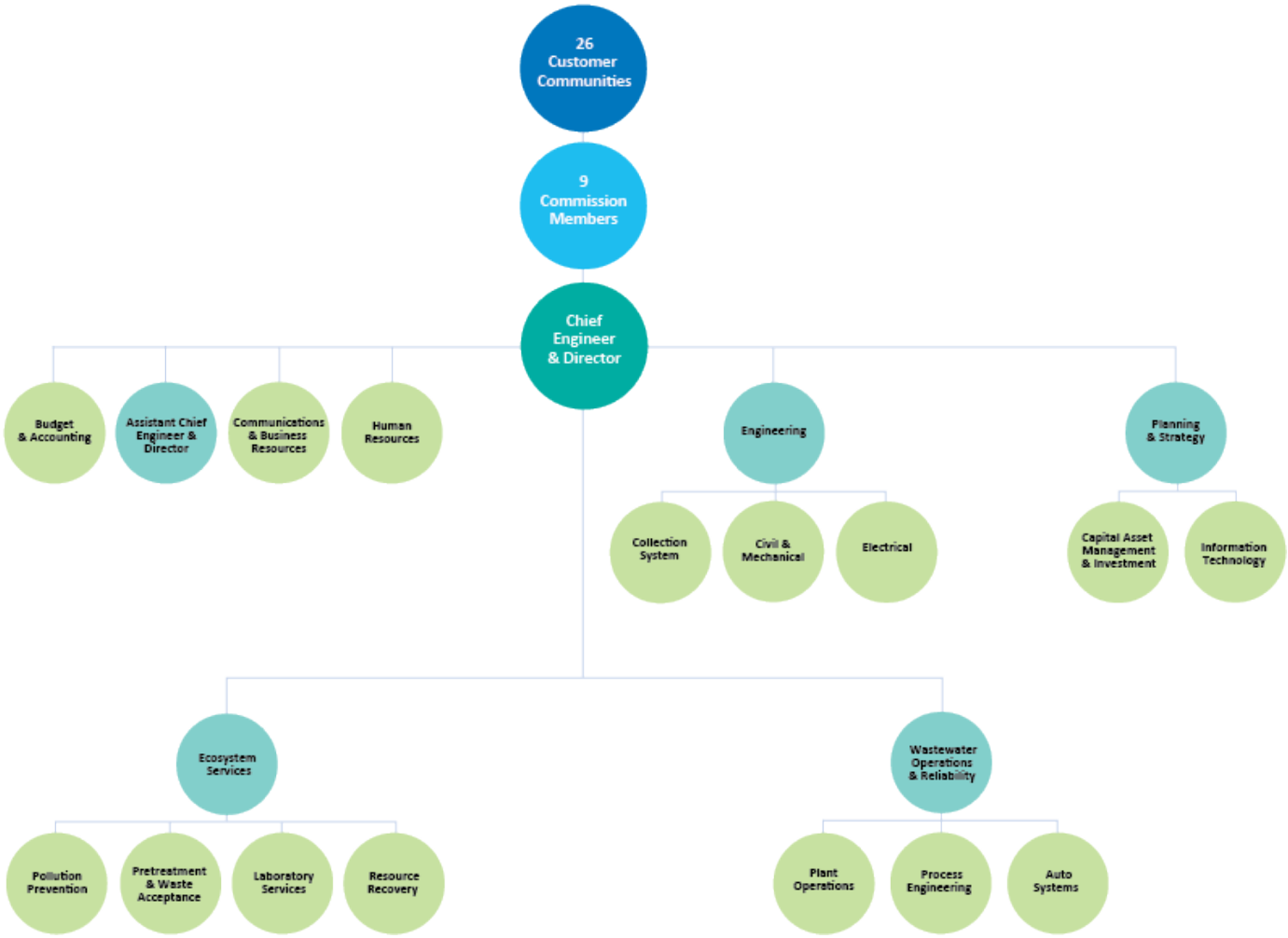
**Moved to District Leadership and Support*

2019 HIRES, RETIREMENTS AND PROMOTIONS OF DISTRICT EMPLOYEES

New Employees	Retirements	Promotions
23	5	10

Figure 1 is an organization chart that represents the District's hierarchy at the end of 2019.

Figure 1 Organization Chart



WHAT WE DO

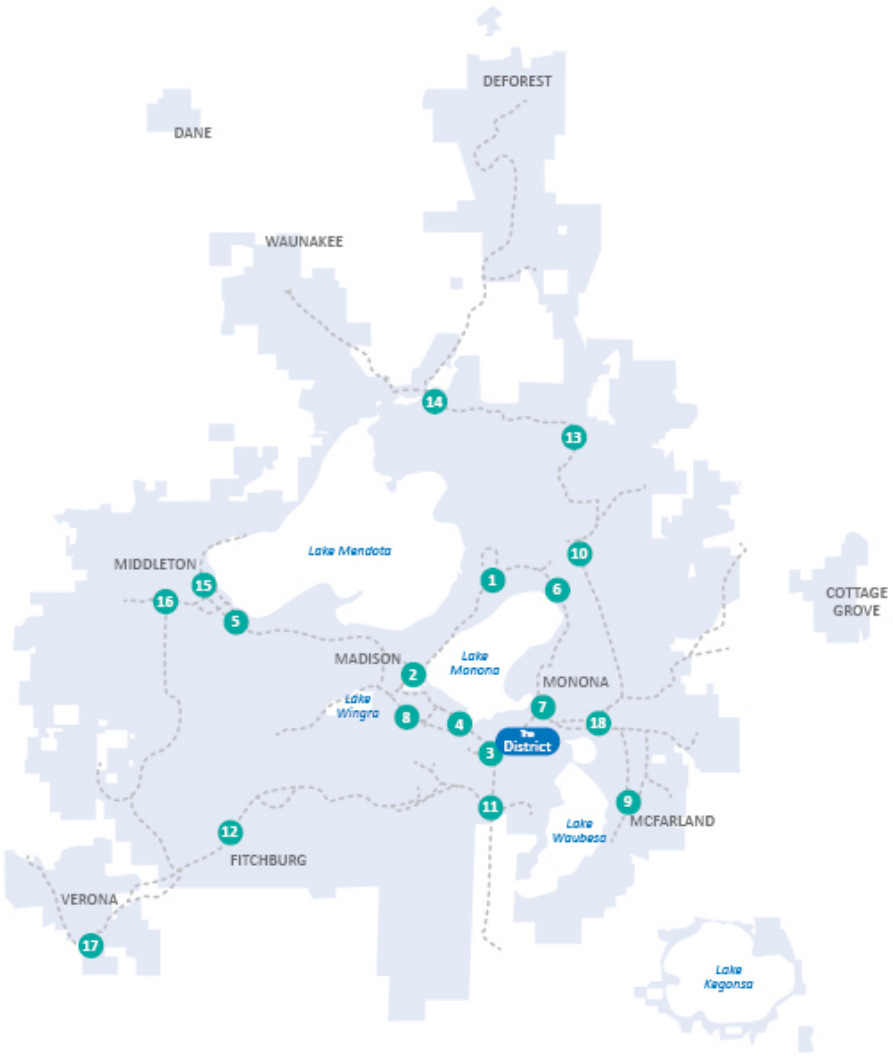
For almost 90 years, the Madison Metropolitan Sewerage District has protected public health and the environment by monitoring, maintaining and operating the complex system of pipes and equipment that convey, treat and return wastewater to the environment.

To convey the wastewater generated from homes, businesses and industries throughout our service area, we operate and maintain approximately 96 miles of gravity sewers known as interceptors. These interceptors collect and transport wastewater from smaller sewers, owned by local municipalities, to 18 regional pumping stations operated by the District. The 18 District-owned pumping stations and the 47 miles of pressurized force mains associated with the pumping stations are required due to the relatively flat topography in the region. All wastewater flow generated in the region, approximately 41 million gallons per day, is pumped to the Nine Springs Wastewater Treatment Plant. Once at the plant, the wastewater proceeds through an advanced treatment process that recovers three valuable resources: 1) treated effluent, 2) energy and 3) biosolids. Treated effluent is pumped to the Badfish and Lower Badger Mill creeks, where it supports diverse ecological environments including numerous species of fish and other aquatic life. Energy is produced via methane, a combustible gas, which is recovered during the treatment process and used to power engines that drive generators and a blower. Biosolids, also known as Metrogro, are an organic fertilizer and soil conditioner that are recycled to area farm fields in the spring and fall.

WHO WE SERVE

In 2019, the District served over 380,000 people in the greater Madison area. Our 186 square-mile service area includes five cities, eight villages and 13 sanitary/utility districts. The District's service area stretches from the Village of Dane in the north to the City of Verona and Lake Kegonsa Sanitary District in the south. Figure 2 shows the District collection system including its 18 pumping stations.

Figure 2 District Collection System



ANNEXATIONS TO THE DISTRICT

In 2019, the District added 510.3 acres in annexations to the District. Table 2 shows information related to these annexations.

Table 2 – Annexations to the District

Annexation Name	Number	Municipality	Acres Added
Well 6 Pump Station	2019-01	City of Verona	2.17
Reynolds property	2019-02	City of Madison	21.69
Herrling property	2019-03	City of Madison	141.85
LB Lands	2019-04	City of Verona	32.1
Former Blooming Grove Lands	2019-05	City of Madison	56.2
Tanimarah Ridge	2019-06	Village of Dane	27.7
Homburg Equipment Annexation	2019-07	Village of Cottage Grove	228.62
		TOTAL	510.3

Department Summaries

DISTRICT LEADERSHIP AND SUPPORT

Staffing

The District Leadership and Support workgroup has 7 full-time employees and 2 part-time employees:

- Chief Engineer and Director
- Communications and Public Affairs Manager
- Human Resources Manager
- Health, Safety and Security Leader
- Executive Coordinator
- Program Resource Assistant
- Program Resource Associate (2 positions - one is part time)
- Multimedia Graphic Artist (part time)

Responsibilities of Workgroup

The workgroup's main responsibilities are as follows:

- Business services
- Communications/marketing
- Commission management
- Executive management
- Human resources
- Public affairs
- Safety

Programs, Initiatives and Work Reporting

GOVERNANCE

While planning has long been woven into the District's fabric, in 2019 the Commission embarked on a series of strategic planning sessions to focus our vision and ideals and codify those programs and policies the District is implementing, developing and learning more about. The result was a formal Strategic Plan that guides our work for today, tomorrow and beyond.

Strategic planning was a governance highlight in 2019, but it was not the only major accomplishment. The Commission implemented the first year of its new performance evaluation process for the chief engineer and director, a collaborative process that includes Commission involvement, self-evaluation and 360-degree feedback from key employees and stakeholders. A new policy and a package of administrative guidelines related to records management were adopted, as was an updated policy for the development and approval of both the strategic financial planning and capital projects budget and the debt service budget.

RESOURCE/COMMUNICATIONS

The District's success in fulfilling its mission is supported by our customer communities and the residents who live in them, which requires public outreach and engagement. In 2019, the Resource and Communications team played a vital role in this by organizing three customer community meetings, which resulted in the initiation of our I/I program and greater discussion on District finances. The team also stepped up its public outreach and engagement by increasing its digital media presence, revamping its email program, and identifying future projects to increase the capacity and reach of both the team and District.

HUMAN RESOURCES

In 2019, the District continued to experience the effects of retirements and a tightening labor market. Half of the 110 full-time District employees have been with the District for six years or less. The executive team has also experienced significant change with over half of the team members hired in the last two years. While this has been a challenge for the organization, the District continues to hire high-quality employees who bring with them a variety of experience and perspectives.

Having a diverse and inclusive work environment has become a necessity, as the District's working environment must evolve to support diversity in order to recruit, retain and engage employees at the highest level. In 2019, the District's inclusion and diversity initiative moved forward with a number of strategies, including an equity analysis of our hiring process, hosting a three-day racial justice training, and developing and implementing a supervisor training with the YWCA. Inclusion and diversity is a Commission priority that will continue to evolve in the years to come.

In 2019, members of the District's Employee Leadership Council (ELC) tackled several important issues for employees including participating in the 360-degree review of the chief engineer and director, developing a coaching guide for supervisors, participating in a joint strategic planning meeting with the executive team and devoting time to employee morale. The council is composed of elected District employees and provides a path for employees to participate in responsible governance of the District. The ELC is a valuable resource to both the employees and the organization.

SAFETY

With workplace violence and security threats becoming more common, the District made significant progress in 2019 on the campus security initiative. A security assessment was completed by the Department of Homeland Security and the District began a contract to upgrade its security cameras.

In 2019, the District saw a significant decrease in the Occupational Safety and Health Administration (OSHA) incident rate and Days Away Restricted or Transferred (DART) rate (Table 3).

Table 3 – Incident and DART Rate Comparison

Year	Incident Rate	DART Rate
2011	5.50	5.50
2012	2.14	1.07
2013	4.18	4.18
2014	9.20	4.60
2015	5.70	2.30
2016	3.4	1.1
2017	3.5	3.5
2018	6.5	4.3
2019	0.88	0

ECOSYSTEM SERVICES

Staffing

The Ecosystem Services department has 17 full-time employees:

- Director of Ecosystem Services
- Lab Manager
- Chemist (6)
- Pollution Prevention Manager
- Pollution Prevention Specialist (2)
- Pretreatment Coordinator
- Resource Recovery Manager
- Metrogro Assistant
- Metrogro Mechanic (2)
- Metrogro Driver

Responsibilities of Workgroup

The purpose for the Ecosystem Services department is to envision and execute next generation water quality and resource recovery solutions. It is responsible for the resource recovery, laboratory, pollution prevention, pretreatment and waste acceptance programs. The team advances initiatives and provides support services so that treatment plant operating systems can be optimized, demand for traditional wastewater treatment infrastructure and collection services can be reduced, resources can be recovered, and environmental quality can be both protected and enhanced. This includes working to advance regulatory and strategic initiatives that provide flexibility and encourage innovation. Ecosystem Services staff work across other District departments on a variety of initiatives, in some cases leading the initiative, while in other cases providing supporting services.

Programs, Initiatives and Work Reporting

POLLUTION PREVENTION

The Pollution Prevention team works to reduce pollutants in the sewer system that the treatment plant is not designed to remove, which helps with protecting the environment and complying with permit requirements at a lower cost to our community. Major pollution prevention activities in 2019 included continued efforts to reduce chloride and mercury and a new survey to gather information about local attitudes and behaviors toward water.

Chloride Reduction

Much of the District's chloride reduction efforts in 2019 related to empowering more people to take action to reduce the amount of salt entering the sewer system. With the help of water softener experts, District Pollution Prevention staff developed a training course and accompanying educational materials to educate service providers about achieving chloride reduction by improving the efficiency of water softeners. After a pilot training in March 2019 with plumbing apprentices at Madison College, the District conducted four additional trainings for softener technicians and plumbers throughout the year, reaching close to 100 service providers with this information.

Several trained service providers went on to participate in a residential softener pilot program that the District launched late in 2019 in partnership with the Town of Dunn. The District worked with the town to develop Salt Savers, a pass-through rebate program that town staff is administering on behalf of the District to incentivize residents to get their water softeners evaluated, optimized and, if necessary, replaced. The service providers participating in the Salt Savers pilot program use an app developed by the District to record information about softeners and recommend improvements that will reduce customers' salt use. The District will take lessons from this pilot to hone the program, which the District hopes to implement in additional customer communities in the future.

The softener improvement app used in the Salt Savers pilot program was also a tool in other softener initiatives in 2019. In a partnership to observe World Water Day, the District awarded a grant to Project Home, a local nonprofit organization that provides home maintenance services to low- and moderate-income households. Project Home staff attended a softener training and used the app to evaluate softeners in their home visits, and the District funded replacement of identified inefficient softeners with new, efficient units that use less salt.

Meanwhile, Pollution Prevention staff worked with graduate students in UW-Madison's Water Resources Management program to guide them through the development of a blueprint to reduce chloride use by 25% on campus. Students developed an inventory of water softeners on the UW campus to provide facilities staff with a prioritization framework for softener improvements, and also identified possibilities for reducing de-icing salt use on campus. This salt reduction blueprint is intended as a model for other larger institutions to find opportunities to lessen their salt use and protect freshwater resources.

Mercury Minimization

In a continuation of the District's successful mercury minimization program, District staff conducted the annual certification of local dental clinics to verify they are taking required actions to keep mercury-containing dental amalgam out of the sewer. The annual dental certification partially relied on virtual tools that the District created in 2018, as the District works to minimize paper reporting and in-person inspections in favor of remote data gathering. District staff sought expert guidance on amalgam separators to identify areas needed for dental clinic education in order to improve mercury reductions. Incoming and outgoing mercury levels at the plant remained low compared to past levels, suggesting that mercury minimization measures continue to produce results.

Community Values Survey

Much of the District's pollution prevention work involves community outreach to encourage residents to take action beneficial to the wastewater plant, such as properly disposing of mercury products and not flushing wipes or other non-flushables. However, prior to 2019, the District did not have a very clear picture of what actions people were actually taking. To better understand what actions people are taking right now and where there is a need for improvement, the District commissioned a social research firm to conduct a random, scientific study of community members' actions and beliefs regarding water.

The survey reached 500 people in the District's service area through phone and online interviews, providing a large enough sample to be fairly representative of the community. It included questions about respondents' awareness of and attitude toward various water agencies, including the District. Other questions sought to gather data about the prevalence of pollutants of concern in the service area, such as mercury-containing materials and non-flushables. Finally, the survey assessed where respondents primarily get their news and information about water issues.

These responses provided insight into actual current conditions in the sewer system, establishing a baseline for measuring the effectiveness of future pollution prevention programs. They will also help inform strategy, as the District refers to the results of the survey when developing programs and outreach approaches. The District plans to supplement this survey with additional data gathering efforts in the future.

PUBLIC EDUCATION

District staff have been working to ramp up the District's educational offerings in recent years. Tours continue to be the District's primary avenue for education; other activities in 2019 included improvements to the physical educational infrastructure in Shop One and exploration of outreach strategies in the community.

Tours

Over 2,000 people visited the treatment plant for tours in 2019, continuing the District's longstanding tradition of educating the public through tours. Meanwhile, District staff also improved tours and general educational programming by gathering input from education experts. The District hired four LTEs with education backgrounds to assess the current tour program and provide recommendations for tailoring tours to younger students. The District also hosted a focus group of teachers who have brought tour groups to the plant in order to get their opinions on potential improvements to tours. The District now has a bank of recommendations to guide future changes to student tours to make them more effective.

In summer 2019, the District also started offering routine public tours the first Friday of every month to give interested members of the public a chance to see the plant without having to schedule a tour group. These tours were a success, and the District plans to continue offering them in 2020.

Shop One

Shop One, the former maintenance building at the District, is the hub for District education activities. The District's goal is to eventually make major improvements to this building to support its educational purpose, and in 2019 the first round of aesthetic and functional improvements was completed. The District worked with consultants to install sound-absorbing materials in Shop One's main conference room to dampen echoes and make the space more usable for hosting meetings and tour groups. As an added enhancement, much of the acoustical material improved the appearance of the room, as it was designed into the shape of lakes and pipes.

The Shop One space also provided an opportunity for UW-Madison Design students in 2019. A design studies class spent their semester developing renderings of what the space could look like, providing an imaginative portfolio of options for the building. This allowed them to gain professional experience while generating ideas for building improvements the District could use in the future.

Community Outreach

District staff worked beyond the plant to conduct outreach in the community at events throughout 2019. Outreach activities included staff appearances at the Madison Children's Museum, a McFarland public works open house, Breakfast on the Farm, Saturday Science at the Wisconsin Institutes for Discovery, and the Friends of Capital Springs Recreation Area Harvest Moon Festival. The District also tried out a new social media public pledge campaign that involved participants posing for a photo with a water drop symbol containing their pledge to perform an action to protect water.

INDUSTRIAL PRETREATMENT PROGRAM

Certain substances, when added to sewage, can impact worker health and safety, the biology of the treatment plant, the quality of Metrogro biosolids, operation of sewers and pumping stations, and water quality in the receiving streams. The District's industrial pretreatment program helps to ensure that toxic substances are kept out of the sanitary sewer system. The program enforces the sewer use ordinance, operates a permitting program and implements pollution prevention and source reduction initiatives.

The core of the permitting program is maintaining relationships with the current 19 significant industrial users with categorical wastewater processes or with discharges affecting pollution prevention initiatives. All industrial permittees submitted self-monitoring repots and compliance monitoring of regulated wastewater discharges occurred in both semi-annual periods. There were no instances of significant noncompliance by permittees or other users in 2019.

The industrial pretreatment program also maintains an additional 21 permits for non-typical organic industrial users, as well as permits with approximately 33 waste haulers. All waste haulers that use District facilities received annual permits in August. Staff members continued to perform waste acceptance reviews and to respond frequently to non-permitted industrial, hauled waste and other waste acceptance requests.

ACCEPTANCE OF SEPTAGE AND OTHER WASTEWATERS

Hauled wastes have been accepted at Nine Springs Wastewater Treatment Plant since 1986. In 2019, the District accepted waste from 33 permitted septage haulers. The haulers are charged a specific rate for each category of septage or type of hauled wastewater that reflects the District's cost of treating the material. In 2019, hauled wastewater treatment revenue exceeded $825,000. Approximately 37 million gallons of wastewater were received via truck in 2019.

The following table lists the five domestic septage categories, the number of gallons of septage received during 2019, and the percent of increase or decrease in volume from 2018 to 2019.

Table 4 – Domestic Septage Received (Gallon)

Septic Tank	Holding Tank	Grease Trap	Settling Basin	Portable Toilet
12,980,000	18,631,000	969,000	215,000	643,000
4% increase	2% increase	40% increase	3% decrease	21% increase

The hauled wastes receiving facility, and infrequently the whey well, are the discharge points for other wastewater not characterized by the five domestic septage categories. In 2019, other wastewater types and volumes that were received are listed in the table below.

Table 5 – Other Wastewater Types Received

Wastewater Received	Volume (gal)
Village of Belleville Biosolids	600,000
Refuse Hideaway Landfill Leachate	57,000
Middleton Landfill Leachate	14,000
Verona Landfill Leachate	558,000
Food Processing Industries	1,396,000
Other Gray Water	276,000
Grocery Store Food Waste	50,000
Remediation Projects Groundwater	37,000
WVDL Tissue Digester Residue	26,000
Laboratories Wastewater	39,000
Other Industrial Wastewater	744,000
Total Other Wastewater Received	**3,797,000**

LAGOON SITE PROJECT

U.S. Environmental Protection Agency Region V conducted its statutorily required annual site review of the lagoon site in late summer of 2019 and included both a site visit and inspection. Routine inspections, operations and maintenance activities continued in 2019. These activities included monthly visual inspections of capped areas and containment dikes, water management and vegetation control. Vegetation control in 2019 involved a controlled burn in a portion of the lagoon site to evaluate efficacy of this method for future management in the whole lagoon system. In fall 2019, muskrat trapping was conducted to help reduce burrows and help protect dike integrity. Capital improvement project planning in 2019 identified a capital project (#A15) to survey and evaluate the lagoon dike system as part of an engineering and maintenance prioritization plan. This was done in response to the 2018 flooding that forced the District to repair a small dike breach that was allowing river water from Nine Springs Creek to enter the lagoon area.

WATERSHED PROJECTS

Yahara Watershed Improvement Network

In 2019, the District-led Yahara WINS adaptive management project completed its third year of the full-scale project aimed at reducing sources of phosphorus in the Yahara River Watershed over the next 20 years. The Yahara WINS partnership has been able to successfully fund projects directly or indirectly that have resulted in hundreds of urban and agricultural practices like cover crop planting, strip tillage and leaf management. In 2019, the partnership was able help implement successful urban and agricultural practices. It is anticipated that 2019 will see the same success as 2018, when more than 45,000 pounds of phosphorus was kept out of area surface waters.

Watershed Monitoring Program

The District conducts monitoring activities in both the Yahara and Sugar River watersheds to help assess the overall condition of select streams. Monitoring initiatives include the collection of water chemistry samples and evaluation of the fish and macroinvertebrate communities to determine the biological health of select streams. In 2019, District staff collected water chemistry samples and conducted macroinvertebrate and fish surveys. All water chemistry samples were analyzed at the District's laboratory. Macroinvertebrate samples were sent to UW–Stevens Point for sorting and classification.

In general, stream water quality as measured by water chemistry was similar to the previous year. The District also has joint funding agreements with the U.S. Geological Survey for two gauging stations in the Yahara River watershed and two gauging stations in the Sugar River watershed. The stations in the Yahara are used for traditional flow measurements. The stations in the Sugar River watershed are used for flow, temperature, dissolved oxygen and conductivity measurements.

LABORATORY ACTIVITIES

During 2019 the District laboratory performed 70,676 analyses on 16,210 samples.

Table 6 – Analyses Performed in 2019

PARAMETERS	QUANTITY
Nutrients (TKN, TP, NH3-N, PO4-P, WEP)	22,536
Solids (Suspended and Total)	22,823
Biochemical Oxygen Demand	5,117
Anions (Cl, NO3-N, NO3+NO2, NO2-N, SO4)	4,738
Field Measurements (pH, TEMP, COND, DO)	5,099
Metals	6,456
Bacteria (FCOLI, TCOLI, ECOLI, Salmonella)	1,390
Volatile Fatty Acids (VFA)	1,064
Misc. Testing (Alkalinity, Density, Chlorophyll, CH4, CN, WET, TDS)	1,453

The District laboratory was also involved in the following activities:

- The laboratory analyzed 955 samples in support of the Yahara WINS adaptive management project. Of these samples, 252 were collected by citizen volunteers.
- The City of Madison Engineering department continued to bring the lab samples from its monitoring program. The City collects samples from various points throughout the collection system to use for billing purposes. The District analyzed 54 samples for TKN, TP, CBOD5, TSS and pH.
- The laboratory continued to provide analytical support for several District-sponsored research pilot projects being conducted with UW-Madison. These projects are investigating potential opportunities for the District to reduce energy demands while maintaining or increasing the level of treatment. The laboratory analyzed 2,332 samples from these projects. This was a three-fold increase from 2018.
- The lab analyzed 257 “special” samples. Among these samples were samples for dewatering projects, chloride reduction initiatives and pilot testing samples for phosphorus reduction initiatives. These types of samples are outside of the normal workflows and require additional steps to process them.

Other noteworthy activities in the laboratory during 2019 were the following:

- The lab obtained a GoPro camera and used it to document maintenance steps on the IC. The plan is to continue to document important processes for future reference.
- New fish survey equipment was put into service and a very successful and efficient survey was completed in July 2019
- Bacteria testing was added to all stream surveys in order to have a more robust data set

METROGRO

Metrogro Operation

The District recycles biosolids to agricultural land through its Metrogro program. Summary hauling and cost information for the last three years is given in Table 7.

Table 7 – Metrogro Program Details for Past Three Years

Year	2017	2018	2019
Gallons Recycled (MG)	34.6	33.5	25.8
Dry Tons Recycled	6,424	6,477	4,890
Acres Applied	4,560	4,396	3,771
Program Cost ($000)	$1,930	$2,096	*
$/1000 Gallons	$55.78	$62.56	*
$/Capita (375,000 residents)	$5.14	$5.58	*
$/Dry Ton	$300	$323	*

**Unable to calculate data in time for publication*

The District continues to produce a high-quality biosolids product. Metal concentrations in 2019 were below the concentrations used by EPA to define an exceptional quality biosolid, as shown in Table 8 (Note: Wisconsin Department of Natural Resources uses the term “high quality" in NR 204).

Table 8 - Metrogro Biosolids Quality 2019 Average Values

Parameter	Concentration	EPA EQ Limit*	EPA Ceiling Limit	Units (Dry Weight)
Total Solids	5.12	NA	NA	%
TKN	8.64	NA	NA	%
NH3-N	3.86	NA	NA	%
Total-K	0.52	NA	NA	%
Total-P	2.75	NA	NA	%
Arsenic	5.30	41	75	mg/kg
Cadmium	1.06	39	85	mg/kg
Chromium	45.29	NA	NA	mg/kg
Copper	574	1,500	4,300	mg/kg
Lead	25.24	300	840	mg/kg
Mercury	0.55	17	57	mg/kg
Molybdenum	20.20	NA	75	mg/kg
Nickel	27.81	420	420	mg/kg
Selenium*	6.8	100	100	mg/kg
Zinc	832	2,800	7,500	mg/kg
PCB	<0.0310	NA	NA	mg/kg

*EQ means "exceptional quality"
NA means not applicable
< data qualifier is used if one or more of the monthly values used to calculate the yearly average is reported as below the analytical limit of detection.

Environmental monitoring to support the Metrogro program continued in 2019. Approximately 643 water samples were collected from private wells, with samples being analyzed for nitrate nitrogen and coliform bacteria. Soil samples were collected through the District, as well as through the farmer's crop consultants.

Each year the District contracts with a number of companies to provide semi tractor-trailers with drivers to pull the District's Metrogro trailers. Several of the companies also provide individuals to operate the District's Metrogro applicators. The District requested submittals from contractors to supply owner-operator semi tractors and equipment operators for 2019.

The District administers a yield guarantee program to secure land during the spring hauling season. The payment structure for the yield guarantee program is based on the date at which application to a given field is completed. Weather conditions in 2019 made the spring hauling season a challenge, requiring the District to utilize all tiers of the yield guarantee program. With the extended wet weather in the fall and an early winter that started in October, biosolids hauling was down in the fall and resulted in the District having to dewater and haul biosolids to the landfill to ensure enough winter biosolids storage.

Metrogro Dry Product

The District's long-term goal of diversifying its overall biosolids management has led to the production of a Class A biosolids cake material. Composting was trialed in 2018 in partnership with Berryridge Farms and their existing on-farm composting facility. This project led to a better understanding of the agronomic potential of various types of biosolids products and to the District putting together a research proposal in 2019 aimed at looking at all options for biosolids management. The study is expected to be completed in 2020 and will assist the District in deciding if composting or another agronomic product should be the District's long-term biosolids management goal. For example, alternate biosolids products could enable cost-effective ways to transport watershed-produced phosphorus with a more targeted approach.

ENGINEERING

Staffing

In 2019, the Engineering department increased from seven full-time employees to eight, as the Collection System Engineer position was added. The department includes six registered professional engineers, one master electrical construction manager, and one part-time project coordinator:

- Director of Engineering
- Electrical Construction Manager
- Electrical Project Engineer
- Project Engineer I (1)
- Project Engineer II (3)
- Collection System Engineer
- Project Coordinator (part time)

Responsibilities of Workgroup

The Engineering department oversees the planning, design, construction and commissioning of all major capital improvement projects at the District. This includes engineering functions encompassing civil, structural, mechanical, plumbing, electrical, controls and HVAC disciplines. These projects range in value from less than $100,000 to $50 million or more. Depending on the scope of the work, smaller capital projects are typically planned and designed in-house.

Consulting services are utilized for larger projects. These services are retained and managed by department staff. The Engineering department typically assumes the lead role during project construction, performing all construction management, inspection and resident engineering.

The department also manages long-term issues associated with the collection system. This includes the development of an inflow and infiltration (I/I) reduction program, which is anticipated to take several years to research and implement. Other duties performed by the Engineering department include:

- General assistance to the O&M department
- Response to emergency and high flow events
- Management of the force main inspection program
- Administration of locating services
- Assistance with long-range asset management, capital planning and budgeting
- PLC programming and HMI (i.e., computer control screen) design

- Assistance with large maintenance projects
- Utility location administration
- Real estate and property issues
- Facility transfers
- Coordination with other municipalities (especially the City of Madison)
- Committee (ELC, I&D, etc.) participation

Programs, Initiatives and Work Reporting

ENGINEERING AND CONSTRUCTION

Nine Springs Valley Interceptor-Morse Pond Extension

The Nine Springs Valley Interceptor-Morse Pond Extension project extends sanitary sewer service to undeveloped land near the intersection of Highways PD and M. The interceptor will serve City of Verona lands south of Highway PD and City of Madison lands north of Highway PD. The new interceptor is a 20-inch diameter sewer located along Raymond Road and extends approximately 3,230 linear feet from the District's Nine Springs Valley Interceptor-Midtown Extension.

Planning and design work for the interceptor were completed in conjunction with Wisconsin Department of Transportation's (WisDOT) reconstruction of Highway M and was performed by MSA Professional Services. The project was bid as part of the WisDOT County Highway M reconstruction project on Aug. 8, 2017. Commissioners approved the District portion and increased the overall total project budget estimate to $2.3 million on Aug. 31, 2017. Construction activities began in late 2017 and were completed in the summer of 2018. Due to delays in final acceptance of work by WisDOT, final closeout is not anticipated to occur until 2020.

Southeast Interceptor Rehabilitation Upstream of Pumping Station 9

The Southeast Interceptor was constructed in 1961 as part of the Southeast Interceptor Project, which began at Pumping Station 7 and ended at the Yahara River in the Village of McFarland. The section upstream of Pumping Station 9 consists of approximately 3,360 feet of 24-inch and 27-inch reinforced concrete pipe that runs parallel to the west side of U.S. Highway 51 and crosses the highway just north of the Yahara River. Annual televising revealed that portions of this sewer were suffering from corrosion above the normal waterline.

The 2018 CIP assumed that all of the interceptor pipe upstream of Pumping Station 9 required rehabilitation with a cured-in-place pipe (CIPP). Upon detailed review by District staff, much of the pipe was determined to be in good structural condition, but many of the joints were leaking. Staff determined that CIPP was not required and the leaking joints could be fixed by injecting grout at the joints, which provided significant cost savings.

District staff completed design in early 2018 and the project was bid on Jan. 31, 2018. The commissioners awarded the contract to Visu-Sewer Inc. on Feb. 22, 2018 at their low bid price of $215,780. Construction activities began in late 2018 and were completed in the spring of 2019. The work was formally accepted by the commissioners on April 11, 2019. The final contract amount, including all change orders, was $225,970.

West Interceptor Rehabilitation: Pumping Station 5 to the Gammon Extension

This section of the West Interceptor was constructed in 1931 and consists of approximately 3,560 feet of 18-inch cast-iron sewer. The sewer was inspected by closed-circuit television, which revealed moderate tuberculation along the entire length. Tuberculation is the buildup of deposits on the inside walls of the pipe due to chemical reactions between the wastewater and the cast-iron pipe. The deposits decrease the capacity of the sewer and compromise the structural integrity of the pipe. District staff recommended that the entire length be cleaned and rehabilitated with cured-in-place pipe (CIPP).

District staff completed design in mid-2018 and the project was bid on Aug. 2, 2018. The commissioners awarded the contract to Visu-Sewer Inc., on Aug. 16, 2018, at their low bid price of $465,320. Construction activities began in the spring of 2019 and were completed by late summer. The work was formally accepted by the commissioners on Sept. 12, 2019. The final contract amount, including all change orders, was $444,722.

Pumping Station 10 Force Main Rehabilitation

The Pumping Station 10 force main consists of 36-inch diameter pre-stressed concrete pipe originally installed in 1963. No improvements have been made to the force main since the original installation. The last 2,000 feet of the force main are relatively flat and the pipe is not full at all times, which led to concrete corrosion in the upper portion of the pipe (similar to what occurs in concrete gravity sewers).

District staff completed design in the summer of 2018 and recommended the force main be rehabilitated by either tite-fit HDPE pipe or CIPP (cured-in-place pipe) methods. The project was advertised in July and bids were opened on Aug. 7, 2018. Commissioners awarded the contract to Murphy Pipeline Contractors, Inc. on Aug. 16, 2018 at their low bid price of $1,247,934. Construction activities began in late 2018 and were completed in the spring of 2019. The work was formally accepted by the Commission on Aug. 15, 2019. The final contract amount, including all change orders, was 1,247,934.

Pumping Station 7 Improvements

Pumping Station 7, one of the most critical assets in the District's collection system, was originally built in 1950 and pumps roughly 11 million gallons of wastewater to the treatment plant each day. The station works in tandem with Pumping Station 18, and the two stations provide critical redundancy and resiliency to the District's overall conveyance system.

Pumping Station 7 is nearly 70 years old and was last rehabilitated in 1992. Given the age of the station, the time that has elapsed since the last rehabilitation, and the complexities of operating Pumping Station 7 in tandem with Pumping Station 18, District staff recommended several improvements at Pumping Station 7. Key objectives associated with the project include the following:

- Replacement of existing controllers and control system
- Replacement of electrical switchgear (including outdoor transformers and utility equipment)
- Installation of an odor control system
- Replacement or modifications to the HVAC system
- Separation of control room space from garage and screen room
- Installation of variable speed drive(s) to optimize pumping operations
- Replacement of manual valves with electrically actuated valves
- Other miscellaneous improvements identified during the design process

Planning and design were completed in late 2018 and the project was bid on Dec. 18, 2018. The commissioners awarded the contract to C.D. Smith Construction Inc. on Jan. 17, 2019 at their low bid price of $3,348,000. Construction activities began in the summer of 2019 and were approximately 62% complete at the end of the 2019.

Southwest Interceptor: Haywood Drive Replacement

The Southwest Interceptor – Haywood Drive Replacement is in the City of Madison along Haywood Drive, between North Wingra Drive and West Shore Drive. This section of the Southwest Interceptor was constructed in 1936 and consists of 24-inch cast-iron sewer. As with other District interceptors made of cast-iron sewer and in excess of 50 years old, this pipeline suffered from the effects of tuberculation. This section of the Southwest Interceptor also serves as an important intertie between Pumping Station 2 and Pumping Station 8 and has been used on numerous occasions to avoid sewer backups during high flows and emergency events.

This project replaced the deteriorated Southwest Interceptor on Haywood Drive. It also provided additional capacity so that flow can be diverted between Pumping Station 2 and Pumping Station 8 during high-flow and/or emergency situations. Approximately 1,500 feet of 24-inch cast-iron sewer were replaced with a 36-inch sewer as part of the improvements.

Planning and design were completed in early 2019 and the project was bid on Jan. 17, 2019. The Commission awarded the contract to Maddrell Excavating LLC on Jan. 31, 2019 at their low bid price of $1,643,273.50. Construction activities began in the spring of 2019 and were completed by fall. The work was formally accepted by the Commission on Nov. 14, 2019. The final contract amount, including all change orders, was $1,591,625.12.

Grass Lake Dike Restoration

In 1958, the District constructed facilities to discharge effluent to the Badfish Creek waterway. Improvements to the waterway included an earthen dike along the western edge of Grass Lake. The dike was constructed to provide a division between Grass Lake and the effluent discharge waterway. The dike is approximately 5,000 feet in length.

In 1988, a permit to maintain the dike and effluent ditch was granted to the District. Conditions of the permit required perpetual maintenance of the bank slopes. Over the decades, portions of the dike banks have eroded. The rate of bank erosion is unknown, but bank subsidence has occurred in many locations. There is also minor damage from animal burrows.

A request for proposals for bank evaluation and design services was developed. The work was awarded to Cardno in August of 2018. Due to issues associated with floodplain management and permitting, the design work was still ongoing at the end of 2019. Design is expected to be complete by mid-2020, with construction of any recommended improvements not anticipated until 2021.

Northeast Interceptor: Truax Extension Relief

The Northeast Interceptor – Truax Extension, between Lien Road and the intersection of U.S. Highway 51 and Rieder Road, is a 48-inch concrete sewer that was constructed in 1969. Television inspection of this 11,000-foot section of pipe revealed a number of structural defects, including corrosion of the interior pipe surface. In addition to this, the Collection System Facilities Plan Update (2011) indicated that capacity relief for the Truax Extension will be needed sometime between 2017 and 2031. To verify this, the District measured current flows, which revealed that the current pipe is at 95% of capacity and relief is required in the next decade.

District staff evaluated preliminary alternatives for the Truax Extension Relief and Rehabilitation projects as part of the CIP and recommended construction of a relief sewer prior to rehabilitation of the existing Truax Extension. This reduces the overall risks and total cost of both projects, as the relief sewer can be used during typical days to bypass flows during the rehabilitation (i.e., lining) process and eliminates the need for expensive and risky bypassing pumping.

The Northeast Interceptor – Truax Extension Relief project consists of 7,800 lineal feet of 42-inch diameter interceptor sewer using open-cut and trenchless techniques. The project also includes construction of a paved path in Reindahl Park that will enhance the park's path network and also provide periodic access for District staff to perform maintenance activities. Planning and design were completed in early 2019 and the project was bid on March 28, 2019. The Commission awarded the contract to Speedway Sand & Gravel, Inc. on April 11, 2019 at their low bid price of $7,034,426. Construction activities began in the summer of 2019 and were approximately 40% complete at the end of the 2019.

Liquid Processing Improvements-Phase 1

The 2016 Liquid Processing Facility Plan recommended improvements to the liquid processing facilities that were to be implemented in phases over a 10+ year period. The first phase (Nine Springs Liquid Processing Improvements-Phase 1) consists of the following main elements:

- Peak flow management improvements: hydraulic capacity upgrades at the Nine Springs Wastewater Treatment Plant, as well as upgrades to allow the activated sludge process to operate in a biological contact process mode during high-flow events
- Ultra violet disinfection system replacement: replacement of the existing ultra violet disinfection system
- Process control system upgrades: replacement of the remaining Bristol Babcock distributed control units (DCUs)
- Electrical substation improvements: construction of one new unit substation to replace the existing substations U11, U12, and U13
- East side blower control replacement: replacement of control panels that are unreliable, poorly documented and use legacy parts that are difficult to replace
- Primary tanks 1 and 2 rehabilitation: restoration of 80-year-old tanks that are still in serviceable condition but require repair of deteriorated concrete
- Primary influent pipeline rehabilitation: rehabilitation of the 54-inch primary influent pipe from the east primary junction chamber to the east primary clarifiers
- Plant flow metering improvements: installation of flow metering equipment to measure flows through the east and west plants
- Secondary clarifier stress testing: testing to determine the maximum solids loading rate of the final clarifiers
- Effluent force main standpipe improvements: design improvements to eliminate intermittent effluent wastewater discharges

Planning and design were completed in the fall of 2019 and the project was bid on October 31, 2019. The Commission awarded the contract to C.D. Smith Construction, Inc. on Nov. 14, 2019 at their low bid price of $12,895,000. Construction activities had not begun at the end of the 2019.

West Interceptor Shorewood Relief

The District's West Interceptor system is a complex network of sewers that provide service to the near west side of the City of Madison, the City of Middleton, the Village of Shorewood and the Town of Westport. The system is generally comprised of two or three parallel sewers that extend westward from Pumping Stations 2 and 8. The majority of the West Interceptor system has adequate long-term capacity. However, several areas of the system need additional capacity. These sections comprise approximately 11,500 feet of sewer near the Village of Shorewood Hills, located along University Avenue between Walnut Street and Whitney Way.

The West Interceptor Shorewood Relief project will provide additional capacity to convey projected future flows from the District's west side service area, including expected growth in the City of Middleton and Town of Westport. Due to the size and complexity of the project, it is anticipated that construction will occur in several phases over a period of approximately 3 years.

A request for proposals for West Interceptor Shorewood Relief design services was developed and the work was awarded to Strand Associates in 2019. The design work was approximately 50% complete at the end of 2019. Bidding of the first phase will occur in late 2020, with construction anticipated to start in the spring of 2021.

Headworks Building Flow Metering Improvements

The Headworks Building was constructed as part of the Tenth Addition to the Nine Springs Wastewater Treatment Plant in 2005. Headworks wastewater processing systems include influent flow metering, fine screen solids removal, vortex grit removal and disposal of screenings and grit.

The influent venturi flow meters are located immediately upstream of the fine screens. The meters were installed at an elevation such that the downstream fine screens must be operated in a manner to maintain meter submergence, which is critical for meter accuracy. Influent flow rates to the Headworks Building can (and do) change quickly and using the screening operations to maintain meter submergence has proven difficult. In addition, this resulted in several other issues associated with operation and maintenance of the screening system:

- The volume of screen wash water required has exceeded expectations
- The energy required to operate the screens and screenings handling equipment has exceeded design estimates
- Maintenance of screening equipment has been higher than anticipated due to additional operating hours
- Rags and solids have been found in downstream processes, which indicates the higher water levels required for meter submergence have resulted in bypasses of the fine screens

The Nine Springs Treatment Plant-Headworks Flow Metering Improvements project will address these issues and improve the reliability of plant flow metering accuracy for customer billing. The intent of this project is to alter conditions to facilitate operating the fine screens as initially intended, with intermittent cleaning cycles based on screenings accumulation and independent of flow meter submergence requirements. To accomplish this, the existing venturi flow meters in the Headworks Building will be repositioned at a lower elevation.

A scope of work associated with design of these improvements was developed and requests for proposals were sent to consulting firms. The design work was awarded to Short Elliott Hendrickson and was essentially complete at the end of 2019. Bidding will occur in early 2020, with construction anticipated in 2020 and 2021.

Badfish Creek Effluent Force Main Standpipe Replacement

The Badfish Creek effluent force main standpipe is located just north of CTH B in the Town of Dunn. The standpipe is part of a complex 5-mile long pipeline that conveys treated effluent from the treatment plant to the outfall. As part of the Liquid Processing Facilities Plan, a surge analysis of the Badfish Creek force main was completed to determine the cause of intermittent discharges from the standpipe. The intermittent discharges were considered to be treatment plant overflows by the WDNR and were causing minor property damage to an adjacent home owner. The Liquid Processing Facilities Plan recommended that the standpipe be improved to better control surges and prevent the intermittent discharges.

Design of the standpipe improvements, which included replacement of the standpipe with an air/vacuum valve housed in a buried structure, was completed in the summer of 2018. The project was bid in September of 2018. Bids were higher than expected (and budgeted), and all bids were subsequently rejected. District staff and the consulting engineer modified the design and the project was re-bid early in 2019. The work was completed by Maddrell Excavating in the summer of 2019 at a final cost of $78,605.50.

2019 Treatment Plant Piping Improvements

Potable water, also known as W1 piping, and hot water piping are both critical to treatment plant function. Sections of both W1 and hot water piping were identified for replacement based on their poor condition. These are described in detail below:

- W1 Piping Improvements: This includes upgrades and repairs to the 1960s-era potable water main (W1) system located inside the east piping galleries.
- Hot Water Piping Improvements**:** This includes hot water piping in the solids gallery between the Boiler Building and Sludge Control Building 1 (SCB 1), which was installed as part of the Fourth Addition in 1961.

The 2019 Treatment Plant Piping Improvements Project involves the removal and replacement of the two piping systems. Approximately 1,200 feet of 4-inch galvanized W1 water pipe will be replaced with 4-inch stainless steel pipe and approximately 550 feet of 6-, 8- and 10-inch carbon steel hot water piping will be replaced with 6-inch carbon steel piping. The project will also involve replacement of seven 4-inch isolation valves on the W1 piping and insulation of both new piping systems.

Design was completed by District staff in mid-2019. On Oct. 22, 2019, bids were opened and at the Oct. 31, 2019 Commission meeting the work was awarded to 1901, Inc. at their low bid price of $418,551. Construction activities began in late 2019 and were approximately 6% complete at the end of the year.

Nine Springs Valley Interceptor-Dunn's Marsh to McKee Road Rehabilitation

The District's Nine Springs Valley Interceptor (NSVI) provides service to the west side of the City of Madison, the City of Fitchburg and the City of Verona. The NSVI system stretches from Pumping Station 11 to McKee Road. Approximately 4,200 lineal feet of pipe along the Cannonball/Military Ridge bike path between McKee Road and Dunn's Marsh is corroded and needs additional capacity.

To meet future capacity needs, either a larger pipe (a replacement sewer) or a second pipe (a relief sewer) working in parallel with the existing pipe is required. The preferred option will be selected through the design analysis. If relief is selected the existing interceptor will remain in place and be relined. If replacement is selected the existing pipe will be filled and abandoned in place.

A scope of work associated with design of these improvements was developed and requests for proposals were sent to consulting firms. The design work was awarded to MSA Professional Services and work commenced in the last quarter of 2019. Bidding will occur in late 2020, with construction anticipated in 2020-2021.

Operations Building 1st Floor Remodel

A portion of the first floor (approximately 5,000 sq. ft.) of the Operations Building was identified as being underutilized and inefficient during studies of the non-process areas of the treatment plant. Other issues such as public/disabled access and building security were also identified as concerns. To solve these issues, a remodel of the area was added to the CIP. Major goals of the project include:

- Better security for the lab and operator area
- Better functionality of the operator area
- Increased safety of the lab, including limiting entrance to only those who need to be in the lab
- More efficient use of space:
    - Currently some of the lab space is underutilized, while a larger and more cohesive area for the Ecosystem Services group is needed. With an increase in pollution prevention and external initiatives in recent years, this department has grown in size. Offices are currently scattered throughout the building and some staff members share offices.
- A more inclusive workplace:
    - Currently, the building entrance for people with mobility issues is separate from the main entrance. This creates two public entrances to the building and requires those with accessibility issues to traverse through hallways and staff areas to reach the front desk. A single revitalized and welcoming public entrance for everyone is desired.

    - A gender-neutral bathroom and a functional private space for nursing moms are desired. These spaces would serve our workforce as well as visitors.
- Improved working conditions and a healthy workplace that promotes employee engagement and satisfaction:
    - A common cafeteria area separate from work areas and conference rooms is desired. The Operations Building currently lacks a common cafeteria area, which requires most employees to eat at their desks or in a conference room. A cafeteria will be a healthier place to eat as well as a place for informal meetings and collaboration.

Engberg Anderson Architects were retained to assist with planning and design of the project. The first phase of this work, which included a space-needs study, adjacency investigation, evaluation of alternatives and selection of a conceptual design, was nearing completion at the end of 2019. Design is anticipated to be complete in the summer of 2020, and bidding will occur in the fall of 2020. Construction is anticipated to start in late 2020 and continue into 2021.

Pumping Station 17 Force Main Relief-Phase 1

The Pumping Station 17 force main was built in 1995 and is 16-inch diameter ductile iron pipe. Upgrades to Pumping Station 17 and the force main will be required in approximately 2024 to accommodate additional flows expected from the completion of the Lower Badger Mill Creek Interceptor. The Pumping Station 17 relief force main, working in combination with the existing force main, will be sized to handle the estimated future flows from this area.

Phase 1 of the Pumping Station 17 Force Main Relief project is being designed in conjunction with the City of Verona Eastside Interceptor, which is in the same corridor. Cost savings are anticipated by sharing common survey, design, and construction costs with the City. The District entered into a Memorandum of Understanding with the City to issue a joint request for proposals, hire a design consultant and construct the projects.

A request for proposals (RFP) for the Pumping Station 17 Force Main Relief-Phase 1 and City of Verona Eastside Interceptor Replacement design services was issued and the work was awarded to Short Elliott Hendrickson. As of the end of 2019 the design work was approximately 50% complete. Bidding is anticipated in late 2020 with construction in 2020 and 2021.

Pumping Stations 13 & 14 Rehabilitation

The District's Collection System Facilities Plan Update (2011) identified Pumping Stations 13 and 14 as requiring firm capacity upgrades and replacement of major equipment. The District's Collection System Facilities Plan Update also included a condition assessment of all District pumping stations across six categories. These categories included peak flow capacity, firm flow capacity, power system redundancy, mechanical condition, structural integrity and electrical condition. Compiling scores across all the six categories, Pumping Station 13 and Pumping Station 14 received the first and third highest point totals, respectively, indicating the need for rehabilitation for these stations in the near term.

It is anticipated that the Pumping Stations 13 & 14 Rehabilitation project will likely include installation of new pumps, enhancement of power system redundancy, replacement of major electrical and control equipment, installation of new HVAC systems, replacement of manual valves and gates, installation of new flow metering equipment, installation of generators and major wet well repairs. Both stations will be rehabilitated at the same time and bid as one project due to their proximity and similar needs.

A scope of work concerning planning and design of these improvements was developed and requests for proposals were sent to consulting firms. The work was awarded to Strand Associates and the design work was approximately 50% complete at the end of 2019. Bidding will occur in mid-2020, with construction anticipated from the fall of 2020 throughout 2021.

FINANCE DEPARTMENT

Staffing

The Finance department has 7 full-time employees:

- Assistant Chief Engineer/Director of Finance
- Budget Manager/Comptroller
- Accountant (2)
- Accounting Assistant (1)
- Procurement Agent
- Purchasing and Inventory Assistant

Responsibilities of Workgroup

- Provides, accounting, budgeting and procurement support for all District departments
- Provides payroll support for all District departments in collaboration with the Human Resources Manager
- Administers Clean Water Fund loans including loan applications and disbursements
- Prepares the annual service charge rates
- Provides accounting services for the Yahara Watershed Improvement Networks (Yahara WINS)
- The procurement group, staffed by the Procurement Agent and the Purchasing and Inventory Assistant, focuses on the purchasing of parts, materials and services for the Operations and Maintenance department while also maintaining the parts inventories
- The Procurement Agent provides support for procurements by groups outside of the Operations and Maintenance department

Programs, Initiatives and Work Reporting

PURCHASING

The group focuses on the purchasing, receiving, and kitting of parts and materials for the Operations and Maintenance department. The group maintains spare parts inventories valued at $1.6 million. The group also supports procurements for groups other than Operations and Maintenance, particularly those procurements requiring formal advertising. At the end of 2019, the Purchasing group consisted of the Procurement Agent, the Purchasing and Inventory Assistant, and a part-time Purchasing Assistant.

Significant achievements and work advanced in 2019 include:

- Completed the re-organization of the Maintenance Facility second floor inventory storeroom using a summer intern. The reorganization work included an improved layout using new, shorter cabinets that provided for safer, easier access and better use of natural lighting. All cabinets and drawers were labeled for location and all parts re-labeled.
- Supported the Operations and Maintenance department's efforts to implement reliability centered maintenance practices. A full-time limited term employee was hired for the last five months of 2019 to support the increased demand for materials.
- Created additional reports to track purchasing functions and implemented regular weekly reviews of the results. The reports focused on the priority and status of Operations and Maintenance department requisitions and purchase orders.

ACCOUNTING/FINANCE

Significant achievements and work advanced in 2019 include:

- Obtained an audit for the District for fiscal year 2019 that found no material weaknesses or significant deficiencies (a “clean” audit)
- Received the Government Finance Officers Association (GFOA) budget presentation award for the District’s 2019 budget document, the District’s seventh year receiving the award
- Continued to implement the 2017 organizational assessment for the accounting group structure that assigns duties to the lowest level that can support the work and maintain a proper level of segregation of duties and internal controls
- Worked with a consultant to map our budget development process and identify process improvements and efficiencies
- Incorporated three new persons, including a new Budget Manager into the four-person accounting team

USER-CHARGE MONITORING AND BILLING

User-charge billing of the District’s municipal customers is performed quarterly using data collected at the Nine Springs Wastewater Treatment Plant and within the collection system. The Collection System Services crew supports quarterly billing by providing sampling and flow measurement at key points in the collection system. The Collection System Services crew and plant staff collected data and samples at 89 sampling points in 2019. The sampling points generated 4,438 samples throughout the year. The analysis of the user-charge field samples and Nine Springs Wastewater Treatment Plant influent samples by the District lab yielded 16,378 sample results for use in the user-charge billing process.

SEWERAGE SERVICE CHARGES

Prior to the beginning of each calendar year, the District furnishes a written estimate of the cost of sewerage service for the ensuing year to each municipality in the district. This estimate is based on the previous year's wastewater contributions, any anticipated changes that may alter the municipality's prevailing volume and loadings trends, and the service charge rates for the ensuing year.

The District's 2019 service charge rates, shown in the Table 9, were adopted on Oct. 25, 2018. The 2019 rates included a 0.66% surcharge to recover the DNR NR101 effluent fees.

Table 9 - Service Charge Rate Summary Information

Parameter	Rate	Units
Volume	$655.36	per million gallons
CBOD	$0.15905	per pound
Suspended Solids	$0.26775	per pound
TKN-Nitrogen	$0.40279	per pound
Total Phosphorus	$4.18724	per pound
Actual Customers	$36.45	per year
Equivalent Meters	$36.38	per year

Wastewater volumes, CBOD loadings, suspended solids loadings, total Kjeldahl nitrogen (TKN) loadings and total phosphorus loadings are determined each quarter for each community.

These determinations are based on a minimum of seven consecutive days of monitoring data for the current quarter and previous quarter's discharge data for each community.

Meter equivalencies are based on the capacities of the different sizes of water meters used throughout the District. A 5/8-inch water meter has a capacity of 20 gallons per minute and is defined as one equivalent meter. The capacities of larger water meters are divided by the 20 gallon per minute capacity of a 5/8-inch water meter to determine their meter equivalencies. An actual customer is defined as one water meter without regard to size. The numbers of equivalent meters and actual customers in each municipality are set by counting the number of each size of water meter in service in each municipality where water meters are used. In municipalities where water meters are not used, the number of each size water meter that would be required is estimated.

In 2019, the average annual residential service charge in the District was about $343. This amount includes $195 for services provided by the District and $148 for services provided by the municipality (e.g. the City of Madison). A survey of 176 of the nation's largest municipalities indicated that the typical residential service charge in the District in 2019 of $343 is 67% of the national average of $512.

Operating costs per million gallons of treated wastewater for the years 2015 through 2019 are shown in Table 10. The cost per million gallons increased in 2019 to $2,259 per million gallons. This 3.3% increase compared to 2018 was due to an overall cost increase of 6.1% and a volume increase of 2.7%. Operating costs per million gallons decreased by 2.4% in 2018 compared to 2017 due to an overall cost increase of 4.0% and a volume increase of 6.5%.

Table 10 - Costs per Million Gallons of Wastewater Treated

District Function	2015	2016	2017	2018	2019
Administration	$297	$357	$369	$368	$403
Collection	$150	$142	$169	$154	$171
Treatment	$828	$774	$810	$777	$782
Debt Service	$847	$866	$891	$887	$903
TOTAL	**$2,122**	**$2,139**	**$2,239**	**$2,185**	**$2,259**

Overall operating costs in 2019 increased 6.1% compared to 2018. Administration costs increased 12.4%, collection costs increased 13.4%, treatment costs increased 3.4% and debt service costs increased 4.5%. The increase in administration costs was largely due to increased pension liability expenses. The increase in collection costs was primarily due to increased salary, contracted services, electricity, replacement parts and services costs. The increase in treatment costs was primarily due to increased contracted services costs.

CLEAN WATER FUND LOANS

In 1989, the State of Wisconsin replaced the Wisconsin Fund Grant Program with the Clean Water Fund Loan Program. The Clean Water Fund is a state revolving loan fund that was capitalized initially with grants from the U.S. Environmental Protection Agency and by bonds issued by the State of Wisconsin. The District has issued general obligation bonds and notes to the State of Wisconsin for 26 loans under this program. A total amount of $234.8 million has been financed through these Clean Water Fund loans.

One new Clean Water Fund loan was obtained in 2019. The District had no other Clean Water Fund loans for which the final disbursement had not been received by the end of 2018. The status of that loan is as follows:

Pumping Station 10 Force Main Rehabilitation

The District issued General Obligation Sewerage System Promissory Notes, Series 2019A, on Sept. 25, 2019, to the State of Wisconsin Clean Water Fund (CWF Project 4010-52). These bonds are for an aggregate amount not to exceed $1,846,530 and are to be repaid at an annualized interest rate of 1.76%. The first interest payment on the loan will be made on May 1, 2020. The first principal payment will be made on May 1, 2020. The final payment will be made on May 1, 2039. The District had received $1,585,533 for this project as of Dec. 31, 2019.

MAINTENANCE OF DISTRICT FACILITIES

Staffing

The Maintenance workgroup has 36 full-time employees:

- Maintenance and Reliability Manager
- Collection System Supervisor
- Collection System Services/Sewer Maintenance Worker (4)
- Electrical Maintenance Supervisor
- Electrician (7)
- Facilities Maintenance Supervisor
- Facilities Maintenance Worker (7)
- Custodian (2)
- Mechanical Maintenance Supervisor
- Mechanic (8)
- HVAC Technician (2)

Responsibilities of Workgroup

The workgroup's main responsibilities are as follows:

- Conducting preventative and reactive maintenance activities at the treatment plant, pumping stations and within the collection system
- Monitoring and sampling collection system wastewater for customer billing
- Facilities management of District properties and buildings

Programs, Initiatives and Work Reporting

MAINTENANCE WORKGROUPS

The Maintenance workgroups of the Operations and Maintenance department are responsible for the maintenance of the Nine Springs Wastewater Treatment Plant, the District pumping stations, the non-District pumping stations covered, the District's interceptor system and the District's rental properties. This work is performed by the Facilities Maintenance section, the Electrical Maintenance section, the Mechanical Maintenance section and the Collection System Services section.

FACILITIES MAINTENANCE

The Facilities Maintenance section spends the majority of the year maintaining the District and non-District pumping stations, the Nine Springs Wastewater Treatment Plant facilities and grounds, odor control equipment, roads and small equipment. Routine work includes landscaping projects, cleaning plant buildings and galleries, maintaining lagoon and dike roads, painting, plumbing and carpentry projects, lawn mowing and maintenance, and snow plowing. This section also performs preventive maintenance work on the District's electrical manholes, process tanks, roofs and floors.

Two new employees were hired in 2019 to fill vacancies that were created by the departure of two Facilities Maintenance workers. A second custodian was also hired in order to bring all custodial duties in house.

The Facilities Maintenance section continued improving snow removal operations and reduced salt use by applying knowledge acquired from attendance at winter roadway maintenance and Dane County "Saltwise" training courses in 2019. The section also purchased and utilized two new "V" plows for plow trucks and a pusher plow for the end loader to remove snow more efficiently, resulting in reduced time needed for snow removal operations.

In 2019, the Facilities Maintenance crew assisted operations and engineering staff with projects including preventative maintenance on plant primary settling tanks, aeration tanks, final clarifiers, sump pumps and pits as well as inspection of plant and pumping station roofs and cleaning wet wells of District-owned pumping stations (in conjunction with the City of Madison).

The crew also contracted services for several major projects in 2019:

- Media blasting and recoating of final clarifiers 17 and 19
- Removal and replacement of approximately 20,000 square feet of low volume roadway at the plant
- Sealcoating of paved areas around the Maintenance Facility
- Repairing of the plant perimeter fence following damage from multiple downed trees and vehicle accidents

ELECTRICAL MAINTENANCE

The Electrical Maintenance section devoted a majority of the year to providing the knowledge and skills necessary to assure a high level of electrical reliability to District facilities and the facilities owned by others yet maintained by the District.

This was accomplished through a mix of preventive and reactive maintenance, electrical staff training, planned improvements, construction projects and daily maintenance. Examples of preventive maintenance tasks performed by the section include: calibration, inspection, testing/cleaning of electrical and instrumentation equipment and thermographic imaging of electrical devices. The continued use of the District's computerized maintenance management system (CMMS) has allowed the section to identify problems by tracking equipment data, scheduling maintenance and creating daily and preventive maintenance work orders.

The section continued to lend its expertise to other departments to facilitate District projects and improve the treatment process, including providing electrical cross-training to District mechanics, operators and HVAC personnel, assisting the Engineering department with submittal reviews and the evaluation of the Liquid Process Facility Plan, collecting data on electrical assets for the CMMS system and operating District portable generators during planned and unplanned power outages.

The following additional improvements and projects completed or continued in 2019 were:

- Continued to upgrade and modify existing electrical equipment at District and non-District facilities to accommodate the requirements of NFPA 70E (Arc Flash)
- Completed the replacement of the radios at pumping stations that communicate through the Lakeview tower, which allows the District to move toward ethernet communication to remote sites
- Completed the replacement of the antennas and antenna cables on the radio tower at the plant with the support of an outside contractor
- Completed installation of new controls and telemetry for Air National Guard Pumping Station 1
- Completed installation of Pumping Station 16 control room supply fan automated controls to pressurize the dry well side of the station
- Completed design, fabrication and installation of new controls and telemetry for Cherokee #1 Pumping Station and Commodore Pumping Station
- Designed and started fabrication of new controls for Lake Farm Park Pumping Station and Debs Road Pumping Station
- Assisted the City of Madison with an on-site generator installation at Carroll, Debs Road, and Cherokee #1 pumping stations
- Evaluated and purchased an UPS unit for the Operations Building to replace the failed power conditioner
- Participated and completed all electrical work associated with the Struvite Harvesting Building reliability centered maintenance pilot project for identification, planning and scheduling work

MECHANICAL MAINTENANCE

The Mechanical Maintenance section maintains mechanical equipment through preventative and reactive maintenance of Nine Springs Wastewater Treatment Plant equipment and District and non-District pump stations. The section verifies proper operation of equipment and ensures that all collected wastewater is conveyed to the plant with the support of operations and other maintenance sections. The section also maintains the District's vehicle fleet and develops the skills of section staff members through the District's apprenticeship program and other training.

In addition to many scheduled and unscheduled maintenance activities, major accomplishments completed in 2019 included:

- Continued developing standard operating procedures for routine mechanical tasks to promote consistency and efficiency in work
- Continued working with the Planning and Strategy department on the District's asset management plan and redefining work flow processes to aide in the selection of a new CMMS
- On a weekly basis, removed rags and other debris from plugged collection system pumps to keep them functioning at required capacities
- Finished the rebuild of engine and generator 2 with outside contractors
- Purchased new style engine oil pan doors on the engine generators to fix chronic oil leak issues
- Replaced coolant circulation valves on engine generator system allowing engines to run at optimal speeds
- Rebuilt headworks screen 1
- Rebuilt and repaired the dissolved air floatation (DAF) tank with new iron rails and rollers
- Repaired or rebuilt several critical process related pumps and mixers
- Rebuilt or replaced several pumps at District and customer community pumping stations
- Participated in the Struvite Harvesting Building blitz, bringing the building up to "like new" standards
- Completed the relocations of the WAS Thickening Building air compressors to an area with improved air quality to extend equipment life
- Repaired several deaerator system pump failures and rebuilt the deaerator system with a new steam valve, steam trap and piping
- Worked with outside contractors to maintain hot water and steam boilers to State of Wisconsin standards

- Attended manufacturer training on Vogelsang rotary lobe pumps to increase internal knowledge on pump function and repairs

COLLECTION SYSTEM SERVICES

This workgroup devotes its time to two major functions for the District. The first is the collection of wastewater samples and flow information from the communities and sanitary districts that are served by the District. The analyses results measured by the District's laboratory on these samples and the flow data recorded by the crew are used to bill the District's municipal customers for treatment services. The crew also collects samples at companies with discharge permits issued by the District's industrial pretreatment program. The second major function is the inspection and maintenance of the District's collection system each year. This work includes the identification and repair of assets by the crew or contractors and working with contractors for the District's annual cleaning and televising of portions of the interceptor system.

During 2019, the following activities were performed by the crew:

- Conducted preventive maintenance work, including all work on air release valves, exercising valves, and inspection of stop logs and flap gate structures
- Monitored and recorded all lateral connections
- Implemented and tested laser and flow monitoring equipment
- Assisted United States Infrastructure Corp. with the location of force mains
- Viewed and coded interceptor televised videos
- Monitored numerous construction projects involving utility crossings of District interceptors and force mains
- Investigated odor complaints
- User charge program repair and construction of manhole weirs
- Collected "First of Month" readings from pump stations and other municipality lift station pumps for billing

2019 Special Projects

- Inspected the manholes and surrounding areas for the following interceptors:
    - Nine Springs Valley-Midtown Ext (21), Morse Pond Ext (11)
    - West Interceptor (38 of 114)
    - North East Int (25), West Int-Ext Replacement (10 of 28)
    - West Interceptor-Campus Relief (18 of 28), Ext Replacement (18)
    - West Interceptor (38 of 114)
    - West Interceptor (38 of 114)

- Investigated large sink hole on Midtown extension MH12-215 to MH12-214 for evidence of soil and water infiltration
- Inspected Morse Pond extension manholes for leaning and tilting deficiencies related to City of Madison new storm sewer filling with soil adjacent to the District's pipe
- Investigated, learned and began using Koterra software for Digger's Hotline system to field locate District force mains, gravity sewers and abandon lines
- Worked in conjunction with District engineers to replace the Badfish Creek force main standpipe with air release values and a manhole vault

MISCELLANEOUS WORK REPORTING

Reliability Centered Maintenance

In 2019, District staff continued development of RCM best practices in a continual effort to shift our maintenance culture. A greater understanding of the IPSECA (Identify, Plan, Schedule, Execute, Close and Analyze) process for completing work and the workflows associated with that process in the CMMS system was achieved. Maintenance staff worked with the Planning and Strategy and Purchasing departments to dig into the current background workflow processes in the CMMS and change those processes to facilitate IPSECA in the most efficient manner. Workflow processes investigated included identification, planning and scheduling of work. Alignment across the District in these workflow processes is a great first step shifting our culture to an RCM focus.

Struvite Harvesting Blitz

In 2019, as part of the RCM movement, District staff decided to trial a building work order blitz. The purpose of a blitz is to identify all work needed within the building to bring the structure and all equipment up to a like-new baseline standard and, in a short timeframe, complete all of the work. The overall goal in bringing up the building to a like-new baseline is to set the standard of maintenance so that the building and equipment are kept in that condition moving forward. Underlying goals of this blitz were to train employees in the use the IPSECA process to complete the work and to identify deficiencies in our workflow processing. The Struvite Harvesting Building was selected for the blitz because of its high level of ongoing maintenance and because of the condition of the equipment within the building. Overall, the blitz was successful; the building was brought up to a like-new standard condition and the O&M group learned their strengths and weaknesses when it comes to work order processing and building upkeep.

2019 Treatment Plant Piping Improvements

In 2018, District staff identified two sections of critical process piping that were compromised to the point where failure could be eminent. Piping consisted of W1 or city water piping and hot water supply/return piping. Both piping systems are critical to treatment processes and permit compliance. In 2019, design was completed internally for a project that would remove and replace approximately 1,200 feet of W1 piping and 550 feet of hot water piping along with several valves and insulation. The project was bid in October and two bids were received for the project from qualified contractors. The low bid was $418,551, which was $275,000 below budget. Demolition began in December of 2019 with all work scheduled to be completed by June 2020.

OPERATIONS

Staffing

The Operations workgroup has 16 full-time employees:

- Director of Wastewater Operations & Reliability
- Operations Manager
- Senior Automation Systems Integrator
- Automation Systems Integrator Technician
- Process and Research Engineer
- Regulatory Performance and Process Engineer
- Operations Supervisor
- Lead Operator
- 12 Hour Operator (4)
- Relief Operator (4)

Responsibilities of Workgroup

The workgroup's main responsibilities are as follows:

- Operation of the Nine Springs Wastewater Treatment Plant (NSWWTP)
- Resource recovery of clean water, biosolids, biogas and phosphorous fertilizer
- Regulatory compliance reporting
- Maintaining the District supervisory control and data acquisition (SCADA) system for collection system and treatment plant monitoring
- Researching, monitoring and testing process efficiencies for greater plant performance

Programs, Initiatives and Work Reporting

OPERATIONS WORKGROUP

The Operations workgroup is primarily responsible for operation of the treatment facility at the Nine Springs Wastewater Treatment Plant and the Process Control System (PCS). Significant projects the group worked on in 2019 included:

- Reorganized operator workgroup schedule and structure
- Implemented an Automated Systems Integrator career path
- Coordinated four low-phosphorus pilot demonstrations related to proposed DNR limits for the Badger Mill Creek outfall
- Initiated an annual digester cleaning program

- Spill response to Metrogro tank #1 spill
- Supported Liquid Processing Improvements Phase 1 planning and design
- Updated SCADA displays

OPERATION OF WASTEWATER FACILITIES

Sources of Wastewater

The District receives and treats wastewater from the cities of Fitchburg, Madison, Middleton, Monona and Verona; the villages of Cottage Grove, Dane, DeForest, Maple Bluff, McFarland, Shorewood Hills, Waunakee and Windsor; and from sanitary and utility districts and other areas in the towns of Dunn, Madison, Pleasant Springs, Verona, Vienna and Westport. The District served a total of 26 municipal customers in 2019. The District also accepts septic tank wastes and similar wastes from unsewered areas located primarily in rural Dane County. In 2019, 510.33 acres of land was annexed by the District. The total area of the District at the end of 2019 was 185.77 square miles.

Interceptor Service

Interceptor sewer service is provided within the District through the District's main and intercepting sewers. The District operated and maintained 97.60 miles of gravity sewers and siphons and 32.04 miles of raw wastewater force mains at the end of 2019. Wastewater collecting systems are owned and operated by the cities, villages and town sanitary and utility districts and are connected to the metropolitan interceptor system.

All wastewater generated in the District is treated at the Nine Springs Wastewater Treatment Plant located at 1610 Moorland Road, Madison, Wisconsin, approximately one mile south of Lake Monona. The easterly part of the District is served by the East Interceptor, the Southeast Interceptor, the Northeast Interceptor and the Far East Interceptor. The westerly part of the District is served by the Lower Badger Mill Creek Interceptor, the West Interceptor, the Southwest Interceptor, the South Interceptor and the Nine Springs Valley Interceptor.

The transmission of wastewater from the metropolitan area to the NSWWTP requires the operation of 135 pumping stations, not including 446 small grinder pump installations. Table 11 and Table 12 list the number of pumping stations operated and maintained by individual communities and the District.

Table 11 – Pumping Stations Operated and Maintained by Communities

Owner	Number of Pumping Stations	Number of Grinder Stations
City of Fitchburg	1	
City of Middleton	8	
City of Monona	8	
Village of Cottage Grove	4	
Village of Dane	1	
Village of DeForest	1	1
Village of McFarland	5	1
Village of Shorewood Hills	1	
Village of Waunakee	3	1
Village of Windsor	4	11
Town of Dunn Kegonsa Sanitary District	5	355
Town of Pleasant Springs Sanitary District No. 1	9	55
Town of Vienna Utility District No. 1	1	
Town of Vienna Utility District No. 2	1	5
Town of Westport Utility Districts	10	13
State of Wisconsin:		4
University of Wisconsin Campus	6	
University of Wisconsin Arboretum	1	
Dane County - Rodefeld Landfill	1	
Total	**70**	**446**

Table 12 – Pumping Stations Operated and Maintained by the District

Owner	Number of Pumping Stations
Madison Metropolitan Sewerage District	18
City of Madison	31
City of Verona	2
Village of Maple Bluff	3
Town of Dunn Sanitary District No. 1	4
Town of Dunn Sanitary District No. 3	3
Town of Madison	3
Dane County Lake Farm Park	1
Total	**65**

Quantity of Wastewater

The District received 16,807,852,000 gallons of wastewater at the NSWWTP in 2019. This was a 2.67% increase from 2018. The average daily quantities of wastewater received from each municipality and through infiltration into the District's intercepting sewers in 2019 are shown in Table 13.

Table 13 – Average Daily Quantities of Wastewater

Municipality	2019 (GPD)	% of Total
City of Fitchburg	1,893,000	4.11
City of Madison	30,085,000	65.33
City of Middleton	2,171,000	4.71
City of Monona	1,293,000	2.81
City of Verona	1,242,000	2.70
Village of Cottage Grove	702,000	1.53
Village of Dane	54,000	0.12
Village of DeForest	1,091,000	2.37
Village of Maple Bluff	226,000	0.49
Village of McFarland	788,000	1.71
Village of Shorewood Hills	138,000	0.30
Village of Waunakee	1,908,000	4.14
Village of Windsor	637,000	1.38
Town of Dunn San. Dist. No. 1	250,000	0.54
Town of Dunn San. Dist. No. 3	83,000	0.18
Town of Dunn San. Dist. No. 4	21,000	0.05
Town of Dunn Kegonsa San. Dist.	128,000	0.28
Town of Madison	653,000	1.42
Town of Pleasant Springs San. Dist. No. 1	67,000	0.14
Town of Verona	600	<0.01
Town of Verona Util. Dist. No. 1	27,000	0.06
Town of Vienna - Wyst59 LLC	100	<0.01
Town of Vienna Util. Dist. No. 1	87,000	0.19
Town of Vienna Util. Dist. No. 2	39,000	0.09
Town of Westport Sewer Utility District	591,000	1.28
Town of Westport - Cherokee Golf & Tennis	3,200	0.01
Total Wastewater	**44,180,000**	**95.94**
Infiltration into District Interceptors	1,804,000	3.92
Groundwater to District Interceptors from MMSD Construction Projects	65,000	0.14
Total Received at the Treatment Plant	**46,049,000**	**100.00**

Wastewater Treatment

The District has a single treatment plant, the Nine Springs Wastewater Treatment Plant. In 2019, the NSWWTP met all Wisconsin Department of Natural Resources discharge limitations with the exception of a single low effluent dissolved oxygen reading during a high flow event.

This level of compliance should qualify the District for a silver award from the National Association of Clean Water Agencies (NACWA).

Preliminary treatment includes influent wastewater fine screening and grit removal. Fine screening is accomplished by three rotating band screens with 6-millimeter openings followed by a vortex grit system for grit removal. Variable speed drives for the band screens are used to control the influent well level and to maintain a minimum level above the influent flow meters. Grit is removed continuously from three vortex grit chambers. The dewatered grit and screenings are conveyed to dumpsters and hauled by a contractor to the landfill three to five times per week.

All material removed by the fine screens is conveyed to a screenings processing well. Pumps macerate the screenings and pump them to compactors which squeeze water out of the screenings before they are placed in a dumpster. Two to four times a day, the grit is removed from this well. The grit and accompanying rags are pumped to a separate settling basin, termed a “snail.” The material settled in the snail is conveyed to the grit and screenings dumpster.

Following preliminary treatment, 19 primary settling tanks are used to remove floatable and settleable material from the wastewater. After primary settling, the wastewater is biologically treated in the activated sludge system. The activated sludge system consists of tanks with anaerobic, anoxic and aerobic zones configured for biological phosphorus removal, ammonia removal and decomposition of organic material. The material flowing out of the aeration tanks is a mixture of cleaned water and microorganisms. It flows to secondary clarifiers for separation. The secondary clarifiers are a combination of center feed/peripheral draw off and peripheral feed/peripheral draw off configurations that efficiently remove the suspended bacterial solids to meet advanced secondary standards. Most of the solids, which contain the microbial culture, are pumped back to the aeration tanks. A certain percentage of solids are removed from the activated sludge process and pumped to the solids handling processes every day to maintain a desired bacterial population; these removed solids are referred to as waste activated sludge (WAS). An eight- to 10-day solids retention time is normally maintained in the process.

During 2019, the secondary portion of the NSWWTP was operated as four separate treatment units. Effluent from the individual plants was monitored to ensure adequate process control and to provide information on differing operating modes.

The treated water is disinfected by ultraviolet irradiation from April 15 through October 15 and pumped to surface outfalls on Badfish Creek and Badger Mill Creek. In 2019, approximately 43.67 million gallons (MGD) per day on average were pumped to Badfish Creek and 3.33 MGD were pumped to Badger Mill Creek.

The open-channel ultraviolet disinfection system has met the effluent fecal coliform concentration standard since it started operation in 1997. All lamp banks are cleaned with citric acid in the winter months when disinfection is not required. Lamp and ballast replacements are also accomplished during this period.

Primary sludge is pumped from the 19 primary settling tanks on a rotating basis and is pumped to three gravity thickener tanks. The solids concentration from the gravity thickeners averaged 5.7% in 2019.

The waste-activated sludge is thickened on three gravity belt thickeners. Generally, two of the three units are in service with one unit as standby. The thickened solids concentration off the gravity belt thickeners averaged 6.2% in 2019.

The anaerobic digestion process was operated as a phased system throughout 2019. The sludge treatment flow train is normally run as follows:

- Gravity-thickened primary sludge is directly fed unheated to acid phase digestion.
- Thickened waste-activated sludge is heated with steam injection and fed to acid phase digestion.
- One acid phase digester is heated to approximately 90 degrees Fahrenheit with an approximately 1.25-day (30-hour) detention time.
- Acid phase sludge is fed to the east digesters 4-9 and the temperature is maintained at 95 to 98 degrees Fahrenheit. The detention time in the east digesters averaged approximately 24 days.
- Digested sludge from east digester 7 is normally pre-heated to approximately 120 degrees Fahrenheit through a Lackeby tube and shell heat exchanger and transferred to west digesters 1-3 for time/temperature Class A batching at 134 degrees Fahrenheit.
- The required batching time at that temperature is approximately 14 hours. In 2019, approximately 13% of the total biosolids mesophilically digested underwent additional time-temperature batch treatment to meet Class A liquid criteria.

Digested sludge from the east digesters is normally thickened on gravity belt thickeners. The thickened sludge is land applied as part of the Metrogro liquid land application program. Class A digested biosolids production started in November 2014. Most of the production has remained in the liquid form and is thickened on gravity belt thickeners in combination with the Class B biosolids and the resulting combination is handled as Class B liquid biosolids. After receiving approval by the Wisconsin Department of Natural Resources on Oct. 18, 2016 for the plan to produce and distribute Class A equivalent biosolids, the limiting factor in production has been demand for the product. In 2019, the centrifuge was operated regularly in February, then starting in November began regular runs to decrease input to liquid biosolids storage.

The digested biosolids concentration averaged 2.9% for 2019 from the east digesters and 2.0% from the west digesters after the time and temperature batching operation. The digested biosolids were thickened to an average concentration of 5.82% in 2019 through the addition of polymer on a gravity belt thickener. An average of 22.6 tons per day of digested biosolids was thickened in 2019.

Anaerobic digester foaming was an issue in early 2019, and uncharacteristically persisted well into summer. The foaming was kept under control through operational measures (such as feed time and temperature adjustments) and the use of chemical defoamant.

Filtrates from the digested sludge gravity belt thickening, centrifuge dewatering and the WAS thickening processes are combined and sent to the Ostara struvite (magnesium ammonium phosphate) harvesting process for nutrient recovery. The purpose of the struvite harvesting process is to remove phosphorus before anaerobic digestion where nuisance struvite is formed, and to reduce phosphorus in the biosolids that will be land applied.

The District utilizes biological phosphorus removal in its secondary process. In this process, anaerobic/aerobic cycling is used to alternately release and take up phosphorus in excess of metabolic requirements. In the anaerobic section, with the availability of organic material in the form of volatile fatty acids, the bacteria release phosphorus. This aspect of biological phosphorus removal is also used in the anaerobic WAS treatment tanks before the WAS gravity belt thickeners. A low flow stream of acid phase sludge is recycled to the treatment tanks and contains significant concentrations of volatile fatty acids, in excess of 5,000 milligrams per liter. The volatile fatty acids in the acid phase sludge are utilized to affect release of phosphorus from the waste-activated sludge.

A significant amount of soluble phosphorus is also released in the acid phase digestion process. The filtrate from the WAS thickeners is thus rich in soluble phosphorus and is combined with the filtrate from the digested sludge thickener, which has a high ammonia concentration. These streams are fed to the struvite harvesting reactors, which were purchased from Ostara.

Magnesium chloride and sodium hydroxide are added to enhance struvite formation. The process forms spheroidal struvite pellets.

By contract, the product is sold to Ostara in one-ton bags. Ostara picks up the product and markets it as a slow-release fertilizer for applications where high phosphorus content is required. Performance optimization efforts in close association with Ostara are ongoing. For 2019, the total production was 691.6 tons being shipped off site. The capture of particulate phosphorus in the reactors continued to improve in 2019 and was accompanied by a noticeable downward shift in average product size.

The digested liquid biosolids produced by the District are marketed under the name "Metrogro." The thickened biosolids from the gravity belt thickeners are either pumped directly to truck loading facilities or to the Metrogro storage tanks. During the winter, all biosolids are stored in the Metrogro storage tanks. The tanks have a storage capacity of 19.5 million gallons. The biosolids are hauled and applied to cropland as a soil conditioner and fertilizer.

As a byproduct of the anaerobic digestion process, gas is produced that is approximately 60% methane. Digester gas production averaged around 825,000 cubic feet per day in 2019. Part of the digester gas was used to fuel boilers for plant heating and to fuel a 650-horsepower blower engine, which provides air to aeration tanks. The remainder of the gas is used to fuel two generator engines in Sludge Control Building #2. Before use in the engines and boilers, the gas is treated by a gas treatment system that removes moisture, hydrogen sulfide and siloxanes from the gas. An average of 17,627 kilowatt-hours of electricity was generated each day in 2019. In addition, the blower engine saved the purchase of approximately 9,378 kilowatt-hours per day of electrical energy. The District supplements digester gas production with natural gas purchased from Madison Gas and Electric.

The District takes advantage of the heat recovered from the engines to heat anaerobic digesters and most plant buildings as well as heating air in the struvite dryers. Jacket water heat and engine exhaust heat are recovered from all three engines when available. Lube oil heat is recovered from the generator engines, but not from the blower engine. If plant heating demands cannot be satisfied with recovered heat, there are three sets of three boilers available for satisfying the heating load.

The section in this report entitled "Nine Springs Energy Use Profile" describes in detail the electrical and thermal demands at the treatment plant. Table 16, "Annual Energy Use Summary" shows a complete breakdown of the thermal and electrical savings from the use of digester gas.

The 2019 wastewater treatment data are reported in accordance with the District's Wisconsin Pollutant Discharge Elimination System Permit (WPDES) and a summary of this information is shown in Table 14. Monitoring data for effluent metals are reported in Table 15.

Table 14 – Yearly log of Plant Operations 2019

Month	Influent Flow (MGD)	BFC Effluent Flow (MGD)	BMC Effluent Flow (MGD)	BOD RAW BOD (MG/L)	BOD Effluent BOD (MG/L)	TSS RAW TSS (MG/L)	TSS Effluent TSS (MG/L)	Nitrogen RAW TKN (MG/L)	Nitrogen Effluent Ammonia (MG/L)	Phosphorus RAW TP (MG/L)	Phosphorus Effluent TP (MG/L)	Effluent FCOLI MPN/100 Mean(1)	Min Hr Effluent D.O. (MG/L)
Jan – 19	42.68	40.79	3.08	245	7.9	208	5.8	43.3	0.48	5.25	0.28		6.72
Feb – 19	43.77	41.44	3.10	252	9.4	197	5.5	44.1	0.66	5.07	0.25		5.28
Mar – 19	48.03	45.64	2.98	232	8.8	193	4.7	39.4	0.71	4.61	0.20		5.38
Apr – 19	44.32	43.03	3.10	253	5.8	207	4.0	43.1	0.39	4.95	0.22	76	6.92
May – 19	47.05	45.22	3.37	244	4.8	208	5.2	41.2	0.20	4.84	0.29	77	6.20
Jun – 19	44.22	42.16	3.41	242	3.8	209	4.1	42.1	0.22	4.97	0.26	55	5.60
Jul – 19	47.82	44.77	3.51	228	4.6	207	6.1	38.3	0.15	4.65	0.34	247	6.23
Aug – 19	44.50	41.08	3.58	250	3.7	222	5.0	40.9	0.16	4.92	0.33	163	6.19
Sep – 19	47.14	44.08	3.59	222	3.6	204	4.7	40.2	0.18	4.92	0.34	79	5.18
Oct – 19	53.13	50.41	3.60	212	4.6	195	4.5	37.6	0.22	4.62	0.30	65	4.52
Nov – 19	46.49	44.51	3.58	242	5.4	222	4.6	41.5	0.23	4.92	0.23		7.34
Dec – 19	43.19	40.85	3.08	238	6.3	191	4.2	40.5	0.17	4.94	0.26		7.34
Average	46.03	43.66	3.33	238	5.7	205	4.9	41.0	0.31	4.89	0.28	109	6.07

BFC is to Badfish Creek Outfall

BMC is to Badger Mill Creek Outfall

(1) Geometric mean

Table 15 – Influent and Effluent Metal Concentrations 2019

Date of Sample	Effluent MGD	Cadmium (T) (PPB) Inf	Cadmium (T) (PPB) Eff	Chromium (T) (PPB) Inf	Chromium (T) (PPB) Eff	Copper (T) (PPB) Inf	Copper (T) (PPB) Eff	Lead (T) (PPB) Inf	Lead (T) (PPB) Eff	Mercury (T) (PPT) Inf	Mercury (T) (PPT) Eff	Nickel (T) (PPB) Inf	Nickel (T) (PPB) Eff	Zinc (T) (PPB) Inf	Zinc (T) (PPB) Eff
Jan-19	43.87	0.20 b	0.20 b	2.42 q	1.0 b	45.3	3.77 q	3.05 q	1.20 b	61.0	0.88	3.29 q	3.61 q	88	35.7
Feb-19	44.54	0.20 b	0.20 b	2.84 q	1.0 b	66.4	7.95 q	2.91 q	1.20 b	54.5	1.63	2.29 q	1.60 b	112	64.9
Mar-19	48.62	0.20 b	0.20 b	2.80 q	1.4 q	55.5	8.50 q	2.26 q	1.40 q	104.0	2.16	2.27 q	1.60 b	106	45.9
Apr-19	46.13	0.20 b	0.20 b	3.19 q	1.0 b	57.8	8.97 q	1.28 q	1.20 b	33.2	1.31	3.77 q	1.60 b	108	43.8
May-19	48.59	0.20 b	0.20 b	2.45 q	1.0 b	54.6	5.89 q	1.93 q	1.20 b	49.0	1.34	2.08 q	1.60 b	99	37.2
Jun-19	45.57	0.20 b	0.20 b	3.17 q	1.0 b	63.2	5.50 q	2.62 q	1.20 b	44.8	0.74	2.10 q	1.60 b	114	43.6
Jul-19	48.28	0.20 b	0.20 b	3.70	1.5 q	62.4	5.03 q	3.57 q	1.20 b	37.1	0.99	1.75 q	1.60 b	104	27.9
Aug-19	44.66	0.20 b	0.20 b	2.73 q	1.0 b	72.0	3.57 q	2.84 q	1.20 b	42.4	1.07	2.54 q	1.60 b	129	36.5
Sep-19	47.67	0.20 b	0.20 b	3.27	1.0 q	67.4	8.05 q	1.20 q	1.20 b	53.9	0.94	1.60 b	1.60 b	118	35.6
Oct-19	54.01	0.20 b	0.20 b	2.26 q	1.0 b	65.4	2.98 q	2.57 q	1.20 b	82.0	1.02	1.60 b	1.60 b	125	34.7
Nov-19	48.09	0.20 b	0.20 b	2.84 q	1.0 b	62.3	7.58 q	1.23 q	1.20 b	47.5	1.17	1.60 b	1.60 b	106	36.8
Dec-19	43.93	0.20 b	0.20 b	3.09 q	1.0 b	58.9	6.87 q	1.69 q	1.20 b	35.4	1.30	1.60 b	1.60 b	96	40.4

"b" validation code indicates that sample concentration is less than the method detection limit

"q" validation code indicates that sample concentration is less than the limit of quantitation and above the method detection limit

RESEARCH

Pilot-scale study to evaluate total nutrient removal with low dissolved oxygen

To address energy independence and constantly strive to provide better treatment, the District continued a research project that was initiated in 2013 with Dr. Daniel Noguera (Civil and Environmental Engineering department, University of Wisconsin–Madison) to explore the possibility of removing both nitrogen and phosphorus at low dissolved oxygen concentrations.

The removal of nitrogen at low dissolved oxygen is established, but the combined removal of both nitrogen and phosphorus at low dissolved oxygen concentrations is a relatively new concept, with full-scale attainment only at a few specialized types of facilities. The purpose of this study is to see if this technology could be implemented at a conventional activated sludge type facility such as the Nine Springs Wastewater Treatment Plant.

This work has continued for several years due to the relatively slow growth rate of the microorganisms involved and the novel nature of the research. The initial phases of work were aimed at reducing input oxygen levels to establish the practical boundaries of treatment. Early results suggested a potential to save approximately 30% on aeration energy costs for treatment while achieving the same or slightly better overall effluent quality. These initial results indicated that full-scale implementation in some form may be possible, but several equipment failures occurred, clouding results.

In 2018 and 2019, several upgrades were made to the pilot to improve equipment reliability. Additional sensors and control equipment were also added to allow the pilot to be operated in a manner closer to what would be expected if implemented at full scale. Work in 2019 focused on monitoring process stability, matching aeration demands to pollutant removal requirements, and developing best operational practices for reliable operations in winter conditions. This work will be extended into 2022 in order to further evaluate process stability as well as understand impacts to sludge settleability, which will be utilized for future liquid process facilities improvements projects.

Pilot-scale study to evaluate nitrite shunt activated sludge process for total nitrogen removal

The 2016 Liquid Process Facilities Plan recommended an alternative to the current modified University of Cape Town activated sludge process at NSWWTP that can reduce the total nitrogen content in the plant effluent. This recommendation was put forward in anticipation of possible stricter permit limits for total nitrogen in the future, as a means to reduce energy demands, and to advance the District's environmental stewardship. The process, known as nitrite shunt, has been shown to improve nitrogen removal while also achieving energy savings with minimal modifications to existing activated sludge infrastructure. However, this process has only been implemented at two facilities in the U.S. and the viability in cold regions such as Madison has not been demonstrated.

This project was initiated in 2016 with Dr. Daniel Noguera (Civil and Environmental Engineering department, University of Wisconsin–Madison). The project aim was to evaluate the viability of adapting biomass from the full-scale University of Cape Town process at NSWWTP to the nitrite shunt process under cold weather conditions. The project originally involved the operation of a sequencing batch reactor that was fed primary effluent from the treatment plant. In 2017, the pilot was upgraded to a continuous flow process that approximates the design proposed in the 2016 Liquid Process Facilities Plan.

The project was intended to last until the end of 2017, but encountered several challenges with process controls, which slowed project progress. The project was extended through 2018, with additional improvements being made to improve process control and allow the system to operate at lower temperatures. Because of the relatively slow growth rate of the microorganisms involved and the novel nature of the research, this study was extended into 2019 in order to allow more time for data collection.

In May 2019, this project was discontinued due to consistent poor results. Despite multiple attempts at improving the process, pilot operators were never able to maintain consistent control of the system and effluent quality consistently exceeded permit requirements for nitrogen removal. While the nitrite shunt process failed to perform at the NSWWTP, this project is considered successful in that the District now knows this alternative from the facilities plan is not viable and should not be pursued.

Pilot-scale study to evaluate total nutrient removal with intermittent aeration

After discontinuing the nitrite shunt pilot, the District initiated an alternative pilot process in May 2019 using intermitted aeration control in an attempt to achieve the same effluent quality goals intended for the nitrite shunt pilot. This project is supported by Dr. Daniel Noguera (Civil and Environmental Engineering department, University of Wisconsin–Madison). The use of intermittent aeration to increase nitrogen removal is established, but this effort seeks to achieve nitrogen and phosphorus removal at low dissolved oxygen concentrations while employing a demand-based intermittent aeration control strategy. The purpose of this study is to see if this novel control strategy can be employed to reduce energy demands and improve nutrient removal with minimal modifications to the current full-scale infrastructure at the Nine Springs Wastewater Treatment Plant.

Work in 2019 focused on establishing process stability and developing best operational practices for operating in winter conditions. Initial results have been promising, with the pilot demonstrating an ability to achieve desired nitrogen and phosphorus removal rates at low dissolved oxygen concentrations. However, sludge settleability has degraded over time, which is believed to be due to a combination of operating procedures as well as pilot plant tank design. This work will be extended into 2022 in order to further evaluate process stability as well as understand impacts to sludge settleability after various operating and physical modifications have been implemented. Results from this pilot will be utilized for future liquid process facilities improvements projects.

NINE SPRINGS ENERGY USE PROFILE

The District fuels three large gas-driven engines with biogas produced in its anaerobic digestion process. Two of these engines drive electric generators, while one powers an aeration system blower. Table 16 shows an estimate of the total amount of electric and thermal energy used at the Nine Springs Wastewater Treatment Plant and the division between purchased and renewable (primarily self-produced) power.

The District uses a five-year window to analyze the energy use profile. During that timeframe, the following events had an impact on the electric and thermal energy used:

- Installation of increased exhaust stack height and oxidation catalysts on three engines was completed in 2015. This successfully resolved air permitting issues between the District and the Wisconsin Department of Natural Resources that began in 2012.
- In March 2016, it was discovered that the catalyst elements on the two generators were failing due to overheating, resulting in damage to one catalyst housing. After discussion with DNR, the District was able to restore one generator to operation but for most of 2016, the second generator was idle until determination of the long-term viability of catalysts was determined before committing to the high cost to repair the catalyst housing.
- In January 2017, an agreement was reached with respect to the air permit allowing the District to operate both generators without catalysts under best available control technologies. The exhaust catalyst on the engine driven blower continues to function in place.
- In early 2018, a generator engine experienced mechanical failure (thought to be attributable to excess temperature operations stemming from catalyst use) and required an off-site rebuild to correct, removing it from service for three months in all. The other engine generator was also scheduled for planned rework in 2018 and started that process in December. Both events reduced the amounts of power generated, as well as thermal energy to recover.
- A sustained high flow event in summer 2018 resulted in high power demands from the plant to maintain operations, specifically related to pumping. This had the impact of increasing overall electric demand which, combined with less generation, reduced the percentages of renewable energy used.

From 2015 to 2019, renewable energy used at the Nine Springs Wastewater Treatment Plant provided roughly 36% of the plant's energy needs and had an estimated total value just over $6.1 million. The 2019 energy use profile is very similar to the data from 2018. This is reflective of the increased overall flow volume in 2019 (though there were fewer large rain events). Also, generators had a higher uptime time and use of heat energy was increased.

Table 16 – Annual Energy Use Summary

Electric Energy	**2015**		**2016**		**2017**		**2018**		**2019**	
	kWh/ Day	% of Total	kWh/ day	% of Total	kWh/ day	% of Total	kWh/ day	% of Total	kWh/ Day	% of Total
Commercial Service Purchased from MG&E	58,536	66.6%	67,775	75.9%	60,442	67.0%	66,867	72.4%	65,943	70.9%
Wind Power Purchased from MG&E	40	0.0%	40	0.0%	40	0.0%	40	0.0%	40	0.0%
Generated from Digester Gas	19,968	22.7%	12,291	13.8%	20,160	22.3%	16,057	17.4%	17,627	19.0%
Avoided Purchase Due to Blower Gas Engine	9,406	10.7%	9,177	10.3%	9,605	10.6%	9,335	10.1%	9,378	10.1%
Total Used & Avoided	**87,951**		**89,284**		**90,247**		**92,299**		**92,988**	
Average cost of purchased power ($/kWh)	$0.0921		$0.0837		$0.0892		$0.0875		$0.0844	
Estimated total monthly value of energy used	$246,277		$228,011		$244,962		$245,730		$238,733	
Estimated monthly value of renewable energy	$82,365	33.4%	$54,929	24.1%	$80,902	33.0%	$67,710	27.6%	$69,434	29.1%
Thermal Energy	**2015**		**2016**		**2017**		**2018**		**2019**	
	therms/ Day	% of Total	therms/ day	% of Total	therms/ day	% of Total	therms/ day	% of Total	therms/ Day	% of Total
Generated from Natural Gas	834	43.0%	361	20.0%	593	25.2%	523	24.2%	533	22.7%
Generated from Digester Gas	111	5.8%	333	18.4%	157	6.7%	280	13.0%	356	15.2%
Recovered from Gas Engines	992	51.2%	1,111	61.6%	1,607	68.2%	1,359	62.9%	1,457	62.1%
Total hot water energy used	**1,938**		**1,806**		**2,357**		**2,163**		**2,163**	
Average cost of purchased gas ($/therm)	$0.4793		$0.4828		$0.5169		$0.5057		$0.4876	
Estimated total monthly value of gas used*	$37,668		$35,454		$49,408		$44,348		$46,391	
Estimated monthly value of renewable energy	$21,455	57.0%	$28,357	80.0%	$36,981	74.8%	$33,621	75.8%	$35,847	77.3%
Total Energy Use	**2015**		**2016**		**2017**		**2018**		**2019**	
	$ per Month	% of Total	$ per month	% of Total	$ per month	% of Total	$ per month	% of Total	$ per month	% of Total
Total Estimated Value of Energy Used	$283,945		$263,464		$294,370		$290,078		$285,125	
Estimated Value of Renewable Energy Used	$103,820	36.6%	$83,286	31.6%	$117,883	40.0%	$101,330	34.9%	$105,281	36.9%

* Conversion of natural gas to heat is assumed to be 75% efficient and heat recovered from the gas engines is assumed to be 40%.
Note – due to rounding, numbers may not add exactly.

PLANNING AND STRATEGY

Staffing

The Planning and Strategy department was formed in 2016 by combining some staff from Engineering and Operations. In the fall of 2018, the information technology (IT) workgroup was transferred to Planning and Strategy from the Administration department.

The Planning and Strategy department has 14 full-time employees:

- Director of Planning and Strategy
- Capital Planning Engineer
- Engineering Technician
- Asset Investment Program Manager
- Asset and Maintenance Management System Administrator
- Asset Management Specialist
- GIS Analyst
- Information Systems Manager
- Records Program Administrator
- Programmer/Analyst (2)
- Network Administrator
- Network Technician
- Database Administrator

Responsibilities of Workgroup

The workgroup's main responsibilities are as follows:

- Asset management
- Capital improvement planning
- Computerized maintenance management system
- Customer community requests for sewer extensions and annexations
- Data management
- Geographic information systems
- IT infrastructure administration and design
- Long-term financial strategy
- Quarterly service charges
- Software needs assessment and design
- Software and systems support
- Technology advising for workgroups and staff

- Business needs and technology systems analysis
- Technology planning and strategy

Programs, Initiatives and Work Reporting

ASSET MANAGEMENT

The department is responsible for the development of a District-wide asset management program with the goal of lowering the life cycle cost of assets while maintaining service levels and managing risk.

The District has completed an asset management plan for assets at the treatment plant. Based on the recommendations of the plan, the next steps will include implementing a reliability centered maintenance program and supporting the design and implementation of a new computerized maintenance management system. In addition, in 2019, the department continued work to update the Collection System Facilities Plan, including asset management issues. The collection system plan will be completed in 2021.

CAPITAL IMPROVEMENTS PLANNING

Each year the department prepares the District's Capital Improvements Plan. This plan includes the major capital projects that will be undertaken by the District in the next six years and the intended funding sources. Also included in the plan is a listing of revenue sources and expenditures for the capital fund and the status of the debt service fund. A draft of the Capital Improvements Plan is introduced to the Commission in July of each year and is accepted by them for planning purposes. Any changes to the plan are incorporated into the document and the plan is then used to prepare the annual capital budget. These documents are available on the District's website at https://www.madsewer.org/Planning/Budget-Finance.

COMPUTERIZED MAINTENANCE MANAGEMENT SYSTEM

The department is responsible for the District's computerized maintenance management system (CMMS). The CMMS is one of the District's most important systems, along with the plant process control system. The CMMS contains information on District assets, including their age, condition and criticality; is used by the maintenance group to plan, schedule and closeout work orders; contains data used in analyzing asset performance, maintenance needs and investment needs; and integrates with the District's financial systems.

The District is in the early stages of replacing its current system. That work is supported by a capital project authorized in 2019. In addition, a new position was added in the 2019 budget to oversee the transition to a new system and to administer the program once implemented. Because a CMMS is only as good as the maintenance practices that underlie it, in 2019 the department's asset management staff began helping implement a reliability centered maintenance program at the District. This is a recommendation of the Nine Springs Plant Asset Management Plan.

COLLECTION SYSTEM

The department is responsible for the review and approval of any proposed connections to, or alterations of, the public sewerage system within the District's service area. District staff ensure that plans for new public sewers are in conformance with the District's sewer use ordinance and determine the amount of connection charges that are due prior to connection to the system.

The department also is charged with adding new lands to the District's service area through the annexation process. Requests for annexation to the District are submitted by the District's customer communities and are reviewed by staff for conformance to District policies and to regional planning standards of the Capital Area Regional Planning Commission. In 2019, the District processed 59 sewer extensions and seven annexations, adding 510 acres to the District's territory.

GEOGRAPHIC INFORMATION PROGRAM

The geographic information program supports the District's need for the management, analysis and mapping of spatial information. The geographic information system (GIS) has been successfully migrated to the ESRI ArcGIS platform, allowing for District-wide access to District GIS data via interactive web maps. Treatment plant maintenance, engineering projects and sewer maintenance are supported by having District asset information accessible on an interactive map both in the office and in the field.

Additionally, the geographic information program has developed applications to improve workflows and distribute information more efficiently. Examples of this include the publicly available Paid Areas Viewer to track District connection charge payment status; the MMSD Collection System Viewer used to provide collection system asset information both internally and externally; the Nine Springs Asset Viewer to inform users about plant assets and utilities; and the new GPS data collection workflow to improve accuracy of the District collection system GIS.

The current publicly available mapping applications are the Paid Areas Viewer, the MMSD Viewer Public (District Collection System GIS), and the MMSD Salt Savers Pilot Eligibility Viewer, which shows eligible parcels within the Salt Savers pilot project area. In 2020, we will introduce a "Virtual Plant Tour" story map for the public to interact with as well.

INFORMATION TECHNOLOGY

The District's information systems (IT) workgroup provides infrastructure support, software support, system administration, cyber security services, design services, data management, database administration, records administration, and technological consulting services for all departments at the District. Services and systems of note are listed by department in the following summary.

Finance

Supported services and applications for the function and productivity of the Finance department include: Sage accounting system; budgeting database system; pumping station billing database and applications; custom maintenance management system reports; Optimas reporting system; and the rate-setting database and applications.

Ecosystem Services

The Ecosystem Services team is supported by IT staff in the management of the Metrogro hauling and land application database; septage receiving database and applications; the laboratory's Ethosoft X-LIMS laboratory information system; and the pretreatment database and applications.

Engineering

Systems supported for the work of the Engineering department include: the construction administration database, construction plan holders application, and the easements database.

Operations and Maintenance

These applications and programs are supported for the work of the Operations and Maintenance department: Data Access and Reporting Center (DARC) process reporting system; process control data transfer and analysis; process control system reporting; lock-out/tag-out database and applications; work scheduler application; Citrix virtual desktop and applications; and the manhole inspection database and applications.

Planning and Strategy

Supported technology for the Planning and Strategy department include: the Geographical Information System (GIS) geodatabase and applications; connection charges database and applications; collection system applications; Oracle Work and Asset Management (WAM) system (especially asset-related functions and applications); and the user charge billing system.

Leadership and Support

Services provided to the District's Leadership and Support department include the administration of technology for the internal and external websites; security camera technology support and administration; support for meeting- and event-related software; and Commission-related technology support.

District-Wide

The IT group supports and administers these District-wide programs and systems: network infrastructure; digital information storage; server virtualization; desktop virtualization; virtual private network; network security; records management and administration; cyber security; email systems; printers, scanners, and plotters; enterprise and workgroup databases; business analysis; computer and device programming; smartphones and cellular devices; technology project management; technology planning and strategy; phone system; software upgrades and

testing; software customization and configuration; license management; technology asset management; and network disaster recovery planning.

Notable changes in 2019 include: implementation of additional cybersecurity tools and guidelines; adoptions of more advanced records management tools for automation and data capture across District workgroups; upgrades to mobile data services and devices; and a significant upgrade to our WAM system.

Financials

FINANCIAL SUMMARY FOR THE YEAR ENDED DECEMBER 31, 2019

This statement is for informational purposes only and is not intended to represent full financial disclosure. Complete financial statements and related footnotes are available on our website at www.madsewer.org or available upon request.

STATEMENTS OF REVENUES, EXPENSES, AND CHANGES IN NET POSITION
Years Ended December 31, 2019 and 2018

	2019	2018
OPERATING REVENUES		
Charges for services:		
Transmission and treatment of sewage	$37,683,788	$36,585,585
Servicing pumping stations	580,300	338,817
Septage disposal	826,433	703,861
Pretreatment monitoring	29,413	21,238
Struvite Harvesting	253,163	257,574
Total operating revenues	**39,373,097**	**37,907,075**
OPERATING EXPENSES		
Administration	6,768,878	6,019,680
Treatment	13,149,173	12,717,863
Collection	3,446,909	2,865,879
Depreciation	8,409,797	8,328,156
Total operating expenses	**31,774,757**	**29,931,578**
Operating income	**7,598,340**	**7,975,497**
NONOPERATING REVENUES (EXPENSES)		
Investment income (losses)	805,271	562,051
Rent	82,289	70,907
Other	286,040	271,032
Capital assets contributed to other governments		
Construction expenses	(477,281)	(375,065)
Disposal of property and equipment	(68,930)	(50,372)
Interest expense	(3,041,096)	(3,270,113)
Total nonoperating revenues (expenses)	**(2,413,707)**	**(2,791,560)**
Income (loss) before capital contributions	5,184,633	5,183,937
CAPITAL CONTRIBUTIONS		
Contributed assets	-	-
Conveyance Facilities Connection/Treatment charges	2,262,579	2,932,675
Total capital contributions	**2,262,579**	**2,932,675**
CHANGE IN NET POSITION	7,447,212	8,116,612
NET POSITION		
BEGINNING OF YEAR, AS PREVIOUSLY REPORTED	141,176,747	133,473,125
RESTATEMENT		($412,990)
BEGINNING OF YEAR, RESTATED	**141,176,747**	**133,060,135**
END OF YEAR	$148,623,959	$141,176,747

SUPPLEMENTAL DETAILED INFORMATION

The following information was prepared by staff members of the Madison Metropolitan Sewerage District and is not part the independent auditor's financial report.

MADISON METROPOLITAN SEWERAGE DISTRICT
GENERAL FUND
Year Ended December 31, 2019
(with comparative amounts for 2018)

Repair and Replacement Expenditures	2018	2019
City of Madison Pumping Stations	38,692	123,903
City of Verona Pumping Stations	2,233	2,185
Collection System	127,900	62,853
Collection System Vehicles	11,400	9,539
Dane County Parks		6,546
East Interceptor	1,479	898
Engineering & Administration	154,877	250,822
Far East Interceptor	300	
Nine Springs Treatment Plant	1,033,069	1,129,508
Nine Springs Treatment Plant Vehicles	151,006	185,431
Nine Springs Valley Interceptor	1,147	
Northeast Interceptor	3,319	110
Pumping Station #1	4,178	2,375
Pumping Station #10	6,014	2,963
Pumping Station #11	4,657	2,897
Pumping Station #12	5,767	962
Pumping Station #13	319	4,293
Pumping Station #14	2,719	516
Pumping Station #15	3,007	4,202
Pumping Station #16	19,111	3,014
Pumping Station #17	6,097	14,575
Pumping Station #18	5,045	8,211
Pumping Station #2	18,167	32,977
Pumping Station #3	100	11,643
Pumping Station #4	(1,766)	1,275
Pumping Station #5	483	1,759
Pumping Station #6	682	5,470
Pumping Station #7	(1,625)	920
Pumping Station #8	441	29,258
Pumping Station #9	2,672	10,070
South Interceptor		585
Southeast Interceptor	13,473	449
Southwest Interceptor	558	667
Town of Dunn SD#1 Pumping Stations	2,061	2,745
Town of Dunn SD#3 Pumping Stations	2,242	2,180
Town of Madison Pumping Stations	1,419	16,378
Village of Maple Bluff Pumping Stations		3,409
West Interceptor	5,724	575
Total Repair & Replacement	1,628,985	1,938,182

Capital Outlay Expenditures	2018	2019
CIP		177,450
Concrete Sewer		-
Office Furniture	40,421	64,897

Electrical Equipment	16,629	49,683
Heavy Mechanical Equipment	320,569	234,067
Light Mechanical Equipment		
General Equipment	79,543	39,550
Office Equipment	42,514	42,112
Lab Equipment	38,519	30,802
Fixed Improvements		
Vehicles	210,078	45,262
Total Capital Outlay	748,275	683,823

Protect public health and the environment.

Madison Metropolitan Sewerage District
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