Appendix C

Alternative Evaluation Technical Memorandum

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Memorandum

To	Kristen Lundeen, City of Mequon – City Engineer	Page 1
CC		
Subject	Alternative 6a Technical Memorandum – East Trunk Sewer and EGA System Improvements – City of Mequon East Trunk Sewer	
From	Kurt Plaumann	
Date	September 17, 2015	

Introduction

For the following alternatives the July 17-18 2014 storm event was used for the analysis. Larger events may occur and the system alternatives may not address additional surcharging or basement back-ups beyond the modeled storm event. An eleven foot clearance from the high water level in the sanitary sewer or containment within the crown of the sanitary sewer was generally the goal for evaluating the potential for surcharging to cause basement back-ups.

The City of Mequon's (City) East Trunk Sewer (ETS) system has experienced surcharged conditions and the need to bypass pump at several locations to minimize basement flooding during wet weather events which exceed the capacity of the existing sanitary system. In an effort to identify the challenges and recommend solutions, the City has engaged AECOM in association with GAI Consultants, Inc. to further the efforts of the Sanitary Sewer System Evaluation (AECOM, January 2011) by performing additional investigation and analysis to address the issue. The scope also included coordinating additional flow monitoring of the lower portion of the sanitary trunk sewer system and recalibrating the hydraulic model to more closely correspond to the conditions observed by the City in this area of the system.

Based on the obtained information, AECOM prepared and presented to the City on July 10, 2015 a series of seven potential alternatives to address the problem, ranging from temporary bypass pumping to a "deep tunnel" relief sewer. The purpose of the presentation meeting was to review the options with the City that were considered and arrive at what was considered by the project team to be the most effective alternative. One of the technical memorandums, submitted separately, addressed the recommended alternative identified as Alternative 6a.

This memorandum introduces the alternatives that were discussed during the July 10th meeting. Each of the alternatives included the re-calibration of the existing model to the recent flow meter data completed along with preliminary routing analysis, costs and constructability. Each alternative would have various levels of protection for sewer surcharging and capabilities to serve the EGA. Respective to these solutions would be wide ranges of costs, depending on the level of protection offered. No alternative studied would guarantee or eliminate the possibility of future basement back-ups due to localized capacity causes not addressed in the trunk sewer system improvements.

Individualized exhibits and write-ups for each of the seven alternatives were reviewed at the aforementioned meeting and have been included as attachments to this document for reference. A Summary of Alternatives table is also attached which compares characteristics, construction costs and total costs for each of the seven alternatives as well as the recommended Alternative 6a.

Based on discussion with staff and evaluating the cost to benefit analysis, the following conclusions were determined:

1. Alternative 1 is a bypass system only with physical improvements to improve the level of service for the ETS. This alternative was conceived during the planning process as a temporary measure while more significant system improvements were identified, designed, and implemented. This alternative was considered because it would provide a mechanical solution to what is otherwise a manual and labor intensive effort for City Staff during wet weather events. However, at this time Alternative 1 is not being considered further due to the temporary nature and estimated total cost of $32,500 to $130,000 to implement. Additionally, since there are several other potential pump bypass locations that need to be monitored and potentially acted on, this would only eliminate one of those sites from full action during a rain event and would also require some monitoring and maintenance during the event (such as inspection to confirm the system was running, mobilization to connect a generator in the event of a power failure, and other reasons) but also on a regular, perhaps weekly basis just as the City maintains other pump stations throughout the sanitary sewer system. The cost of the bypass pump arrangement was deemed not cost effective enough at this time since additional improvements would need to be made within a few years making the Alternative 1 bypass obsolete or less in demand.

2. Alternative 2 proposed a 48-inch diameter sanitary storage/relief sewer extending from the connection point to the Milwaukee Metropolitan Sewerage District (MMSD) at the southern boundary of the City to the existing force main outfall at Zedler Lane. It would reduce some surcharging of the existing system flows, but conveyance and storage characteristics were not sufficient to mitigate the impact of neither future infill development flows nor the additional flow projected from the East Growth Area (EGA). Larger size relief sewers were also reviewed, but did not decrease the surcharging sufficiently and for these reasons was deemed unacceptable and no longer under consideration because it did not address the EGA and infill flows.

3. Alternative 3 is an expansion of the improvements envisioned under alternative 2 which proposes that the 48-inch diameter sanitary storage/relief sewer from Alternative 2 be extended further north up to Donges Bay Road. It also included a new 12-inch sanitary relief sewer extending from the 48-inch sanitary storage/relief sewer at Donges Bay Road north and west to the intersection of Sunnydale Lane and Oriole Drive to help increase conveyance capacity that is needed through this area which experiences significant surcharging and would still experience some level of surcharging with the implementation of the 48-inch relief sewer without this additional relief sewer component.

   This alternative was evaluated under future infill flows and was found to be sufficient to manage those future flows. The alternative as shown did not directly include the additional flows of the EGA, but was evaluated for its ability to manage those flows and it was determined that the storage capabilities of the system as shown were sufficient to mitigate those flows but the 12-inch diameter sewer in Port Washington Road is not likely to be able to convey both the relief flows from the Hidden Reserve subdivision area and would either

need to be increased in size or the EGA flows would need to be connected directly to the 48-inch relief sewer.

This alternative was determined by the project team to show significant promise for correcting some of the core deficiencies of the system including reducing bypassing at Brookdale Drive and Clover Lane under the modeled event and accommodating the EGA and future development but was not fully satisfactory as shown. The EGA connection needed to be more thoroughly evaluated and there was also further discussion on modifying the 12-inch gravity sewer both because disturbing the new pavement in Port Washington Road was not desirable and the size needed to be re-evaluated due to the potential connection of the EGA to this line. Because of these factors, the consensus with the project team was that a route through the Hidden Reserve subdivision area, while more disruptive during construction to the local residents, placed the improvement at the location of a high incidence of basement flooding and would provide an opportunity to replace older infrastructure with a new, larger sewer, that would also reduce inflow and infiltration flows in this area. This option was deemed viable and was set aside for further consideration and ultimately determined to contain components that were desirable to move forward as part of the recommended alternative as discussed in the associated Alternative 6a Technical Memorandum, submitted separately.

4. Alternative 4 is comprised of a 48-inch gravity sanitary storage/relief sewer extending from the connection point to the MMSD at the southern boundary of the City to approximately Eastbrook Drive and then west to Lift Station E (LSE). The sewer was designed to be deep enough to accept all LSE flows and allow LSE and Lift Station P (LSP) to be abandoned and potentially Lift Station F (LSF) in the future by extending the line northward to Liebau Road or Dorothy Place in the future. This alternative would reduce surcharging, basement backups and bypassing along the existing trunk sewer from LSE to the MMSD connection point for the modeled event except for some surcharging near the connection point associated with the MMSD Interceptor Sewer (MIS). However, due to the extremely deep reaches of the sewer, construction costs are estimated to be about $35.5 million without connecting sewer or force main to the EGA. Including engineering, legal and administrative expenses of approximately 30%, the total cost for this alternative is about $46.2 million. Due to the extremely high cost, this alternative was rejected.

5. Alternative 5 is similar to Alternative 4 and comprised of a shallower 48-inch gravity sanitary storage/relief sewer extending from the connection point to the MMSD at the southern boundary of the City to a point about 1,400 feet north of Eastbrook Drive to divert about 40% of the LSE flow. This alternative also includes a smaller diameter gravity service line from the EGA to the northern end of the 48-inch relief sewer. This alternative would reduce surcharging (except near the MIS connection), basement backups and bypassing along the existing trunk sewer south of LSE, reduces flows to be stored and pumped by LSE and allows elimination of LSP. Construction costs are estimated to be about $32 million. Including engineering, legal and administrative expenses of approximately 30%, the total cost for this alternative is about $41.6 million. Due to the extremely high cost, this alternative was rejected.

6. Alternative 6 is a similar option to Alternative 3 providing four sub-option routes for the 48-inch sanitary storage/relief sewer relief sewer, EGA lift station with or without storing EGA flows and a force main to convey flow to the sanitary storage/relief sewer; however, the 12-inch sanitary sewer extending beyond Donges Bay Road was not included in this

alternative because, although there was some minor surcharging of the sanitary sewer line in the area of the Hidden Reserve subdivision, it was not extensive and was primarily impacted under future infill development evaluation scenarios in the model. Bypassing was reduced at Clover Lane and Brookdale Drive with minor surcharging (≤ 1 foot) surcharging through Hidden Reserve and near the MIS connection with this alternative but was deemed necessary to further evaluate in conjunction with Alternative 3 as an acceptable alternative. As presented in the Alternative 3 discussion, it is important that this area be reviewed closely because of the history of basement backups and it was the consensus of the project team that the recommended solution should include improvement in this area of the sanitary system.

7. Alternative 7 is a combination of improvements presented in Alternatives 4 and 5, comprised of a 48-inch gravity sanitary storage/relief sewer extending from the connection point to the MMSD at the southern boundary of the City to a point approximately 1,400 feet north of Eastbrook Drive and a separate connecting line west to LSE as well as a gravity sewer line to service EGA flow. This alternative would reduce surcharging (except near MIS connection), basement backups and bypassing along the existing trunk sewer for the modeled event and allows elimination of LSE. Construction costs are estimated to be about $36.8 million - $41.7 million, depending on which EGA option is selected. Including engineering, legal and administrative expenses of approximately 30%, the total cost for this alternative ranges from about $47.8 million to $54.2 million. Due to the extremely high cost, this alternative was rejected.

Final Conclusions

The consensus of the project team was to move forward with a “hybrid” alternative incorporating elements from both Alternatives 3 and 6 as well as additional components to provide an increased level of protection to Lift Station E. This new Alternative 6a is discussed in a separate memorandum that was developed for the purpose of presenting the recommended alternative to the City of Mequon Utilities Committee.

Summary of Alternatives

ALT NO.	DESCRIPTION	ADVANTAGES	DISADVANTAGES	COST OF CONSTRUCTION	TOTAL COST (w/30% BURDEN)	CONCLUSIONS
1	Bypassing wet-weather sanitary flow to storm sewer at Clover Lane & Brookdale Drive. Utilizes sanitary MH/flow meter/piping/storm MH under gravity conditions; valve vault/wet well/piping/pumps w/o gravity flow	• Semi-automatic bypassing • Reduces basement backup occurrence at Clover Lane and Brookdale Drive • Reduces City staff efforts during wet weather events	• Temporary measure • Environmentally unsound practice • Does not include EGA service • Does not address Lift Station E (LSE) • Risks due to mech/elec failure • Lengthy permitting effort • Ability to implement gravity bypass not yet determined	$25,000 - $100,000	$32,500 - $130,000	Alternative 1 is not being considered further due to the temporary nature and estimated total cost of $32,500 to $130,000 to implement. Additionally, since there are several other potential pump bypass locations that need to be monitored and potentially acted on, this would only eliminate one of those sites from full action during a rain event and would also require some monitoring and maintenance during the event. The cost of the bypass pump arrangement was deemed not cost effective at this time since additional improvements would need to be made within a few years making the Alternative 1 bypass obsolete or less in demand.
2	New 48-inch gravity relief sewer from Zedler Lane to MIS discharge	• Less pipe than other alternatives • Least expensive alternative (except Alt 1 – neither of which fully meets the goals of the project)	• Does not address aging infrastructure including LSE • Cannot manage EGA & future flows • Does not fully meet the goals of the project	$6.4 million	$8.3 million	This alternative would limit some surcharging of the existing system flows, but conveyance and storage characteristics were not sufficient to mitigate the impact of neither future infill development flows nor the additional flow projected from the East Growth Area. Larger size relief sewers were also reviewed, but did not decrease the surcharging sufficiently and for these reasons was deemed unacceptable and no longer under consideration because it did not address the EGA and infill flows.
3	New 48-inch gravity relief sewer from Donges Bay west of Pt. Washington Road to Milwaukee Metropolitan Sewerage District (MMSD) Municipal Interceptor Sewer (MIS) discharge and 12-inch sanitary sewer from Sunnydale & Oriole to 48-inch at Pt. Washington Road	• Reduces surcharging in trunk sewer downstream of LSE except near MIS for the modeled event • Bypassing reduced at Clover Lane and Brookdale Drive for the modeled event • Includes ability to serve the EGA • Several alignments to MIS available	• Does not address aging infrastructure including LSE •	$12.2 million w/o gravity or force main from EGA included in current alternative as shown	$15.9 million	Disturbing the new pavement in Port Washington Road was not desirable and the size needed to be re-evaluated due to the potential connection of the East Growth Area to this line. Alternative 3 was ultimately determined to contain components that were desirable to move forward as part of the recommended alternative as discussed in the associated Alternative 6a Technical Memorandum.
4	New 48-inch gravity relief sewer from LSE to MIS discharge (“deep tunnel” alternative)	• Reduces surcharging in trunk sewer downstream of LSE except near MIS for the modeled event • Bypassing reduced at Clover Lane and Brookdale Drive for the modeled event • Potential to eliminate several lift stations • Eliminates recurring LS maintenance costs for discontinued lift stations • Potential for EGA service by gravity sewer	• Long construction duration • Requires some trunk line segments to be constructed deeper to connect system components • Higher future sewer line O&M costs • Poor cost effectiveness when comparing option of keeping lift stations in use after 60-yr service life	$35.5 million w/o gravity or force main from EGA included in current alternative as shown	$46.2 million	Due to the extremely deep reaches of the sewer, construction costs are estimated to be about $35.5 million without the connecting sewer or force main to the EGA. Including engineering, legal and administrative expenses of approximately 30%, the total cost for this alternative is about $46.2 million. Due to the extremely high cost, this alternative was rejected.
5	Similar shallower configuration to Alternative 4 which extends to Glen Oaks to relieve 40% flow from LSE east tributary line but does not connect to LSE	• Reduces surcharging in trunk sewer downstream of LSE except near MIS for the modeled event • Bypassing reduced at Clover Lane and Brookdale Drive for the modeled event • Limits flow to LSE to reduce infrastructure stress • Allows elimination of LSP and reduces associated O&M costs	• Long construction duration • Does not eliminate LSE or LSF • Still very deep in spots and not significantly less costly than Alt 4	$32.0 million	$41.6 million	Due to the extremely high cost, this alternative was rejected.

Summary of Alternatives

ALT NO.	DESCRIPTION	ADVANTAGES	DISADVANTAGES	COST OF CONSTRUCTION	TOTAL COST (w/30% BURDEN)	CONCLUSIONS
		• Potential for EGA service by gravity sewer				
6	Similar to Alt 3 without the 12-inch gravity sewer, designed to work in conjunction with it	• Reduces surcharging in trunk sewer downstream of LSE except near MIS for the modeled event • Bypassing reduced at Clover Lane and Brookdale Drive for the modeled event • Includes EGA service • Less surface disturbance than Alt 3	• Results in minor surcharging in Hidden Reserve subdivision which may not be acceptable • Does not address aging infrastructure including LSE • Potential odor control may be needed in EGA due to storage • Maintenance costs for LS in EGA • Construction costs for LS in EGA • 3 miles of force main from EGA	$12.4 million - $21.6 million, depending on EGA option selected	$16.1 million - $28.1 million, depending on EGA option selected	The consensus of the project team is that the recommended solution should include improvement in the Clover Lane and Brookdale Drive and Hidden Reserve areas of the sanitary system.
6a	Similar to Alt 6 with 24-inch to 27-inch diameter replacement (not relief) sewer between Sunnydale Lane and Donges Bay Road through the Hidden Reserve subdivision area and diversion of LSF force main from current connection to LSE to proposed EGA lift station on Port Washington Road at Dorothy Place	• Reduces surcharging in trunk sewer downstream of LSE except near MIS for the modeled event • Bypassing reduced at Clover Lane and Brookdale Drive for the modeled event • Reduces inflow and infiltration (I/I) via new construction in Hidden Reserve Subdivision • Reduces basement backups • Addresses LSE infrastructure impacts, reduces surcharging and bypass flows at LSE	• Potential odor control may be needed in EGA due to storage • (Option 1) • Maintenance of lift station in EGA (Options 1 and 2) • Cost of new lift station/storage • Over 3 miles of force main (Options 1 and 2)	$17.1 million - $21.3 million, depending on EGA option selected	$22.3 million - $27.7 million, depending on EGA option selected	The recommended Alternative 6a incorporates the most effective benefits from Alternatives 3 and 6 as the basis of design, which limits basement flooding during wet weather events which exceed the capacity of the existing sanitary system. Since this alternative also provides many other advantages, such as reducing chances of trunk sewer surcharging, required bypassing, inflow and infiltration, moderates pumping demands on the aging infrastructure at Lift Station E, and improves the overall level of service for the system, the consensus of the project team was to move forward with this “hybrid” alternative incorporating elements from both Alternatives 3 and 6 as well as the additional components discussed in the Alternative 6a Tech Memo to provide an increased level of protection to Lift Station E.
7	Designed to work in conjunction with Alt 4 utilizing 48-inch gravity relief from MIS to LSE and extending to Glen Oaks Lane to service EGA force main or gravity sewer	• Reduces surcharging in trunk sewer downstream of LSE except near MIS for the modeled event • Bypassing reduced at Clover Lane and Brookdale Drive for the modeled event • Storage in EGA allows smaller gravity sewer to convey EGA flows • Addresses aging infrastructure including LSE	• Most costly alternative • Potential odor control may be needed in EGA due to storage • Maintenance costs for LS in EGA • Construction costs for LS in EGA	$36.8 million - $41.7 million, depending on EGA option selected	$47.8 million - $54.2 million, depending on EGA option selected	Due to the extremely high cost, this alternative was rejected.

Alternatives Overview

City of Mequon East Trunk Sewer

Alternative 1 – Bypass Only

Alternative 1 consists of bypassing flows from the existing sanitary sewer to the storm sewer to help prevent possible basement backups and sanitary surcharging. This alternative will involve adding a new bypass manhole in conjunction with adding a possible storm sewer manhole with piping between the manholes to convey the overflow from the sanitary system into the storm system. Within the sanitary manhole a flow meter will be installed. The bypass manhole will eliminate the need for City staff to visually monitor the water level within the sanitary manhole. A back-flow preventer will also be installed within the bypass to prevent storm water from entering the sanitary system.

Alternative 1 Notes

- Gravity bypass located at Clover Lane and Brookdale Drive
- Would be considered by DNR and MMSD as only a temporary measure until improvements to contain sewerage are completed.
- The cost to add the bypass manhole with a flow meter and appropriate piping is as follows:

  Manhole with flow meter = $10,000
  Additional piping and manhole to make sanitary to storm connection = $8,000
  Mobilization and other misc. costs including possible storm manhole = $7,000
  Total Cost = $25,000

- If a gravity bypass system is not possible due to the HGL within the storm a cost for a pump option is as follows:

  Pump Station with valve vault, wet well, piping and pumps = $90,000
  Mobilization and other misc. costs = $10,000
  Total Cost = $100,000

Alternative 1 Advantages

- Least expensive option
- Can be used in conjunction with other alternatives including I/I removal
- Least disturbance
- Allows flow to be bypassed automatically without visual inspections during storm events
- Basement backups reduced

Alternative 1 Disadvantages

- This is only a temporary solution to avoid City staff from having to monitor the bypass during storm events until permanent infrastructure is installed to address surcharging and basement backups.
- Not environmentally sound practice
- Does not reduce flows to Lift Station E

Alternatives Overview

- Does not address East Growth Area
- Does not eliminate surcharging within system due to undersized pipe upstream of the bypass
- Risk of failure/Mechanical failure
- Permitting may be an issue; past experience for DNR and MMSD bypassing has been on extreme events and part of long term solutions implemented.

Legend

- By-Pass Manhole with Flow Meter
- Lift Stations
- Manholes
- Gravity Main
- Force Main
- Abandoned
- East Growth Area

ADVANTAGES

- LEAST EXPENSIVE OPTION [COST=$32,500 - $130,000]
- LEAST DISTURBANCE
- INCLUDES METER TO RECORD BYPASS FLOW VOLUME

DISADVANTAGES

- DOES NOT ADDRESS AGING INFRASTRUCTURE INCLUDING LIFT STATION E
- DOES NOT PREVENT SURCHARGING OR BACK-UPS
- DOES NOT ADDRESS EGA

T
C
W
F
E
P
Q
O
ST. MARY'S
CONCORDIA UNIVERSITY
DONGES BAY RD
BROOKDALE DR
CLOVER LN
43
57
167
PS

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City of Mequon
Ozaukee County, Wisconsin

Alternative I
By-Pass at Clover Ln and Brookdale Dr

N

0 2,500 ft

gai consultants

AECOM

Alternatives Overview

Alternative 2 – Increase Conveyance from Zedler Lane to MIS Connection

Alternative 2 consists of adding new 48" sanitary sewer from Zedler Lane (discharge point of long force main from Lift Station E) to the Metropolitan Interceptor System (MIS) connection to help increase conveyance and provide in-line storage before discharging into the MIS. The revised hydraulic model for this option indicates that with the relief sewer, the existing sewer flows at capacity without surcharging except at the downstream end of the system near the MMSD connection point which is primarily due to the tailwater in the MIS and is common to all alternatives. However, when infill flows for future development and the East Growth Area were included, the system becomes unacceptably surcharged. Assuming that these future flows are realized, this alternative is not viable.

Alternative 2 Notes

- New gravity sewer from intersection of Zedler Lane and Brookdale Drive to MIS connection
- Approximately 5,300 feet of 48" pipe and 18 manholes needed
- The cost to add the manholes and appropriate piping is as follows:

18 manholes at $25,000/MH = $450,000

5,300 feet of 48" pipe at $1,200/LF = $6,360,000

Total Cost = $6,810,000

Alternative 2 Advantages

- Less pipe and cost than all other alternatives except Alternative 1

Alternative 2 Disadvantages

- Does not reduce flows to Lift Station E
- Cannot manage East Growth Area and future flows
- Does not directly address basement backups documented in subdivisions to the west

Legend

- New Gravity Sewer
- Lift Stations (PS)
- Manholes
- Gravity Main
- Force Main
- Abandoned
- East Growth Area

ADVANTAGES

- LESS COSTLY THAN OTHER ALTERNATIVES
- MINOR LAND DISTURBANCE AS COMPARED WITH OTHER ALTERNATIVES

DISADVANTAGES

- DOES NOT ADDRESS AGING INFRASTRUCTURE INCLUDING LIFT STATION E
- CANNOT MANAGE EGA & FUTURE FLOWS

TOTAL COST IS $8.3 MILLION

- APPROXIMATELY 18 MANHOLES
- APPROXIMATELY 5300 FEET OF 48" PIPE

T
C
W
ST. MARY'S
CONCORDIA UNIVERSITY
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E
P
Q
43
57
167
DONGES BAY RD
BROOKDALE DR
ZEDLER LN
48"
48"

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City of Mequon
Ozaukee County, Wisconsin

Alternative 2
Increase Conveyance from Zedler Ln to MMSD Connection

N

0 2,500 ft

gai consultants

AECOM

Alternatives Overview

Alternative 3 – Inline Storage and Conveyance

Alternative 3 consists of adding new 48" sanitary sewer from the MIS connection to MH 0430-087 located west of the intersection of Donges Bay Road and Port Washington Road and new 12" sanitary sewer from the 48" sanitary at Donges Bay Road north to the intersection of Sunnydale Lane and Oriole Drive to help increase conveyance and provide in-line storage. Modeling results, which include East Growth Area (EGA) flow, show that increasing the conveyance from Donges Bay Road to the MIS connection will alleviate the restrictions in the system due to undersized pipe and allow the flow upstream to properly convey without surcharging, except at the downstream end of the system near the MMSD connection point which is primarily due to the tailwater in the MIS and is common to all alternatives. Several optional layouts can be analyzed if this alternative is chosen to determine which is the most cost effective. Versions of this alternative were designed to work in conjunction with Alternative 6 which should be referenced therein.

Alternative 3 Notes

- New 48" gravity sewer from manhole 0430-087 located west of the intersection of Donges Bay Road and Port Washington Road to MIS connection
- New 12" gravity sewer from 48" gravity sewer at Donges Bay Road north to intersection of Sunnydale Lane and Oriole Drive
- Approximately 8,200 feet of 48" pipe and 25 manholes needed
- Approximately 5,250 feet of 12" pipe and 15 manholes needed
- Bypass at Clover Lane and Brookdale Drive is eliminated
- The cost to add the manholes and appropriate piping is as follows:

  40 manholes at $25,000/MH = $1,000,000

  5,250 feet of 12" pipe at $250/lf = $1,312,500

  8,200 feet of 48" pipe at $1,200/LF = $9,840,000

  Total Cost = $12,152,500*

  * Cost does not include gravity sewer or force main to convey EGA flow (See Alternative 6 write-up)

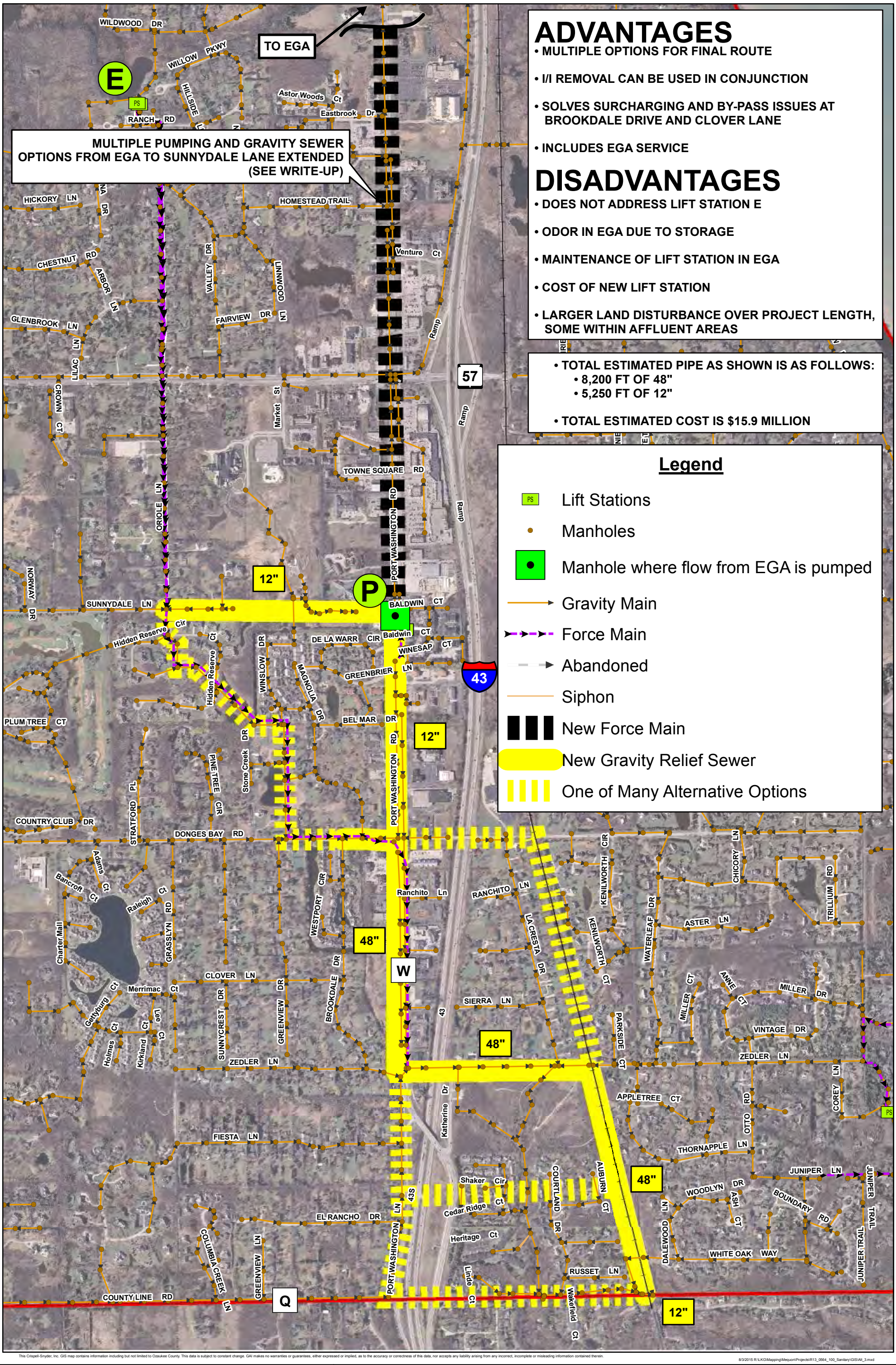
Alternative 3 Advantages

- Downstream improvements sized to receive future EGA flows
- Multiple options for final route
- I/I removal can be used in conjunction and may reduce pipe size
- Reduces surcharging (except at the downstream end of the system near the MMSD connection point which is primarily due to the tailwater in the MIS and is common to all alternatives), basement backups and bypassing at Brookdale Drive and Clover Lane for the modeled storm event

Alternative 3 Disadvantages

Alternatives Overview

- Does not reduce flows to Lift Station E
- Potential odor control may be needed in EGA due to storage
- Maintenance of lift station in EGA
- Cost of new lift station



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City of Mequon
Ozaukee County, Wisconsin

Alternative 3
East Trunk Sewer
Inline Storage and Conveyance

N

0 1,000 ft

gai consultants

AECOM

Alternatives Overview

Alternative 4 – Inline Storage and Conveyance (Deep Tunnel)

Alternative 4 consists of a gravity sewer from the Lift Station E to Metropolitan Interceptor System (MIS) connection. This alternative has been referred to as the "deep tunnel" alternative since some pipe is approximately 60 feet deep. The depth was determined based on eliminating Lift Station E and conveying the flow utilizing gravity sewer instead of force main. Due to the extreme depth construction will be slow and costly with only a few contractors in the area that can do the work. The model shows a 48" pipe will be adequate to convey the flows but due to concerns with minimal grade in some areas along with the expansion of the East Growth Area (EGA) a 54" pipe might make more sense with a limited cost increase. One of the main benefits of this option is the potential to eliminate several lift stations including E & P and possibly F in the future. Another major benefit is the possibility of adding an extension from the "deep tunnel" in the future to serve the EGA.

Alternative 4 Notes

- Trenchless technology such as microtunneling will need to be utilized for this alternative
- Portions of the deep sewer are flat with a minimum grade of 0.034%
- Approximately 19,000 feet of 48"pipe and 68 manholes needed
- The cost to add the manholes and appropriate piping is as follows:

  25 manholes (Ave. Depth =35') at $75,000/MH = $1,875,000

  23 manholes (Ave. Depth =45') at $130,000/MH = $2,990,000

  20 manholes (Ave. Depth =60') at $200,000/MH = $4,000,000

  19,000 feet of 48" pipe at $1,400/LF = $26,600,000

  Total Cost = $35,465,000

- Advantages
  - Reduces all surcharging in trunk line south of Lift Station E, except at the downstream end of the system near the MMSD connection point which is primarily due to the tailwater in the MIS and is common to all alternatives for the modeled storm event
  - Reduces backups and bypassing along the trunk sewer south of Lift Station E for the modeled storm event
  - Allows the elimination of Lift Stations E, P and possibly F in the future if desired
  - May be able to eliminate three lift stations east of I-43
  - Eliminates recurring operation and maintenance costs of lift stations
  - Allows for potential future gravity sewer from the EGA

- Disadvantages
  - Costly
  - May take several years to complete
  - Portions of existing sewer will need to be relayed to connect to deep tunnel
  - Requires reconstruction of a recently reconstructed section of Port Washington Road

Alternatives Overview

- Operation and maintenance cost with new deep and flat sewer is higher than that of smaller diameter sewer at an increased slope
- Cost benefit analysis shows that after 60 years the "deep tunnel" alternative is $30 Million dollars more costly than keeping the existing lift stations (see following life cycle cost analysis) – does not appear cost effective compared to maintaining the current lift stations and practices

60-YEAR LIFE CYCLE COST ANALYSIS OF ALTERNATIVE 4 VERSUS KEEPING LIFT STATIONS E and P																			
Lift Station E Elimination Sewer							$	34,834,250			Lift Station E Capital							$	4,678,972
Decommission Pebble Valley PS							$	10,000			Lift Station E O&M							$	487,098
Decommission Tallgrass PS							$	35,000			Lift Station P Capital							$	367,988
Interceptor Sewer O&M (19,800 LF @ $5/LF and 6.2325 PW Factor)							$	363,526			Lift Station P O&M							$	154,986
Easement Acquisition (30 FT wide x 1,500 LF @ $1/SF)							$	162,750											
Interceptor Sewer Lining at 50 Years ($190/LF for 50%)							$	957,323											
Interceptor Sewer Salvage Value (0.0695x)							$	(1,065,231)											
Interceptor Sewer Lining Salvage Value							$	(187,177)											
						TOTAL	*$*	*35,110,441*									*TOTAL*	*$*	*5,689,043*
										Δ =	*$*	*(29,421,397)*	*-517%*					

Pump Stations E and P Life Cycle Costs for 20, 50, and 60-years

Alternatives Overview

Lift Station E - New Pump Station in 1968										
#1 Pump replaced in 2013			$22,000							
#2 Pump new VFD in 1999, new starter in 2004, new seal in 2008										
#3 Pump Rebuilt in 1997, Replaced in 2012										
#4 Pump Replaced in 2009			$31,000							
New Control Panel in 2000			$2,300							
3 new VFD's in 2013										
Force Mains Replaced in 2001 (PVC)										
LIft Station 2013 Structural Value			$ 2,040,000							
Lift Station 2013 Electrical / Controls Value			$ 1,254,000		10 MGD Lift Station					
Lift Station 2013 Pump Value			$ 106,000							
Year	Year from 1968	Year from 2008	Year from 2013	Year from 2027	Action	2013 Value	FW Value (3% Inflation)	PW Value (4.6% Interest Rate)		
2015	47	7	2		Pump #2 Rebuild	$ 11,000	$ 11,670	$ 10,666		
2016	48	8	3		Pump #4 Rebuild	$ 11,000	$ 12,020	$ 10,503		
2019	51	11	6		Pump #3 Rebuild	$ 11,000	$ 13,135	$ 10,028		
2020	52	12	7		Pump #1 Rebuild	$ 11,000	$ 13,529	$ 9,875		
2022	54	14	9		Pump #2 Rebuild	$ 11,000	$ 14,353	$ 9,575		
2023	55	15	10		Pump #4 Rebuild	$ 11,000	$ 14,783	$ 9,429		
2026	58	18	13		Pump #3 Rebuild	$ 11,000	$ 16,154	$ 9,003		
2027	59	19	14	0	Lift Station Replacement	$ 3,400,000	$ 5,142,805	$ 2,740,037		
2027	59	19	14	0	Force Main Replacement	$ 1,500,000	$ 2,268,885	$ 1,208,840		
2033	65	25	20	6	20-Year Pump Station Structural Salvage Value	N/A	N/A	$ (1,348,912)		
2033	65	25	20	6	20-Year Force Main Salvage Value	N/A	N/A	$ (991,847)		
2033	65	25	20	6	20-Year Pump/Control/Generator Salvage Value	N/A	N/A	$ (699,436)	$ 977,762	20 YEAR
2034	66	26	21	7	Pump Rebulid (4)	$ 53,000	$ 98,596	$ 38,344		
2041	73	33	28	14	Pump Rebuild (4)	$ 53,000	$ 121,260	$ 34,422		
2048	80	40	35	21	Pump / Control Replacement (4)	$ 1,360,000	$ 3,826,853	$ 792,926		
2055	87	47	42	28	Pump Rebuild (4)	$ 53,000	$ 183,417	$ 27,740		
2062	94	54	49	35	Pump Rebuild (4)	$ 53,000	$ 225,580	$ 24,903		
2063	95	55	50	36	50-Year Pump Station Structural Salvage Value	N/A	N/A	$ (377,544)		
2063	95	55	50	36	50-Year Force Main Salvage Value	N/A	N/A	$ (277,606)		
2063	95	55	50	36	50-Year Pump/Control/Generator Salvage Value	N/A	N/A	$ (157,310)	$ 4,123,831	50 YEAR
2069	101	61	56	42	Pump / Control Replacement (4)	$ 1,360,000	$ 7,119,074	$ 573,653		
2073	105	65	60	46	60-Year Pump Station Structural Salvage Value	N/A	N/A	$ (188,773)		
2073	105	65	60	46	60-Year Force Main Salvage Value	N/A	N/A	$ (138,804)		
2073	105	65	60	46	60-Year Pump/Control/Generator Salvage Value	N/A	N/A	$ (503,394)	$ 4,678,972	60 YEAR
					Initial Capital Cost	$ -				
					20-Year Additional	$ 977,762				
					50-Year Additional	$ 3,146,069				
					60-Year Additional	$ 555,142				

Alternatives Overview

Lift Station P									
Installed in 1970									
Force Main is 427 LF of PVC									
No Backup Generator									
LIft Station 2013 Structural Value			$ 120,000						
Lift Station 2013 Electrical / Controls Value			$ 60,000						
Lift Station 2013 Pump Value			$ 20,000						
Year	Year from 1970	Year from 2013	Year from 2030	Action	2013 Value	FW Value (3% Inflation)	PW Value (4.6% Interest Rate)		
2013	43	0		Pump Rebuild	$ 10,000	$ 10,000	$ 10,000		
2020	50	7		Pump Rebuild	$ 10,000	$ 12,299	$ 8,977		
2027	57	14		Pump Rebuild	$ 10,000	$ 15,126	$ 8,059		
2030	60	17		New Lift Station and Install Standby Generator ($50K)	$ 250,000	$ 413,212	$ 192,369		
2030	60	17		New Force Main	$ 64,000	$ 105,782	$ 49,246		
2033	63	20	3	20-Year Pump Station Structural Salvage Value	N/A	N/A	$ (83,756)		
2033	63	20	3	20-Year Force Main Salvage Value	N/A	N/A	$ (13,959)		
2033	63	20	3	20-Year Pump/Control/Generator Salvage Value	N/A	N/A	$ (49,960)	$ 120,976	20 YEAR
2037	67	24	7	Pump Rebuild	$ 10,000	$ 20,328	$ 6,908		
2044	74	31	14	Pump Rebuild	$ 10,000	$ 25,001	$ 6,201		
2051	81	38	21	Pump / Control Replacement	$ 80,000	$ 245,983	$ 44,535		
2058	88	45	28	Pump Rebuild	$ 10,000	$ 37,816	$ 4,997		
2063	93	50	33	50-Year Pump Station Structural Salvage Value	N/A	N/A	$ (24,985)		
2063	93	50	33	50-Year Force Main Salvage Value	N/A	N/A	$ (13,325)		
2063	93	50	33	50-Year Pump/Control/Generator Salvage Value	N/A	N/A	$ (14,806)	$ 288,177	50 YEAR
2065	95	52	35	Pump Rebuild	$ 10,000	$ 46,509	$ 4,486		
2072	102	59	42	Pump / Control Replacement	$ 80,000	$ 457,600	$ 32,219		
2073	103	60	43	60-Year Pump Station Structural Salvage Value	N/A	N/A	$ (13,484)		
2073	103	60	43	60-Year Force Main Salvage Value	N/A	N/A	$ (7,191)		
2073	103	60	43	60-Year Pump/Control/Generator Salvage Value	N/A	N/A	$ (30,140)	$ 367,998	60 YEAR
				Initial Capital Cost	$ 10,000				
				20-Year Additional	$ 110,976				
				50-Year Additional	$ 167,201				
				60-Year Additional	$ 79,821				

Legend

- New Gravity Sewer
- Lift Stations (PS)
- Manholes
- Gravity Main
- Force Main
- Abandoned
- East Growth Area

ADVANTAGES

- ELIMINATION OF LIFT STATIONS EAST OF I--43
- ELIMINATION OF LIFT STATIONS E AND P
- ELIMINATES REOCCURRING OPERATION AND MAINTENANCE COSTS OF LIFT STATIONS
- ALLOWS FUTURE SEWER FROM EGA

DISADVANTAGES

- EXTREMELY HIGH INITIAL COST
- MAY TAKE SEVERAL YEARS TO COMPLETE
- PORTIONS OF EXISTING SEWER WILL NEED TO BE RELAYED TO CONNECT TO DEEP TUNNEL
- MAINTENANCE OF SEWER IN DEEP AREAS

TOTAL COST AND QUANTITIES

- APPROXIMATELY 68 MANHOLES
- APPROXIMATELY 19,000 FEET OF 48" PIPE
- TOTAL COST = $46.2 MILLION

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DONGES BAY RD
BROOKDALE DR
ZEDLER LN

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City of Mequon
Ozaukee County, Wisconsin

Alternative 4 (Deep Tunnel)
Gravity Sewer from MIS
Connection to Lift Station E

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0 2,500 ft

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Alternatives Overview

Alternative 5 – Inline storage and conveyance where eastern flow to Lift Station E is intercepted and conveyed to MIS connection

Alternative 5 consists of a gravity sewer from a location east of lift station E to the connection to the Metropolitan Interceptor System (MIS). Alternative 5 is similar to Alternative 4 but does not eliminate Lift Station E. Instead it only conveys about 40% of the flow from the east away from Lift Station E into the new sewer on Port Washington Road. This reduces the depth and size of the pipe needed to convey the flow to the MIS connection. Flow from downstream of the Oriole Lane force main is allowed to discharge into the new gravity sewer at Donges Bay Road. Benefits of this option include the potential to eliminate Lift Station P and the possibility of adding an extension in the future to serve the East Growth Area (EGA) by gravity.

Alternative 5 Notes

- The depth of the new gravity sewer down Port Washington Road is shallower than Alternative 4 and can still serve the EGA by gravity.
- Trenchless technology such as microtunneling will still need to be utilized for this alternative, but for a reduced length.
- Bypass volume at Clover Lane and Brookdale Drive is eliminated for the modeled event
- Approximately 22,600 feet of pipe and 77 manholes needed
- The cost to add the manholes and appropriate piping is as follows:

  20 manholes (Ave. Depth =20') at $25,000/MH = $500,000

  20 manholes (Ave. Depth =30') at $40,000/MH = $800,000

  37 manholes (Ave. Depth =40') at $105,000/MH = $3,885,000

  17,200 feet of 48" pipe at $1,400/LF = $24,080,000

  2,700 feet of 24" pipe at $600/LF = $1,620,000

  2,700 feet of 18" pipe at $400/LF = $1,080,000

  Total Cost = $31,965,000

- Advantages
  - Reduces most surcharging, except at the downstream end of the system near the MMSD connection point which is primarily due to the tailwater in the MIS and is common to all alternatives for the modeled event
  - Reduces backups and bypass in exiting sewers south of Lift Station E along the trunk sewers
  - Reduces flows to be stored and pumped by Lift Station E
  - Allows for future gravity sewer from the EGA
  - Can still eliminate three lift stations east of STH 43 if desired
  - Elimination of Lift Station P
  - Eliminates recurring operation and maintenance costs of lift stations

- Disadvantages
    - Costly
    - May take several years to complete
    - Does not eliminate Lift Stations E or F
    - Requires reconstruction of a recently reconstructed section of Port Washington Road
    - Although shallower than Alternative 4 the pipe will still be extremely deep in some locations and microtunneling will still need to be utilized which does not result in much of a cost difference than Alternative 4

Legend

- New Gravity Sewer
- Lift Stations
- Manholes
- Gravity Main
- Force Main
- Abandoned
- East Growth Area

ADVANTAGES

- ELIMINATION OF LIFT STATIONS EAST OF I--43
- ELIMINATION OF LIFT STATION P
- ELIMINATES REOCCURRING OPERATION AND MAINTENANCE COSTS OF LIFT STATIONS
- ALLOWS FOR FUTURE SEWER FROM EGA

DISADVANTAGES

- EXTREMELY HIGH INITIAL COST
- MAY TAKE SEVERAL YEARS TO COMPLETE
- PORTIONS OF EXISTING SEWER WILL NEED TO BE RELAYED TO CONNECT TO DEEP TUNNEL
- MAINTENANCE OF SEWER IN DEEP AREAS

TOTAL COST AND QUANTITIES

- APPROXIMATELY 77 MANHOLES
- APPROXIMATELY 17,200 FEET OF 48" PIPE
- APPROXIMATELY 2,700 FEET OF 24" PIPE
- APPROXIMATELY 2,700 FEET OF 18" PIPE
- TOTAL COST = $41.6 MILLION

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FLOW FROM EAST TO BE DIVERTED TO MIS CONNECTION
DONGES BAY RD
BROOKDALE DR
ZEDLER LN
48"
48"
PS

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City of Mequon
Ozaukee County, Wisconsin

Alternative 5

Inline Storage and Conveyance where eastern flow to Lift Station E is intercepted and conveyed to MIS Connection

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Alternatives Overview

Alternative 6 – EGA Storage and Lift Station to In-line Storage and Conveyance

Alternative 6 was developed to address the future flows from the East Growth Area (EGA) as well as provide in-line storage and improve conveyance to eliminate flow restrictions within the system. Four options were looked at to work in conjunction with Alternative 3, which has a 48" gravity system starting at Donges Bay Road to the Metropolitan Interceptor System (MIS) connection and with or without a tributary 12" gravity system from the intersection of Sunnydale Lane and Oriole Drive to the 48" sewer at the intersection of Port Washington Road and Donges Bay Road. Modeling results for Alternative 3 show that increasing the conveyance from Donges Bay Road to the MIS connection will alleviate the restrictions in the system due to undersized pipe and allow the flow upstream to properly convey without surcharging for the modeled event. Without the tributary 12" gravity sewer, modeling results indicate minor (1 ft or less) surcharging of sewer near the upstream end of the modeled system. This surcharging is attributable to assigned infill flow in the hydraulic model. If future conditions warrant, the 12" sewer could be constructed as a second phase of the work.

One benefit of this alternative is avoiding a costly deep tunnel beyond Donges Bay Road and replacing it with a less expensive force main. A major disadvantage of this alternative is the fact that it does not address the aging infrastructure north of Donges Bay Road including Lift Station E.

Four options to achieve the desired hydraulic conditions are identified below.

Alternative 6 Notes

- New Gravity sewer from Donges Bay Road to MIS connection (Same as Alternative 3)
- Bypass volume at Clover Lane and Brookdale Drive is eliminated for the modeled event

- **Option 1 Cost with wet weather storage in EGA with small lift station to convey dry weather flows is as follows:**

  25 manholes at $25,000/MH = $625,000

  8200 feet of 48" pipe at $1,200/LF = $9,840,000

  14,050 feet of 4" force main at $100/LF = $1,405,000

  Storage in EGA = $4,500,000

  Small Lift Station = $200,000

  Total Cost =$16,570,000*

- **Option 2 Cost with no storage in EGA with large lift station sized for dry and wet weather flows is as follows:**

  25 manholes at $25,000/MH = $625,000

  8200 feet of 48" pipe at $1,200/LF = $9,840,000

  14,050 feet of 4" force main at $100/LF = $1,405,000

Large Lift Station = $500,000

Total Cost =12,370,000*

- **Option 3 Cost with wet weather storage in EGA and gravity sewer to MIS connection is as follows:**

  65 manholes at $25,000/MH = $1,625,000

  14,050 feet of 12" pipe at $250/LF = $3,512,500

  8200 feet of 48" pipe at $1,200/LF = $9,840,000

  Storage in EGA = $4,500,000

  Total Cost =19,447,500*

- **Option 4 Cost with no storage in EGA and gravity sewer to MIS connection is as follows:**

  65 manholes at $25,000/MH = $1,625,000

  8200 feet of 48" pipe at $1,200/LF = $9,840,000

  14,050 feet of 24" pipe at $600/LF = $8,430,000

  Total Cost =19,895,000*

* Optional 12" gravity sewer line cost is determined as follows:

5,250 feet of 12" pipe at $250/lf = $1,312,500

15 manholes at $25,000/MH = $375,000

Total Additional Cost =$1,687,500

- Advantages
  - Includes flow from future EGA service sewer
  - Reduces surcharging and bypassing at Brookdale Drive and Clover Lane for the modeled event
  - Less land disturbance than other options
  - I/I reduction can be used in conjunction
  - Addresses future sewer from EGA

- Disadvantages
  - Potential need for odor control in the EGA if the storage option is implemented (options 1 and 3)
  - Maintenance of lift station in EGA (options 1 and 2)
  - Cost of new lift station/storage
- Does not reduce flows to Lift Station E
  - 3 Miles of force main (options 1 and 2)

Legend

- EGA Storage Lift Station
- Manhole where flow from EGA is pumped
- New Force Main
- New Gravity Sewer
- Lift Stations
- Manholes
- Gravity Main
- Force Main
- Abandoned
- East Growth Area

ADVANTAGES

- LESS LAND DISTURBANCE THAN OTHER OPTIONS
- I/I REDUCTION CAN BE USED IN CONJUNCTION
- INCLUDES EGA SERVICE
- SOLVES SURCHARGING AND BY-PASS ISSUES AT BROOKDALE DRIVE AND CLOVER LANE

DISADVANTAGES

- ODOR IN EGA DUE TO STORAGE
- MAINTENANCE OF LIFT STATION IN EGA
- COST OF NEW LIFT STATION
- DOES NOT ADDRESS LIFT STATION E

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MULTIPLE PUMPING AND GRAVITY SEWER OPTIONS FROM EGA TO DONGES BAY ROAD (SEE WRITE-UP)

E

167

MEQUON RD

57

P

DONGES BAY RD

48"

ZEDLER LN

48"

Q

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City of Mequon
Ozaukee County, Wisconsin

Alternative 6
Flow from EGA Stored and Pumped
Inline Storage and Conveyance

N

0 2,500 ft

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transforming ideas into reality

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Alternatives Overview

Alternative 7 – EGA Storage and Lift Station to In-line Storage and Conveyance

Alternative 7 was developed to address the future flows from the East Growth Area (EGA) as well as provide in-line storage and improve conveyance to eliminate flow restrictions within the system. Four options were looked at to work in conjunction with Alternative 4, which has a gravity system starting east of Lift Station E and just south of Glen Oaks Lane on Port Washington Road to the Metropolitan Interceptor System (MIS) connection. This alternative includes a portion of Alternative 4 where the gravity sewer is utilized from the MIS connection to Lift Station E. The benefit of this alternative is that it allows the elimination of Lift Stations E and P.

Alternative 7 Notes

- New force main or gravity sewer from East Growth Area to east of Lift Station E
- New Gravity sewer from Lift Station E to MIS connection (Same as Alternative 4)
- Bypass volume at Clover Lane and Brookdale Drive is eliminated for the modeled event

- **Option 1 Cost with wet weather storage in EGA with small lift station to convey dry weather flows is as follows:**

  25 manholes (Ave. Depth =35') at $75,000/MH = $1,875,000

  23 manholes (Ave. Depth =45') at $130,000/MH = $2,990,000

  20 manholes (Ave. Depth =60') at $200,000/MH = $4,000,000

  19,000 feet of 48" pipe at $1,400/LF = $26,600,000

  7,000 feet of 4" force main at $100/LF = $700,000

  Storage in EGA = $4,500,000

  Small Lift Station = $200,000

  Total Cost =$40,865,000

- **Option 2 Cost with no storage in EGA with large lift station sized for dry and wet weather flows is as follows:**

  25 manholes (Ave. Depth =35') at $75,000/MH = $1,875,000

  23 manholes (Ave. Depth =45') at $130,000/MH = $2,990,000

  20 manholes (Ave. Depth =60') at $200,000/MH = $4,000,000

  19,000 feet of 48" pipe at $1400/LF = $26,600,000

  7,000 feet of 8" force main at $120/LF = $840,000

  Large Lift Station in EGA = $500,000

  Total Cost =$36,805,00

Alternatives Overview

- **Option 3 Cost with wet weather storage in EGA and gravity sewer to MIS connection is as follows:**

  25 manholes (Ave. Depth =35') at $75,000/MH = $1,875,000

  23 manholes (Ave. Depth =45') at $130,000/MH = $2,990,000

  20 manholes (Ave. Depth =60') at $200,000/MH = $4,000,000

  19,000 feet of 48" pipe at $1,400/LF = $26,600,000

  7,000 feet of 12" pipe at $250/LF = $1,750,000

  Storage in EGA = $4,500,000

  Total Cost =$41,715,000

- **Option 4 Cost with no storage in EGA and gravity sewer to MIS connection is as follows:**

  25 manholes (Ave. Depth =35') at $75,000/MH = $1,875,000

  23 manholes (Ave. Depth =45') at $130,000/MH = $2,990,000

  20 manholes (Ave. Depth =60') at $200,000/MH = $4,000,000

  19,000 feet of 48" pipe at $1,400/LF = $26,600,000

  7,000 feet of 24" force main at $600/LF = $4,200,000

  Total Cost =$39,665,000

- Advantages
  - Reduces bypassing/surcharging south of Lift Station E along the main trunk sewer for the modeled event except near the connection point as discussed previously
  - Smaller pipe needed downstream due to storage in EGA (options 1 and 3)
  - Addresses future sewer from EGA
  - Addresses aging infrastructure such as Lift Station E
  - I/I reduction can be used in conjunction

- Disadvantages
  - Potential need for odor control in the EGA if the storage option is implemented (options 1 and 3)
  - Maintenance of lift station in EGA
  - Cost of new lift station/storage
  - Somewhat costly due to deep gravity sewer from MIS connection to Lift Station E

Alternatives Overview

Large EGA Lift Station Cost

Large EGA Lift Station (1.5 MGD)							
Installed in 2013							
Force Main is 12,150 LF of 8" PVC ($120/LF)		$ 1,458,000					
Backup Generator							
LIft Station 2013 Structural Value		$ 300,000					
Lift Station 2013 Electrical / Controls Value		$ 100,000					
Lift Station 2013 Pump Value		$ 100,000					
Year	Year from 2013	Action	2013 Value	FW Value (3% Inflation)	PW Value (4.6% Interest Rate)		
2013	0	Pump Station Installation	$ 500,000	$ 500,000	$ 500,000		
2013	0	Force Main Installation	$ 1,458,000	$ 1,458,000	$ 1,458,000		
2020	7	Pump Rebuild	$ 50,000	$ 61,494	$ 44,886		
2027	14	Pump Rebuild	$ 50,000	$ 75,629	$ 40,295		
2033	20	20-Year Pump Station Structural Salvage Value	N/A	N/A	$ (146,940)		
2033	20	20-Year Force Main Salvage Value	N/A	N/A	$ (714,130)		
2033	20	20-Year Pump/Control/Generator Salvage Value	N/A	N/A	$ (7,347)	$1,174,764	20 YEAR
2034	21	Pump and Control Replacement	$ 200,000	$ 372,059	$ 144,693		
2041	28	Pump Rebuild	$ 50,000	$ 114,396	$ 32,473		
2048	35	Pump Rebuild	$ 200,000	$ 562,772	$ 116,607		
2055	42	Pump and Control Replacement	$ 200,000	$ 692,139	$ 104,680		
2062	49	Pump Rebuild	$ 50,000	$ 212,811	$ 23,493		
2063	50	50-Year Pump Station Structural Salvage Value	N/A	N/A	$ (23,134)		
2063	50	50-Year Force Main Salvage Value	N/A	N/A	$ (112,430)		
2063	50	50-Year Pump/Control/Generator Salvage Value	N/A	N/A	$ (55,521)	$2,274,041	50 YEAR
2069	56	Pump Rebuild	$ 50,000	$ 261,731	$ 21,090		
2073	60	60-Year Pump Station Structural Salvage Value	N/A	N/A	$ -		
2073	60	60-Year Force Main Salvage Value	N/A	N/A	$ -		
2073	60	60-Year Pump/Control/Generator Salvage Value	N/A	N/A	$ -	$2,486,216	60 YEAR
		Initial Capital Cost	$ 500,000				
		20-Year Additional	$ 674,764				
		50-Year Additional	$ 1,099,277				
		60-Year Additional	$ 212,175				

Alternatives Overview

Small EGA Lift Station Cost

Small EGA Lift Station (0.5 MGD)							
Installed in 2013							
Force Main is 12,150 LF of 4" PVC ($100/LF)		$ 1,215,000					
Backup Generator							
LIft Station 2013 Structural Value		$ 120,000					
Lift Station 2013 Electrical / Controls Value		$ 60,000					
Lift Station 2013 Pump Value		$ 20,000					
Year	Year from 2013	Action	2013 Value	FW Value (3% Inflation)	PW Value (4.6% Interest Rate)		
2013	0	Pump Station Installation	$ 200,000	$ 200,000	$ 200,000		
2013	0	Force Main Installation	$ 1,215,000	$ 1,215,000	$ 1,215,000		
2020	7	Pump Rebuild	$ 10,000	$ 12,299	$ 8,977		
2027	14	Pump Rebuild	$ 10,000	$ 15,126	$ 8,059		
2033	20	20-Year Pump Station Structural Salvage Value	N/A	N/A	$ (58,776)		
2033	20	20-Year Force Main Salvage Value	N/A	N/A	$ (595,108)		
2033	20	20-Year Pump/Control/Generator Salvage Value	N/A	N/A	$ (7,347)	$ 770,805	20 YEAR
2034	21	Pump and Control Replacement	$ 200,000	$ 372,059	$ 144,693		
2041	28	Pump Rebuild	$ 10,000	$ 22,879	$ 6,495		
2048	35	Pump Rebuild	$ 80,000	$ 225,109	$ 46,643		
2055	42	Pump and Control Replacement	$ 200,000	$ 692,139	$ 104,680		
2062	49	Pump Rebuild	$ 50,000	$ 212,811	$ 23,493		
2063	50	50-Year Pump Station Structural Salvage Value	N/A	N/A	$ (9,254)		
2063	50	50-Year Force Main Salvage Value	N/A	N/A	$ (93,692)		
2063	50	50-Year Pump/Control/Generator Salvage Value	N/A	N/A	$ (22,208)	$1,632,885	50 YEAR
2069	56	Pump Rebuild	$ 10,000	$ 52,346	$ 4,218		
2073	60	60-Year Pump Station Structural Salvage Value	N/A	N/A	$ -		
2073	60	60-Year Force Main Salvage Value	N/A	N/A	$ -		
2073	60	60-Year Pump/Control/Generator Salvage Value	N/A	N/A	$ -	$1,762,257	60 YEAR
		Initial Capital Cost	$ 200,000				
		20-Year Additional	$ 570,805				
		50-Year Additional	$ 862,080				
		60-Year Additional	$ 129,372				

Legend

- EGA Storage Lift Station
- Manhole where flow from EGA is pumped
- New Force Main
- New Gravity Sewer; ALT 3
- Lift Stations
- Manholes
- Gravity Main
- Force Main
- Abandoned
- East Growth Area

ADVANTAGES

- SMALLER PIPE NEEDED DOWNSTREAM DUE TO STORAGE DUE TO EGA
- ADDRESSES FUTURE SEWER FROM EGA
- ADDRESS AGING INFRASTRUCTURE SUCH AS LIFT STATION P

DISADVANTAGES

- ODOR IN EGA DUE TO STORAGE
- MAINTENANCE OF LIFT STATION IN EGA
- COST OF NEW LIFT STATION
- SOMEWHAT COSTLY DUE TO GRAVITY SEWER FROM MIS CONNECTION TO LIFT STATION E

T
C
W
F
E
P
Q
ST. MARY'S
CONCORDIA UNIVERSITY
RIVER OAKS
GLEN OAKS LANE
MEQUON RD
DONGES BAY RD
ZEDLER LN
43
57
167
48"
PS

MULTIPLE PUMPING AND GRAVITY OPTIONS FROM EGA TO GLEN OAKS LN (SEE WRITE-UP)

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City of Mequon
Ozaukee County, Wisconsin

Alternative 7
EGA Storage and Lift Station to In-Line Storage and Conveyance to Eliminate L.S. E

N

0 2,500 ft

gai consultants
transforming ideas into reality

AECOM