Operations Management and Facilities Services
2021 Annual Report

Northport Leelanau Township Utilities Authority Wastewater Treatment Plant

Jacobs

Challenging today.
Reinventing tomorrow.

Jacobs

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Jacobs

Letter from Project Manager Mark Huggard

Jacobs is pleased to present our 2021 annual report to our client and partner, the Village of Northport. Your wastewater treatment facilities are a key community asset, and they demonstrate your commitment to wastewater treatment and environmental protection.

For the past 13 years, it's been a pleasure working with the Village's Northport/Leelanau Township Utilities Authority (NLTUA) board and staff—our collaboration and strong partnership allows us to continue to provide excellent services for the community's wastewater treatment plant. The department of public works staff, including Chris Holton, assist our staff during callouts and repairs not because they have to but because they want to. We cannot express our gratitude enough.

2021 didn't come without its challenges. A small COVID-19 outbreak affected our staff in November, but by following our continuity of operations plan, we kept the plant staffed and operating. A few hiccups such as high flows and a pump break added to our operational challenges, but our team is prepared and trained to successfully handle such events.

On the upside, our Jacobs team successfully completed our biosolids haul, and in 2022 we will be working to meet new requirements issued by the state. We are thrilled to welcome new experienced and talented staff thanks to Jacobs' notoriety in the industry. At a time when acquiring quality staff in this field seems almost impossible, we did not face any staff shortages. Finally, we overcame supply chain issues and delays by using innovation, such as installing sump pumps to maintain reject chamber levels until our new (delayed) pumps arrived.

2022 looks to be an exciting and successful year ahead, and we look forward to completing numerous projects around the facility, including upgrading the 7th Street lift station and ferric room, evaluating our solids handling and performing a capacity study to name a few.

On behalf of our entire team, we are excited to present to you this report of Jacobs' annual activities for the facility's performance. We thank you for your support and are excited to continue our partnership to bring the best operations, technical and economic benefits to the Village of Northport.

Sincerely,

Mark Huggard
Project Manager

Our team

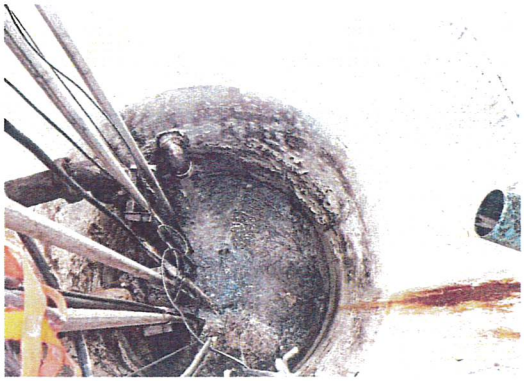
At Jacobs, we are empowered to contribute in a meaningful manner. We approach each day with this in mind, striving to improve as a team and as individuals. Our dedication to inclusion ensures everyone's ideas are heard, which results in the best possible solutions to the many challenges we face. Effectively sharing historical knowledge through training procedures and written training materials, while collaborating to improve our current approach to operating and maintaining your facility, we learn and grow together, and with you, as a work family. Exhibit 1 proudly highlights our local Jacobs family and some members of our support family.

Exhibit 1
Our Jacobs family

Name	Position	Education/Certification/Licenses
Nick Lenzi	Regional Business Manager	**Degree:** B.S. Mathematics **Certifications:** State of Illinois Op 1 License, State of Illinois Collection System Operations License, Certified Reliability Leader (CRL)
Mark Huggard	Project Manager	**Degree:** Associate's Water Environmental Technologies **Certifications:** Wastewater A, L1, and L2, Water F4 and S4, and Certified Maintenance Reliability Technician (CMRT)
Andrew Waldron	Maintenance Supervisor	**Certifications:** CMRT, CRL, Water Resource Recovery Technician (WRRT) Certification
Justin Straub	Operations Supervisor	**Degree:** B.S. Biology and Conservation and Natural Resource Use
Josh Lycka	Operator/Industrial Pretreatment Program (IPP) Coordinator	**Degree:** B.S. Natural Resource Management **Certifications:** Wastewater C and CMRT
Luke Bonser	Operator-in-Training	**Degree:** Spring Arbor University Associate of Arts
David Dyal	Operator-in-Training	None
Justin Pippel	Operator-in-Training	**Degree:** B.S. Earth Science and Secondary Education
Dalton Brown	Operator-in-Training	U.S. Army Reserves Certificates of Water Treatment Training
Rick Shaw	Operator-in-Training	**Certification:** CMRT
Zack Niec	Operator	**Degree:** B.S. Environmental Science
Alex Arnold	Laboratory Analyst	**Degree:** B.S. Physics, Mathematics, Computer Science
Shane Wyatt	Mechanic	**Certification:** CMRT
Kerry Gensler	Mechanic	**Certification:** CMRT
Dean Lewis	Utility Worker	**Degree:** B.S. in Forrestry
Dillion Luna	Mechanic-in-Training	None
Support staff		
Elizabeth Hart	Midwest Senior Operations Specialist	**Degree:** B.S. Water Science **Certifications:** Wastewater A, L1, and L2, Water F4, Stormwater Certified, and CMRT
Maria Lenzi	Administrative Specialist	None
Kevin Dahl	Regional Director	**Degrees:** B.S. Civil Engineering and M.S. Environmental Engineering **Certifications:** New England Water Environment Association Class IV Wastewater Collection Systems Operator, CMRT, CRL, Connecticut Class IV Wastewater Treatment Operator, and Rhode Island Class IV Wastewater Treatment Operator
Shelly Campbell	Business Manager	**Degree:** M.S. Accounting
Duyen Tran	Sustainability and Operations-Envision Professional (ENV SP)	**Degree:** B.S. Chemistry **Certification:** Arizona Wastewater Class IV
Jim Fischer	Jacobs Engineer	Professional Engineer
Allen Gelderloos	Jacobs Engineer	Professional Engineer
Jeff Heroux	Compliance and Reporting Manager	**Certification:** Massachusetts Wastewater 7
Rebekka Maier	Compliance and IPP Coordinator	**Degree:** B.S. Environmental Engineering; Certification: Idaho Wastewater Treatment Class 1
Ryan Vedrode	Compliance and Laboratory Coordinator	**Degree:** B.S. Chemistry **Certification:** Michigan Wastewater A
Josue Escobar	Supervisory control and data acquisition (SCADA) -Systems Configuration Specialist	**Degree:** Engineering Technology, Navy Electrician "A" School
Harry Sellers	Maintenance Specialist	**Certifications:** CMRT and CRL
JD Verbrugge	Regional Safety Coordinator	**Degrees:** B.A. Criminal Justice, B.S. Zoology, M.S. Environmental Studies

Achieving excellence together

Our collaborative relationship began in 2008. We have collaborated for more than 13 years to see that the treatment facility is operated in a regulatory compliant and fiscally efficient manner. Our scope of services has been summarized in Exhibit 2, and the accomplishments Jacobs and the NLTUA achieved throughout the years are highlighted in Exhibit 3 Milestones and accomplishments.



Main Street lift station.

Exhibit 2
Jacobs' current scope of services

Item	Description	Performance/Related exhibits (see Appendix)
Scope: wastewater and collection system operations		
Staffing and oversight	Operate, maintain and monitor the treatment facility and collection system twenty-four hours a day, seven days a week. Class C operator oversight required by the state.	The Jacobs team is on site Monday, Tuesday, Thursday and as needed, and on-call twenty-four hours a day, seven days a week. Refer to the "Our team" section of the report for details pertaining to certifications held.
Reporting	Provide weekly process reports and monthly operation reports summarizing activities performed and monthly financial status, as well as annual report summarizing operations, maintenance, compliance, financials and other pertinent information.	Jacobs provides reports to the NLTUA weekly, monthly, annually and as needed.
Meetings	Attend monthly Utility Authority meetings and meet with the client at least quarterly.	Jacobs attends the monthly Utility Authority meetings to keep the Board informed of plant operations and other relative issues.
Financial management and planning	Prepare a list of proposed expenditures including chemicals and laboratory supplies to assist NLTUA in preparing an operating budget for the facility.	Jacobs coordinates the procurement of spare parts, repairs, and specialized contractors and supplies. Jacobs also advises and consults with the NLTUA on operational issues, capital improvements, major repairs and submits monthly financial updates to the Board.
Scope: compliance		
Effluent and groundwater quality	Manage, operate and maintain the treatment plant in a manner that results in the facility meeting or exceeding its discharge permit requirements.	Refer to Appendix A. Jacobs completed the following task as required by the Department of Energy, Great Lakes, and Environment (EGLE): Quarterly and annual monitoring well sampling events: annual flow meter verifications (flow meters passed their verification).
Biosolids quality	Manage biosolids in accordance with the state-approved residual management plan. Facilitate biosolids hauls, ensure biosolids meet all regulatory requirements before land application, conduct sampling and analyses, field inspections and annual state required biosolids reporting.	We facilitated the hauling and land application of approximately 250,000 gallons of biosolids in accordance with state and federal regulations. Prior to the haul, we removed approximately 150,000 gallons of decant (water that had separated from the solids). This effort decreased hauling cost by approximately $15,000. We performed a field inspection during the haul and no issues were noted. Jacobs submitted the Annual Biosolids Report to the state.
Reporting	Compile, review and submit all required reports to the regulatory authority. Interface with regulator as directed by Authority.	Jacobs submitted the Monthly Discharge Monitoring Reports and the Annual Sara Title III Tier II Report as required.
Sample and analysis	Perform or contract and administer all laboratory testing and sampling required by the discharge permit. Maintain a laboratory analysis program with a proper data management and quality assurance/quality control plan (QA/QC).	Jacobs facilitates/performs and pays for all compliance sampling and analysis. Jacobs utilizes HachWims for our data management needs.

Achieving excellence together

Exhibit 2 (continued)
Jacobs' current scope of services

Item	Description	Performance/Related exhibits (see Appendix)
Scope: maintenance		
Routine preventive maintenance (PM) and repair	Perform PM and repairs for the project subject to the repairs limits. Provide computerized maintenance.	Refer to Appendix B for a summary of repair cost over $500 B-1, B-2 repair hours summary and B-3 work order summary.
Collection system	Provide a maintenance schedule detailing the following: lift station inspection/maintenance, sanitary sewer manholes and castings cleaning and inspection, gravity and low pressure sewer flushing; repairs to the sanitary sewer, low pressure sewer and forcemains subject to the repairs limits. Help facilitate the cleaning and televising of the sanitary sewer as needed.	Jacobs utilizes a computerized maintenance management system (CMMS) to plan and schedule the lift station inspection/maintenance, sanitary sewer manholes and castings cleaning/inspection, gravity and low pressure sewer flushing, and to track repairs performed on the sanitary sewer, low pressure sewer and forcemains. In general, collection system cleaning and inspections are performed annually and repairs are performed as needed. Jacobs provides separate reports to the NLTUA pertaining to these activities. Lift stations are inspected weekly and repairs are performed as needed. Exhibit 3 is an illustration of one of our lift station inspections in 2021.

Exhibit 3
Milestones and accomplishments

2008

Plant Startup - Jacobs was awarded a competitively bided 3 year contract to operate and maintain the Village of Northport's newly commissioned and unique waste water treatment facility and collection system.

2011

Jacobs was awarded a contract to operate and maintain the treatment plant and collection system, extending our partnership 3 years.

2013

Created a Biosolids Residuals Management Plan that allows the NLTUA to land apply accumulated biosolids that meet or exceed state regulations.

2014

Jacobs was awarded a contract to operate and maintain the treatment plant and collection system, extending our partnership 5 years.

2014

Submitted the Ground Water discharge permit renewal application on behalf of the NLTUA. New ground water permit was issued in 2015.

Successfully inspected and cleaned the entire low pressure force main portion of the collection system.

2015

Completed the facilities first biosolids land application. Successfully land applying 53 dry tons of biosolids.

2017

Completed the facilities second biosolids land application. Successfully land applying 52 dry tons of biosolids.

2018

Jacobs was awarded a contract to operate and maintain the treatment plant and collection system, extending our partnership 10 years.

2019

Installed new pumps at the Northport Point Road lift station, as part of our 2018 contract renewal the pumps were purchased by Jacobs at no cost to the NLTUA, saving approximately $8,500.

2020

Overhauled each sand filter which included removing the original sand filter media (sand), cleaning and inspecting each empty chamber and replacing the sand with new.

Successfully inspected and cleaned the entire low-pressure force main portion of the collection system.

Facilitated the completion of the following capital improvement projects (CIP) projects: lining of seven sanitary sewer manholes and the treatment plant fine screen wet well to prevent any further corrosion. Replacement of aeration blower #1.

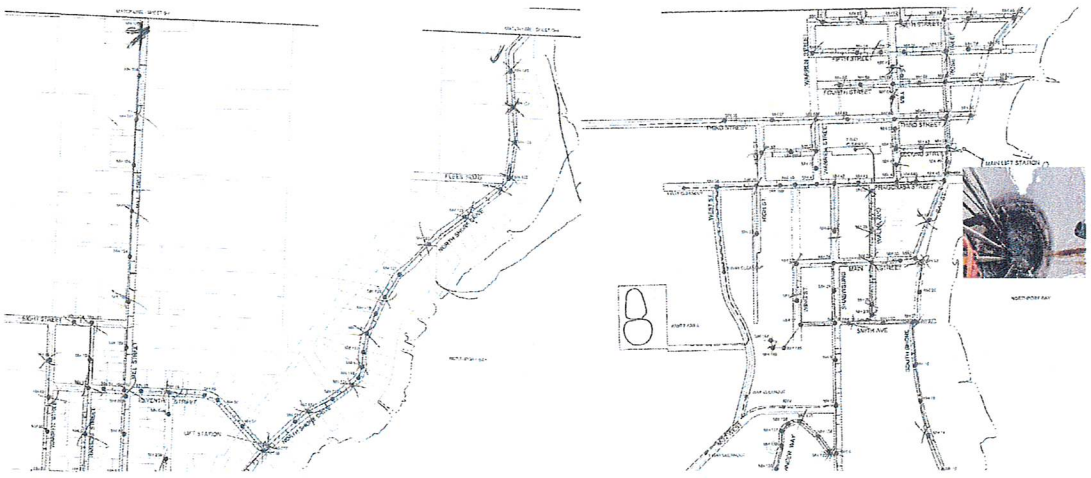
On behalf of the NLTUA we submitted the treatment facilities groundwater permit renewal application.

2021 proactive performance highlights

While operating and maintaining the collection system and treatment facility, we identify upgrades, improvements and modifications that could be made to maintain and/or enhance current operational practices. With the support of the NLTUA, we effectively addressed several of these items throughout the year. Exhibit 4 spotlights these performance amplifying activities.

Exhibit 4
Proactive performance highlights

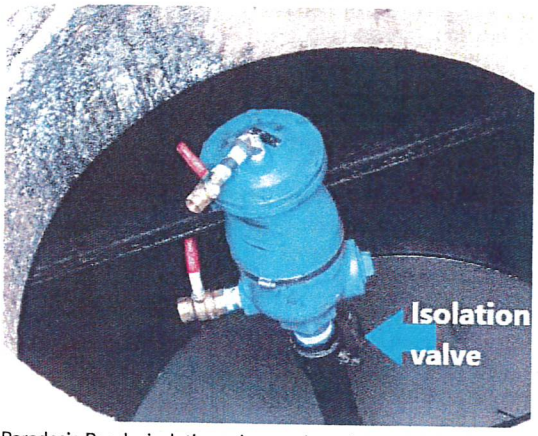
Maintenance item	Description of action taken	Benefit
Programmable logic controller/ human machine interface (PLC/HMI) maintenance	Replaced all the batteries in the PLCs at the treatment plant and lift stations. Downloaded all PLC and HMI programs to an external storage device. Installed an uninterrupted power supply (UPS) battery backup device for the treatment plant PLC.	Working batteries are needed to maintain PLC function in the event of a power outage or interruption. If a PLC or HMI failure occurs, the stored programs can be loaded into a new PLC/HMI reducing system downtime and costs associated with writing new programs. The UPS provides power to the PLC ensuring the system remains active during a power loss or interruption.
Residential grinder system maintenance	The following actions are performed each time we respond to a residential grinder system alarm: remove grease and debris from grinder tank; remove all grease buildup from control float switches; verify all float switches operate properly and are positioned properly; confirm proper pump operation; verify alarm light is operational and audible alarm, if applicable; inspect wet well components (rail guides, lift chain, float switch support, piping, anti-syphon valve, wet well walls and lid); replace both the start and run capacitor, if not changed in past year. Inform homeowner of findings and what not to put in their sewer.	Reduces the likelihood of repeated issues with the grinder systems and helps to reduce callout hours.
Collection system	In cooperation with the Leelanau Township Fire Department and Village staff, we flushed the low-pressure force mains located on East Circle Drive and Indian Beach Road. Northport Point Road was flushed in April following the force main repair.	Helps to prevent odors and obstruction from developing in the collection system.
	We performed annual manhole inspections. Structural items inspected for corrosion, cracking, damage, missing components and alignment of the lid/cover, ring and frame, cone and riser, barrel, ladder rungs, and bench and channel. Hydraulic items inspected included the flow channel for grease, debris, silt, infiltration, surcharging and flow rate characteristics (slow, steady, pulsating, excessive etc.).	Enables us to identify potential structural and flow restrictions before a system surcharge or failure is encountered. As a result of these inspections, many manholes were flagged and added to the capital improvement plan (CIP) for rehabilitation. The rehabilitation will help ensure the manhole structural integrity remains intact. In 2020, as scheduled in the CIP, several flagged manholes were lined. The remaining problematic locations will be addressed as expeditiously as possible, with the Main lift station manhole being a priority.



Manhole inspections.

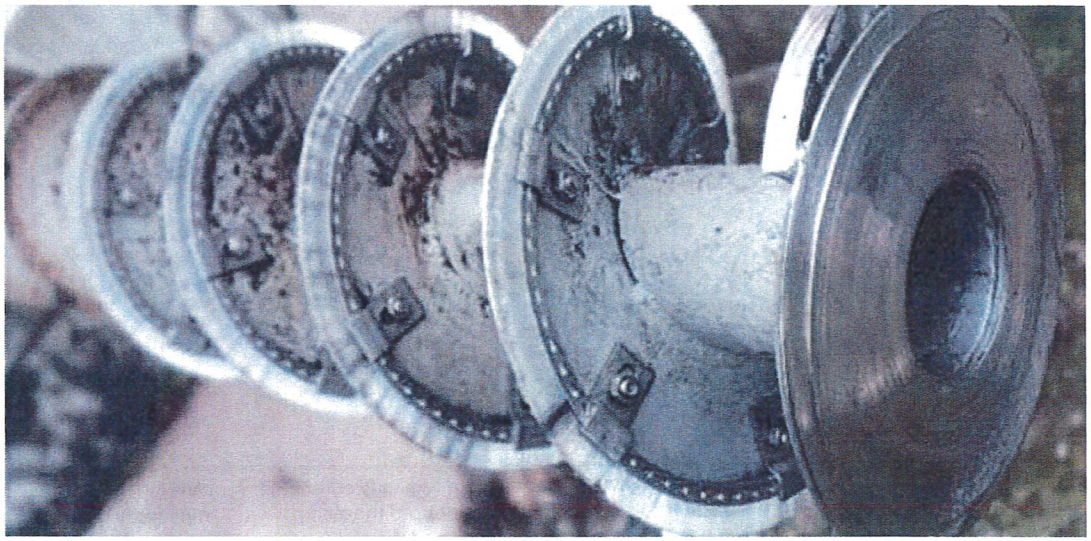
2021 proactive performance highlights

Exhibit 4 (continued)
Proactive performance highlights

Maintenance item	Description of action taken	Benefit
Collection system	We completed the annual air release valve (ARV) inspections. The West Street ARV was the only location found in need of cleaning. Grease and debris were removed from the float chamber before returning it to service. The remaining locations, with the exception of the ARV at Northport Point Road, west near Woolsey Lake Road, were found to be in good working condition. The isolation valve handles for the ARVs at Northport Point Road west near Woolsey Lake Road, and East Paradesia Road, are severely corroded and currently inoperable. Jacobs recommends replacing the valve handles with 316 stainless steel or equivalent.	Inspecting the ARV valves on a regular schedule helps to identify and plan for maintenance needs and reduces the possibility of issues arising as a result of equipment failure.
	 Paradesia Road – isolation valve needs replaced.	
	We facilitated the connection of a general alarm from the main lift station generator to the lift station dialer. This alarm will provide us notification in the event any generator fault occurs. Previously, we would receive an alarm only if the generator failed to start.	Reduced the possibility of a lift station pump startup delay and resulting system surcharge. We'll now receive notification of an issue as soon as it occurs so it can be addressed prior to an emergency situation.

Maintenance item	Description of action taken	Benefit
Treatment plant	**Fine screen unit maintenance:** Incoming flow enters the facility through the lower portion of the fine screen unit, screening debris larger than ¼" from the waste stream. The fine screen unit contains brushes that, when rotated by the auger, keep the screen clean. We inspect the brushes and replace them proactively before they no longer effectively clean the screen. In 2021, we performed a brush replacement. During replacement we also inspected the fine screen wear bars, hardware and the integrity of the auger itself. We found them to be in good working order. Note: In 2014 we noticed significant pitting on the auger body, which prompted us to have the auger coated with an epoxy coating to extend its useful life.	When fine screen brushes begin to wear, they no longer effectively clean the screen causing the flow to automatically bypass the screening process, allowing debris in the waste stream to bypass and eventually cause issues with downstream moving bed biofilm reactor (MBBR) equipment. Proactively replacing the brushes prevents this from occurring.

Fine screen augar removal by crane.



Fine screen augar brush replacement.

	We completed the semi-annual **Landia mixer PM** task and installed the new Landia mixer #3. All mixers were found to be in good condition.	Optimal operation of the mixers in the MBBR ensures that the media will remain in suspension effectively removing pollutants.

Anoxic basin mixers.

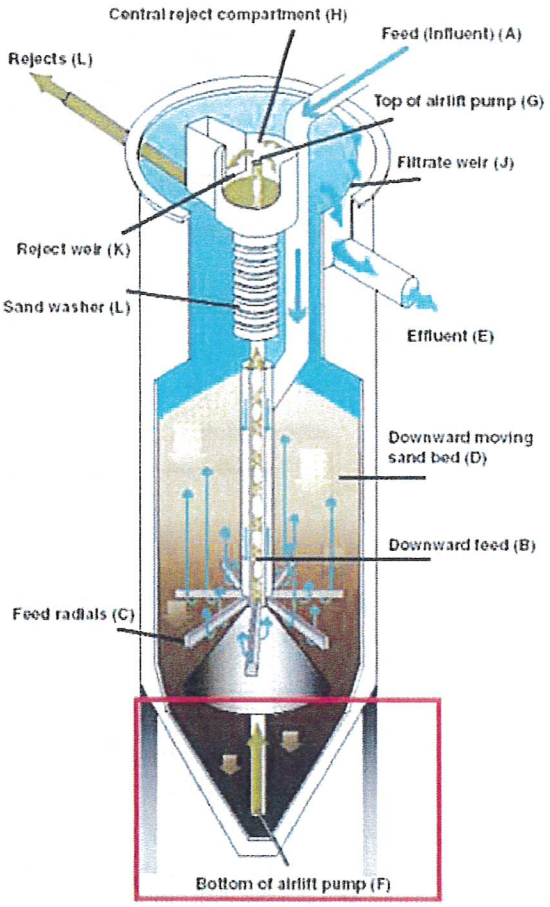
	Solids basin: While performing plant inspections, we noticed the solids holding basin level was higher than normal. Further investigation found a failed float control switch was not allowing the decant pump to operate automatically. To resolve the issue, we replaced the float control switch.	Avoided solids/decant processing issues.

2021 proactive performance highlights

Exhibit 4 (continued)
Proactive performance highlights

Maintenance item	Description of action taken	Benefit
Treatment plant	**2021 capital improvement project: Kaeser blower replacement.** A new Kaeser blower was installed in place of failed blower #1. Blower #1 failed under warranty. Jacobs and the Village are working with Kaeser to recoup the costs. Blower #2 is available for redundancy.	The blowers provide air (oxygen) to the MBBR. The microorganisms in the MBBR need this air to metabolize pollutants in the waste stream. Without the proper addition of air (oxygen) to the basin, the plant will fail to effectively treat the waste stream and possibly meet the requirements of its discharge permit.
	Floc mixer #2, next to the upper sand filter, was rebuilt and placed back in service.  Rebuilt and reinstalled floc mixer.	The mixer is used to keep solids suspended in the waste stream and, when feeding ferric chloride at this location, it also ensures the ferric chloride is mixed homogenously throughout the waste stream for optimum removal of phosphorus.
	Sand filters: While performing our regularly scheduled inspection on the sand filters, we noticed the air distribution inlet tube at the bottom of the air lift pump showed signs of wear. In response to this observation, both the upper and lower filter tubes were changed. The purpose of the tubes is to create a venturi effect at the bottom of the air lift that pulls the sand from the bottom of the filter to the top where the sand is dispensed into the sand washer and regenerated. It is normal for the distribution tube to wear out over time as a result of continuously coming in to contact with sand. Once these tubes are worn, the sand filters' ability to move sand is compromised.	Washing the sand prevents it from binding, which impedes flow through the filter and can lead to a plant backup.
	Sand filters: We installed new head loss sight tubes in both sand filters. We purchased the sight tube material from an online plastics supplier, purchasing both sight tubes for less than $45 versus purchasing from the manufacturer at over $800.	These sight tubes help us visually monitor the filters performance to ensure water is passing through the filter at the desired rate.

Maintenance item	Description of action taken	Benefit
	Sand filters: We replaced the air lift pump on the upper sand filter. The purpose of the air lift pump is to move sand from the bottom of the filter to the top where it is dispensed into the sand washer and regenerated. It is normal for the air lift pump to wear out over time as a result of continuously coming into contact with sand.	Washing the sand prevents it from binding, which impedes flow through the filter and can lead to a plant backup.



Sand filter illustration and description.

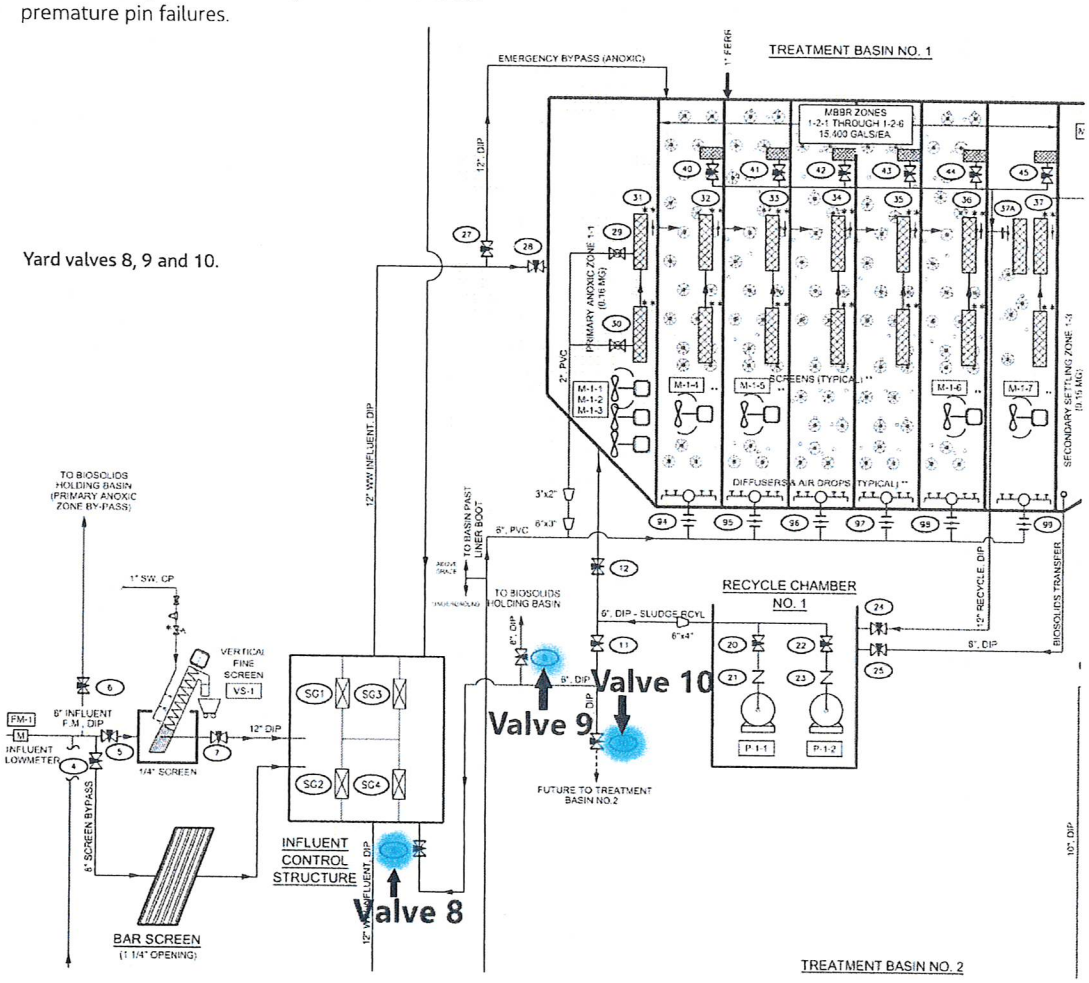
The following is the treatment sequence for the polishing filters:

- Plant effluent enters the polishing filter (A, B) and flows to the bottom of the filter where its dispersed through distribution radials (C) into the bottom of the sand bed.
- As the water flows up through the sand bed (D) the solids are captured within the sand particles.
- The clean water eventually flows through the top of the sand bed into the effluent weir trough (J).
- The sand is pumped from the bottom of the filter via an air lift pump (F), up into the reject trough (G, H) where it then passes down through the sand washer (L) before dropping onto the top of the sand bed.
- The washer bounces the sand back and forth knocking the solids loose, floating them up to the reject trough and over the reject weir (K) discharging into the reject chamber.
- The reject chamber discharges the dirty filter reject water to biosolids basin 3 for further treatment. There are two pumps located in the reject chamber set to alternate starts.

2021 proactive performance highlights

Exhibit 4 (continued)
Proactive performance highlights

Maintenance item	Description of action taken	Benefit
	Reject chamber: Reject pump B failed, requiring removal and installation of the spare pump from inventory. We looked into the cause of the premature pump failures experienced in the reject chamber and found that a different model pump would be better suited at this location. The pumps are going to be ordered and installed. Jacobs is going to install a barrier in the reject chamber to help protect the pumps from grit.	The reject pumps are located in the reject chamber. They pump wash water, ridden with solids, to the solids basin for storage and land application. Having a spare pump on hand when reject pump B failed ensured we could remove solids from the system as designed and continue to achieve optimal treatment, which reduces compliance vulnerabilities and operational issues. Identifying a different model pump, better suited for the conditions in the reject chamber, will help reduce future equipment issues and failures, and save money on replacement parts and repairs. The grit barrier will help prevent grit from wearing out the pumps.
	Yard valves: Kal Excavating excavated failed yard valve #9, located next to the influent chamber. The failure resulted from a broken drive nut pin; the pin was replaced and since the excavation required exposing yard valves #8 and #10, we changed their pins as well. Because these valves are buried and require excavation to access, we always verify the replacement pins are stainless steel, and we coat them with a marine grade grease. Kal Excavating also added sacrificial anodes to each valve to prevent electrolysis that could cause premature pin failures.	Proactively replacing the pins on valves #8 and #10 with stainless steel pins reduced the likelihood of incurring additional excavation costs related to repairing these two valves and ensured proper operation of the valves would be maintained.



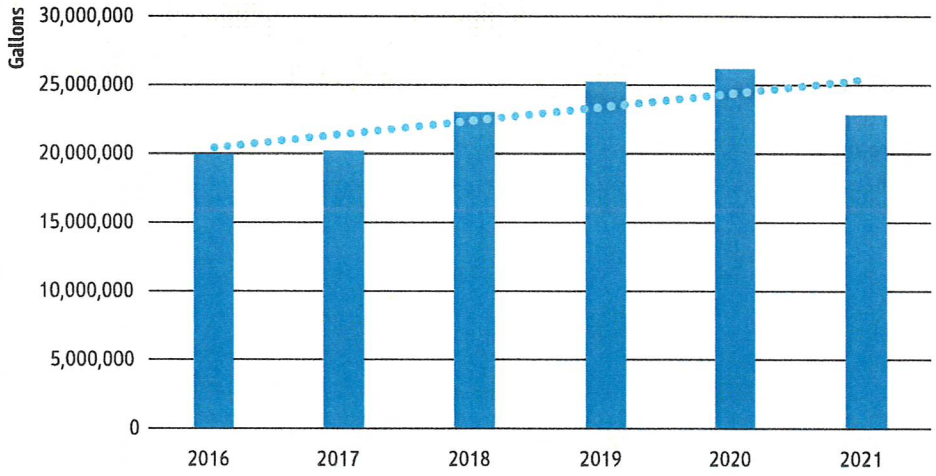
Yard valves 8, 9 and 10.

Superior permit management and regulatory compliance

Influent versus effluent.

Jacobs treated more than 22.8 million gallons of wastewater at the NLTUA wastewater treatment plant (WWTP) in 2021. During this time, the facility produced a high-quality effluent. A detailed summary of NLTUA's effluent compared to permit requirements is provided in Appendix A. Exhibit 5 is a graphical summary of the total flows treated at the facility each year for the past five years. From 2016 to 2021, a 15 percent increase of flow volume treated at the facility occurred—with a 13 percent decrease in 2021 compared to 2020. Plant influent flows have significantly declined compared to 2020. This decrease is most likely due to efforts made by the NLTUA to eliminate residential sump connections from the sewer collection system and the decreasing lake levels. Groundwater levels decrease as the lake levels recede and therefore lessen the inflow from unfound residential sump connections and other infiltration sources.

Exhibit 5
NLTUA WWTP influent flow 2016-2021



Superior permit management and regulatory compliance

Force main leak collaboration

In April, Village staff and Jacobs worked together to minimize the impact of a low-pressure force main leak that occurred on Northport Point Road. Chris Holton and Kerry Gensler went door to door asking residents to minimize their water use until a repair could be made by contractors the following morning. We installed a makeshift collection barrel to capture as much of the leaked sewage as possible. We delivered the captured sewage to the lift station just down the road.

A failed service line connection on public conservancy land caused the leak. The service line is not needed for future connections and was disconnected during the repair. Matt's Underground Service completed the repairs, Jacobs completed all compliance reporting.

High flows prompt bypass of effluent flow meter

The facility's effluent flow meter is not sized appropriately to handle high flows. Because of this, the flow meter bottlenecks during high flows and leads to plant backups. When this occurs, it is necessary to bypass the effluent flow meter. As part of our high flow management plan, approved by the state, we bypassed the facility's effluent flow meter twice in 2021.

On July 5, flows were elevated because of an influx of visitors to the area. On July 26, a heavy rain event led to the elevated influent flows experienced at the facility. Our staff notified EGLE and documented both events in the facility's July 2021 Discharge Monitoring Report. When the effluent flow meter is bypassed, the effluent leaving the facility receives complete treatment—it simply is not measured by the effluent flow meter.

Well casing pipe

During our quarterly monitoring well sampling event in August, we discovered the well casing pipe for monitoring well 13 was broken, preventing us from sampling. We repaired the well casing pipe. We notified EGLE of the repair and informed them the missed annual sampling from August would be included in the November sampling event.

Broken well casing pipe.

Repaired well casing pipe.

Preparation saves the day and money

On December 11, we responded to a main lift station pump 1 failure alarm (pump 2 previously failed on October 29). Pump 1 was originally installed in 2018. We confirmed the pump was unable to operate, which left the station without either submersible pump available.

As dictated by our emergency response plan, we set up a second bypass pump at the lift station. The first bypass pump was set up when pump 2 failed; we scheduled a 24/7 pump watch to ensure the continuity of pump operations and wastewater conveyance to the treatment plant. With neither pump 1 nor 2 repairable, to regain pumping capabilities as expeditiously as possible, Jacobs consulted with Kerr Pump's repair team to see if the two failed pumps might be used to build one operable pump.

Kerr provided us with one operable pump within two weeks. The pump was installed and tested on January 1, 2022. This new pump eliminated the need for 24/7 pump watch and bypass pump rental. Exhibit 6 details the estimated cost savings associated with eliminating the pump watch. The cost to combine the failed pumps was recovered within nine days of installation, resulting in continued savings of approximately $894 per day until the new pump(s) arrived.

Main lift station bypass pumping.

Exhibit 6

Main lift station pump repair cost summary

Item	Estimated cost	Comment
Pump watch and bypass pump rental	Pump watch labor – $4,620 per week Bypass pump rental – $1,641 per week	$6,261 total per week.
Combining two failed pumps to make one operational pump	$7,648 total	When compared to maintaining the pump watch and additional bypass pumping, this expense was paid for in less than nine days with a savings of $894 per day every additional day until the new pumps arrive.
Two new submersible pumps	$30,179 total	Ordered and awaiting delivery.

Superior permit management and regulatory compliance

A-Garage, B-Ferric Storage Tank, C-Influent Screening and Metering, D-Equipment Building (Ferric Day Tank and Feed System, Control Room, Blower Room), E-Anoxic Basin, F-Moving Bed Biofilm Reactor (MBBR), G-Solids Settling Basin, H-Spare Reactor Basin, I-Effluent Control Structure, J-Sand Filters, K-Effluent Sampler

NLTUA arial photo.

Repurposing biosolids

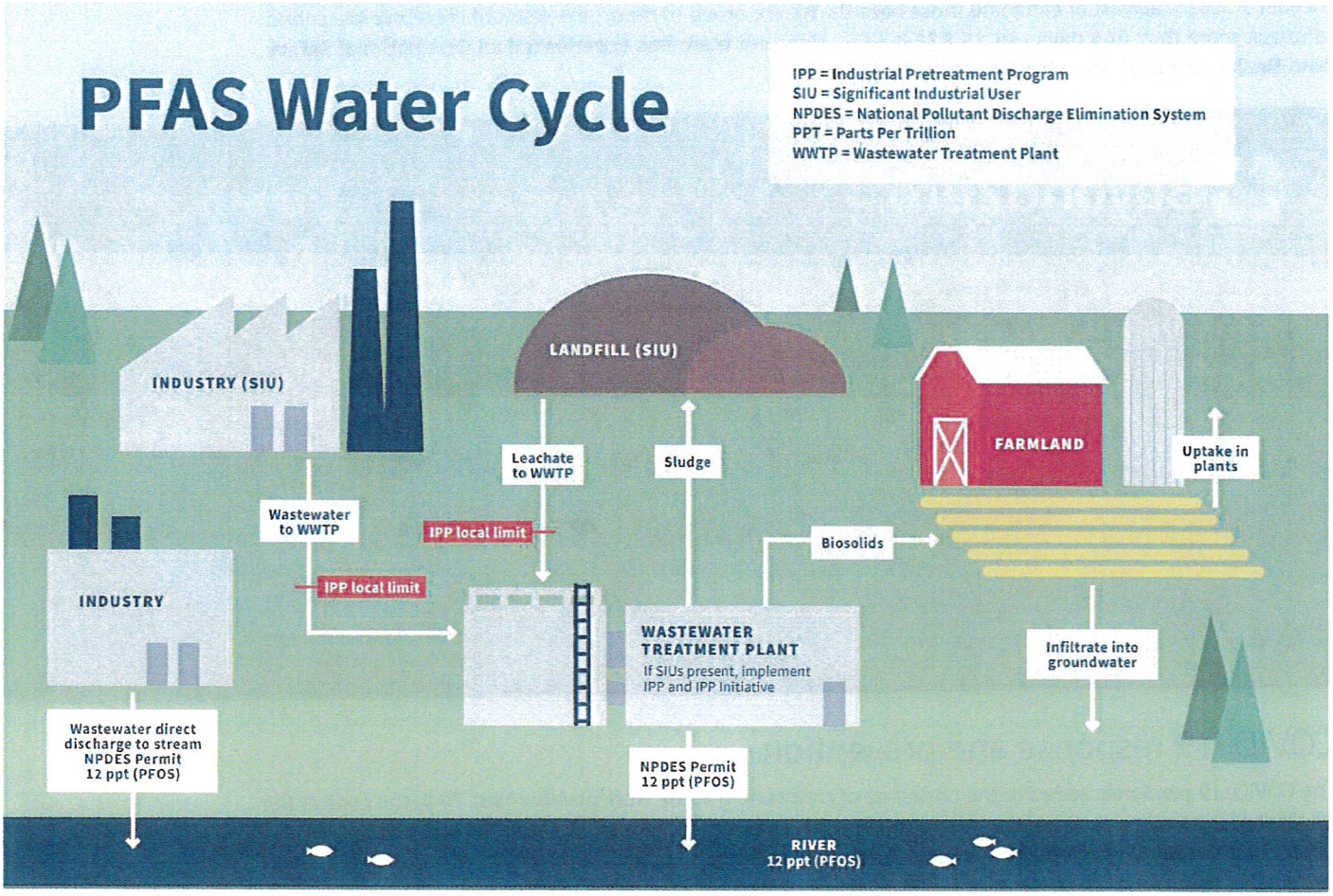
Biosolids are a byproduct of the wastewater treatment process. During treatment the liquids are separated from the solids and stored in the biosolids basin at the facility. When the lagoon reaches capacity, and with prior approval from the state, the solids are hauled to preapproved farm fields for land application in accordance with regulatory requirements.

Land application is an economically and environmentally sustainable means of biosolids disposal that involves the beneficial reuse of biosolids as fertilizer at sites preapproved by state regulators. To approve a facility for land application, the state requires that it has an approved Residual (Biosolids) Management Plan (RMP) and that the sampling and analysis detailed in the plan demonstrates the biosolids generated at the facility meet state regulations.

In 2021, EGLE issued a letter effectively modifying the facility's RMP to include new perfluoroalkyl (PFA) and polyfluoroalkyl substances (PFAS) requirements. We are now required to sample and analyze the facility's biosolids for PFAS compounds prior to the next biosolids haul. The sampling and analysis will be facilitated by Jacobs through a third party and is tentatively scheduled for the summer of 2022. Sampling and analyzing the biosolids next summer will ensure we have ample time to respond should further actions be required. Refer to Exhibit 7 for a pictorial representation of the PFAS water cycle, per EGLE.

Exhibit 7

EGLE's PFAS water cycle



Graphic credit to the State of Michigan

Safety

Jacobs' focus on safety and worker well-being—known as BeyondZero™—empowers our employees to create and sustain a positive, safe and healthy work environment by fostering a culture in which associates look out for one another at all times.

Our Jacobs-developed site-specific work safety control plan defines our team's safety responsibilities, which include developing activity hazard analyses (AHAs) for routine and non-routine tasks. We reference these AHAs in our daily pre-task plans (PTP), which are created and reviewed by all associates at our morning safety meetings. The PTP helps the team define hazards present that day and spells out the personal protective equipment (PPE) needed to guard against or eliminate those hazards. We are proud to report the result of the above-described efforts is **more than 664 days—or 15,936 hours—since our team has experienced an Occupational Safety and Health Administration (OSHA)-recordable incident.**

BeyondZero℠

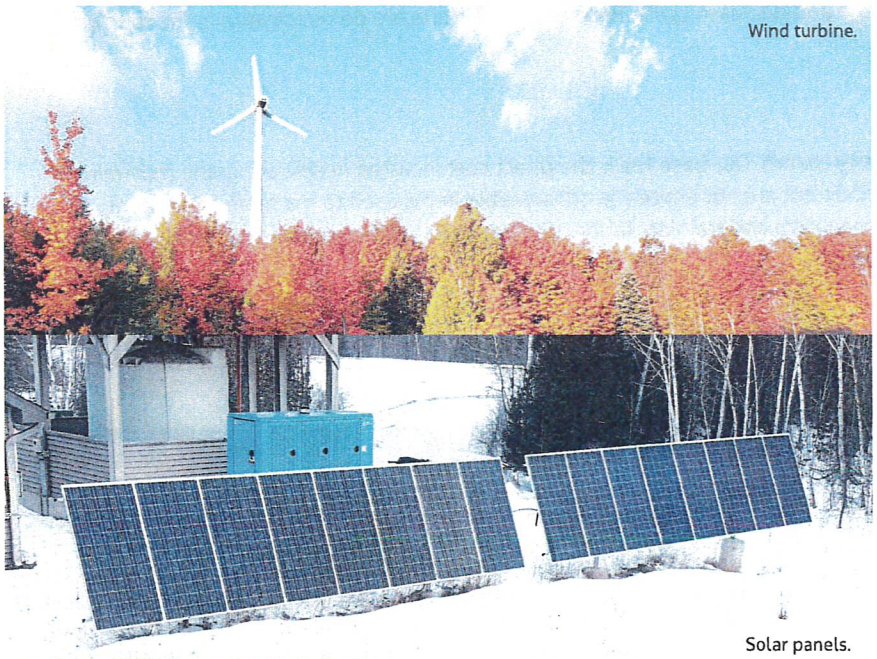
BeyondZero is about keeping our people safe. That means not getting injured, not allowing others to be injured and not allowing unsafe practices, behaviors or conditions to exist. It's about creating a culture of caring by actively engaging and involving employees and influencing their beliefs and behaviors.

COVID-19 response and prevention

The COVID-19 pandemic added to the challenge of maintaining a safe work environment. To better control the risk of staff exposure, ensure continuity of operations and maintain access to vital supplies and services, we established a **continuity of operations plan**. Among other things, the plan included scheduling modifications designed to maintain physical distancing and minimize contact between team members. We also screened everyone, checked temperatures and symptoms before starting work shifts and conducted safety briefings and meetings via conference call to avoid larger gatherings.

Sustainability

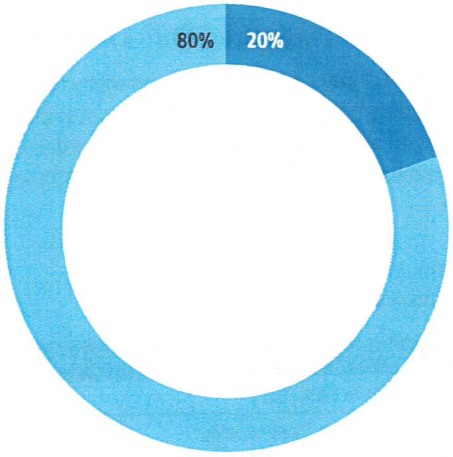
In 2021, the wastewater treatment plant received 20 percent of its overall energy from renewable energy sources. Wind generated electricity accounted for 67 percent of the renewable energy used at the facility, and solar generated electricity accounted for 33. percent of the renewable energy used at the facility (refer to Exhibit 9). Jacobs strives to reduce energy consumption by maintaining plant equipment, monitoring equipment run times to identify and correct issues promptly and limiting water and electrical usage (Exhibit 8) where opportunities exist. We are proud to serve a community that shares a passion for a renewable and sustainable future.



Wind turbine.

Solar panels.

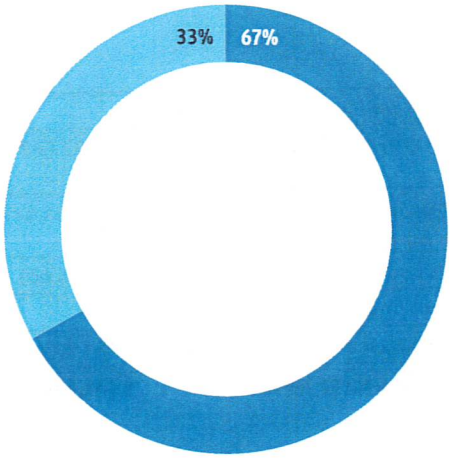
Exhibit 8
Treatment plant electrical usage summary



Nitrile glove recycling.

Jacobs bolstered our nitrile glove recycling program in 2021. We use these gloves during operations as personal protective barriers to help guard against exposure to harmful chemicals and microbes. To make our safety practices more sustainable, we have equipped the facility with a glove recycling station where we dispose of a vast majority of used nitrile gloves.

Exhibit 9
Renewable energy usage summary



Fiscal summary

We understand that the NLTUA has many financial demands. As a result, we are focused on minimizing the financial impact operating and maintaining the wastewater treatment plant and collection system has on the budget. As we care for your system, a core part of our mission is to help you avoid, manage and decrease costs. Results of our efforts are demonstrated in the following cost reconciliation.

Base fee/direct cost overview

The NLTUA pays Jacobs a fraction of our base fee every month. Our base fee is the direct cost incurred in operating and maintaining the facility, plus our margin. Direct cost expenses include but are not limited to consumable items used to maintain equipment (belts, oils and greases), expenses related to employee safety and training, laboratory expenses, office supplies and vehicle expenses. Exhibit 10 summarizes our 2021 reconciliation.

Exhibit 10

Summary of 2021 reconciliation

Line item	2021 total expense/payment	Comments
Expense item summary		
Total direct costs (less repairs, repairs labor over 300 hours)	($4,111.55)	The direct cost budget for 2021 was $133,610.00 and includes the actual costs, incurred for the direct benefit of the project including, but not limited to, expenditures for direct labor (includes 300 repair labor hours), employee benefits, chemicals, lab supplies, repair parts ($8,000.00 limit), safety supplies, gasoline, oil, equipment rental, travel, office supplies, other supplies, uniforms, telephone, postage, utilities, tools, memberships and training supplies.
Repairs non-labor total	$16,154.42	The NLTUA is responsible for repair expenses over $8,000.00. Refer to Appendix B-1. for a breakdown of repair expenses over $500. Expenses exceeding the annual limit were approved by the NLTUA.
Repairs labor hours total (over 300 hours)	$30,885.00	The NLTUA is responsible for repair labor hours exceeding the 300 hour annual limit. Major repair items contributing to repair labor hours in 2021 included but are not limited to air release valve repairs, fine screen repairs, sand filter repairs, Kaeser blower replacement and residential grinder pump system repairs. Appendix B-2 contains a summary of repair labor hours.
Reconciliation invoice summary		
Total expense overage	$42,927.87	Includes repairs non-labor over $8,000.00, repairs labor hours over 300, and 50% of the direct cost overage.
Repair overages invoiced and paid	($46,414.47)	Repairs exceeding the $8,000.00 annual limit and repair labor hours over the annual limit of 300 hours are billed monthly.
Total reconciliation	($3,486.60)	To be reimbursed to the NLTUA.
Jacobs' total fee 2021		
O&M base fee	$161,562.00	Direct cost plus margin
Total fee paid to Jacobs	**$204,489.87**	**Includes direct cost plus margin and the total expense overage**

Looking forward

As we look to 2022, our team is thrilled to collaborate with the NLTUA to implement several projected treatment plant and collection system enhancements. Projects currently scheduled for the coming fiscal year include:

- Biosolids PFAS sampling and analysis
- Low pressure force main cleaning and televising
- Main lift station lining
- 7th Street lift station upgrade
- Ferric room upgrade
- Solids handling evaluation
- MBBR roof coating
- Capacity study

Jacobs and the NLTUA have worked together for more than a decade to create a mutually beneficial partnership. Together, by using institutional knowledge and cohesive communication, we have successfully reduced operational vulnerabilities, exceeded performance expectations and worked through countless challenges. We enthusiastically embrace the opportunities the coming years will bring to further demonstrate the advantages of our effective partnership.

Appendix A

Exhibit A-1
WWTP performance

Parameter description	Effluent permit limit	Plant effluent quality	Importance
Influent flow – amount of wastewater received daily in gallons (reference Appendix A-2).	132,000 gallons per day (gpd)=maximum daily influent flow	Maximum daily influent flow= 106,660 gpd	When the treatment system is hydraulically overloaded beyond design capacity proper treatment and or removal of pollutants may be compromised.
Effluent flow – amount of water discharged from the treatment plant daily in gallons (refer to Appendix A-3 and A-4).	405,000 gallons/day (gpd)= maximum daily effluent flow | 48,180,000 gallons/ year= maximum annual effluent flow	Maximum daily effluent flow=108,498 gpd | maximum annual Effluent= flow 21,361,039 gpd	Exceeding the designed effluent flow can adversely affect effluent polishing at the sand filters and rapid infiltration beds design loadings can affect groundwater quality.
Rapid infiltration bed (RIB) application rate – amount of effluent discharged in gallons per day per square foot (refer to Appendices A-5 – A-7).	Maximum daily RIB application rates (gallons per day per square foot, gpd/sqft)	Maximum daily RIB application rates	Rapid infiltration beds allow for rapid discharge of effluent and provide some additional polishing Exceeding design application rates may adversely affect groundwater quality.
	RIB 3A – 12.1 gpd/sqft	3A – 7.9 gpd/sqft	
	RIB 3B and 3C – 14 gpd/sqft	3B and 3C– 8 gpd/sqft	
	RIBs 1 and 2 – 9 gpd/sqft	1 and 2 – 4 gpd/sqft	
Total phosphorus (TP) – the measure of organic and inorganic phosphorus in plant effluent (refer to Appendices A-8 and A-9).	0.5 milligrams per liter (mg/L) =daily maximum | 0.3 mg/L =monthly average	Daily maximum= 1.8 mg/L, exceeding the permitted limit. Please refer to Appendix A8 for further details | maximum monthly average= .3 mg/L	Phosphorus is an essential element for plant life, but when there is too much of it in water, it can cause eutrophication. Eutrophication is when a body of water becomes over enriched with nutrients. It often leads to algae blooms that disrupt the normal ecosystem functioning of a body of water. The algae blooms consume available oxygen and reduce sunlight in marine environments, resulting in the death of many aquatic organisms including fish.
Biochemical oxygen demand (BOD) – the measure of the amount of pollutants in plant effluent. (Refer to Appendices A-10 and A-11).	45 mg/L= daily maximum | 30 mg/L= monthly average	Daily maximum= 15 mg/L | maximum monthly average= 7 mg/L	When BOD concentrations in the effluent are high, it can lead to decreased DO in the receiving stream adversely affecting the health of the fish and other aquatic organisms.
Effluent pH – the measure of how acidic/basic the water is. (Refer to Appendices A-12 and A-13).	9.0 standard units (s.u.)= maximum daily | 6.5 s.u.= minimum daily	Maximum daily= 7.3 s.u. | minimum daily= 6.8 s.u.	Extremes in pH can make waterways inhospitable to life. Acidic water also speeds the leaching of heavy metals harmful to fish.
Monitoring well (MW) pH – the measure of how acidic/basic the water is (refer to Appendices A-14 and A-15).	9.0 s.u.= maximum daily | 6.5 s.u.= minimum daily	Maximum daily= 8.2 s.u. | minimum eaily= 6.9 s.u.	Extremes in pH can make waterways inhospitable to life. Acidic water also speeds the leaching of heavy metals harmful to fish.

Exhibit A-2

Influent daily maximum flow versus permitted daily maximum flow

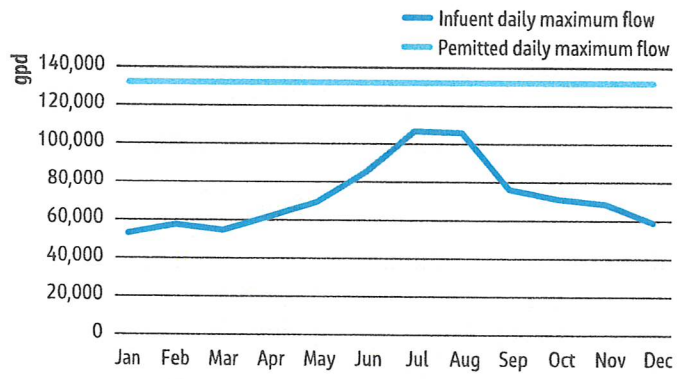


Exhibit A-3

Effluent daily maximum flow versus permitted daily maximum flow

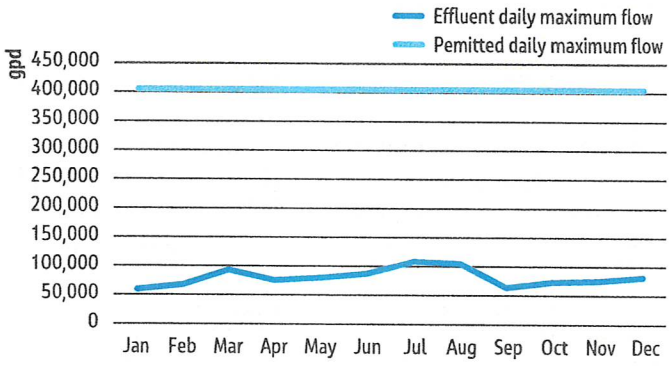


Exhibit A-4

Annual effluent flow versus permitted annual flow

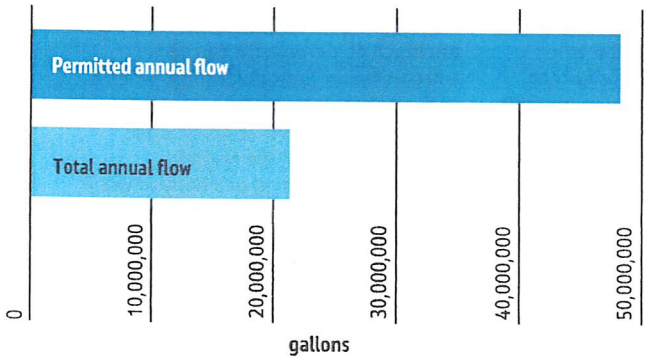


Exhibit A-5

Rapid infiltration bed 3A maximum loading versus permitted limit

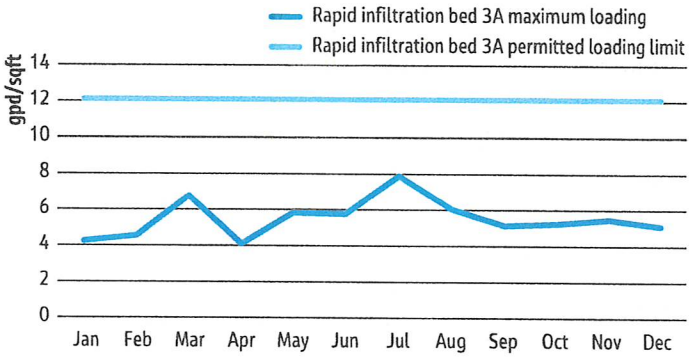


Exhibit A-6

Rapid infiltration bed 3B and 3C maximum loading versus permitted limit

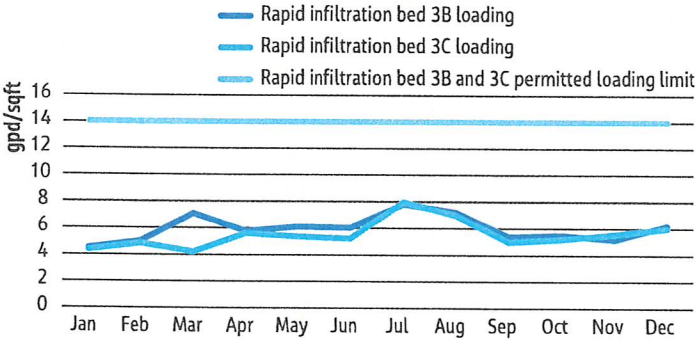
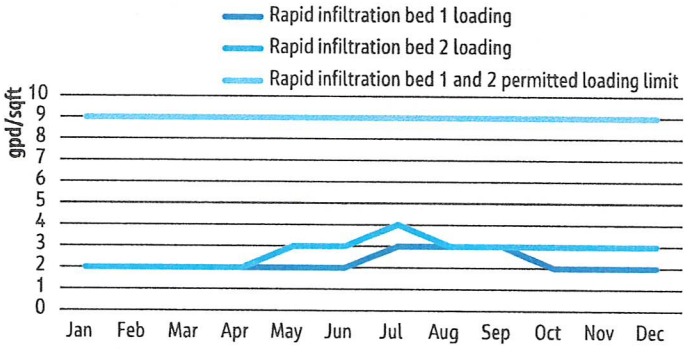


Exhibit A-7

Rapid infiltration bed 1 and 2 maximum loading versus permitted limit



The final effluent total phosphorus result from Monday November 1, 2021 exceeded the daily maximum limit of 0.5 mg/L with a result of 1.8 mg/L. The facility returned to compliance the following day, Tuesday November 2nd, 2021 with a result of 0.2 mg/L. It's our conclusion that a contaminated sample bottle was utilized and caused the falsely high effluent total phosphorus results on November 1st. To help reduce the likelihood of a repeat occurrence we will use only new sample bottles for effluent sample collection, therefore eliminating the use of washed previously used sample bottles for final effluent monitoring. EGLE was notified of the exceedance and our facility sampling plan was up-dated to reflect the sample procedure changes.

Exhibit A-8

Effluent TP daily maximum concentration versus permitted limit

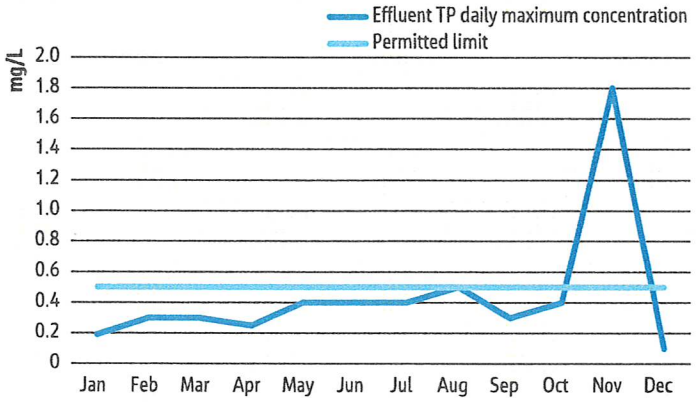


Exhibit A-9

Effluent TP monthly average concentration versus permitted limit

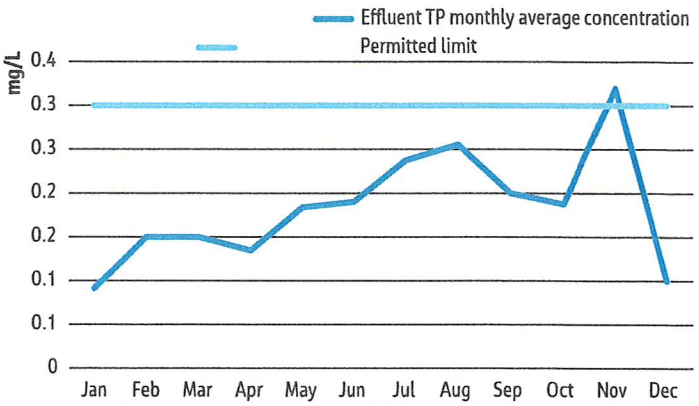


Exhibit A-10

Effluent BOD daily maximum concentration versus permitted limit

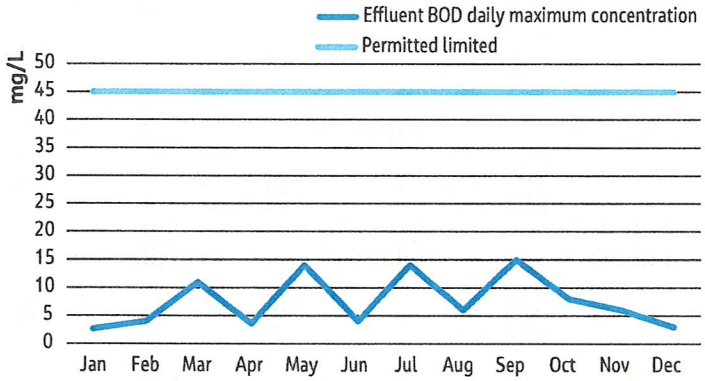


Exhibit A-11

Effluent BOD monthly average concentration versus permitted limit

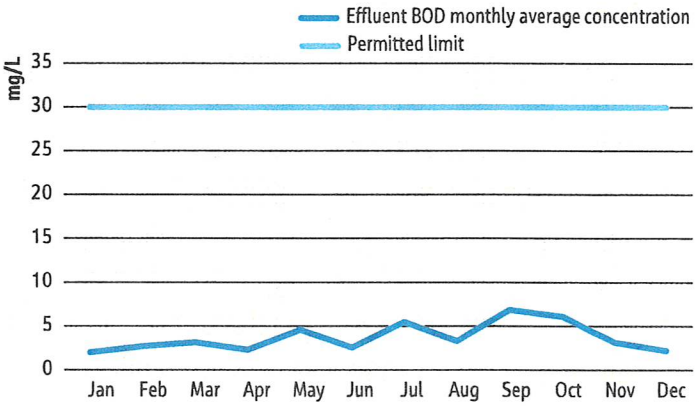


Exhibit A-12

Effluent pH monthly maximum value versus permitted maximum limit

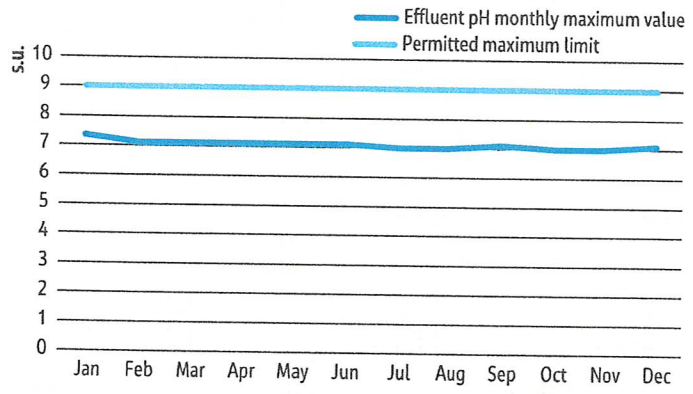


Exhibit A-13

Effluent pH monthly minimum value versus permitted minimum limit

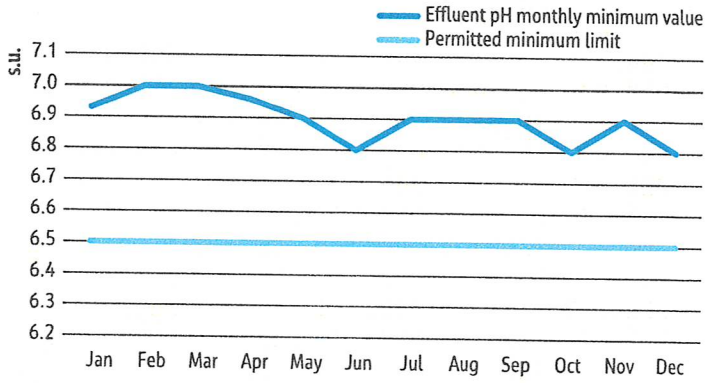


Exhibit A-14

MW maximum pH versus permitted maximum pH

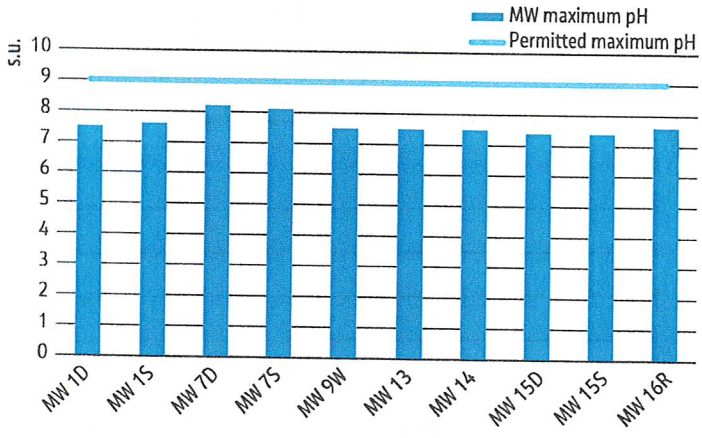
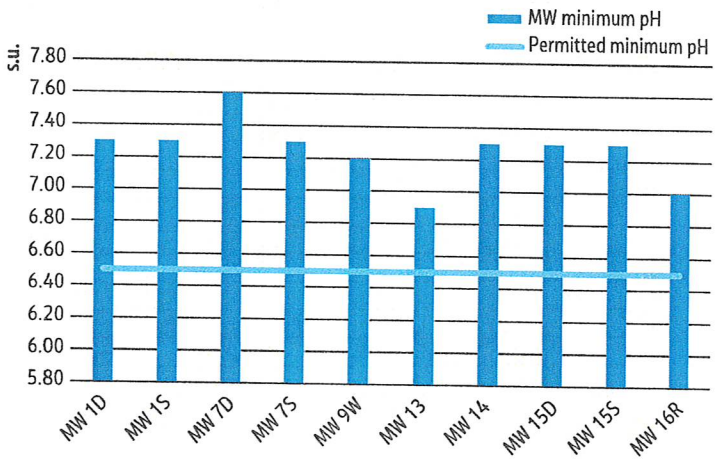


Exhibit A-15

MW minimum pH versus permitted minimum pH



Appendix B

Exhibit B-1

2021 repair expenses Over $500

Repair	Expense
Milan supply – Five residential grinder pumps-purchased as needed throughout the year to maintain a spare inventory as grinder pumps were replaced	$9,462.10
Northern A-1 –12978 Northport Point Road – jet roding	$1,571.18
Windemuller – PLC battery replacement and program backup	$1,475.00
Elmer's Dozer & Crane Inc – removal and reinstall of fine screen augar	$1,450.00
Windemuller – 129778 Northport Point Road – grinder pump troubleshooting	$940.00
Huber Technologies – fine screen replacement brushes	$936.33
Parkkson – replacement sand filter pump	$898.46
USA Bluebook – YSI portable pH – dissolved oxygen (DO) meter	$829.74
Windemuller- Main lift station generator alarm added	$686.71
Grand Traverse Rubber – bypass pump auxiliary connections and piping/hoses	$626.00
Hach – luminescent dissolved oxygen (LDO) replacement caps	$535.77

A total of 826.5 repair hours were accumulated in 2021. Included in this total are residential grinder pump repairs, collection system repairs, and treatment plant repairs. In 2021, almost half of all repair hours were related to collection system repairs. 26% of all repairs were residential grinder pump repairs. Treatment plant repairs made up 25% of the repair hours total.

Exhibit B-2

2021 repair labor hours summary

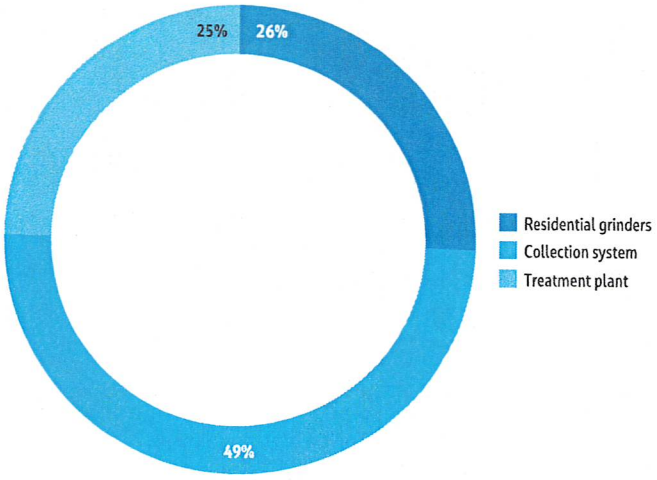


Exhibit B-3

2021 work order summary