FACT SHEET
WASTEWATER FACILITIES PLAN
VILLAGE OF OAKFIELD

A. WHAT IS THE VILLAGE WORKING ON?

The Village has partnered with MSA Professional Services, Inc. to develop a Wastewater Facilities Plan. The plan evaluates the condition of the facilities and recommends long-term improvements to accommodate growth, replace aging equipment, and maintain current and future permit requirements.

B. WHY IS THE PROJECT NEEDED?

- The Village's permit to discharge wastewater under the Wisconsin Pollutant Discharge Elimination System (WPDES) is expected to renew in 2024. The new WPDES permit will require the Village to significantly reduce effluent phosphorus concentrations and loads. Phosphorus is currently removed biologically, and the existing system cannot meet the future permit limit. Further treatment is needed. The Wastewater Facilities Plan determined that chemical phosphorus removal is the most cost-effective way to achieve the future effluent phosphorus permit limits. Chemical phosphorus removal involves the precipitation of soluble phosphorus to particulate phosphorus and removing those solids via gravity settling. A new chemical addition system and properly functioning final clarifier would effectively remove phosphorus to meet the new permit limit.
- Raw wastewater is pumped into the wastewater treatment facility (WWTF) via dry-pit pumps. The pumping system is required to be sized to manage 100% of the incoming flow. The existing pumping system is undersized. The pumps require regular maintenance and repair, indicating the system needs to be replaced due to poor condition, performance, and capacity. **Figure 1** presents a photo of the raw wastewater pumps.
- Preliminary treatment is accomplished by passing wastewater through two coarse screens. The screens remove coarse solids such as sticks, rags, and other debris. The existing screens do not have automatic cleaning features and need to be manually cleaned by an onsite operator. Debris that is removed needs to be manually disposed of into a container. If the screen is not cleaned or if it becomes clogged, raw wastewater will flood the building. In addition, the coarse screen does not remove smaller particles which may result in the accumulation of particles in downstream treatment processes. The screen could be replaced to provide the removal of smaller particles and mechanical cleaning to provide a safer environment for the onsite operator. **Figure 2** presents a photo of the coarse screens.
- Biological treatment is accomplished by a single aeration tank. The tank consists of a mixture of microorganisms and wastewater. The microorganisms treat pollutants when they come in contact with wastewater. Aeration equipment is used to provide air and oxygen for the microorganisms to treat pollutants. The same aeration system is used to mix the microorganisms with the wastewater. The existing aeration system consists of blowers and diffusers. The blowers were installed in the early 1980's and are past their useful life. In addition, the blowers waste energy due to their lack of control features. The blowers should be replaced with newer technology that is more reliable and more energy efficient. The single aeration tank lacks operational flexibility and has limited capacity. An additional aeration tank would provide a higher level of treatment capacity, provide the ability to treat different pollutants, and allow for operational flexibility. **Figures 3** and **4** present photo of the aeration tank and the aeration blowers, respectively.
- Treated wastewater and microorganisms from the aeration tank need to go through a liquid-solids separation phase. This phase is accomplished by gravity settling. Solids settle to the bottom of a tank, called the final clarifier, and the resulting liquid exits near the top of the tank. A properly functioning clarifier removes over 99% of solids. The liquid existing near the top of the tank is considered treated effluent. The existing final clarifier is not large enough to handle peak flow rate, thus reducing its ability to remove solids which may result in permit exceedances. A new, larger clarifier would be sized to manage peak flows. Features such as flocculant addition and density current baffles can be used to improve the liquid-solids separation process. **Figure 5** presents a photo of the existing final clarifier.
- Solids that settle on the final clarifier floor consist of the microorganisms needed for successful biological treatment. These microorganisms need to be returned to the aeration tank. The existing system uses air lift pumps to accomplish that task. The control of solids throughout the system is critical for successful treatment. The existing sludge pumping system does not provide sufficient control of solids. The system should be upgraded to a system that can be continuously monitored and controlled to optimize treatment capabilities.
- Solids that are removed from the biological treatment system are further stabilized by an aerobic digestion process. The existing process uses air to stabilize sludge and results in Class B biosolids with are either land applied or hauled to a nearby facility. The condition of the aerobic digestion system is poor and many mechanical items

are not functioning properly. The aeration blowers are past their useful life, waste energy, and have little operational control. The mechanical items within the tank should be replaced. The blowers should be replaced with newer technology that is more reliable and more energy efficient. **Figure 6** presents a photo of the existing aerobic digester.

- If biosolids are not hauled to a nearby facility, solids can be dewatered using sludge drying beds. The structure of the drying beds have visible cracking in the concrete which may result in sludge flowing out of the tank. During winter, the beds freeze and pumping to them is not possible. Repairing the concrete structure and providing an option for sludge removal directly from the aerobic digester will provide operational flexibility when removing excess sludge. In addition, a new liquid sludge storage tank would allow the Village to store sludge for longer periods of time in the event land application fields and nearby sites are unavailable. **Figure 7** presents a photo of the existing sludge drying beds.
- The final treatment process is disinfection. The existing treatment process consists of a liquid chemical addition system. Use of disinfection chemicals have a number of disadvantages, including the danger of handling chemicals, the potentially dangerous room environment chemicals can create, fluctuations in chemical costs, and disinfection byproducts (DBPs) that can be created. The effectiveness of a chemical disinfection system is largely based on contact time between the chemicals and treated effluent. During peak flows, the contact time between chemicals and treated effluent may be insufficient, thus causing the potential for disinfection to be ineffective. Proven and safer technologies are available, one of which is ultraviolet light (UV) disinfection. Upgrading to this type of system would provide reliable treatment, generate little to no DBPs, and provide a safer environment for onsite operators. **Figure 8** presents a photo of the existing disinfection system.
- The existing Main Service Building includes treatment equipment, electrical equipment, and a testing laboratory. The building experiences significant water leaks during rain events. Occupied spaces and electrical areas are directly connected to areas that house raw wastewater pumping equipment/piping and sludge equipment/piping. Because these areas are not physically isolated, there are fire and explosion risks that need to be addressed. Electrical gear and equipment are past their useful life and much of the equipment in these areas do not comply with the National Fire Protection Association standards in wastewater treatment and collection facilities. Physically separating these rooms, upgrading ventilation equipment, and upgrading electrical equipment would mitigate the existing fire and explosion risks. In addition, remodeling the building, include replacing the roof, would eliminate damage from adverse weather conditions. **Figure 9** presents a photo of the existing Main Service Building.
- In addition to the above items, yard piping, miscellaneous valves, fitting, piping, conduits, and site features need to be modified to accommodate the proposed upgrade. Flood elevations will need to be verified during the preliminary design phase of the proposed project. A berm within the existing facility's site may be constructed to mitigate flood hazards. In addition, the existing generator will need to power critical equipment in the event of power outages. The installation of new generator would mitigate treatment concerns during such events.

C. WHAT IS BEING RECOMMENDED AND HOW MUCH DOES IT COST?

As described above and based on a comprehensive capacity, condition, and performance evaluation of the existing wastewater facilities, several areas of concern need to be addressed. The table below summarizes the proposed upgrades and budgetary cost for all aspects of the project. The estimate includes contractor construction costs, engineering design, bidding, and construction related services costs, and funding costs. It also includes a 20% contingency to account for unknowns prior to the design, bidding, and construction of the project.

Table 1. Description of Upgrade and Summary of Estimated Capital Cost

Estimated Capital Cost: $10,000,000

• Phosphorus Removal
  o Construct a new chemical building to house feed pumps, chemical storage, chemical spill containment, and safety equipment.
  o Include a new electrical room in the Chemical Building to isolate upgraded electrical equipment.
• Raw Wastewater Pumping
  o Remove and replace existing pumps and install new pumps to meet future peak flows.
• Preliminary Treatment Screening
  o Install a fine screen with mechanical cleaning capabilities
• Biological Treatment
  o Remove and replace the existing aeration delivery system, including diffusers and blowers.
  o New blowers will be more energy efficient and can speed up and down based on new dissolved oxygen probes.
  o Existing clarifier to be retrofitted to a new aeration basin that is incorporated into the aeration delivery system.
• Clarification
  o Construction of a new final clarifier with more surface area to handle peak flow events.
  o Construction of new solids pumping station to effectively control solids within the biological system.
  o Construction of a scum removal system to remove floatable solids from the final clarifier's surface.
• Aerobic Digestion and Biosolids
  o Removal and replacement of the existing aeration equipment to provide better air control and mixing capabilities.
  o Repair of the existing concrete sludge drying beds.
  o Construction of a new liquid sludge storage tank to allow for sludge storage during the winter.
• Disinfection
  o Replace the existing liquid chlorine disinfection system with a UV disinfection system.
  o Size the new system to manage peak flow events.
• Main Service Building
  o Replace roof to eliminate damage from adverse weather conditions.
  o Isolate areas to comply with the National Fire Protection Association standards in wastewater treatment and collection facilities.
  o Improve ventilation and upgrade electrical equipment to mitigate fire and explosion risks.
• Other
  o Piping, valves, conduits, fittings, and electrical items will be replaced to accommodate new equipment and processes.
  o Site work will include new fencing, berm, hydrants, sidewalks, and driveway access to ensure the site is accessible and protected.
  o Emergency power will be provided such that treatment is possible during power outages.

D. HOW WILL WE PAY FOR THIS?

The preliminary financing and funding analysis determined that the Clean Water Fund (CWF) Loan Program is the most favorable financing option. The Village qualifies for 15% general principal forgiveness (PF), up to $2,000,000, and 50% phosphorus PF, up to $1,000,000, for the project. To pay the debt service on the loans, the Village will need to increase sewer user rates.

It is estimated that the average residential sewer user currently pays approximately $45 per month or 0.6% of the Village's $92,000 MHI. The following table summarizes the financial impacts to the average residential user for different funding scenarios. The actual rate increase will depend on the final composite interest rate, parallel cost ratios, industrial contributions, awarded PF, the possibility of other grants, and the final cost of the project. The sewer rates shown are considered planning level information. The Village is planning to conduct a sewer user study to help determine final sewer rates and if there are additional funding options available, such as sharing total project costs with local industries that contribute wastewater to the WWTF.

Description	Financing Options	
Program Source	CWF	
Total Project Cost	$10,000,000	
Estimated Grant	$1,520,000	
	Scenario A	Scenario B
Composite Interest Rate [c]	2.4%	2.6%
Term	20 years	30 years
Current Monthly Sewer Rate	$45	$45
Rate Increase [a]	$90	$70
Total Monthly Sewer Rate [a]	$135	$115
Percent of MHI [b]	1.8%	1.5%

a. The actual rate increases will depend on the final composite interest rate, parallel cost ratios, industrial contributions, awarded PF, the possibility of other grants, and the final cost of the project.
b. Percent of MHI is based on the 2017-2021 ACS Village of Oakfield MHI of $91,736
c. The composite rate is based on the market rate (DNR) and subsidized interest rate (55% of market)

E. WHAT IS THE PROPOSED SCHEDULE?

The Village is considering moving forward to maximize the opportunity for additional funding and minimize the impact of process deficiencies at the WWTF. A proposed schedule is included in the following table.

Description	Target Date
Submit Wastewater Facilities Plan Report to DNR	November 2023
Design phase of project	November 2023 – September 2024
Submit plans/specs and apply to CWF program	September 30, 2024
Bid and award construction project	December 2024 – February 2025
Deadline to raise sewer user rates	March – May 2025
CWF loan closing	April – July 2025
Construction	March 2025 – June 2026

ATTACHMENT 1
DIGITAL PHOTOGRAPHS OF THE OAKFIELD WWTF


Figure 1. Raw Wastewater Pumps

Figure 2. Coarse Screen

Figure 3. Aeration Tank

Figure 4. Aeration Tank and Aerobic Digester Blowers

Figure 5. Final Clarifier

Figure 6. Aerobic Digester

Figure 7. Sludge Drying Beds

Figure 8. Disinfection System

Figure 9. Ceiling and Lower Level of the Main Control Building