Jacobs

Challenging today.
Reinventing tomorrow.

Operations Management
and Facilities Services

2023-2024
Annual Report

Traverse City, Michigan

By the numbers

16+ million gallons treated wastewater effluent reused for treatment processes

100% compliant with National Pollutant Discharge Elimination System permit

Over 1.5 billion gallons of wastewater treated

1,212 dry tons of land-applied Class B biosolids

>1,500+ pounds of mixed recyclables collected

141 years of combined team experience

>110 pounds of recycled exam gloves through Terracycle

100 staff training courses completed

150 pounds of recycled batteries

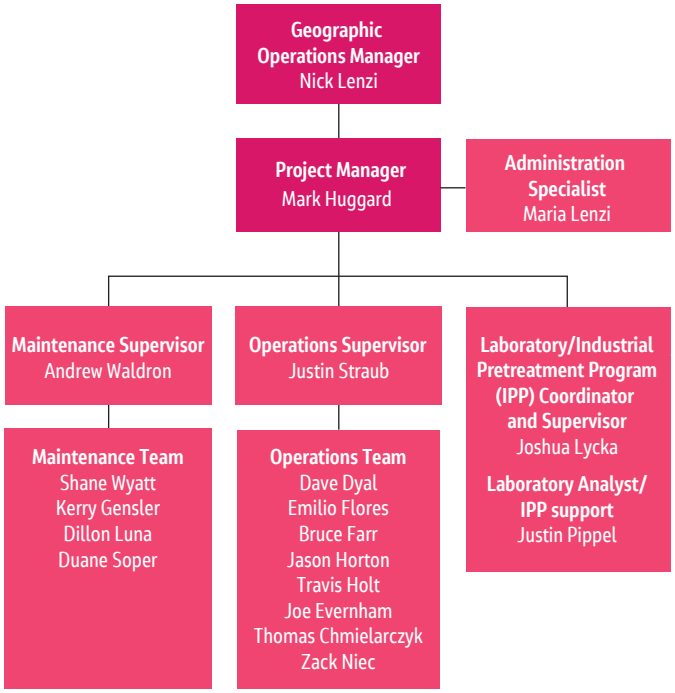
4+ years without a recordable or lost-time safety incident

3,817 completed maintenance work orders – with **96%** preventive or predictive maintenance

2,400 hours of Jacobs' regional and technical support provided

Celebrating experience and excellence

Our Traverse City team brings 141 years of combined expertise, delivering efficient, compliance operations with steadfast commitment to excellence.



EMPLOYEE RETIREMENT

Joe Brown retired after 32 years at the Traverse City Regional Wastewater Treatment Plant (TCRWWTP). As our longest-tenured wastewater treatment operator and a valued Jacobs team member, Joe's dedication, expertise and work ethic will be greatly missed. Joe consistently ensured the quality and safety of our operations and mentored his colleagues. Joe, we appreciate your loyalty, commitment and friendship. You have made a lasting impact on our plant and our lives. Enjoy your well-deserved retirement!

AWARD-WINNING EXCELLENCE

- Joshua Lycka received the Jacobs Laboratory Analyst of the Year award
- Award of Excellence in Wastewater by Jacobs

Value-add 10-year renewal features

Our unwavering commitment to delivering the highest quality of service is demonstrated through our strategic investments and value-added initiatives. These efforts not only enhance operational efficiency but also provide direct financial and functional benefits to Traverse City. Key examples from this year include:

AERATION BLOWER UPGRADE

Jacobs specified and purchased a new turbo aeration blower in 2024. While we wait for the arrival of the blower, a request for proposal (RFP) will be issued to demo the existing blower and install the new one. Installation will occur in 2025.

City benefit: Upon completion in 2025, the new turbo aeration blower will reduce electrical usage, improve redundancy, operational control and reliability.

LED LIGHTING UPGRADE

Jacobs is replacing 488 fixtures with energy-efficient LED lighting. During the last contract year, we upgraded 428 fixtures.

City benefit: LED lights reduce electrical and energy usage and save money.

INNOVATION WORKSHOP

Jacobs' industry leaders and experts attended this one-day, annual event to collaborate and tailor stormwater, water and wastewater strategies that align with the City's specific goals and priorities. The workshop featured presentations on stormwater planning and implementation, monitoring and mitigation of nitrous oxide (N_2O), digester gas reuse options, climate resiliency and the role of wastewater treatment plants (WWTPs).

City benefit: Provide the city insight into the latest technologies and advancements related to stormwater, wastewater treatment, climate resiliency and many other topics. An example of the benefit of these workshops is the $1.6 million grant the city was awarded in 2023 from the Michigan Public Service Commission, which was a direct result of our Solar Study presentation at the 2022 Innovation Workshop. The grant is earmarked for installing rooftop solar photovoltaic (PV) and a battery energy storage system at the TCRWWTP.

DIGESTER GAS REUSE STUDY

Jacobs is currently conducting digester gas reuse options and feasibility evaluations, including distributing gas back into the grid, purchasing combined heat and power (CHP) systems for energy production and setting up a compressed natural gas station for fleet vehicles. The CHP system is emerging as the most viable option for the facility. Study results were presented at the Spring 2024 Innovation Workshop.

City benefit: Results from this study indicated a potential savings in energy costs while reducing greenhouse gases.

Value-add 10-year renewal features

ROOFTOP SOLAR AND BATTERY ENERGY STORAGE SYSTEM (BESS) STUDY

With the $1.6-million Michigan Public Service Commission grant, the city will install rooftop solar PV and a BESS. Solar PV is estimated to reduce annual energy consumption by 10%. The city will issue an RFP for final design and construction in fall of 2024. The solar component is anticipated to be operational by July 2025.

City benefit: The study identified and prioritized solar opportunity options within the WWTP and city limits.

CITY WATER TREATMENT PLANT (WTP) ASSET MANAGEMENT SUPPORT

In collaboration with the City's WTP staff, Jacobs provides quarterly value-add asset management resources as part of our contract. These quarterly activities include vibration analysis, infrared inspections and oil analysis of critical equipment at the city's WTP and water pumping stations.

City benefit: After each predictive maintenance (PdM) cycle, Jacobs provides a detailed report to WTP staff, outlining findings and recommendations. It is Jacobs' honor to share resources and knowledge regarding asset management with the city.

ENGINEERING SERVICES DISCOUNT

City benefits: Preferred pricing schedule, identifying up to $250,000 in engineering services; streamlined access and clear, managed processes.

ELECTRIC VEHICLE (EV) CHARGING STATION DESIGN AND INSTALLATION

Jacobs has committed to installing an EV charging station at the WWTP. Installation is anticipated to occur in fall of 2024. Jacobs purchased one Ford F150 Lightning EV vehicle in 2024 and plans to convert more of its fleet to EV soon.

City benefit: The EV reduces the facility's carbon footprint by aligning with the City's environmental goals and objectives.

PRO 2D COMPUTER MODEL CALIBRATION

Calibrating the pro 2D computer model of the WWTP will allow us to identify process deficiencies and provide next steps for enhancing biological phosphorus removal. Calibration is funded by Jacobs providing approximately $30,000 in value to the city at no cost.

City benefit: Computer calibration potentially reduces operational costs like chemical usage and decreases overall greenhouse gas emissions.

WASTEWATER VIRUS SAMPLING

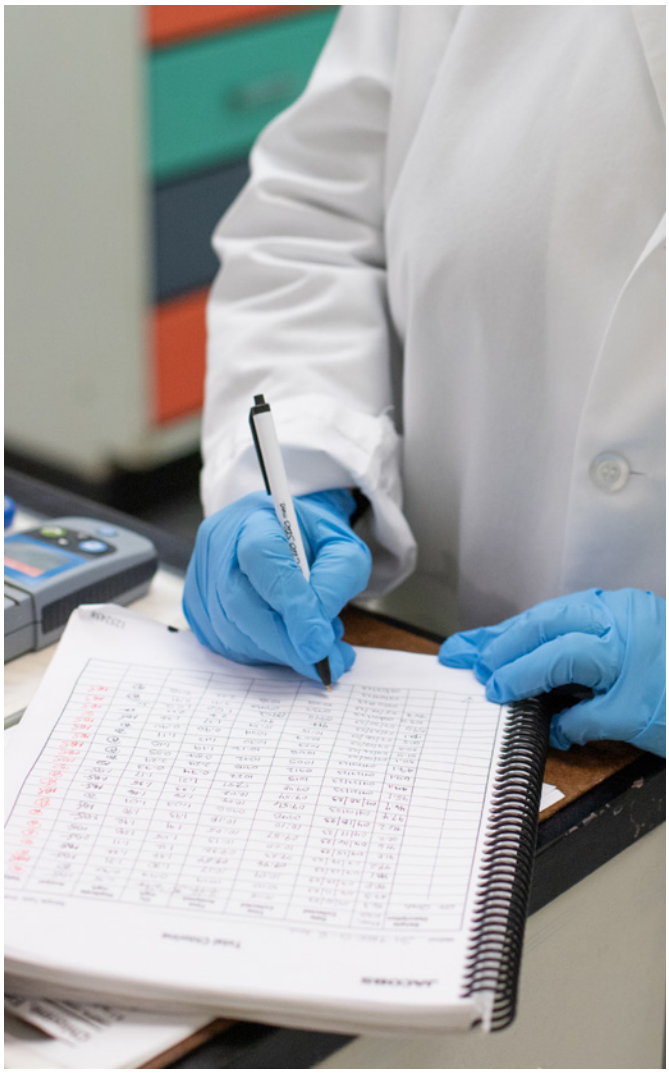
Jacobs joined the Wastewater SCAN program, sending weekly influent samples for infectious disease analysis, including respiratory and gastrointestinal viruses to fungal infections.

City benefit: Testing the wastewater samples can detect infectious disease even when people do not feel sick. It provides public health officials with results before people are sick, which helps prepare and provide necessary information to the public to protect their health.

WASTEWATER NITROUS OXIDE EMISSIONS MONITORING

N_2O emissions from wastewater treatment facilities are a significant and often underestimated source of greenhouse gases, with a global warming potential higher than that of carbon dioxide. Precise monitoring and a thorough understanding of N_2O production mechanisms are essential, given the extensive variability in emissions between different facilities and over time. Present estimation techniques, which rely on emissions factors, lack accuracy and necessitate enhanced facility monitoring to minimize uncertainties and inform effective mitigation measures.

City benefit: Jacobs' sustainability team selected the TCRWWTP for a project aimed at measuring and analyzing N_2O emissions starting in late 2023. The data collection process has been ongoing to continue monitoring and evaluating the data to identify N_2O risk factors and provide guidance for future research. This added value is provided at no cost to the city.



Laboratory quality assurance and quality control

Jacobs prides ourselves on the quality control measures we take to validate and corroborate our analytical data. Joshua Lycka and Justin Pippel serve as our onsite laboratory technicians. Jacobs' laboratory staff analyzed over 4,001 samples, 1,493 National Pollutant Discharge Elimination System (NPDES) required compliance samples in house and 2,508 process and control and interjurisdictional agreement samples. Our in-house laboratory analyzes most of the compliance and process control samples collected over the course of the year, with additional analytes outsourced.

Other notable highlights include:

- Traverse City achieved 100% compliance, calculated as the percentage of all permit-required data that was within permitted limits.
- Regular preventive maintenance (PM) was performed on our laboratory dishwasher, deionized water system, discrete chemistry analyzer and other laboratory meters, probes and apparatuses.
- We have expanded our laboratory subcontractors to include Prein and Newhof, Merit Laboratories, Great Lakes Environmental Center and Eurofins Laboratories to analyze a wide range of specialty analytes including effluent toxicity, metals and per- and polyfluoroalkyl substances (PFAS).
- We conducted a 10-day biological phosphorus sampling campaign that analyzed up to 19 analytes in 15 separate locations (both in house and outsourced) to populate a systems dynamics model to optimize plant efficiency.

Industrial pretreatment program

BACKGROUND

The IPP is a core element of the NPDES aimed to protect water resources and municipal biosolids from industrial pollutants. This program places responsibility for the oversight of industrial facilities on the Publicly Owned Treatment Works (POTW). It also ensures that the POTW has legal authority to set and enforce requirements for all commercial users to protect the sewer collection system and POTW. Jacobs administers the IPP for the City of Traverse City.

The City of Traverse City also serves as the control authority for seven connected townships, establishing consistent discharge regulations for all sewered users in the connected region. Additionally, the City serves as the control authority for the Grand Traverse Regional Septage Treatment Facility, which receives trucked waste from both in and out of the county.

It is the IPPs responsibility to inventory the commercial and industrial users in this wide service area, ensure all proper regulations are followed, conduct inspections and sampling of permitted users and conduct investigations into emerging pollutants and disruption to the collection system (usually grease obstructions).

CONTRACT DELIVERABLES

- In addition to a one-day compliance inspection by Great Lakes and Energy, Jacobs performed our annual independent self-assessment of the IPP. No changes were made to state or federal pretreatment standards over contract year 34 that affected Traverse City's IPP.
- Our team conducted the triennial industrial user survey to identify any changes to the industrial user base in the service area. We mailed surveys on an ongoing basis to update the database with known changes and perform a mass mailing every three years to ensure the database files are correct. Updates were made to 464 commercial users as part of this database update. No changes to permitted significant industrial users (SIUs) or categorical industrial users were made during this update.
- Jacobs conducted all required inspections and sampling events for all six permitted SIUs.
- Our team reviewed permit applications for two SIUs, drafted new permits, facilitated these draft permits through the public participation process and presented them to the city for issuance. A third permit was updated to address an inconsistency in the permit.
- Jacobs evaluated self-monitoring reports and drafted enforcement responses as necessary. This included five corrective actions/notices of violations issued to industrial users.

Operational and industrial pretreatment program highlights

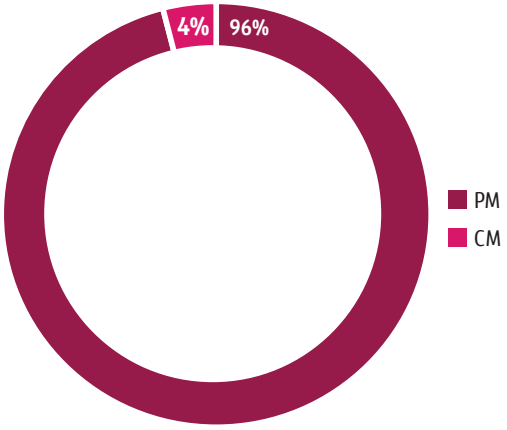
- Worked with a community partner to monitor a known PFAS contamination site for residual PFAS, and to perform a public sewer line cleaning
- Conducted additional sampling of the collection system and conducted industrial inspections as part of the PFAS initiative
- Oversaw and permitted one groundwater dewatering event to the sanitary sewer
- No industries were in significant noncompliance for the 2023–2024 contract year
- Treated more than 1.5 billion gallons of wastewater
- Land applied 1,212 dry tons of biosolids
- 100% compliant with NPDES permit – Refer to Appendix A for detailed information illustrating plant performance in comparison to permit limits for each monitored pollutant.

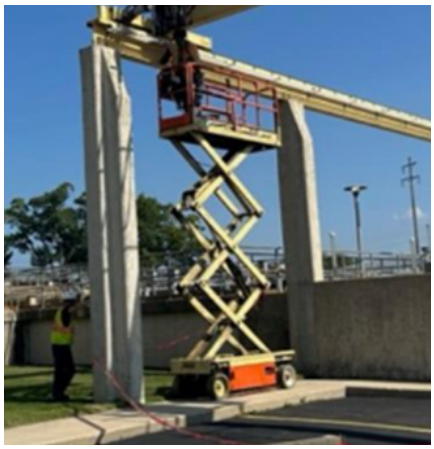
Maintenance/asset management

Jacobs is committed to protecting the City's investment in its facilities by proactively maintaining its assets. Corrective maintenance (CM) occurs when equipment repairs are needed, but our principal emphasis is on PM and PdM. Jacobs maintains the City's assets with the goal of minimizing unplanned and emergency repairs.

The goal of having a maintenance excellence standard is to extend the useful life of the project's assets by routinely performing service on a pre-determined schedule, also known as PM. Best management practice standards indicate that a successful maintenance program performs 80% or greater PM and 20% or less CM. The total work order count was 3,173, with 96% PM versus 4% CM. Our maintenance practices exceed industry standards.

Work orders





We performed annual maintenance on the membrane and air release valve. We provided inspections on the switchgear and crane. The odor control system carbon was replaced. Finally, we performed semi-annual cleaning of the lift stations.

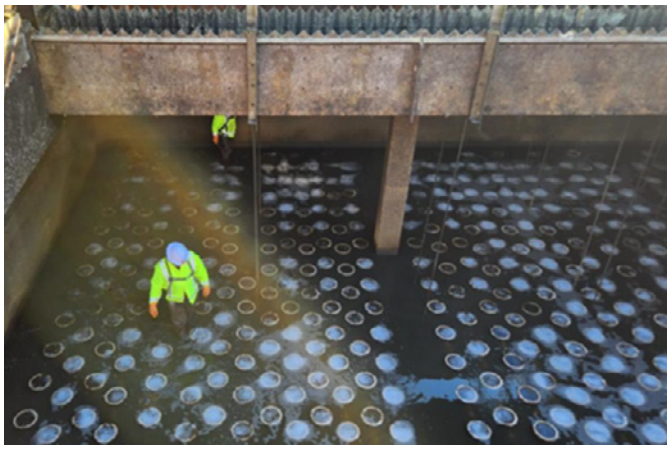
Maintenance/asset management

MAINTENANCE HIGHLIGHTS

- Rebuilt scour blower five of five, completing the first initial round of scour blower rebuilds

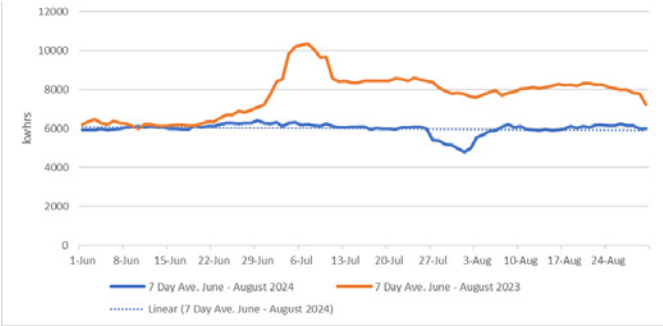
- Removed the coatings from trains three and four, concluding coating removal needed to protect the membranes. Future coating requirements will be reviewed for applicability and coordination during future membrane replacements.

- Cleaned the north aeration basin. The south aeration basin is scheduled for cleaning in fall of 2024.

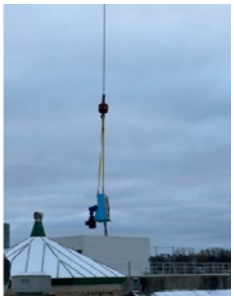


- Replaced the inlet control valve on aeration blower #2 and fine-tuned the blower control system to improve dissolved oxygen control in the aeration basin and reduce energy use. The following illustrates the reduction in electrical consumption as a result of this upgrade.

Electrical reduction 2023 versus 2024



- Replaced digester 3 linear mixer gearbox twice, first in August under warranty due to overheating and failed oil analysis. The manufacturer replaced it again in December with a new, reconfigured unit. Both replacements were covered by warranty, and the gearbox has been functioning well since.



Capital improvement upgrades

- Completed the upgrade of the membrane chemical feed piping, valving, pumps and heating, ventilation, and air conditioning (HVAC). The HVAC was converted to electric from natural gas. Jacobs completed this project through an out-of-scope agreement and was under budget by $9,713.73.

- Completed the upgrade of both dual fuel boilers. These upgrades included the replacements of both burner assemblies and both control panels. The upgrades of these components will ensure maximum equipment life and reliability, while also increasing efficiency and decreasing natural gas consumption. Jacobs completed this project through an out-of-scope agreement and under budget by $31,456.36.

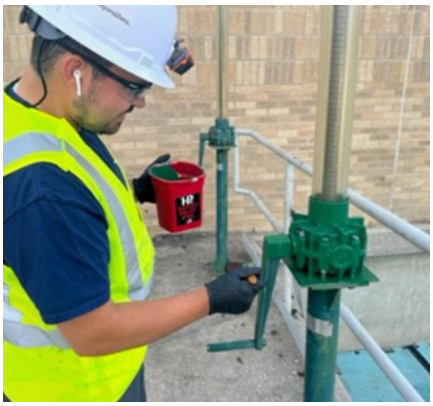
- The first cleaning and condition assessment of anaerobic digester #5 has been completed by Jacobs through an out-of-scope agreement. The volume of grit, hair and other materials was higher than greater than anticipated, leading to an unexpected change order request for an additional $137,326. Jacobs did not apply the standard markup to this extra cost to reduce the impact of the higher than expected cost. Future upgrades to the grit removal system and insights from this initial cleaning should help reduce the risk of future change orders.

Facility appearance and upkeep

Maintaining the physical condition of the WWTP is essential to ensuring smooth operations and extending the life of critical infrastructure. Regular upkeep not only enhances the efficiency and reliability of our systems but also contributes to the safety and well-being of our staff and the surrounding community. By proactively addressing maintenance needs, we prevent costly repairs and downtime, allowing us to continue delivering high-quality service without interruption.

At Jacobs, our commitment to facility upkeep is reflected in ongoing efforts to keep equipment in optimal working condition, improve site aesthetics and create a work environment that fosters pride and productivity. These actions are fundamental to maintaining operational excellence and supporting long-term sustainability. Examples include:

- Painted equipment, pipes, cranes, storage tanks, buildings, etc.
- Power washed structural exteriors
- Sealed concrete surfaces
- Weeded rock beds
- Performed general building maintenance

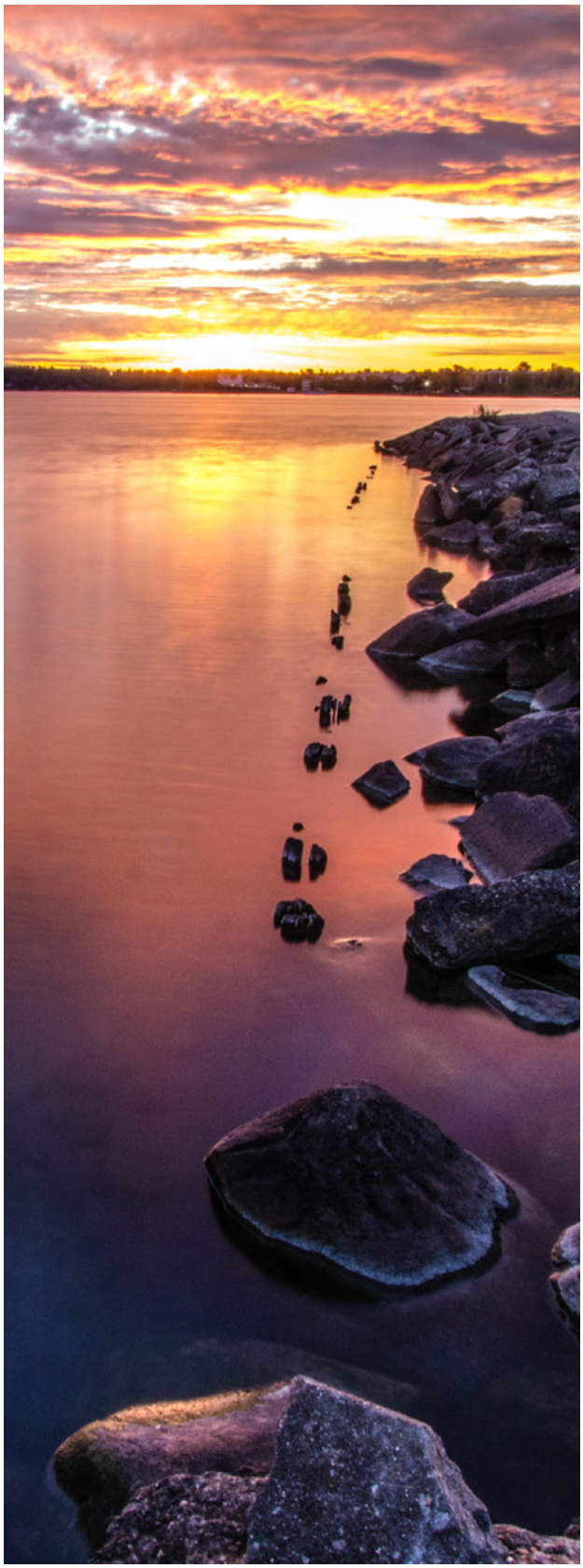


Community

Fostering strong relationships within the community is essential to creating lasting, positive impacts. By sharing knowledge and offering support, we not only contribute to the growth of local industries but also help bridge the gap between generations, ensuring a bright future for water and wastewater management. Our team participated in the following activities:

- Celebrated Arbor Day by planting trees with the Grand Traverse County Conservation District at Medalie Park
- Volunteered with registration of participants at the annual Paddle Antrim festival
- Donated toys to Toys for Tots
- Hosted a science, technology, engineering and mathematics teacher training event with hands-on wastewater activities, learning and a facility tour
- Picked up trash throughout the year at Hull Park, the adjacent Traverse Area Recreation Trail (TART) trail and around the facility grounds
- Hosted the third-annual public open house, offering public tours and giving presentations and demonstrations
- Sponsored the 2023 Michigan Municipal League Conference
- Provided plant tours to the Ausable Institute, Northwester Michigan College students, city commissioner candidates and various other public individuals or groups

★ 5	Dale	Very informative and proactive with the waste water.	04 August, 2024
★ 5	Andrew	Great tour of a well managed facility, staffed by engaged and dedicated professionals.	03 August, 2024
★ 5	Kathleen	I thoroughly enjoyed the tour at the Water Treatment Facility. The Jacobs representatives were professional, informative, and knowledgeable. Thank you for the excellent tour.	02 August, 2024



Sustainability

During contract year 34, Jacobs established several sustainability goals to pursue.

These goals were to:

- Support the city in grant funding, design and installation of a solar energy array and backup battery system
- Utilize an oil analysis program to reduce frequency of routine oil changes in equipment
- Replace existing fluorescent lighting with LED retrofits and new panels
- Reduce gasoline usage by implementing an electric truck and utility bicycle into our fleet for sampling, lift station rounds and industrial inspections
- Reduce ferric chloride use by achieving biological phosphorous removal through process changes

Pursuit of these goals resulted in the following outcomes:

- Nearing 65% design completion on the solar array system, with a current grant extension request in progress to extend the project completion date to July 1, 2025
- Most oil samples sent for analysis indicated the oil quality was still satisfactory and did not require a change; avoiding unnecessary oil changes and saved a significant quantity of oil
- Since our LED replacement project began, we have converted 428 of 488 fluorescent fixtures to LED
- Over contract year 34, 181 miles were traveled on the utility bicycle
- Implemented an electric Ford F150 Lighting into the truck fleet, which we have used to reduce our overall gasoline use by incorporating it into our daily work tasks
- Conducted extensive testing and modeling to better understand process changes required to more frequently achieve biological phosphorous removal

Other activities conducted as part of Jacobs commitment to sustainability were:

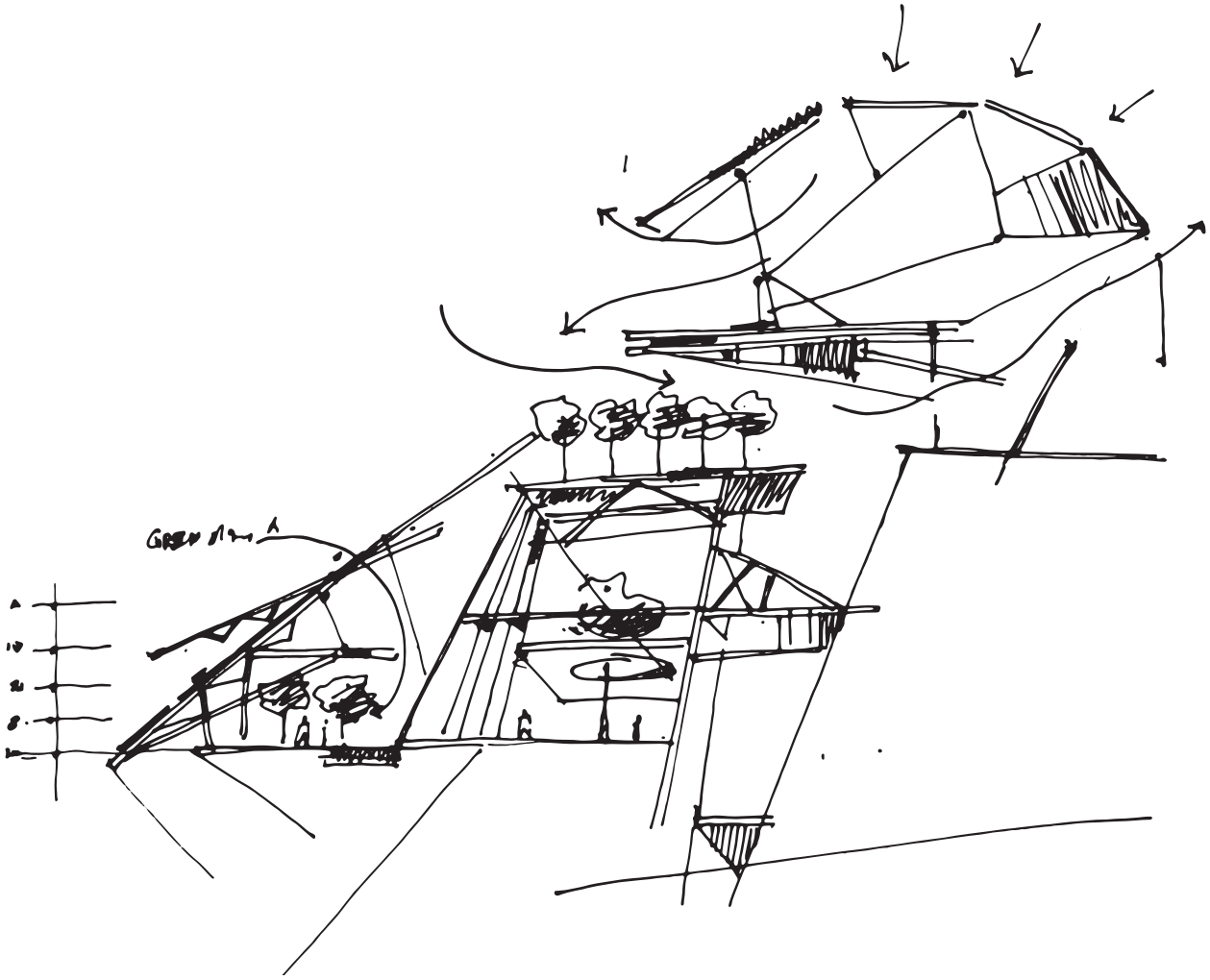
- Performed trash pickups at neighboring Hull Park and along the TART Trail six times
- Making donations to local nonprofit organizations with environmental alignment

Looking ahead

Heading into 2024-2025, we have targeted the following:

- Value-add projects:
  - Install a new turbo aeration blower
  - Install an EV charging station at the WWTP
  - Finalize computer model calibration for biological phosphorus removal study
  - Conduct the third annual Innovation Workshop
- Capital improvement projects:
  - Complete the programmable logic controllers and supervisory control and data acquisition upgrades
  - Complete the headworks and ultraviolet system upgrade design and start of construction
- Construct and commission the rooftop solar PV and battery energy storage system
- Participate in a N_2O emissions study to accurately estimate and understand N_2O emissions at water resource recovery facilities

The Jacobs team is proud to serve the City of Traverse City as your partner. We look forward to moving our partnership forward as we support your community, public health and environment.



Appendix A

Appendix A

Exhibit A1

Plant performance compared to permit requirements

Parameter description	Effluent permit limit	Plant effluent quality	Importance
Carbonaceous biochemical oxygen demand (CBOD) is the measure of the amount of pollutants in the waste stream. Otherwise known as an indicator of the strength of wastewater.	85% removal/monthly average concentration of 25 milligrams per liter (mg/L)	97 % removal/maximum monthly average concentration <2 mg/L (refer to Exhibit A2).	When biochemical oxygen demand (BOD) levels are high, dissolved oxygen (DO) levels decrease because the oxygen that is available in the water is being consumed by the bacteria. Since less DO is available in the water, fish and other aquatic organisms may not survive.
Total suspended solids (TSS) are the measure of material suspended in a known volume of water that is trappable in a filter.	85% removal/monthly average concentration of 30 mg/L	98 % removal/maximum monthly average concentration 1 mg/L (refer to Exhibit A3).	High TSS in water can block sunlight, decreasing the growth of vegetation in water ways, even killing of vegetation. This vegetation produces the DO needed to support life in a body of water. Reduced vegetation would impact the health and growth of other organisms, such as fish. In addition, the decrease in water clarity caused by TSS can affect the ability of fish to see and catch food. Suspended sediment can also clog fish gills, reduce growth rates, decrease resistance to disease and prevent egg and larval development.
Total phosphorus (TP) is the measure of organic and inorganic phosphorus compounds in water.	Monthly average concentration of 0.5 mg/L	Maximum monthly average concentration 0.5 mg/L Note: The addition of ferric chloride is used to remove TP from the wastewater. To reduce the expense of purchasing ferric chloride, we monitor the concentration of TP in the plant effluent closely and only add ferric chloride as needed to meet the permit requirement (refer to Exhibit A4).	Phosphorus is an essential element for plant life, but when there is too much of it in water, it can speed up eutrophication (a reduction in DO in water bodies caused by an increase of mineral and organic nutrients).
Ammonia nitrogen (NH_3-N) is the measure of the amount of ammonia, which is a toxic pollutant often found in landfill leachate and in waste products, such as sewage, liquid manure and other liquid organic waste products.	Monthly average concentration of 11 mg/L (May 1 - September 30)	Maximum monthly average concentration 0.8 mg/L (refer to Exhibit A4).	NH_3-N in excess of recommended limits is toxic to humans and other organisms.
DO measures of the amount of oxygen in water.	DO concentration limit (Sept. 1-May 31) 4 mg/L / DO concentration limit (June 1-August 31) 6 mg/L	Plant effluent minimum DO concentration 7.8 mg/L (refer to Exhibit A5).	Low DO primarily results from excessive algae growth caused by phosphorus. This can result in insufficient amounts of DO available for fish and other aquatic life. Die-off and decomposition of submerged plants also contributes to low DO.
pH measures how acidic/basic water is.	Minimum pH limit 6.5 standard units (s.u.)/maximum pH limit 9 s.u.	Minimum pH value 6.8 s.u./maximum pH value 7.5 s.u. (refer to Exhibit A6).	Extremes in pH can make a waterways inhospitable to life. Acidic water also speeds the leaching of heavy metals harmful to fish.

Exhibit A1

Plant performance compared to permit requirements

Parameter description	Effluent permit limit	Plant effluent quality	Importance
Fecal coliform alone are typically not pathogenic; they are indicator organisms, which means they may indicate the presence of other pathogenic bacteria.	Plant effluent fecal coliform 7-day geomean limit 200 counts/100 milliliters (mls)	Plant effluent fecal coliform maximum 7-day geomean <1 counts/100mls (refer to Exhibit A7).	The presence of fecal coliform bacteria in aquatic environments indicates that the water has been contaminated with the fecal material of man or other animals.
Mercury	Required to monitor and report Mercury concentrations monthly. Further requirements are triggered if effluent results exceed 5 nanograms per liter (ng/L)	Plant effluent maximum concentration <0.5 ng/L (refer to Exhibit A8).	Mercury in excess of recommended limits is toxic to aquatic organisms, wildlife and humans.
Copper	Monthly average concentration requirement	Plant effluent maximum concentration 6.7 micrograms per liter (ug/L) (refer to Exhibit A9).	Copper in excess of recommended limits is toxic to aquatic organisms, wildlife and humans.

Exhibit A2

2023-2024 percent removals versus NPDES permit requirement

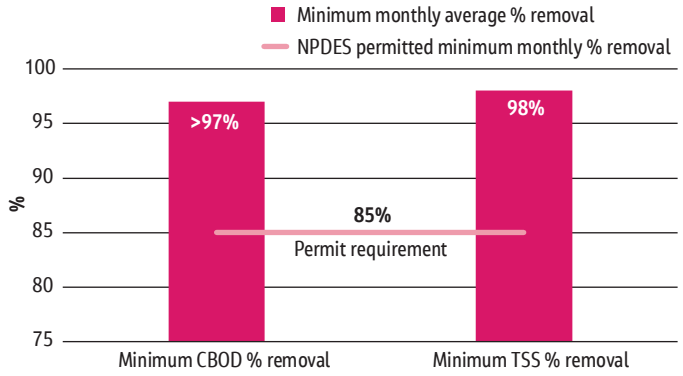


Exhibit A3

2023-2024 plant effluent maximum monthly average CBOD/TSS concentrations versus NPDES permit monthly average concentration requirements

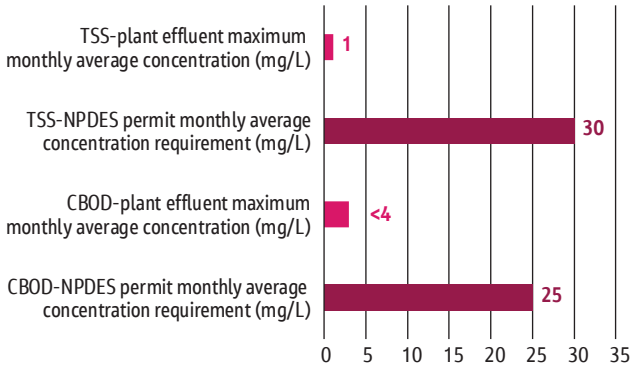


Exhibit A4

2023-2024 plant effluent maximum monthly average nutrient concentrations versus NPDES permit monthly average concentration requirements

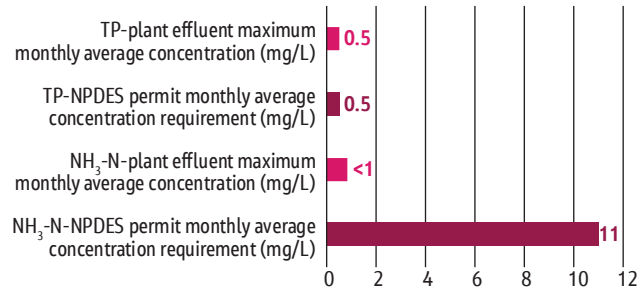


Exhibit A5

2023-2024 NPDES plant effluent DO requirement versus plant effluent minimum DO concentration

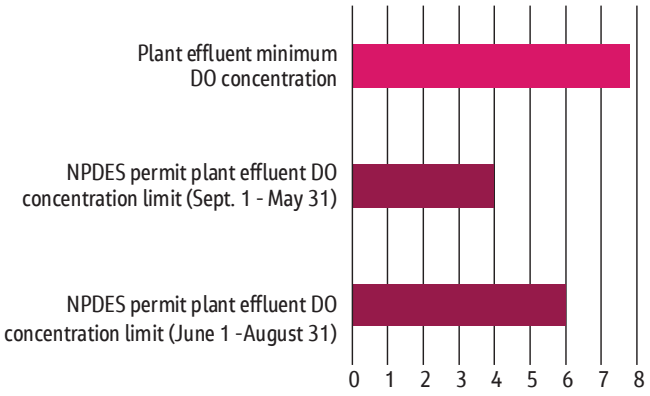


Exhibit A6

2023-2024 NPDES permit plant effluent pH requirement versus plant effluent minimum/maximum pH values

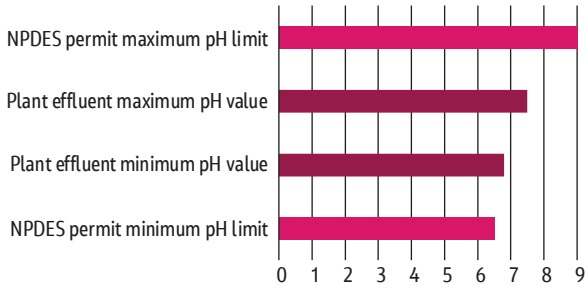


Exhibit A7

2023-2024 NPDES permit fecal coliform requirement versus plant effluent maximum fecal coliform 7-day geomean (counts/100mls) fecal coliform 7-day geomean (counts/100mls)

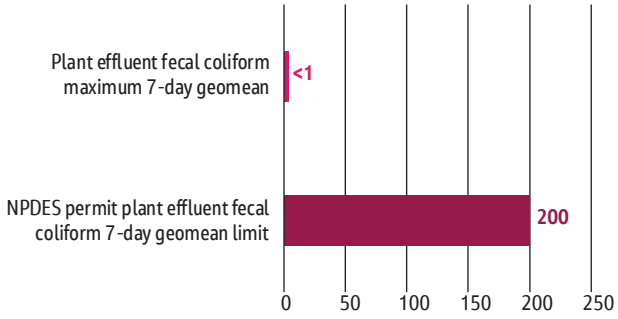


Exhibit A8

2023-2024 plant effluent maximum mercury concentration versus NPDES permit mercury concentration requirement

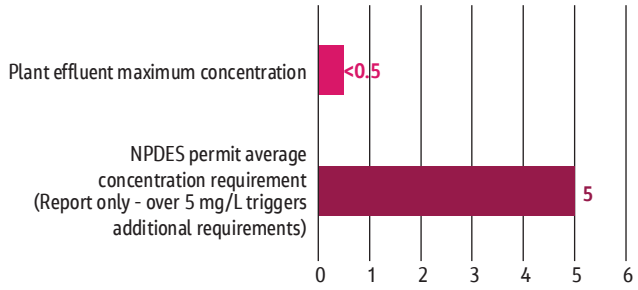
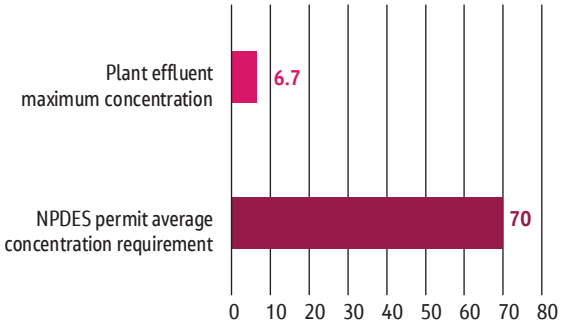


Exhibit A9

2023-2024 plant effluent maximum copper concentration ug/L versus NPDES permit copper concentration requirement ug/L



Company values

We do things right
We always act with integrity — taking responsibility for our work, caring for our people and staying focused on safety and sustainability. We make investments in our clients, people and communities, so we can grow together.

We challenge the accepted.
We know that to create a better future, we must ask difficult questions. We always stay curious and are not afraid to try new things.

We aim higher.
We do not settle — always looking beyond to raise the bar and deliver with excellence. We are committed to our clients by bringing innovative solutions that lead to profitable growth and shared success.

We live inclusion.
We put people at the heart of our business. We embrace different perspectives, collaborating to make a positive impact. Through a strong focus on inclusion, with a diverse team of visionaries, thinkers and doers, we build trust — in each other and across our company.

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