Facilities Plan and Plant Improvements

Project Update

Wastewater Utility Commission Meeting

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Agenda

- Facilities Plan
- Conveyance Projects
- Treatment Plant Projects
- Energy Efficiency and Sustainability
- Future Needs
- Current Project Status
- Recommendations

Facilities Plan

Basis for Planning

Village of Caledonia Requests Additional Capacity

- IGA Requires Planning Be Initiated When Additional Capacity Requested
- Capacity Allocated in the Facilities Plan for the Treatment Plant
- Capacity Allocated in the Conveyance System Based on Previous Modeling

20 Years Since Last Facilities Plan

Mount Pleasant TID 5

Aging Equipment – Last Major Upgrade and Expansion in 2005

Maintain Permit Compliance

Basis for Planning (continued)

Request for Capacity Triggered Planning under the Intergovernmental Agreement

Re-initiated Technical Advisory Committee

- Representatives from All Contributing Communities
- Meetings Held Approximately Monthly

Major Evaluations of Conveyance System and Treatment Plant

Facilities Plan Background

- Required by DNR to Identify Required Improvements
  - Conveyance System
  - Wastewater Treatment Plant
- Completed and Submitted for Review by DNR and SEWRPC
- Comments Response Required

Conveyance Projects

Conveyance Projects

– 2020-2025

- Pike River Lift Station, Forcemain, and Flow Equalization

– 2020-2030

- TID 5 Interceptor Sewer (Mt. Pleasant)

– 2025-2030

- Equalization at Central Lift Station (Caledonia)
- Equalization at Hoods Creek Lift Station (Caledonia)

– 2030-2035

- Equalization at Lift Station No. 1
- Additional Equalization at Caledonia 1

– 2035-2040

- Additional Equalization at Lift Station 31 (Caledonia)
- Equalization at Chicory Road (Racine/Mt. Pleasant)
- Equalization at Main and Goold
- Miscellaneous Interceptor and Trunk Sewer Upsizing

Conveyance Projects

- 2020-2025
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  - Equalization at Main and Goold
  - Miscellaneous Interceptor and Trunk Sewer Upsizing

Prioritized due to Peak Flow Exceedances

Treatment Plant Projects

Plant Improvements

Categorized By:

- Remedy Deficiency – Past Useful Life or Deficient in Performance
- Further Evaluation – Potential Improvements in Performance or Efficiency
- Future Improvements – Lesser Priority or Longer-Term Needs

Alternatives Identified By:

- Unit Process Number
- Structure Number
- Sequential Number

Alternatives Evaluated

Treatment Plant Area	Number of Alternatives
General	11
Equalization	3
Administration Building	6
Chemical Area	2
Laboratory	7
Preliminary Treatment	2
Primary Treatment	9
Aeration System	10
Final Clarifiers	9
UV Disinfection and Outfall	7
Solids Handing	5
Digestion and Biogas	9

Treatment Plant Recommendations

Prioritize Current Deficiency Projects

Identify Studies Required for Evaluation

Consider Future Projects as the Need Arises or Funding is Available

Initiated Technical Memoranda and Preliminary Design for Nine Items

Treatment Plant Major Issues

Plant Area	Description
Equalization	Upgrades to improve O&M and peak flow management
Preliminary Treatment	Minor improvements
Primary Treatment	Access and equipment upgrades
Secondary Treatment	New aeration blower system; RAS/WAS improvements
Phosphorus Removal	Retain existing; Bio-P is feasible with pros and cons.
Anaerobic Digestion	Cover and roofing improvements
Solids Management	Piping upgrades.
Digester Gas System	New biogas conditioning and CHP System
Disinfection	UV equipment replacement
WWTP Facilities	Misc. upgrades to buildings, HVAC, roofs; CNH site.

Facility Plan Needs

Facility Plan Needs

Facility Plan Needs & Alternatives

Facility Plan Needs

Energy Efficiency and Sustainability

Energy Efficiency Opportunities

- Blowers
- Aeration System
  - Diffusers
  - Aeration Control
- Digester Gas Utilization
- UV Disinfection
- Solar Panels
  - Administration Building Roof
  - Over Effluent Structure
  - Buffer Zone for Future Plant Expansion

Blower Type	Typical Turndown Range (from maximum capacity)	Typical Blower Efficiency
Multistage Centrifugal	20% to 40%	55% to 70%
Single-Stage Integrally Geared	50 to 60%	70% to 78% (dual guide vanes)
High Speed Direct Drive (Turbo)	35 to 55%	65% to 75%
Positive Displacement (Rotary Lobe)	40 to 60%	45% to 65%

Condition*	Required Power Production kW	Cost	Area Dimensions ft
Maximum Month	1002	$4,010,000	300 x 600
75th Percentile	890	$3,558,000	280 x 560
50th Percentile	824	$3,296,000	270 x 540
25th Percentile	769	$3,075,000	260 x 520
Minimum Month	710	$2,839,000	250 x 500

Sustainability Opportunities

- ENVISION Framework
  - Five Categories
  - 64 Evaluation Questions
- Potential Opportunities
  - Renewable Fuel
    - Optimal Use of Digester Gas
    - Solar Field on CHN Site
  - Energy Efficiency
    - Blowers
    - Aeration Process Control
    - UV Disinfection
    - Energy Efficient motors - plant
- Potential Opportunities (continued)
  - Clean Air
    - Minimize Digester Gas Flaring
    - Reduced Engine Emissions
  - Other Sustainable Practices
    - Trenchless Construction
    - Energy Efficient Motors – Lift Stations
    - Green Roofs
    - LED Lighting
    - Green Infrastructure

Future Needs

Contributing Communities Future Capacity Requests

Population Projections Identified Adequate Capacity

Requests Received for Future Capacity in Excess of Current Allocation

Community	2016-2018 Average MGD[1]	Current Flow Allocation Average Day[2] MGD	Requested/Projected 2040 Flow Average Day MGD
Caledonia	3.60	5.13[3]	9.75[4]
Mount Pleasant	6.06	11.49[3]	19.60[5]
Somers			
Elmwood Park	0.10		
North Bay	0.07		
Sturtevant	1.02	1.78	3.00[6]
Wind Point			
Racine	11.28	17.06	17.06[7]
Total	**22.13**	**35.46**	**49.41**

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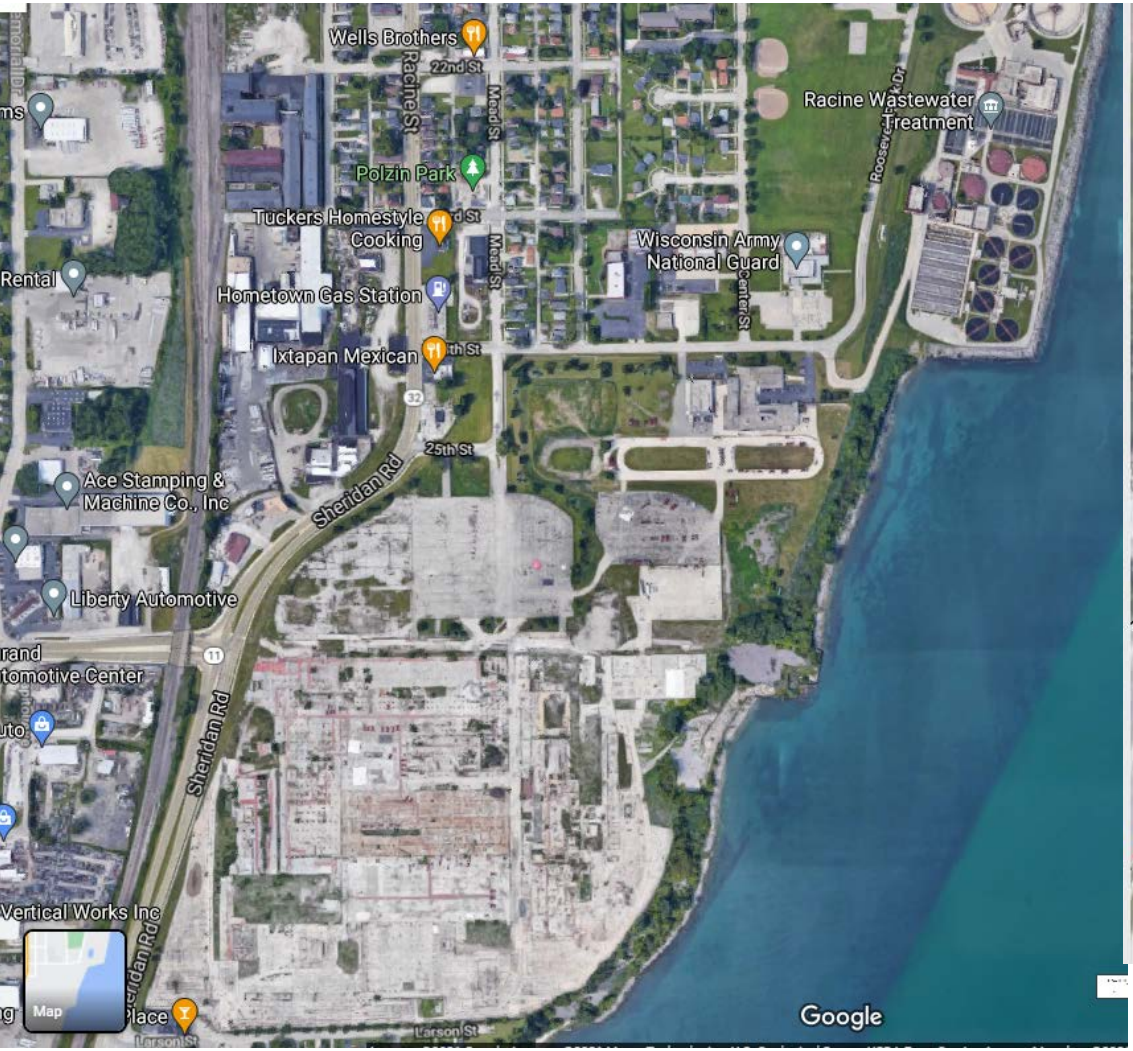
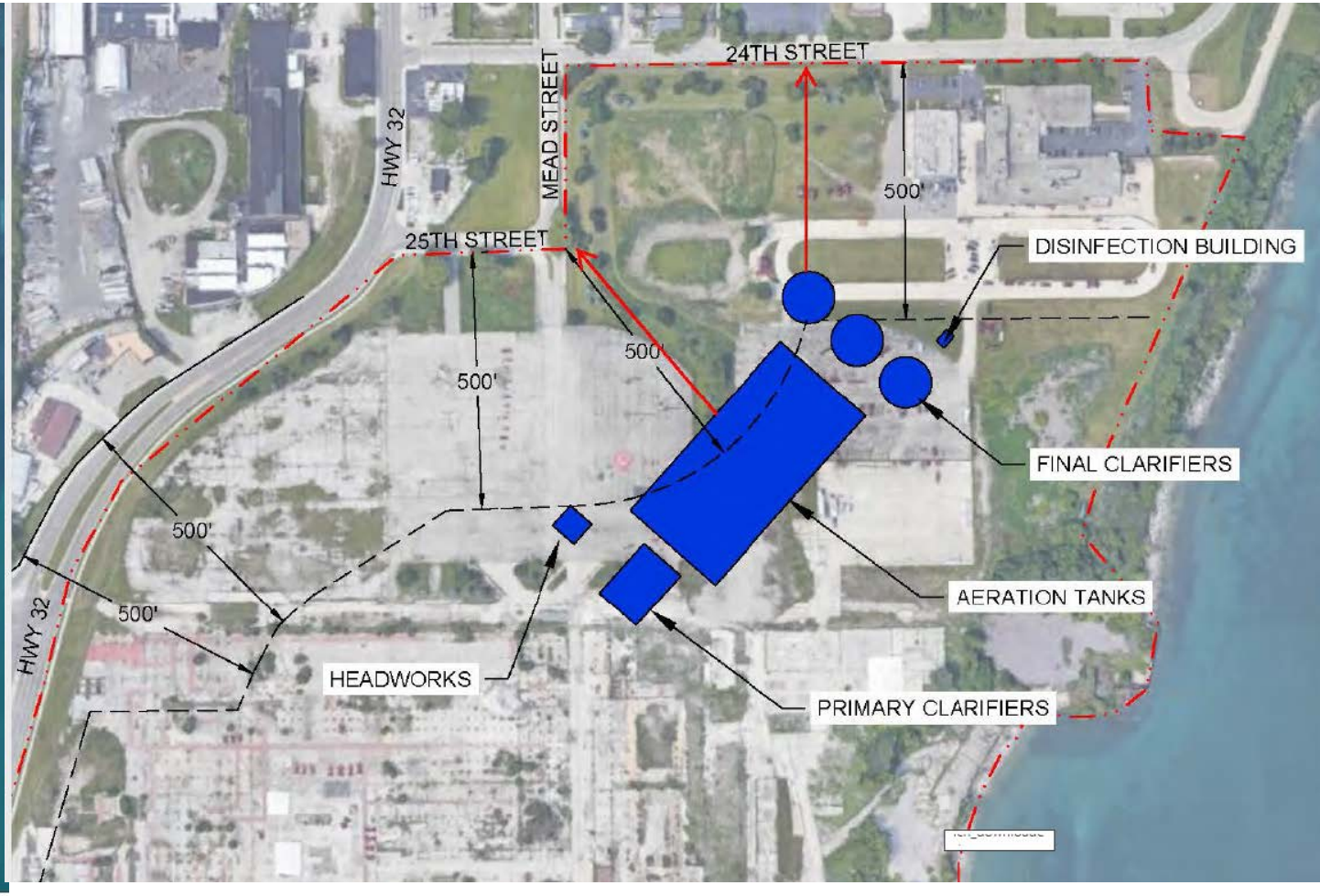
Future Growth Plant Site

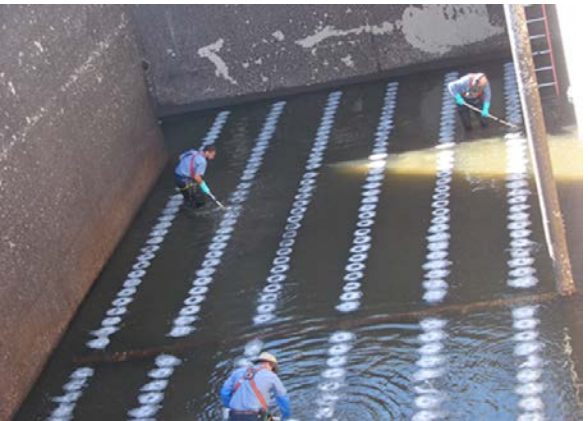




Current Project Status

Initial Wastewater Treatment Plant Projects

- Identified Several Priority Projects
- Plant Staff Determined Many Could Be Done Internally or Deferred
- Prioritized Blowers, Aeration System, and Digester Gas Utilization
    - Several Components 50 Years Old
    - Opportunity for Energy Efficiency
    - Opportunity for Improved Process Control
    - Redundancy and Reliability for Critical System
- Diffuser Efficiency Evaluated
- Digester Gas Fuelled Engine/Generators



Actions Completed to Date

- Investigation into Digester Cover Condition and Modifications by Plant Staff
- Initial Conceptual Evaluations for Effluent Sampler and Multi-Use Building
- Aeration Diffusers Being Replaced
- Evaluation of Alternative Engine/Generators
  - Vendor Contacts
  - Site Visits and Calls
  - Defined Size for Selected Vendors
- Evaluation of Alternative Blowers
  - Evaluated Direct Drive Versus Internally Geared
  - Highest Efficiency with Internally Geared Turbo Blowers
  - Held Workshop to Review Options and Construction Sequencing

Evaluation of Blowers, Engine/Generators, and Engine Drives

- Existing System Has Three Engine Driven Blowers
  - Provides Redundancy for Digester Gas Use
  - Air Permitting Issues
- Held a Second Workshop
  - Identified Alternative Combinations of Blowers Engine/Generators, and Blower Drivers
  - Considered Engine Driven Blowers

Engine #5	Engine #4	Engine #3	Engine #2	Engine #1
440 H.P. 935 RPM Natural / Bio. Model L5108G S.N. C-93532/1	300 H.P. Electric Model - S.N.-	675 H.P. 935 RPM Natural / Bio. Model – L7042G S.N. – C-93531/1	380 H.P. 795 RPM Natural / Bio. Model L5108G S.N. C-93839/1	500 H.P. Electric Model S.N. 295635
Manufactured in 92? Installed: 1/12/94	Installed: 1976	Manufactured in 92? Installed: 3/14/94	Shipped 7/25/97 Installed:1998	Installed: 1976
Overhauled: 1 top end (About $32,000) Total Hrs. – 59,925 (N.G. - 10,077 hrs) (D.G. – 59,925 hrs)	Cleaned & adjusted Rings (L&S) 2003 Total Hrs. – 53,264	Overhauled: 3 top end (About $32,000) Total Hrs. -125,245 (N.G. – 6965 hrs) (D.G. – 118,280 hrs)	Overhauled: 1 top end (About $32,000) Total Hrs. – 45,185 (N.G. – 8,070 hrs) (D.G. – 37,115 hrs)	Overhauled: Never Total Hrs. – 12,197
11/11/11 24 New pushrods, plugs, adjusted valves	4/12/17 Badger reinsulated and rebuilt 8/1/18 New MCC	Front main seal 2010 1/19/2013 Overhauled 121,223 total hours 1/18/19 New Heads		8/1/18 New MCC
Roots Blower New 1992 1633 RAS WispAir S.N. 51585 RP68 935 RPM Input 14.08 Pressure 9,600 CFM at 8.5 psig 24" Discharge Pipe	Roots Blower Installed 3/1976/1968 Type SM RAS S.N. 295634 4160 Volt, 33.3 Amps 720 RPM Input Pressure - 6,900 CFM at 8.2 psig 18" Discharge Pipe	Roots Blower 1840 RAS-J WispAir S.N. 37914-5 935 RPM Input 14.08 Pressure Size – 1840 Overhauled: 6/23/03 15,000 CFM at 8.5 psig 24" Discharge Pipe	Roots Blower Installed 1997 1633-JV RAS S.N. LR97-749 935 RPM Input Pressure -14.08 9,600 CFM at 8.2 psig 18" Discharge Pipe	Roots Blower 1633 RAS-JV Wispair 18 X 40 S.N. 37914 720 RPM 4160 Volt, 58 Amps Overhauled: 5/14/04 11,000 CFM at 7 ½ psig 24" Discharge Pipe

Proposed Configuration

Engine #5
440 H.P.
935 RPM
Natural / Bio.
Model L5108G
S.N. C-93532/1

Manufactured in 92?
Installed: 1/12/94

Overhauled: 1 top end
(About $32,000)
Total Hrs. – 59,925
(N.G. - 10,077 hrs)
(D.G. – 59,925 hrs)

11/11/11
24 New pushrods, plugs, adjusted valves

Roots Blower
New 1992
1633 RAS WispAir

S.N. 51585 RP68

935 RPM
Input 14.08 Pressure

9,600 CFM at
8.5 psig

24" Discharge Pipe

New DG/NG engine/generator

Delete

Engine #4
300 H.P.

Electric
Model -
S.N.-

Installed: 1976

Cleaned & adjusted
Rings (L&S) 2003
Total Hrs. – 53,264

4/12/17 Badger reinsulated and rebuilt

8/1/18 New MCC

Roots Blower
Installed 3/1976/1968
Type SM RAS

S.N. 295634
4160 Volt, 33.3 Amps
720 RPM
Input Pressure -

6,900 CFM at
8.2 psig

18" Discharge Pipe

Leave as is for now.

Leave as is for now.

Engine #3
675 H.P.
935 RPM
Natural / Bio.
Model – L7042G
S.N. – C-93531/1

Manufactured in 92?
Installed: 3/14/94

Overhauled: 3 top end
(About $32,000)
Total Hrs. -125,245
(N.G. – 6965 hrs)
(D.G. – 118,280 hrs)

Front main seal 2010

1/19/2013 Overhauled
121,223 total hours
1/18/19 New Heads

Roots Blower
1840 RAS-J WispAir
S.N. 37914-5
935 RPM
Input 14.08 Pressure
Size – 1840
Overhauled: 6/23/03

15,000 CFM at
8.5 psig

24" Discharge Pipe

Replace with biogas/NG engine

New – keep coupled – higher capacity?

Engine #2
380 H.P.
795 RPM
Natural / Bio.
Model L5108G
S.N. C-93839/1

Shipped 7/25/97
Installed:1998

Overhauled: 1 top end
(About $32,000)
Total Hrs. – 45,185
(N.G. – 8,070 hrs)
(D.G. – 37,115 hrs)

Roots Blower
Installed 1997
1633-JV RAS

S.N. LR97-749
935 RPM
Input Pressure -14.08

9,600 CFM at
8.2 psig

18" Discharge Pipe

Replace with biogas/NG engine – similar to 3 do first

New blower - larger

Engine #1
500 H.P.

Electric
Model
S.N. 295635

Installed: 1976

Overhauled: Never

Total Hrs. – 12,197

8/1/18 New MCC

Roots Blower
1633 RAS-JV Wispair
18 X 40
S.N. 37914
720 RPM
4160 Volt, 58 Amps
Overhauled: 5/14/04

11,000 CFM at
7 ½ psig

24" Discharge Pipe

Leave as is.

Leave as is.

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Recommendations

Recommendations and Conclusions

- Aeration Diffuser Replacement Completed
- Develop Blowers Competitive Selection Process
- Include Engine Drives with Blowers
- Biddable Construction Documents by September 2022

Questions?

Thank you.

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