### FACILITY PLAN NEAR-TERM IMPROVEMENTS SUMMARY



AT THE GREEN BAY FACILITY



PROJECT	DRIVERS	CAPITAL COST RANGE (2021\$)	TARGET COMPLETION YEAR
Thickening Improvements	Capacity, O&M, Asset Renewal	\$14-21M	2022
Primary Sludge Degritting	O&M, Asset Renewal	\$8-10M	2023
Primary Clarifier Rehabilitation	Asset Renewal, Capacity	\$14-20M	2024
GBF North Final Clarifiers	Asset Renewal, O&M	\$21-31M	2024
Biosolids Handling and Storage	Capacity, O&M	\$13-19M	2025
GBF Headworks and Pumping	Capacity, O&M, Asset Renewal	\$30-44M	2025
GBF Aeration Basin Improvements	O&M, Regulatory, Energy	\$4-6M	2029
GBF Blowers	Asset Renewal, O&M, Energy	\$22-33M	2029
GBF South Final Clarifiers	Asset Renewal, O&M	\$8-11M	2029
Sludge Screening	0&M	\$9-13M	2030

### Juil a FACILITY PLAN **GBF** Thickening Improvements

#### COMPONENT DESCRIPTION

Thickening of waste activated sludge (WAS) and primary sludge (PS) is critical for the operation of both the DPF and the GBF. The ability to thicken solids controls the liquids capacity, and the ability to effectively thicken to a 6% solids concentration controls the ultimate capacity of the Resource Recovery and Energy Efficiency (R2E2) facilities. To achieve reliable operation in the future, improvements to gravity thickeners for PS, followed by mechanical thickening for both PS and WAS, will be implemented. The gravity thickening provides operational flexibility to manage swings in primary sludge concentration, grease management, and partial thickening. Mechanical thickening ensures a 6% solids concentration for the R2E2 facilities. In addition, improvements to the thickened sludge pumping and piping were developed to eliminate the capacity issues associated with transfer of thickened solids to R2E2.

#### PHASED IMPLEMENTATION CONSIDERATIONS

Thickening is a critical operational bottleneck for NEW Water. A single phase that includes gravity thickener improvements, mechanical thickening improvements, and thickened sludge pumping improvements will be implemented. A pilot test of rotary drum thickening (RDTs) will be completed prior to design for comparison to gravity belt thickener (GBT) operation.



Potential Cost Range	\$14-21M
Target Year of Completion	2022
Operating Cost Impact	Increased R2E2 efficiency from higher thickened solids percentage



### **PROJECT DRIVERS** CAPACITY

 From industrial user growth at the GBF and growth at DPF

#### **ASSET RENEWAL**

 Existing mechanical thickeners will be replaced; the gravity thickeners will be rehabilitated

#### **M**&**O**

 A high degree of flexibility will be achieved for solids management

#### PROJECT TRIGGERS

• Online prior to 2025 Green Bay Packaging expansion

#### **PROJECT BENEFITS**

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- Positive energy balance impacts
- Increased R2E2 efficiency
- Improved primary sludge degritting performance

- New mechanical thickening
- Rehabilitation of four gravity thickeners
- Pumping and piping improvements



## FACILITY PLAN GBF Primary Sludge Degritting



#### COMPONENT DESCRIPTION

A key aspect of solids management prior to the R2E2 facilities is removal of grit material from the primary sludge. The existing primary sludge degritting facilities have reached the end of their useful life. A detailed comparison of continued sludge degritting versus influent grit removal was completed, and it was determined that a properly sized and designed primary sludge degritting facility was as effective as influent grit removal, for a significantly lower capital cost. Replacement of the existing facilities with state-of-the art facilities will be completed.

#### PHASED IMPLEMENTATION CONSIDERATIONS

The primary sludge degritting project was developed as part of the holistic evaluation for influent pumping capacity, screening, and grit removal. The primary sludge degritting project has flexibility to be completed at several points relative to the other screening and pumping projects.



Potential Cost Range	\$8-10M
Target Year of Completion	2023
Operating Cost Impact	Decreased maintenance cost from pump wear and grit clean-up throughout facility

# PROJECT DRIVERS

• Equipment has reached the end of its useful life

#### 0&M

• Current equipment difficult to maintain because of age

#### **PROJECT TRIGGERS**

• Aging equipment is at the end of useful life

#### PROJECT BENEFIT

 Improved degritting performance will protect down stream processes and reduce maintenance costs

- Renewal of sludge degritting equipment
- Miscellaneous renewal items



# FACILITY PLAN GBF Primary Clarifier Rehabilitation



#### COMPONENT DESCRIPTION

Primary clarifiers at the GBF play a critical role in overall facility capacity and R2E2 performance. The existing primary clarifier mechanisms are five decades old and need to be replaced. Recent primary clarifier mechanism failures have resulted in 25% reduction in operating capacity and months long outages as well as emergency repair costs. A previous clarifier rehabilitation study evaluated several alternatives for improvements, and identified the cost effective project to improve primary clarifier reliability and performance. In addition, hydraulic improvements have been added to the rehabilitation project to provide increased peak wet weather flow capacity.

#### PHASED IMPLEMENTATION CONSIDERATIONS

The rehabilitation project should be incorporated in the CIP in the next five years.



Potential Cost Range	\$14-20M
Target Year of Completion	2024
Operating Cost Impact	Increased reliability

# PROJECT DRIVERS

 Primary clarifiers are at the end of their useful life, as demonstrated by recent failures

#### CAPACITY

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 Hydraulic improvements needed to treat peak flows

### PROJECT TRIGGERS

- Aging primary clarifier infrastructure requires replacement
- Improved hydraulic capacity for peak flow treatment

### PROJECT BENEFITS

- Decreased maintenance costs
- Improved reliability for critical treatment infrastructure

- Replacement of primary clarifier mechanisms
- Addition of hydraulic modifications to allow direct feed of high flows to South Plant
- Miscellaneous renewal improvements



# FACILITY PLAN GBF North Final Clarifiers



#### COMPONENT DESCRIPTION

Final clarifiers are critical for permit compliance. The solids generated in the activated sludge process, where the majority of treatment occurs, are settled in the final clarifiers. Reliable, high functioning final clarifiers are a necessary part of wastewater treatment. A previous project identified final clarifier rehabilitation as a need for the GBF, and these projects need to be incorporated into the overall CIP as the clarifiers are about 50 years old. The North Final Clarifier project will replace aging infrastructure and improve facilities for increased capacity and permit compliance.

#### PHASED IMPLEMENTATION CONSIDERATIONS

The rehabilitation project should be incorporated in the CIP in the next five years.



Potential Cost Range	\$21-31M
Target Year of Completion	2024
Operating Cost Impact	Increased reliability

### PROJECT DRIVERS

• Reliable clarifiers are required to meet peak flow conditions

#### **ASSET RENEWAL**

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• Existing clarifiers are 50 years old

#### **REGULATORY COMPLIANCE**

 Without rehabilitation, there is an increased risk of not meeting permit requirements

#### PROJECT TRIGGERS

- Aging clarifier infrastructure requires replacement
- Improved TSS performance

#### PROJECT BENEFITS

- Decreased effluent TSS
- Improved reliability

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- Replacement of final clarifier mechanisms
- Miscellaneous renewal improvements



# FACILITY PLAN GBF Biosolids Storage

#### COMPONENT DESCRIPTION

Equipment reliability, solids characteristics, and landfill disposal options have evolved over the course of startup and operation of the R2E2 facilities. As is common with large infrastructure projects, there is often a need for a "debottlenecking" analysis to identify additional infrastructure required for operational stability. As part of the Facility Plan, biosolids storage after dewatering, prior to drying, was identified as an improvement that would stabilize liquids stream performance, provide the ability to incinerate a larger percent of the annual biosolids, and increase operational stability and reliability.

#### PHASED IMPLEMENTATION CONSIDERATIONS

Construction of biosolids handling and storage improvements should only be completed after the execution of the biosolids handling and storage evaluation and optimization project. The evaluation and optimization project will identify the root cause of some of the biosolids characteristic challenges observed that are site specific for NEW Water, and then develop a final solution customized for the R2E2 processed biosolids.



Potential Cost Range	\$13-19M
Target Year of Completion	2025
Operating Cost Impact	Decreased landfill disposal, improved liquid stream operation



## PROJECT DRIVERS

 Maximizes liquids capacity by limiting variable solids wasting operation

#### 0&M

 Reduces need for landfill disposal of solids and provides more operating flexibility

### PROJECT TRIGGER

 Completion of the biosolids handling and storage evaluation and optimization project

#### PROJECT BENEFITS

- Decreased reliance on landfill disposal during incineration maintenance periods
- Improved liquid stream operation stability and reliability

#### IMPROVEMENTS SUMMARY

 Provides for approximately 1-week of biosolids storage to increase O&M flexibility and manage costs



# FACILITY PLAN GBF Headworks and Pumping



Ragging is one of the largest maintenance issues at the GBF. Influent screening removes rags from the influent wastewater, and the influent screens at the GBF require replacement due to age and performance issues. In addition, the influent pump station requires expanded capacity to handle peak flow rates, and the influent screens need to be expanded by 50% to treat peak flow rates. To address the capacity and aging infrastructure concerns, a project was developed that adds influent pumping, adds two additional influent screens, and address several aging infrastructure needs.

#### PHASED IMPLEMENTATION CONSIDERATIONS

GBF screening and pumping improvements were developed as a holistic solution for NEW Water screening, grit, and pumping needs. The GBF screening and pumping should be completed prior to the sludge screening project and potentially at the same time as GBF primary sludge degritting. Prior to beginning the GBF screening project, an applied research effort may be completed to understand the need for full peak flow screening facilities.



Potential Cost Range	\$30-44M
Target Year of Completion	2025
Operating Cost Impact	Decreased maintenance cost associated with ragging



# PROJECT DRIVERS

• Peak flow capacity limitation for pumping and screening

#### ASSET RENEWAL

 Replaces Aging Equipment (Influent Pumps are over 50 years old)

#### **0&M**

 Maintenance impacts of limited screening capacity throughout GBF

### PROJECT TRIGGERS

- Verification of peak flow screening needs
- Urgent capacity and condition concerns

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- Improved performance of thickening unit processes
- Decreased ragging issues in GBF
- Achieve full pumping and screening of peak flow

- Replace four existing screens
- Add two additional screens
  and channels
- Influent pumping
  improvements
- Miscellaneous renewal items



## FACILITY PLAN GBF Aeration Basin Improvements



#### COMPONENT DESCRIPTION

Aeration basin modifications were developed for the GBF aeration basins to accomplish improved nutrient removal, improved settling, and decreased aeration demand. Process modeling identified a simple modification to the A2O process configuration as a feasible solution to achieve more nitrogen and total phosphorus removal, while also decreasing effluent total suspended solids and reducing aeration energy costs. Phased implementation to provide applied research testing of the configuration is recommended.

#### PHASED IMPLEMENTATION CONSIDERATIONS

**Phase I:** Applied research, conversion of South Basin to A2O with low DO operation

Phase II: Full plant implementation

**Phasing consideration:** Implement aeration basin modifications before blower improvements



Potential Cost Range	\$4-6M
Target Year of Completion	2029
Operating Cost Impact	Enables decreased aeration costs

### PROJECT DRIVERS

 Improved operability of aeration control

#### REGULATORY COMPLIANCE

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• TP and TN removal, as well as improved TSS removal

#### ENERGY EFFICIENCY

 Reduced energy use and associated costs

### PROJECT TRIGGER

• Full implementation after demonstration testing in one aeration basin

#### PROJECT BENEFITS

- Potential for a net energy reduction of 10% for NEW Water
- Decreased effluent TP, TN and TSS

- Improved performance
- Diffuser modifications to reduce the number of diffusers
- Dropleg improvements
- Mixed liquor recycle pumping



# FACILITY PLAN GBF Blowers

#### COMPONENT DESCRIPTION

Aeration basin modifications were developed for the GBF aeration basins to accomplish improved nutrient removal, improved settling, and decreased aeration demand. To fully realize the decreased aeration demand, and thus the 10% reduction in energy costs for NEW Water, new aeration blowers/ compressors are required. While they operate well, the current blowers were installed in 1975 and are oversized. A solution was developed that replaces the four existing blowers with five, small blowers that better meet NEW Water's airflow ranges. In addition, aging infrastructure related to piping, power supply, and control valves are addressed in this project.

#### PHASED IMPLEMENTATION CONSIDERATIONS

**Phasing consideration:** Implement aeration basin modifications before blower improvements.

The blower project can be broken into two potential phases. The first phase would install two blowers to handle 90% of the loading conditions. This initial project would have a significant payback. The second phase would address aging infrastructure and install the remaining three blowers.



Potential Cost Range	\$22-33M
Target Year of Completion	2029
Operating Cost Impact	Decreased aeration; 10% whole system energy savings



# PROJECT DRIVERS

• Existing blowers were installed in 1975 and are at the end of their useful life

#### 0&M

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• Due to their age, blowers are becoming harder to maintain

#### **ENERGY EFFICIENCY**

• Existing blowers are oversized and so inefficient

#### PROJECT TRIGGER

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 Blower replacement should occur after aeration basin modifications and testing is completed

#### PROJECT BENEFITS

- Decrease in NEW Water energy use of 10%
- Improved resilience for backup power and blower operation

- Replacement of all blowers at the GBF
- Electrical and piping
  improvements
- Miscellaneous renewal improvements



# FACILITY PLAN GBF South Plant Clarifiers



#### COMPONENT DESCRIPTION

Final clarifiers are critical for permit compliance. The solids generated in the activated sludge process, where the majority of treatment occurs, are settled in the final clarifiers. Reliable, high functioning final clarifiers are a necessary part of wastewater treatment. A previous project identified final clarifier rehabilitation as a need for the GBF, and these projects need to be incorporated into the overall CIP. The South Final Clarifier project will replace aging infrastructure and improve facilities for increased capacity and permit compliance.

#### PHASED IMPLEMENTATION CONSIDERATIONS

The rehabilitation project should be incorporated in the CIP in the next five to ten years.



Potential Cost Range	\$8-11M
Target Year of Completion	2029
Operating Cost Impact	Increased reliability

## PROJECT DRIVERS

• Reliable clarifiers are required to meet peak flow conditions

#### ASSET RENEWAL

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 Existing clarifiers are 50 years old

#### **REGULATORY COMPLIANCE**

• Without rehabilitation, there is an increased risk of not meeting permit requirements

#### PROJECT TRIGGERS

- Aging clarifier infrastructure requires replacement
- Improved TSS performance

### PROJECT BENEFITS

- Decreased effluent TSS
- Improved reliability

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- Replacement of final clarifier mechanisms
- Miscellaneous renewal improvements including RAS Pumps



# FACILITY PLAN GBF Sludge Screening



#### COMPONENT DESCRIPTION

Ragging is a challenge in many areas of the GBF. The area most impacted, and creating a capacity impact, is solids handling. From thickening through incineration, there are multiple issues with clogging and equipment wear created by rags. Influent screening improvements at the GBF and the DPF should reduce the accumulation of rags in the solids process. As a potential solution beyond influent screening, to ensure that the solids processing is not impacted by ragging, screening of the solids (waste activated sludge and primary sludge) will be considered.

#### PHASED IMPLEMENTATION CONSIDERATIONS

The solids screening project was developed as part of the holistic evaluation for influent pumping capacity, screening, and grit removal. Implementation of solids screening should be after completion of the DPF and GBF influent screen projects, which will allow for a reassessment of the need for solids screening facilities. A pilot project should be completed as part of the applied research project to assess the impact and operability of solids screening equipment.



Potential Cost Range	\$9-13M
Target Year of Completion	2030
Operating Cost Impact	Decreased O&M expenses, ragging in R2E2 for increased efficiency, and reduced downtime

## PROJECT DRIVERS

 Ragging in the solids processing facilities limits the achievable capacity of the R2E2 project

#### 0&M

• Ragging creates a significant labor requirement

### PROJECT TRIGGER

 After completion of the GBF and and DPF influent screenings projects and only if there are still operational issues with ragging

### PROJECT BENEFIT

- Improved thickening operation efficiency
- Improved R2E2 operational efficiency

#### IMPROVEMENTS SUMMARY

 Sludge screening for all WAS and all PS

