

GENOA TOWNSHIP, MICHIGAN

**S. Latson Road Service Area Water
Distribution and Sanitary Sewer Collection
System Report**

Prepared by:



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Appendices A & C have been removed from this document for size reduction purposes. Please e-mail kelly@genoa.org if you would like a copy of these appendices.

Executive Summary

The Michigan Department of Transportation is currently constructing new access ramps for I-96 at Latson Road in Genoa Township. With the improved access to the freeway, development requiring municipal water, provided by the Marion-Howell-Oceola-Genoa Sewer and Water Utilities (MHOG), and sanitary sewer service, provided by the Genoa-Oceola Sewer and Water Authority (GO) is expected. Furthermore, Genoa Township is considering a connection between the Oak Pointe water distribution network, which the Township operates independently, and the MHOG system to improve the performance and reliability of the Oak Pointe system because development in the proposed S. Latson Road Service Area along Nixon Road (Latson Road becomes Nixon Road south of I-96) would bring the MHOG water distribution network closer to Oak Pointe. Therefore, the purpose of this report is to evaluate and identify necessary infrastructure improvements to provide an adequate water and sanitary sewer service to the proposed S. Latson Road Service Area and secondary improvements necessary to provide water service to the Oak Pointe water system.

The proposed S. Latson Road Service Area is located along S. Latson and Nixon Roads in Genoa Township. The majority of the proposed service area is located south of I-96. There are expected to be about 1,630 REUs in the proposed service area. This report also considers the impacts of 935 REUs of infill development along Grand River Avenue in Genoa Township west of Dorr Road, and 1,000 REUs (already existing) in the Oak Pointe system (Oak Pointe is only included in the water system improvements).

Alternatives developed in this report were based on past reports, which identified major system improvements, and additional recent information provided by the Township. The alternatives include both the infrastructure necessary to provide service to the local area and systemic improvements needed to maintain proper system performance once the existing systems becomes stressed by growth. Some of the improvements, especially along Nixon Road, south of I-96 are larger than necessary for the local area as they would become part of the transmission infrastructure if growth expanded beyond the limits identified in this project. An example of this is the 16-inch water main along Nixon Road, which would only need to be a 12-inch water main if it were to provide service to the local area only.

A timeline of system improvements for both the water distribution and sanitary sewer systems is included in the report to identify trigger points that require certain aspects of the plan to become necessary. The trigger points are based on development in Genoa Township.

The major water system improvements included the following items:

- water main to serve the proposed S. Latson Road Service Area
- water main to connect Oak Pointe to MHOG
- water main between the WTP and the Marion Tanks, Sanitorium and Peavy Roads, and Lucy Road and Grand Oaks Drive
- new pump station near Lucy Road and I-96 to replace the Industrial Drive Pump Station
- new pump stations to serve Oak Pointe and another near Latson Road and M-59

The major sanitary sewer system improvements include the following items:

- sanitary sewer to serve the proposed S. Latson Road Service Area
- new regional pump station with force main to the GO WWTP
- new interim pump station prior to the construction of a regional pump station
- improvements to and re-direction of the existing Pump Station No. 6 and No. 9

The total opinion of cost for all phases of the water distribution system improvements for the proposed S. Latson Road Service Area and the existing Oak Pointe service area is \$14,690,000 if Oak Pointe connected to MHOG at Nixon Road following development in the proposed S. Latson Road Service Area or \$14,290,000 if Oak Pointe connected to MHOG at Dorr Road prior to development in the proposed S. Latson Road Service Area. The total opinion of cost for all phases of the sanitary sewer collection system improvements for the proposed S. Latson Road Service Area is \$20,360,000. These costs do not include tap fees for the purchase of existing plant capacity, existing distribution system components, or existing collection system components.

Introduction

The new access ramp at I-96 and Latson Road will provide access to and from the freeway in Genoa Township and provide a roadway that connects the relatively densely developed north side of I-96 and the lesser developed area south of I-96. Development, requiring water and sewer services, is expected because of the increased access. Future water service will be provided by the Marion, Howell, Oceola, Genoa Sewer and Water Utilities (MHOG). Future sanitary sewer service will be provided by Genoa-Oceola Sewer and Water Authority (GO).

Genoa Township defined a future utility service area boundary for the potential development that includes 46 acres along S. Latson Road, north of I-96 and 457 acres along Nixon Road south of I-96, extending about a quarter mile south of Sweet Road. There is an additional transitional development area in Genoa Township's development plan between that point and Crooked Lake Road that was not included in this analysis at the request of the Township. Genoa Township staff estimate that at full development, there will be 1,630 REUs in the proposed S. Latson Road Service Area (excluding the transition area).

Figure 1 shows the location of the new interchange and the proposed service area relative to the existing MHOG, Oak Pointe, and GO service areas. It also shows the major components of each system.

For the water distribution analysis only, a proposed connection between the Oak Pointe and MHOG water distribution systems was also reviewed. The Oak Pointe water system is currently independently operated by Genoa Township. Its service area is roughly bounded by Crooked Lake, Nixon, Brighton, and Dorr Roads. It has a maximum day demand (MDD) of 1.38 million gallons per day (MGD) with a peak hour demand of 2.76 MGD (*Oak Pointe Water Distribution Reliability Study*, page 11).

Past Study Efforts

Several studies have been completed by MHOG and GO to assess the need for system improvements as development occurs. As conditions changed or become better defined, periodic updates to the recommendations in past reports were completed. This document takes the past reports into consideration to summarize and make appropriate recommendations.

In February 2010, the *Genoa Oceola Sanitary Sewer Collection System Grand River 15" Evaluation* was completed to determine the available sanitary sewer capacity in the 15-inch gravity sewer in Grand River Avenue. The report stated that the current capacity was being completely used by flows from existing customers and recommended that flows from upstream pump stations be directed away from this sewer to provide capacity for future development directly tributary to the gravity sewer.

In March 2010, the *I-96 / Latson Road Service Area Utility Master Plan* report was published. It recommended that water service be provided to the future service area with a 12-inch looped system. It also recommended a gravity sanitary sewer system for most of the defined service area with wastewater conveyed to a pump station, which would then discharge directly to the GO WWTP. It also provided documentation on storm sewer and road improvements that would be necessary because of the development.

The *Lake Chemung Area Pump Capacity Analysis* report in June 2010 provided the estimated peak flow rates and firm capacities of several pump stations, including Pump Station No. 6 and No. 9. It recommended increased pumping capacity at both pump stations because of flows from existing customers.

In August 2012, the *Genoa-Oceola Pump Station 16 Discharge Point Realignment Study* was completed. It recommended re-directing Pump Station No. 16 force main away from the gravity sewer in Grand River Avenue and into the Pump Station No. 47 dual force mains. This recommended work was subsequently completed. The study showed that removing the Pump Station 16 flows from the gravity sewer would allow an additional 733 REUs to be developed in Genoa Township without requiring additional sanitary sewer collection system improvements.

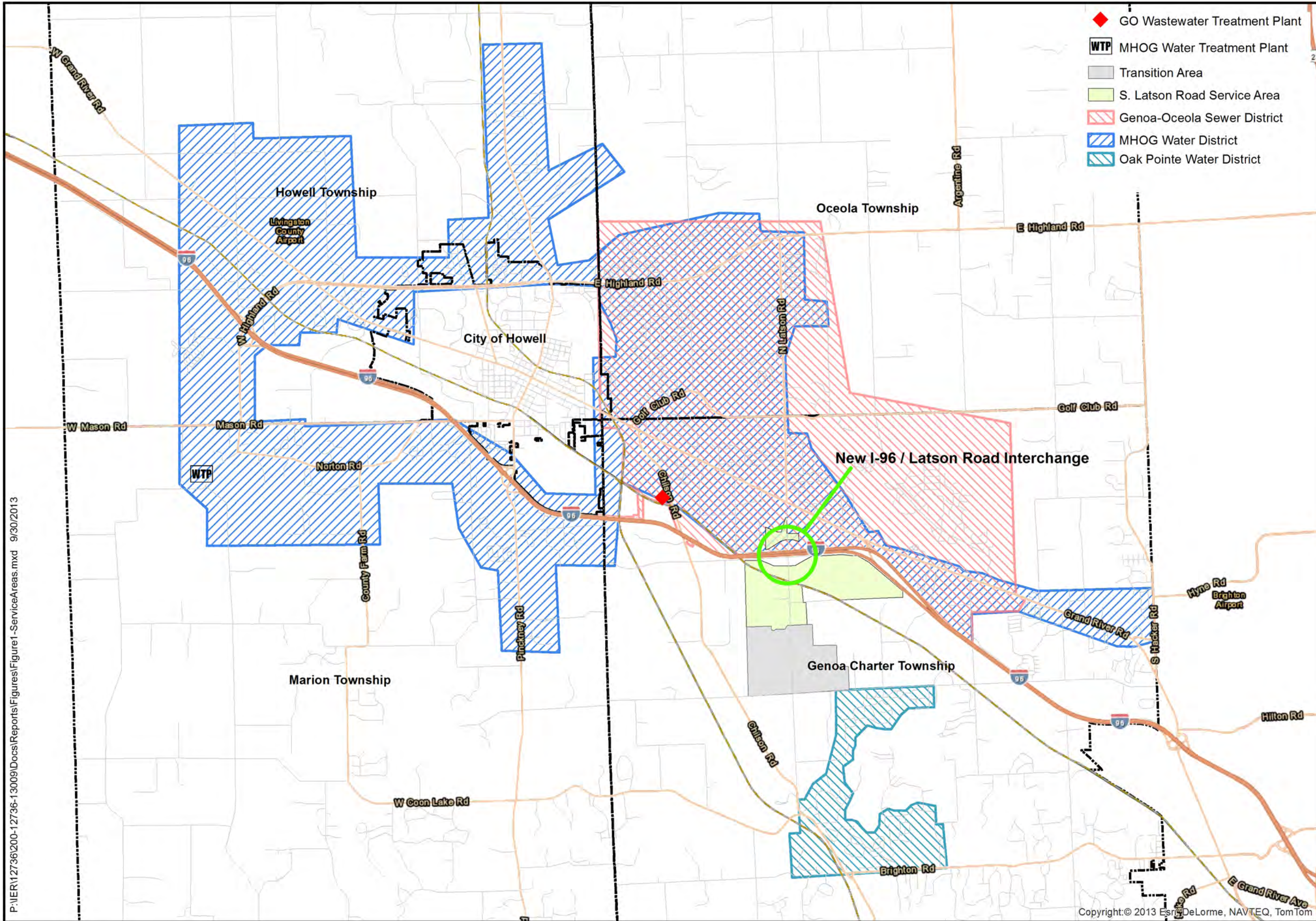
MHOG's water system has been periodically reviewed to prioritize improvements due to growth within the system. The most recent system-wide planning documents were the 2010 *Phase 1* and *Phase 2 Distribution System Hydraulic Modeling Summary Reports* in January and March 2010, respectively. These reports recommended a timeline of improvements that would be necessary as certain levels of demands were reached. Some of the improvements recommended in these two reports have already been implemented by the Authority as part of the 2012 Water Improvements project.

An analysis of the MHOG water distribution system in August 2012 assumed 500 REUs were immediately available for development in the Latson / Nixon Road corridor and showed that no improvements for the greater system were necessary to accommodate the demand from this level of development. The additional demand caused pressures to drop by 1 to 2 psi from the baseline conditions described in the memo.

In 2011 and 2012, three studies were completed for the Oak Pointe water distribution system. The *Oak Pointe Water System 2011 Water Pressure Study Report & Base Water Model* (November 2011) provided documentation for the development and calibration of the system's water model. The study recommended opening a closed valve to improve water pressure in the northern portion of the service area. This valve was subsequently opened.

The April 2012 *Oak Pointe Water Reliability Study* showed that the system had reliable water supply and distribution for the existing and near future (within 5 years) time period. However, for the 20-year planning period, its water supply was calculated to be insufficient for the increased demand.

In August 2012, the *Oak Pointe Water Supply / Treatment Report* was prepared. It also recommended adding water supply for future growth with another well as well as improvements to the treatment process.



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Figure 1
Service Area Map

S. Latson Road Service Area Water Distribution and Sanitary Sewer Collection System Report

Water Distribution Analysis

MHOG currently provides potable water to portions of Genoa Township north of I-96. The proposed S. Latson Road Service Area, most of which is on the south side of I-96, is just south of the current MHOG service area. Oak Pointe is located southeast of the proposed S. Latson Road Service Area.

MHOG utilizes a numerical model of its water distribution system to determine the impacts of development and recommend alternatives to maintain adequate water pressure and fire flow for its customers. The impacts of the additional demand from the proposed S. Latson Road Service Area and the Oak Pointe system were calculated, and improvements recommended, using the numerical model. The recommended improvements are provided as a timeline based on the level of demand in the system.

Existing Facilities and Demands

The MHOG Water Treatment Plant (WTP) is located in Marion Township west of Burkhardt Road. Water is pumped from the WTP to ground storage tanks on Sanitorium Road where the water is distributed throughout the pipe network. The maximum day demand in the MHOG system is currently 4.5 MGD.

The Industrial Drive Pump Station, located in the northwest corner of Genoa Township can pump up to 3,200 gpm of water into Genoa Township. A 16-inch water main along Grand River Avenue is the main conduit for distributing the water. A 12-inch water main along Grand Oaks Drive is the most probable point of connection for the proposed S. Latson Road Service Area.

Water pressure in Genoa Township is maintained by the 500,000 gallon Cleary University Tower, which is approximately 3,000 feet north of Grand Oaks Drive.

Genoa Township operates the Oak Pointe water distribution system independent of the MHOG water distribution system. The Oak Pointe water is supplied by wells within its service boundary. It has a 150,000 gallon elevated storage tower and a 500,000 gallon ground storage tank with a well capacity of 1.45 MGD (excluding the North Shore well). The current maximum day demand in the Oak Pointe system is 1.38 MGD (*Oak Pointe Water Reliability Study*, page 11).

Approach to Addressing Growth Impacts and Future Demands

The baseline conditions consist of the current MHOG system, plus the Sanitorium Road Booster Station, Hometown Village Tower, and the Butler Road Pump Station suction line, which will all be constructed prior to the peak demand season in 2014. These were the major improvements for 4.5 MGD MDD level identified in the *Phase 1* and *Phase 2 Modeling Reports*.

The proposed S. Latson Road Service Area was divided into four smaller districts, which are shown on Figure 2. Beginning on the north side, the demands for each district were successively added to demands already in the model to determine the point when specific improvements would be required. The Genoa Township infill demand was added once the entirety of the proposed S. Latson Road Service Area demands was included in the model. Adding Oak Pointe to the MHOG system was analyzed two ways, first assuming it was connected to MHOG before

any development in the proposed S. Latson Road Service Area and also after full development of that service area.

The Genoa Township infill demands represent demands for vacant parcels in Genoa Township largely along Grand River Avenue west of Dorr Road.

The transition area is an area that is not currently proposed to be serviced by water and sewer, but could be in the future. No demands from the transition area were included in the alternatives in accordance with guidance from the Township, but the design (sizes, locations, depths, etc.) of any infrastructure in the proposed S. Latson Road Service Area considered the possibility of eventually serving the transition area and other areas outside the proposed S. Latson Road Service Area.

Each of the demand levels was modeled as a distinct scenario with the demands determined from the number of REUs in each of the individual districts. For new development, the MHOG standard 500 gallons per day per REU for the maximum day demand was used. Oak Pointe demands were assumed to be the same as the existing conditions, so the demands used in Oak Pointe are greater than 500 gallons per day per REU. Each successive scenario includes the demands and improvements from earlier scenarios. The scenarios are summarized in Table 1.

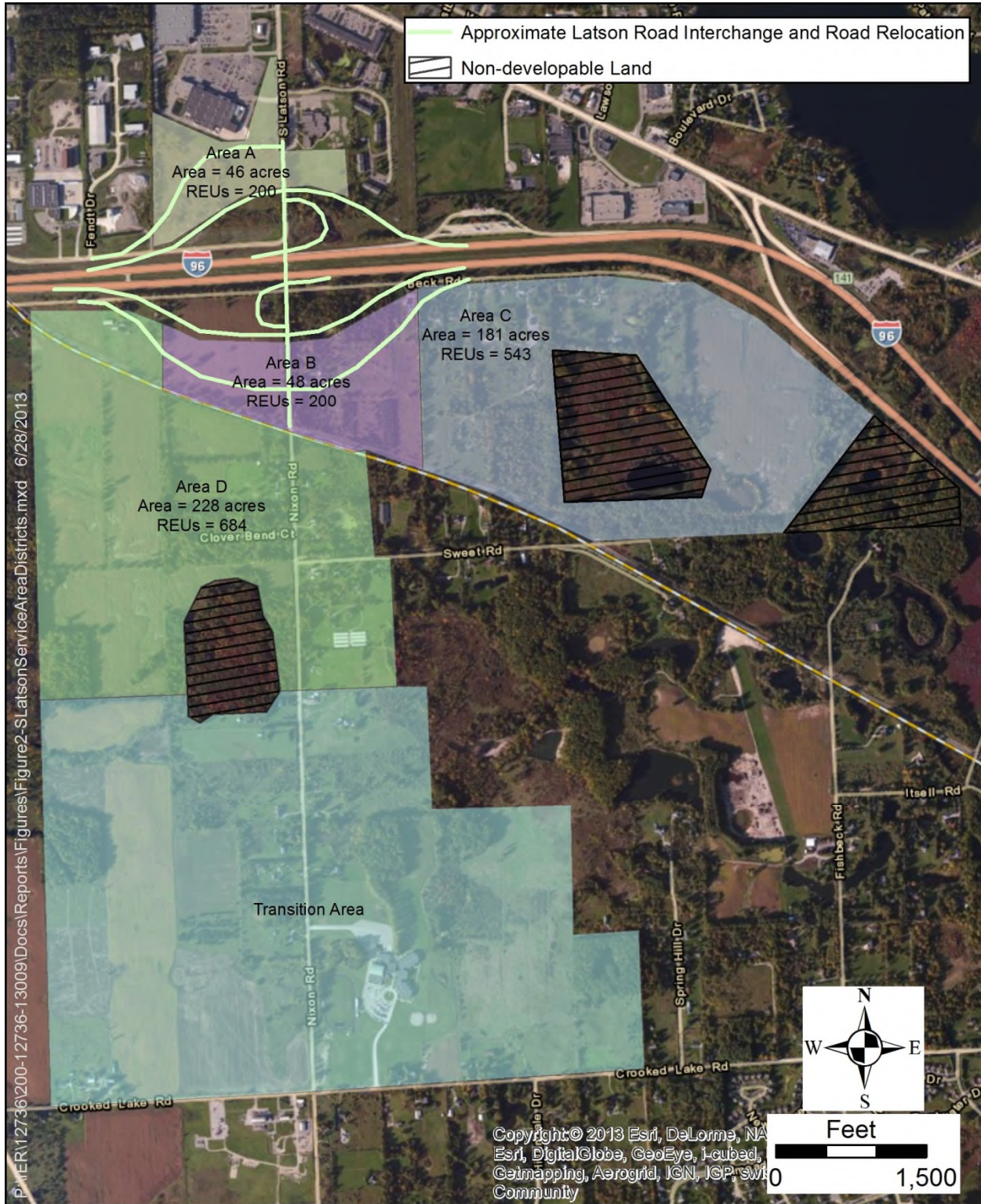
Table 1 – Scenario Summary

Scenario	Service Area Added	Incremental REUs Added	Incremental MDD Added, MGD	System-wide MDD, MGD
Baseline	none	0	0.00	4.5
A	S. Latson Road Service Area A	200	0.10	4.6
B	S. Latson Road Service Area B	200	0.10	4.7
C	S. Latson Road Service Area C	543	0.27	5.0
D	S. Latson Road Service Area D	684	0.34	5.4
E	Genoa Township Infill	935	0.47	5.8
F1	Oak Pointe ¹	1,000	1.38	7.2
F2	Oak Pointe ²	1,000	1.38	5.9
Total		3,562	2.66	7.2

¹ Scenario F1 connects Oak Pointe to the MHOG system following full development of the proposed S. Latson Road Service Areas A through D and the Genoa Township Infill.

² Scenario F2 connects Oak Pointe to the MHOG system prior to any development of the proposed S. Latson Road Service Area or Genoa Township Infill.

Figure 2 – Proposed S. Latson Road Service Area Districts



Water Distribution Model Setup

Innovyze's InfoWater version 8.1 was used as the modeling software. The model is set up as an extended period simulation (EPS) and was based on the model used for past modeling projects, including the Phase 1 and Phase 2 modeling projects. Additional pipes were added for the scenarios to distribute demands for the proposed S. Latson Road Service Area and connect to the Oak Pointe system. The entirety of the Oak Pointe system was imported from work done for its water reliability study.

The maximum day demand in the base model is 4.5 MGD, which excludes future demands for the proposed S. Latson Road Service Area, Genoa Township infill, and Oak Pointe. The diurnal demand curve is the same as used in the Phase 2 modeling, and produces a peak hour demand approximately twice the MDD.

For the EPS, the WTP starts supplying water to the system at 5 a.m. until the Marion tanks fill. The initial tank levels in the model represent the tank levels when the plant shuts off for the prior day and they vary by scenario because for all scenarios, the initial tank level should be approximately the same as the final tank level after 24 hours to ensure that consecutive days with the maximum demand can be accommodated and to ensure a proper calculation of the water demanded.

The water treatment plant supplies the entirety of the maximum day demand to the system. Future pipe and pumping configurations could allow for additional hydraulic capacity. The pump rates and controls used in the model for pump stations and valves in the Baseline Scenario were based on those used currently in the system, but also were adjusted for each scenario as the demands required adjustments to be made.

The proposed S. Latson Road Service Area was assumed to be connected to the existing MHOG system at Grand Oaks Drive west of Fendt Drive. The Oak Pointe system was assumed to be connected to the existing MHOG system via new water mains in the proposed S. Latson Road Service Area if development in the proposed S. Latson Road Service Area occurred prior to connecting Oak Pointe. The Oak Pointe system was assumed to be connected to the existing MHOG system at Dorr Road, just north of I-96, if it was to be connected prior to development in the proposed S. Latson Road Service Area.

Water Distribution System Design Criteria

The following design criteria will be used to determine when improvements to the system are necessary:

- Minimum pressures will be maintained above 40 pounds per square inch (psi) during the peak hour where there are service connections.
- Maximum pressures should remain below 80 psi where there are service connections, unless pressure reducing valves are a reasonable option.
- Available fire flows will be maintained above 1,000 gallons per minute (gpm) during the maximum day demand.

-
- The initial and final tank levels should be approximately the same to ensure that consecutive maximum day demands can be reliably met. The minimum tank volume should be greater than 25 percent.
 - The total system storage volume should be equal to or greater than the water demanded during the maximum day.
 - Proposed water mains were sized to maintain a velocity during the maximum day of 2 to 5 feet per second to maintain low energy losses. Note that to keep the analysis simpler, looped systems were not modeled in the proposed S. Latson Road Service Area, although a looped network with the equivalent area of the single pipe sized in this analysis would be acceptable to the single main size provided.
 - A minimum pipe size of 8 inches was assumed.
 - The water treatment plant will operate up to 16 hours a day.

Scenarios and Demands

This section summarizes the improvements necessary to meet the increased demand in each scenario. Appendix A provides a more detailed description of the issues and improvements of each scenario and shows the recommended infrastructure improvements and the pressure and fire flow contours for each of the scenarios.

Summary of Water Distribution Alternatives

For this analysis, the majority of the demand that was added to the system was added outside the extents of the current service area and over 6 miles from the source of the water at the WTP. Therefore, all improvements require transporting more water to the extents of the system by providing more conveyance capacity through additional pipe networks and increased pumping rates.

Currently, the MHOG system has a storage volume of 6.8 million gallons (MG) compared to its maximum day water use of 4.5 MG, so storage improvements are not needed immediately.

The current system can accommodate at least an additional 400 REUs (0.2 MGD during the maximum day) in Genoa Township without any improvements necessary. Pump rates, durations, and tank levels may change, but no additional infrastructure is necessary.

Once growth in Genoa Township occurs beyond the first 400 additional REUs, the general improvements to the system include:

- additional water main, summarized in Table 2, including:
 - local pipes to provide service to the proposed S. Latson Road Service Area and Oak Pointe
 - water main from the WTP to the Marion Tanks
 - water main from the Marion Tanks to the Hometown Village Tower
 - water main from the proposed Lucy Road pump station to Grand Oaks Drive
- two new pump stations to convey water to Genoa Township and one to convey water to Oak Pointe

The 16-inch diameter water main along S. Latson Road is required because of demands from both the proposed S. Latson Road Service Area and Oak Pointe. If service were to be only provided to the proposed S. Latson Road Service Area, the demands in that local area would require only a 12-inch water main.

The basis for the flow rates in Table 2 is different between the two Oak Pointe alternatives because of the operation of the existing storage and booster station within Oak Pointe.

Table 2 – Proposed Water Main Summary

Location ¹	Diameter ² , inches		Length, feet	Flow Rate Basis ³ , gpm		Velocity, ft/s	
	A	B		A	B	A	B
1. Service Area B – Grand Oaks to Nixon	16	12	3,400	2,270	965	3.6	2.7
2. Service Area C – east of Nixon	8	8	1,400	370	370	2.4	2.4
3. Service Area D – Nixon Road	16	8	3,200	1,760	460	2.8	2.9
4A. Oak Pointe – Nixon Road to Oak Pointe (only if Oak Pointe follows S. Latson Road development)	16 12	12 12	4,300 6,400	1,300	1,300	2.1 – 3.7	3.7
4B. Oak Pointe – Door Road to Oak Pointe (only if Oak Pointe precedes S. Latson Road development)	12 16	12 16	3,600 4,500	1,100	1,100	1.8 – 3.1	1.8 – 3.1
5. Oak Pointe – Broadmoor Drive (both Oak Pointe alternatives)	12	12	600	1,020	1,020	2.9	2.9
7. Sanitorium to Peavy Roads	20	-	6,600	2,830	-	2.9	-
9. WTP to Marion Tanks	24	-	9,800	9,420	-	6.7	-
12. Lucy Road to Grand Oaks Drive	16	-	8,300	2,200	-	3.5	-

¹ The item numbers refer to numbers used in Appendix B.

² The diameter in column A is the recommended diameter to plan for potential customers beyond the limits of the defined future Service Area in this project. The diameter in column B is the diameter necessary to serve only the local area.

³ The flow rate basis is the peak hour flow rate with the proposed S. Latson Road Service Area and Genoa Township infill fully developed, and Oak Pointe connected to MHOG.

The improvements are summarized in Table 3 using a range of additional REUs needed to develop before the improvement is necessary. A range was used because of the step-wise manner in which additional demands were input to the model. The lower limit represents the maximum number of additional REUs for which the improvement is not necessary. The upper limit represents the maximum number of additional REUs for which the improvement is required. For example, the existing system performs adequately for up to 400 REUs, but the next scenario modeled added 500 REUs and at that scenario's demand level the 20-inch water main became necessary. Therefore, the 20-inch water main becomes necessary between 400 and 900 REUs of

growth. The Utility should be prepared to construct each of the improvements within the range provided. Some of the improvements are specific to the locations of the development, so these improvements are summarized under the “As development requires” and “Oak Pointe” rows. The improvements are also shown on a map in Appendix B. Costs are summarized in Table 3 with details provided in Appendix C.

These improvements are based on a peaking factor of 2 for the peak hour demand relative to the maximum day demand. Often, as systems grow, the peaking factor decreases, so these alternatives may be somewhat conservative at this point and future analysis should be used to confirm the alternatives prior to design, especially those at the higher demand levels.

Most of the proposed improvements will be constructed in the existing right-of-way, but some easements may be necessary. No determination of the location of easements was made in this report.

Table 3 – Summary of Recommended Water Distribution Improvements

Additional REUs¹	System-wide Demand	Recommended Improvements²	Cost
As development requires	-	1. 3,400 feet of 16-inch water main for S. Latson Road Service Areas B through F along Beck Road	\$940,000
		2. 1,400 feet of 8-inch water main for S. Latson Road Service Area C	\$240,000
		3. 3,200 feet of 16-inch water main for S. Latson Road Service Area D	\$970,000
Oak Pointe (only if Oak Pointe follows S. Latson Road development)	-	4A. 4,300 feet of 16-inch water main and 6,400 feet of 12-inch water main from S. Latson Road Service Area to Oak Pointe	\$2,660,000
		5. 600 feet of 12-inch water main on Broadmoor Court to replace existing 8-inch water main	\$260,000
		6. 1,100 gpm pump station at the east of Seim Road	\$1,000,000
Oak Pointe (only if Oak Pointe precedes S. Latson Road development)	-	4B. 3,600 feet of 12-inch water main and 4,500 feet of 16-inch water main from MHOG to Oak Pointe	\$2,260,000
		5. 600 feet of 12-inch water main on Broadmoor Court to replace existing 8-inch water main	\$260,000
		6. 1,100 gpm pump station near Dorr and Crooked Lake Roads	\$1,000,000
400 – 900	5.0	7. 6,600 feet of 20-inch water main from Sanitorium Road to Peavy Road and Hometown Tower	\$1,610,000
		8. switch the pumping direction of the high and low head pumps at the Marion tanks	\$100,000
1,600 – 2,500	5.8	9. 9,800 feet of 24-inch water main from the WTP to the Marion Tanks	\$2,560,000
2,500 – 3,500	7.2	10. abandon Industrial Drive Pump Station	\$70,000
		11. 3,700 gpm pump station near Lucy Road and I-96	\$1,400,000
		12. 8,300 feet of 16-inch water main from Lucy Road to Grand Oaks Drive	\$1,990,000
		13. 800 gpm pump station near Latson Road and M-59	\$890,000

¹ The additional REUs are not tied to a specific development. They may be composed of REUs located in any combination of the proposed S. Latson Road Service Area, the Genoa Township infill, and Oak Pointe. For example, 1,000 REUs added to MHOG in Oak Pointe would require the same improvements as if 300 REUs were added from Genoa Township infill and 700 REUs were added from development in the proposed S. Latson Road Service Area.

² The item numbers refer to numbers used in Appendix B.

Sanitary Sewer Collection System Analysis

GO currently provides sanitary sewer service to portions of Genoa Township, including the area immediately north of the proposed S. Latson Road Service Area. Oak Pointe operates its own wastewater treatment plant (WWTP), although a force main to connect Oak Pointe to the GO WWTP is currently being designed.

The improvements recommended to provide sanitary sewer service to the proposed S. Latson Road Service Area are summarized by the number of REUs needed to initiate the improvement.

Existing Facilities and Demands

The GO sanitary sewer collection system transports wastewater to its WWTP, located on Chilson Road north of I-96, approximately 1.5 miles northwest of the new Latson Road / I-96 interchange. The WWTP treats an average of 0.9 MGD, which will increase to about 1.2 MGD if the Oak Pointe collection system is connected. The peak flow rate to the WWTP is 3.3 MGD with equalization provided in the 1.2 million gallon oxidation ditch.

The main interceptor for Genoa Township is a 15-inch sewer located along Grand River Avenue. In addition to the services directly connected to it, the interceptor receives flow from Pump Stations 6, 7, 15, and 45. It discharges to Pump Station No. 5 located at Grand River Avenue and Golf Club Road, where it is pumped to the GO WWTP.

According to page 2 of the report *Genoa Oceola Sanitary Sewer Collection System Grand River 15" Evaluation*, dated February 16, 2010, the most restrictive segment of pipe is approximately 120 feet long, has a capacity of 1,400 gpm (the capacity in the report is listed at 1,140 gpm, but was increased when the slope of the pipe was later surveyed and found to be steeper than on the drawings). The next most restrictive segment of pipe, approximately 3,700 feet long, has a capacity of 1,700 gpm. For the purpose of this report, the capacity of the Grand River Avenue interceptor is assumed to be 1,700 gpm because the surcharge in the 120-foot segment of pipe at 1,700 gpm is less than 0.5 feet. Observed peak flow rates in the same segments of sewer were 1,570 gpm. No problems have been reported because of the local surcharge.

Subsequent to the February 2010 capacity analysis, Pump Station No. 16 was re-directed from the Grand River Avenue interceptor to the Pump Station No. 47 dual force main. This removed 500 gpm from the interceptor (*Genoa Oceola Sanitary Sewer Collection System Grand River 15" Evaluation*, page 1).

According to the *Lake Chemung Area Pump Station Capacity Analysis Report* (page 4-12) from June 2010, Pump Station No. 6 has a firm capacity of 800 gpm. The capacity is less than the projected peak influent flow rate if the recommended Pump Station No. 9 improvements were implemented. The same report lists the firm capacity for Pump Station No. 9 to be 570 gpm, which is also less than its projected peak influent flow rate.

Based on the wet well volume of Pump Station No. 6, the station could accommodate an additional influent flow rate of 25 gpm without surcharging the influent sewer during the peak hour (assuming the Pump Station No. 9 pump rate remains the same).

Approach to Addressing Growth Impacts

The sanitary sewer improvements are based on an estimate of flows using the REU data presented on page 7. Oak Pointe was excluded in the collection systems analysis because it already has sanitary sewer service and is unlikely to be connected to the same portion of the GO collection system that S. Latson Road would be connected to. The average flow rate is assumed to be 260 gallons per day (gpd) per REU. The peak flow rate uses the Ten States Standards peaking factor equation based on population, with the assumption of 2.6 persons per REU, $Q_p = \frac{18 + \sqrt{P/1000}}{4 + \sqrt{P/1000}}$, where P is the population.

Table 4 – Summary of REUs and Wastewater Flow Rates

Service Area Added	Incremental REUs Added	Incremental Average Flow Rate Added, MGD	Incremental Peak Flow Rate Added, MGD
S. Latson Road Service Area A	200	0.05	0.20
S. Latson Road Service Area B	200	0.05	0.20
S. Latson Road Service Area C	543	0.14	0.52
S. Latson Road Service Area D	684	0.18	0.65
Genoa Township Infill	935	0.24	---
Total	2,562	0.66	---

Note: Peak flow rates are not provided for the infill and total area because there is not a distinct outlet that would only contain flows generated in these areas.

The Genoa Township infill development can be further broken down into three subareas that will be important for the alternatives, one directly tributary to the gravity sewer, one directly tributary to Pump Station No. 6, and one tributary to Pump Station No. 9. The estimated breakdown of REUs for the Genoa Township infill provided by Genoa Township is summarized in Table 5.

Table 5 – Genoa Township Infill Development REU Location Summary

Location	REUs
Directly tributary to Grand River Avenue gravity sewer (west of Latson Road)	442
Tributary to the Grand Avenue gravity sewer via Pump Station No. 6, but downstream of Pump Station No. 9 (Latson Road to the Grand River Avenue / I-96 partial interchange)	420
Tributary to Pump Station No. 6 sewer via Pump Station No. 9 (east of the Grand River Avenue / I-96 partial interchange)	73
Total	935

Collection System Design Criteria

The following design criteria were used to define improvements to the system, unless otherwise described in the report:

- The minimum gravity sewer pipe size is 8 inches.
- Minimum slopes were assumed for gravity sewers.
- Force mains were sized to have a velocity of 5 to 10 feet per second.

Summary of Collection System Alternatives

When Pump Station No. 16 was re-directed away from the gravity interceptor in Grand River Avenue, the peak flow rate decreased to 1,520 gpm, below its capacity of 1,700 gpm. Now, the 15-inch interceptor can accommodate an additional peak flow rate of 180 gpm without reaching its nominal capacity, which is approximately the peak flow rate from 250 REUs. Given that there was no history of basement backups or overflows with Pump Station No. 16 connected, the full amount removed (500 gpm) when Pump Station No. 16 was re-directed could be added back into the interceptor as 770 REUs of development. (This amount of available growth is similar to the 733 REUs listed in the August 2012 *Genoa-Oceola Pump Station 16 Discharge Pointe Realignment Study*.) These REUs could be a combination of Genoa Township infill and development in the proposed S. Latson Service Area.

Before the development of these 770 REUs, it is recommended that Pump Stations No. 6 and 9 be diverted away from the gravity sewer to a new regional pump station located at the east dead end of Beck Road. The elevation of this site is approximately 975 feet and is in a relatively low area to accommodate gravity flow from a portion of the proposed S. Latson Road Service Area south of I-96. The regional pump station would then transport wastewater directly to the GO WWTP. Pump Stations No. 6 and / or 9 may need larger pumps and / or to be diverted to the proposed regional pump station prior to 770 REUs if they are unable to keep up with their influent flows.

The *Lake Chemung Area Pump Station Capacity Analysis* recommended an increase in Pump Station No. 6 and No. 9 pump rates to accommodate existing peak flow rates. Therefore, the Authority should periodically monitor the pump station performance as growth occurs to ensure that the pump stations can accommodate influent flows, including any wet weather response.

Once re-directed to the regional pump station, Pump Station No. 6 would only collect flows from the area directly tributary to it and manifold with the Pump Station No. 9 force main. It would be reduced to a firm capacity of 580 gpm (0.8 MGD) (290 gpm from the difference in design flow rates between Pump Station 6 and 9 from the *Lake Chemung Area Pump Station Capacity Analysis* and 290 gpm for 420 REUs of infill growth). Pump Station No. 9 would have the same tributary area it does now, but the firm capacity would be increased to 1,100 gpm (1.6 MGD) (1,040 gpm was projected flow from pages 4-10 of the *Lake Chemung Area Pump Station Capacity Analysis* plus 50 gpm for 73 REUs of infill growth).

For the 1,427 REUs in the future service area south of I-96, a local collection system can be constructed and connected to the regional sanitary pump station at the east end of Beck Road. Based on the topography, the land north of the railroad is higher in elevation than the regional

pump station, so wastewater from proposed S. Latson Road Service Areas B and C and the portion of Area D north of the railroad could be transported to the regional pump station by gravity. The portion of proposed S. Latson Road Service Area D south of the railroad would have a gravity system discharging to a local pump station in the low area on the south side of Service Area D. The elevation of this pump station would be approximately 950 feet. A force main would be constructed from local booster station to the gravity sewer north of the railroad to convey the wastewater to the regional booster station. The design of infrastructure south of I-96 should be sized and located considering the possibility of eventually extending service to the transition area or other areas south of the proposed S. Latson Road Service Area D.

If there is development in the proposed S. Latson Road Service Area south I-96 before the need for the regional pump station, an interim pump station could be constructed on the east side of Area B and a force main constructed across I-96 to discharge into the Pump Station 47 dual force main. The calculations for Scenario B-3 completed for the *Genoa-Oceola Pump Station 16 Discharge Point Realignment Study* are similar to having an interim pump station discharge to the dual force mains. Using the calculations from that study, it was determined that the flows from 500 REUs could be added to the PS 47 dual force main without negatively impacting the performance of PS 47. When the regional pump station was needed, the interim pump station would be abandoned.

Most of the pipes constructed in the future service area south of I-96 will be 8-inch collector pipes. Along Nixon Road to the regional pump station, larger diameter pipes will be needed to collect wastewater flows from the service area. The proposed trunk sewers are summarized in Table 6. The sewers are listed approximately from upstream to downstream. The pipe diameter is based on using the minimum pipe slope.

Table 6 – Proposed S. Latson Road Service Area Trunk Sewers

Location ¹	REUs	Length, feet	Peak Flow Rate, MGD	Pipe Diameter ² , inches	
				A	B
28. Nixon Road – railroad to Sweet Road	342	1,300	0.3	8	8
29. Nixon Road – Sweet Road to local pump station	684	2,400	0.6	10	10
27. Force Main – local pump station to Nixon Road gravity sewer north of railroad	684	3,700	0.6	8	6
26. Nixon Road – railroad to Beck Road	684	400	0.6	15	12
22. Beck Road – railroad to Nixon Road	100	1,800	0.1	8	8
21. Beck Road – Nixon Road to Service Area C	884	1,400	0.8	15	12
23. Beck Road – Service Area C to regional pump station	1,427	2,800	1.2	18	15
15. Force Main – regional pump station to GO WWTP	-	14,000	3.7	12	12

¹ The item numbers refer to numbers used in Appendix B.

² The diameter in column A is the recommended diameter to plan for potential customers beyond the limits of the defined future Service Area in this project. The diameter in column B is the diameter necessary to serve only the local area. For potential trunk sewers, one pipe size was added to the diameter in column B to produce column A.

The GO WWTP has an average daily flow capacity of 1.6 MGD. The average daily flow from the current service area is 0.9 MGD, and the average daily flow from the Oak Pointe service area will add 0.3 MGD if its force main is constructed. This leaves 0.4 MGD of average daily flow capacity available at the WWTP. Approximately 1,500 REUs of development are needed to reach the 1.6 MGD average daily flow capacity.

Currently, the WWTP has a 1.6 MGD oxidation ditch (which also provides equalization of the peak flows) and 0.7 MGD sequential batch reactors. Once the development causes flows to approach the capacity, it is recommended that a second oxidation ditch be constructed. This would increase the WWTP average daily flow capacity to 3.2 MGD (and provide additional equalization). This would exceed the average daily flow of 1.9 MGD with full infill along Grand River Avenue and full development in the future service area (2,562 REUs total).

The existing peak flow rate in the 2002 Basis of Design was 3.3 MGD. The peak flow rate from Oak Pointe is about 1.1 MGD (*I-96 / Latson Road Service Area Utility Master Plan*, page 11), but would be equalized near its source and designed to add only its average flow rate (0.3 MGD) to the peak flow rate at the GO WWTP if it is connected. The complete growth from Genoa Township infill and the proposed S. Latson Road Service Area is expected to add 2.1 MGD to the peak flow rate. These three areas produce a peak flow rate of 5.7 MGD. The hydraulic capacity of the influent pump station is 6.0 MGD (2002 Basis of Design), so improvements to the headworks will not be required for the full development in this report.

The WWTP's sludge handling system improvements recommended in the *I-96 / Latson Road Service Area Utility Master Plan* to accommodate future demands is in the process of being improved as part of the possible Oak Pointe consolidation, so no additional improvements to this process are projected for development considered in this report.

Genoa Township will also incur some costs because they eventually will have to contract for capacity from Oceola Township to meet the proportion of the flows they consume. Currently, wastewater generated in Genoa Township accounts for about 60 percent of the 0.9 MGD average daily flow with Genoa Township being allotted 50 percent of the 1.6 MGD capacity. Genoa Township can add about 0.26 MGD (0.80 MGD – 0.54 MGD) average daily flow, from approximately 1,000 REUs, before additional capacity needs to be purchased.

The collection system for the future service area is largely independent of the level of development because any development will require the infrastructure to be constructed. The proposed infrastructure is summarized in Table 7. A map of the recommended improvements is included in Appendix B. Details of the cost information are provided in Appendix C.

Most of the proposed improvements will be constructed in the existing right-of-way, but some easements may be necessary. No determination of the location of easements was made for this report.

Table 7 – Summary of Recommended Sanitary Sewer Collection System Improvements

Trigger	Recommended Improvements ¹	Cost
<p>770 REUs developed in Service Area A or as infill in Genoa Township (Grand River Interceptor Capacity is reached)</p>	<p>14. Construct 2,600 gpm (3.7 MGD) regional pump station at the east end of Beck Road south of I-96</p>	<p>\$2,220,000</p>
	<p>15. Construct 14,000 feet of 12-inch force main from the regional pump station to the WWTP</p>	<p>\$2,200,000</p>
	<p>16. Abandon existing Pump Station No. 6 force main and re-direct flows from Pump Station No. 6 to the existing Pump Station No. 9 force main. Reduce the firm capacity of the pump station to 580 gpm (0.84 MGD) by replacing the existing pumps.</p>	<p>\$90,000</p>
	<p>17. Increase the firm capacity of Pump Station No. 9 to 1,100 gpm (1.6 MGD).</p>	<p>\$160,000</p>
<p>Up to 500 REUs developed in Service Areas B through D (minimum infrastructure needed to serve area)</p>	<p>19. Construct 350 gpm (0.50 MGD) interim pump station on the east side of Service Area B (only if regional pump station has not been constructed)</p>	<p>\$240,000</p>
	<p>20. Construct 1,300 feet of 4-inch force main from the interim pump station to the Pump Station No. 47 12-inch dual force main (only if regional pump station has not been constructed)</p>	<p>\$240,000</p>
	<p>21. Construct 1,400 feet of 15-inch sewer along Beck Road (relocated) from Nixon Road to the interim pump station</p>	<p>\$440,000</p>
	<p>22. Construct up to 1,800 feet of 8-inch sewer along Beck Road (relocated) from the railroad tracks to Nixon Road (as needed to provide service)</p>	<p>\$480,000</p>
<p>More than 500 REUs developed in Service Areas B through D (flow rate added to the Pump Station 47 dual force mains offsets flow rate removed from dual force mains when Pump Station 16 was re-directed)</p>	<p>23. Construct 2,800 feet of 18-inch sewer from the interim pump station to the Beck Road regional pump station</p>	<p>\$1,100,000</p>
	<p>24. Abandon the interim pump station and force main</p>	<p>\$60,000</p>

**Table 7 – Summary of Recommended Sanitary Sewer Collection System Improvements
(continued)**

Trigger	Recommended Improvements ¹	Cost
Development in Service Area D (minimum infrastructure needed to serve area)	25. Construct 450 gpm (0.65 MGD) local pump station (initial pumps in interim condition may need to be smaller and pump station may need to accommodate larger pumps if service is eventually provided beyond the proposed S. Latson Road Service Area)	\$270,000
	26. Construct 400 feet of 15-inch sewer along Nixon Road from the railroad to Beck Road (relocated)	\$220,000
	27. Construct 3,700 feet of 8-inch force main along Nixon Road from local pump station to gravity sewer north of the railroad	\$520,000
	28. Construct up to 1,300 feet of 8-inch sewer from the railroad to Sweet Road (as needed to provide service)	\$510,000
	29. Construct up to 2,400 feet of 10-inch sewer from Sweet Road to the local pump station (as needed to provide service)	\$1,010,000
1,000 REUs developed in Genoa Township (Genoa Township reaches its allotment of the WWTP capacity)	Obtain additional WWTP capacity from Oceola Township	not determined
1,500 REUs developed (Average daily flow treatment capacity of 1.6 MGD is reached)	30. Add 1.6 MGD oxidation ditch to GO WWTP	\$10,130,000

¹ The item numbers refer to numbers used in Appendix B.

Conclusions

Most of the required water and sanitary sewer infrastructure within the future service area will need to occur with the development of any of the property and is not tied to a specific number of REUs developed. Infrastructure needs within the existing water and sewer service areas are more closely tied to the number of developed REUs.

The portion of the proposed S. Latson Road Service Area north of I-96 has no costs associated with improvements in this report because it is already adjacent to the existing MHOG and GO service areas and has too few REUs to require increases in the size of existing infrastructure. The costs are summarized by location in Table 8. Improvements that were required because of growth in more than one location are listed in the row *Infrastructure Not Required for a Specific Area*.

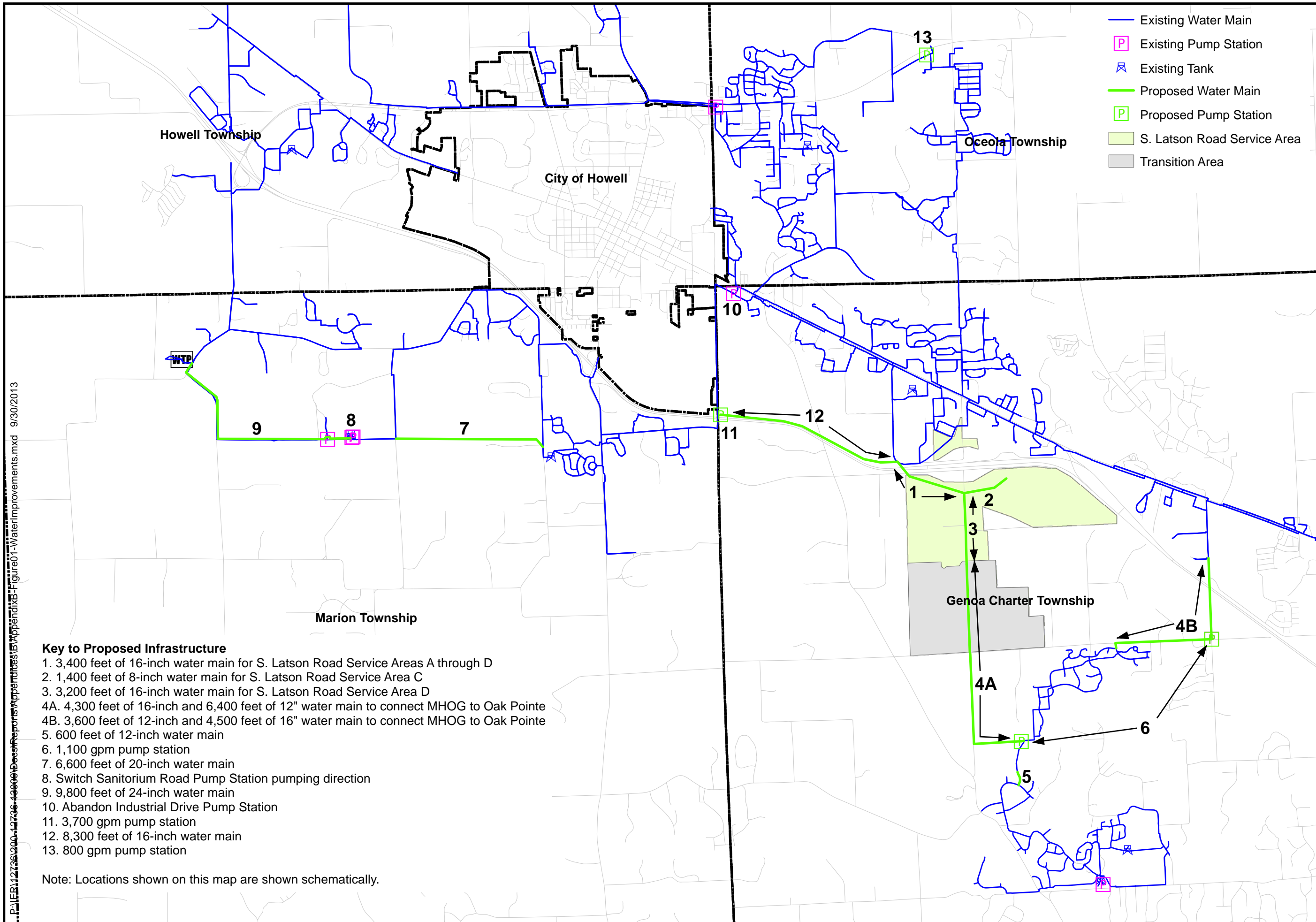
No attempt was made to split costs for one alternative among more than one location. For example, the cost of the 16-inch water main in Item 1 in Table 3 could be split proportionally between S. Latson Road Service Areas B through D and Oak Pointe because a smaller size pipe would be needed to serve only one or the other.

Table 8 – Cost Summary by Area of Development

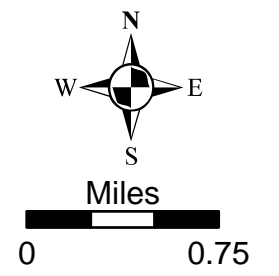
Location	Items ¹	Water Cost (\$M)	Sanitary Cost (\$M)	Total Cost (\$M)
S. Latson Road Service Area A north of I-96	-	\$0	\$0	\$0
S. Latson Road Service Areas B – D south of I-96	1 – 3, 19 – 29	\$2.15	\$5.09	\$7.24
Oak Pointe	4A or 4B, 5, 6	\$3.92 (with 4A) \$3.52 (with 4B)	-	\$3.92 (with 4A) \$3.52 (with 4B)
Genoa Township Infill	16 – 18	\$0	\$0.72	\$0.72
Infrastructure Not Required for a Specific Area	7 – 13, 14, 15, 30	\$8.62	\$14.55	\$23.17
Total	1 – 30	\$14.69 (with 4A) \$14.29 (with 4B)	\$20.36	\$35.05 (with 4A) \$34.65 (with 4B)

¹ The item numbers refer to numbers used in Appendix B.

Recommended water distribution improvements are provided in Table 3 on page 13. Recommended collection system improvements are listed in Table 7 on page 20.



- Existing Water Main
- Existing Pump Station
- ⊗ Existing Tank
- Proposed Water Main
- Proposed Pump Station
- S. Latson Road Service Area
- Transition Area



Key to Proposed Infrastructure

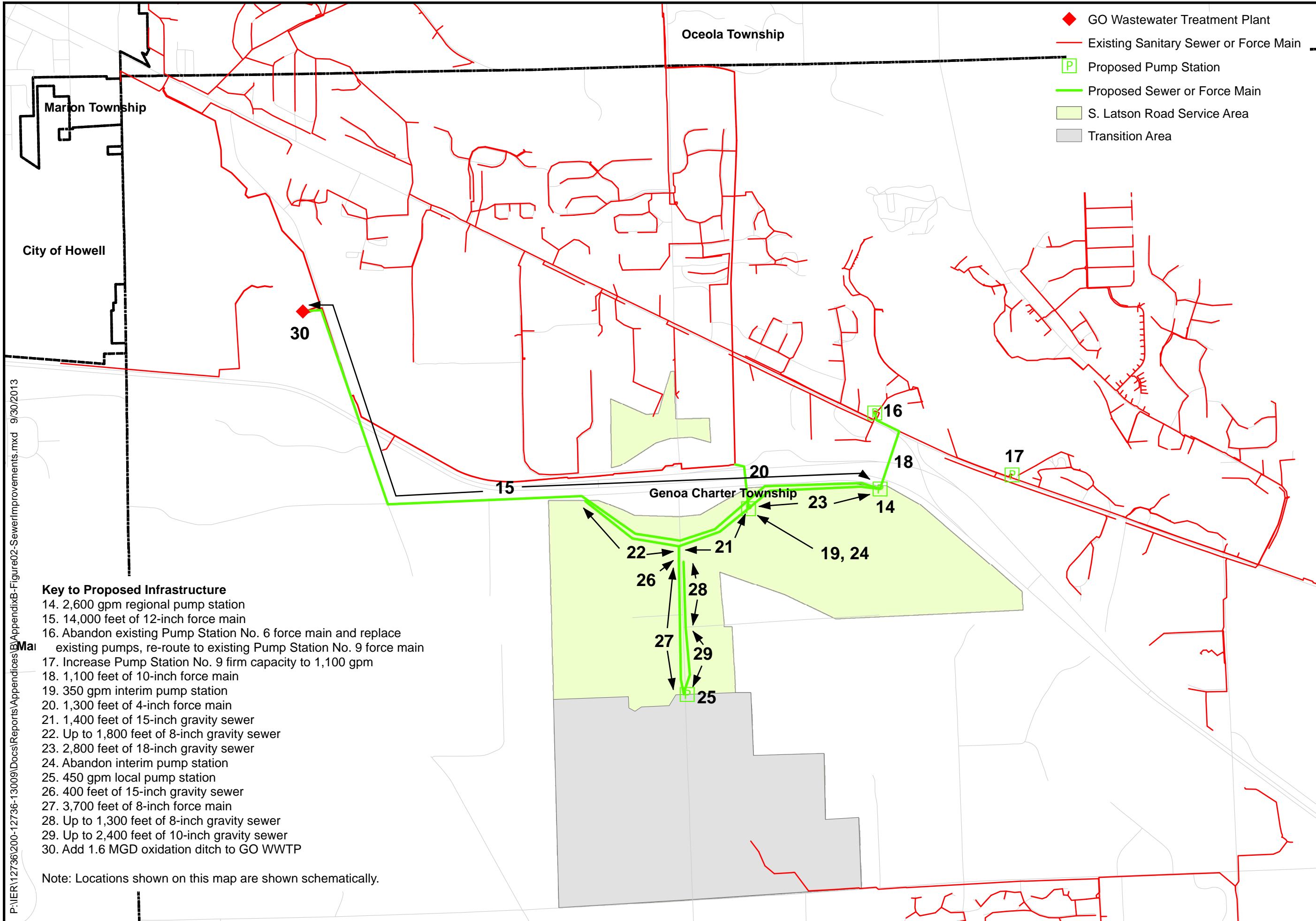
1. 3,400 feet of 16-inch water main for S. Latson Road Service Areas A through D
2. 1,400 feet of 8-inch water main for S. Latson Road Service Area C
3. 3,200 feet of 16-inch water main for S. Latson Road Service Area D
- 4A. 4,300 feet of 16-inch and 6,400 feet of 12" water main to connect MHOG to Oak Pointe
- 4B. 3,600 feet of 12-inch and 4,500 feet of 16" water main to connect MHOG to Oak Pointe
5. 600 feet of 12-inch water main
6. 1,100 gpm pump station
7. 6,600 feet of 20-inch water main
8. Switch Sanitorium Road Pump Station pumping direction
9. 9,800 feet of 24-inch water main
10. Abandon Industrial Drive Pump Station
11. 3,700 gpm pump station
12. 8,300 feet of 16-inch water main
13. 800 gpm pump station

Note: Locations shown on this map are shown schematically.

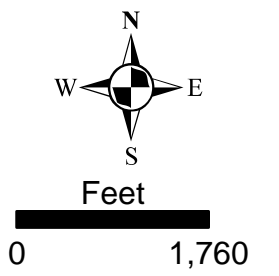
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**Figure B1
Water Distribution System Improvements**

S. Latson Road Service Area Water Distribution and Sanitary Sewer Collection System Report



- ◆ GO Wastewater Treatment Plant
- Existing Sanitary Sewer or Force Main
- Proposed Pump Station
- Proposed Sewer or Force Main
- S. Latson Road Service Area
- Transition Area



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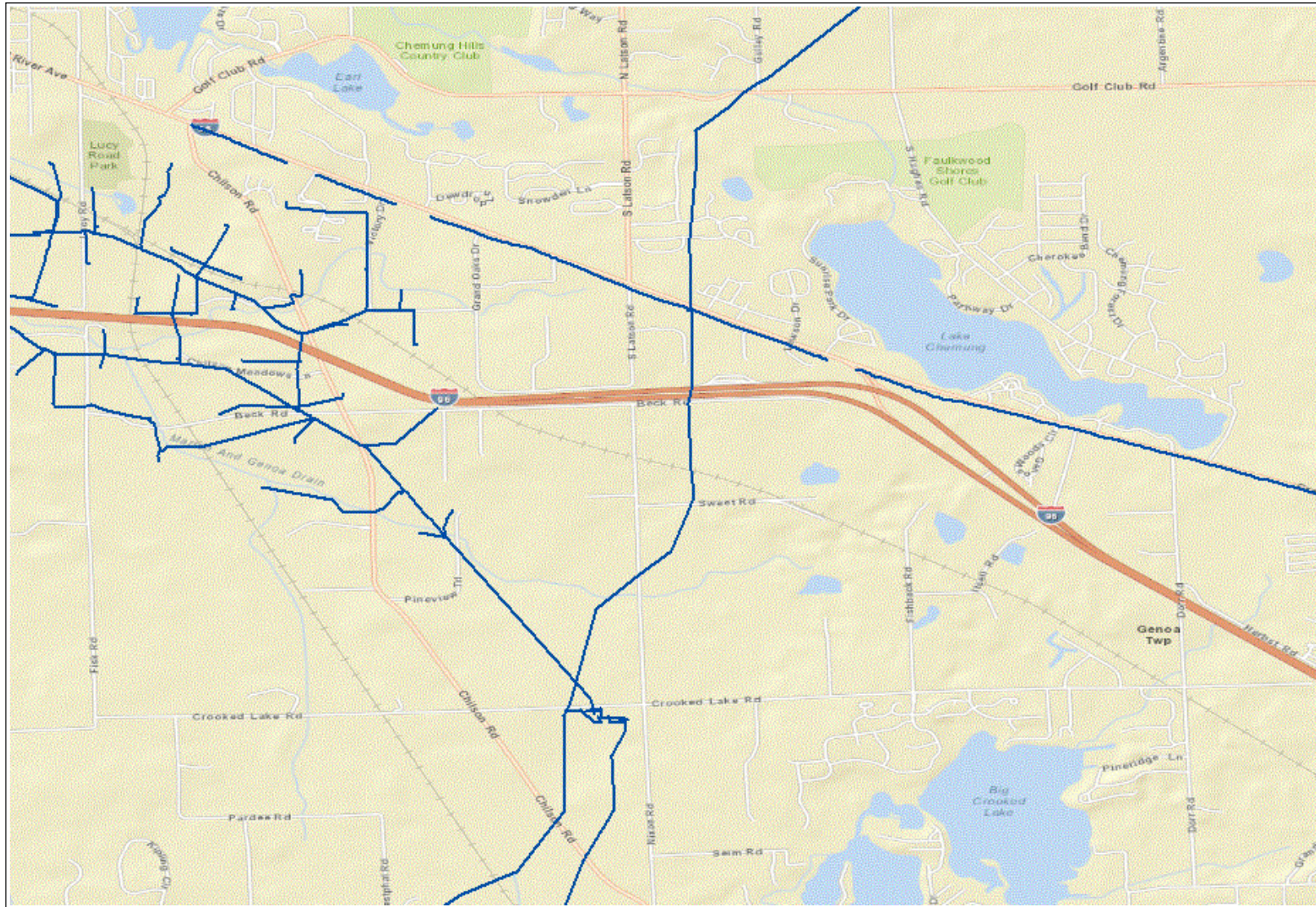
Key to Proposed Infrastructure

- 14. 2,600 gpm regional pump station
- 15. 14,000 feet of 12-inch force main
- 16. Abandon existing Pump Station No. 6 force main and replace existing pumps, re-route to existing Pump Station No. 9 force main
- 17. Increase Pump Station No. 9 firm capacity to 1,100 gpm
- 18. 1,100 feet of 10-inch force main
- 19. 350 gpm interim pump station
- 20. 1,300 feet of 4-inch force main
- 21. 1,400 feet of 15-inch gravity sewer
- 22. Up to 1,800 feet of 8-inch gravity sewer
- 23. 2,800 feet of 18-inch gravity sewer
- 24. Abandon interim pump station
- 25. 450 gpm local pump station
- 26. 400 feet of 15-inch gravity sewer
- 27. 3,700 feet of 8-inch force main
- 28. Up to 1,300 feet of 8-inch gravity sewer
- 29. Up to 2,400 feet of 10-inch gravity sewer
- 30. Add 1.6 MGD oxidation ditch to GO WWTP

Note: Locations shown on this map are shown schematically.

Figure B2
Collection System Improvements
 S. Latson Road Service Area Water Distribution and Sanitary Sewer Collection System Report

NATIONAL PIPELINE MAPPING SYSTEM



Legend

- Gas Transmission Pipelines
- Hazardous Liquid Pipelines

0 0.3 Miles

Pipelines depicted on this map represent gas transmission and hazardous liquid lines only. Gas gathering and gas distribution systems are not represented.

This map should never be used as a substitute for contacting a one-call center prior to excavation activities. Please call 811 before any digging occurs.

Questions regarding this map or its contents can be directed to npms-nr@mbakercorp.com.

Projection: Geographic

Datum: NAD83

Map produced by the NPMS Public Viewer at www.npms.phmsa.dot.gov

Date Printed: Mar 12, 2013



There are underground natural gas storage pipelines in the area. For questions regarding these pipelines, contact Tim Walter with Panhandle Eastern Pipe Company at timothywalter@energytransfer.com or reach Panhandle at (517) 546-4772.