NORTHFIELD TOWNSHIP

WASTEWATER
ASSET MANAGEMENT PLAN

DRAFT

200-12748-18002

September 2020

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Northfield Township, MI
8350 Main Street
Whitmore Lake, MI 48189

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twp-northfield.org
Steven Aynes, Township Manager, 734-449-2880 ext. 12
SAW Grant No. 1277-01

EXECUTIVE SUMMARY

Northfield Township is located in the northeastern corner of Washtenaw County and is home to 8,728 residents (2018 census). The Township consists of approximately 36 square miles of area. The Township provides wastewater collection and treatment services within a service area that includes portions of Northfield Township and Green Oak Township. Sewers serve the area along the North Territorial Road/US-23 interchange, as well as a majority of the residential areas around Horseshoe Lake, Whitmore Lake, and Wildwood Lake. In addition, the wastewater from the rest stop south of Northfield Church Road is also treated at the Northfield Township Wastewater Treatment Plant (WWTP). Approximately 3,294 households and commercial/industrial customers are served.

In 2017, Northfield Township was awarded Stormwater, Asset Management, and Wastewater (SAW) Grant No. 1277-01 by the Michigan Department of Environmental Quality (MDEQ), which is now the Michigan Department of Environment, Great Lakes, and Energy (EGLE), to develop an Asset Management Plan (AMP) for the sanitary sewer system and wastewater treatment plant (WWTP). The grant amount was $535,847 with a local match of $59,538, for a total cost of $595,385. The grant allows reimbursements to be requested for expenses incurred between January 2013 and December 2020.

The requirement for an AMP and associated annual updated report are included in National Pollutant Discharge Elimination System (NPDES) Permit No. MI0023710 for the Northfield Township WWTP, which went into effect on August 1, 2014. Part I.A.8 of the NPDES Permit contains a requirement to develop an AMP by February 1, 2015. A preliminary AMP was prepared to meet these requirements, as the SAW grant had not been awarded to the Township prior to this date. Tetra Tech was engaged by Northfield Township to provide a more detailed AMP for the sanitary collection system, pump stations, and WWTP. This AMP report includes information on the assets owned and operated by the Township, which includes the portion of Green Oak Township that is sewered.

This AMP has been designed to provide the Township with a proactive and sustainable long-term plan to help ensure the well-being of the community and environment. The AMP approach centers on the following five core elements:

1. Asset Inventory and Condition Assessment
2. Level of Service
3. Criticality of Assets
4. O&M Strategy and Revenue Structure
5. Capital Improvement Planning

Asset Inventory

Existing Township geographic information system (GIS) data were used as a basis for the plan, and was augmented with survey data, detailed equipment and collection system asset inventories and replacement costs. To aid in this analysis, the system information has been integrated with Lucity™ Asset Management Software (AMS), which was purchased and implemented as part of this program. The Lucity™ software operates as an extension of the GIS and is primarily a work order and capital improvement planning tool aimed to help the Township streamline administrative processes and simplify mandatory reporting.

The current value of the entire wastewater infrastructure exceeds $50 million. The current value of the Township's sanitary sewer collection system is approximately $33 million, with 57% of the system cost associated with gravity mains and manholes and the remaining cost attributed to pump stations, force mains, and grinder stations. Table ES-1 summarizes the quantity and baseline system replacement value (in 2019 dollars).

Table ES-1. Collection System Asset Summary and Cost

System Component	Quantity (unit)	Baseline System Value (Current Replacement Cost)
Gravity Mains	175,485 feet	$13,036,000
Manholes	781 each	$7,810,000
Force Mains	29,426 feet	$2,589,000
Pump Stations	15 each	$9,289,000
Grinder Stations	10 each	$200,000
	Total	**$32,924,000**

The Township's WWTP includes a collection of 600 assets that represent the total facility processes and have a replacement cost of over $25 million. Table ES-2 summarizes the various WWTP assets by process or building and the associated replacement value of those assets (in 2019 dollars).

Table ES-2. WWTP Asset Summary and Cost

Process Location	Assets	Baseline System Replacement Cost
Preliminary Treatment	44	$1,136,0000
Primary Treatment	44	$1,224,,000
Intermediate Treatment	10	$1,881,000
Aeration System	105	$2,936,000
Final Settling Tanks	35	$1,591,000
Tertiary Filtration/Disinfection	99	$3,100,000
Sludge Treatment	155	$7,402,000
Chemical Feed System	33	$1,404,000
Miscellaneous Assets	75	$4,457,000
Total	**600**	**$25,131,000**

Figure ES-1 summarizes the replacement costs for the entire sanitary sewer collection and treatment system, including the WWTP, gravity mains, manholes, force mains, and pump stations.

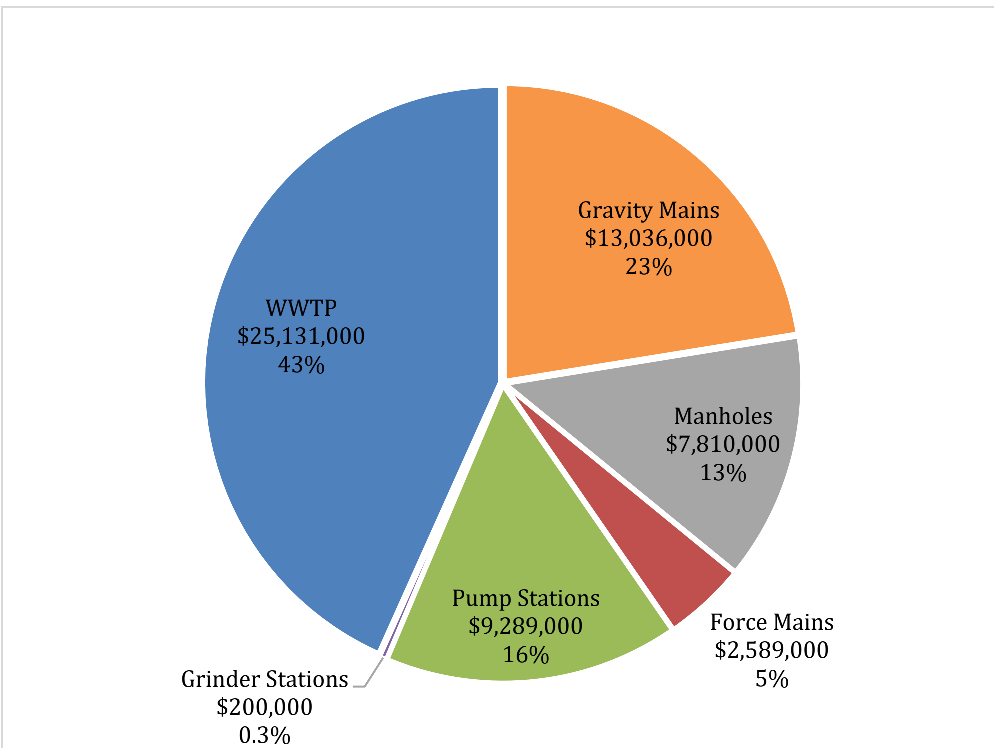

Figure ES-1. Replacement Costs for Sanitary Sewer Collection System

Level of Service

A major factor in the quality of community life is the condition of the community's facilities, services and amenities. Level of Service is a measure of the amount and/or quality of the public facility which must be provided to meet that community's basic needs and expectations. The Township developed a list of key performance indicators (KPIs) to hold as goals for the Level of Service for their sanitary sewer facilities, which can be seen in Table ES-3. The Township currently is implementing the maintenance tracking system. The remaining performance goals in Table ES-3 are being met. The Township will focus on maintaining this high Level of Service.

Table ES-3. Level of Service KPIs

Level of Service Key Performance Indicators
Reduce basement backups
Reduce infiltration/inflow rates and volumes
Provide capacity to convey EGLE design storm
Reduce odor complaints
Clean all sewers at least once in 5-year period
Replace underperforming pump stations
Meet requirements of NPDES permit
Implement equipment inventory and maintenance tracking system

Criticality

The criticality of assets are assessed and used to prioritize future improvements so that money is invested in the most needed projects. Criticality is quantified by use of a numerical score called Business Risk Evaluation (BRE).

BRE is defined as the product of probability of failure (POF) of an asset and the consequence of failure (COF) for that asset. That is, BRE = POF x COF, with numerical values assigned for both POF and COF.

POF is based on the condition of the asset. For this project, the age of each asset was identified and evaluated with additional information such as equipment records, staff observations and field condition analysis. In the case of the collection system, 262 of the manholes and 90,204 feet of gravity sewer were inspected to assign a condition rating to the assets, which was used to develop the POF. Assets in the 25 pump stations were visually assessed. POF values at the WWTP were also influenced by the condition of the assets. Major assets, including buildings, tanks, piping process, mechanical, and electrical equipment were visually assessed unless they were inaccessible.

COF is based on the consequence to the utility, public and environment of the asset failing. Numerical scores were assigned to each asset based on these factors.

A BRE was subsequently determined for each asset in the Township's system. The BRE for process assets at the WWTP also allowed for redundancy (expressed as a decimal) to be considered, if additional units were included in the design to provide firm capacity. The BRE for these assets was calculated as BRE = POF * (1 – Redundancy) * COF. These BRE ratings, combined with Township Staff experience, were used to define a Capital Improvement Plan for Northfield Township.

Revenue Structure

The Township completed a revenue structure report that demonstrates that the Township's wastewater utility generates sufficient revenue to fund the operation and maintenance of the wastewater utility. The SAW grant does not require the Township to fund capital improvements through wastewater rates although Northfield Township, like most municipalities, typically does for smaller projects. Larger projects within the Township typically require loans and other funding to be completed. A separate report has been prepared to analyze the ability of the Township's rates to implement the CIP in this report. The Revenue Structure Report was submitted to EGLE for review on February 6th, 2020.

Capital Improvement Plan

A 20-year capital improvement plan (CIP) was developed for both the collection system and the WWTP using the results of the business risk evaluation conducted in this AMP. The capital improvement plan identifies areas in the collection system and WWTP where funding should be provided over the next 20 years. This CIP should be routinely updated to ensure that it includes short- and long-term needs. It will provide the Township with defensible documentation for setting aside and safeguarding funds for projects. The 20-year CIP is presented in Table ES-4. Projects beginning with CS indicate a collection system project and WWTP denotes a project at the plant. Bolded projects are proposed to occur within the next five years.

Table ES-4. Northfield Township 20-Year Capital Improvement Plan (2021-2040)

Project Number	Description	Project Year	Project Cost
WWTP-1	**Wet Weather Storage Tank Construction**	**2021**	**$4,662,500**
CS-1	**Grade 5 Defect Repairs**	**2021**	**$82,000**
WWTP-2	**Aeration Improvements and Blower Replacement**	**2021**	**$339,000**
WWTP-3	**Secondary Settling Tanks Restoration**	**2023**	**$405,000**
CS-2	**Main Street Pump Station Replacement**	**2025**	**$441,000**
WWTP-4	**Filter Building No. 1 Rehabilitation**	**2025**	**$151,000**
WWTP-5	**Controls Replacement**	**2025**	**$448,000**
CS-3	**Grade 4 Defect Repairs**	**2025-2026**	**$209,000**
WWTP-6	Primary Switchgear Replacement	2026	$528,000
WWTP-7	Miscellaneous Pump Replacement	2027	$96,000
WWTP-8	Motor Control Centers Replacement	2027	$700,000
CS-4	24-inch Cross Lot Sewer Replacement	2030	$2,039,000
CS-5	East Shore 2 Pump Station Replacement	2030	$635,000
CS-6	North Shore 1 Pump Station Replacement	2030	$509,000
CS-7	Horseshoe Lake 1 Pump Station Replacement	2030	$650,000
CS-8	Future Grade 5 Sewer Repairs	2030	$123,000
WWTP-9	Roof Refurbishment	2030	$340,000
CS-9	18-inch Cross Lot Sewer Replacement	2035	$690,000
CS-10	North Shore 2 Pump Station Replacement	2035	$629,000
CS-11	Future Grade 4 Sewer Repairs	2035	$313,500
WWTP-10	Digester Building Improvements	2035	$649,000
WWTP-11	Generator Replacement	2037	$372,000
CS-12	Horseshoe Lake 2 Pump Station Replacement	2040	$545,000
WWTP-12	Tertiary Filters Replacement	2040	$1,637,000
	CIP Projects in First 5-years	**Subtotal**	**$6,737,500**
	Remaining CIP Projects	**Subtotal**	**$10,455,500**
		Total	**$17,193,000**

This AMP only includes potential projects that may be needed over the next 20 years. The information stored for each of the assets can be used to project the expected end of useful life, and subsequent replacement date over a longer time period. Figure ES-2 below is a visual display of the potential replacement cost if each asset in the system were run to failure and required replacement at the end of the expected useful life.

Figure ES-2 shows the projected replacement costs over 5-year intervals for the next 50 years and reveals that there are some intervals in which significant amounts of work may be expected. The replacement cost values are in 2019 dollars. This information can be used to begin planning to fund this future work in advance. Figure ES-2 shows that over the next 50 years there may be up to $41 million of infrastructure improvements to be made. This is an average of approximately $4.1 million spent every 5 years, or $0.81 million annually. $0.81 million annually represents a maintenance budget of approximately 1.4% of the system's value each year. A value of 2 to 3% for a consolidated collection system and treatment system is common. Therefore, Northfield Township may be wise to budget this amount or higher to adequately maintain its wastewater system.

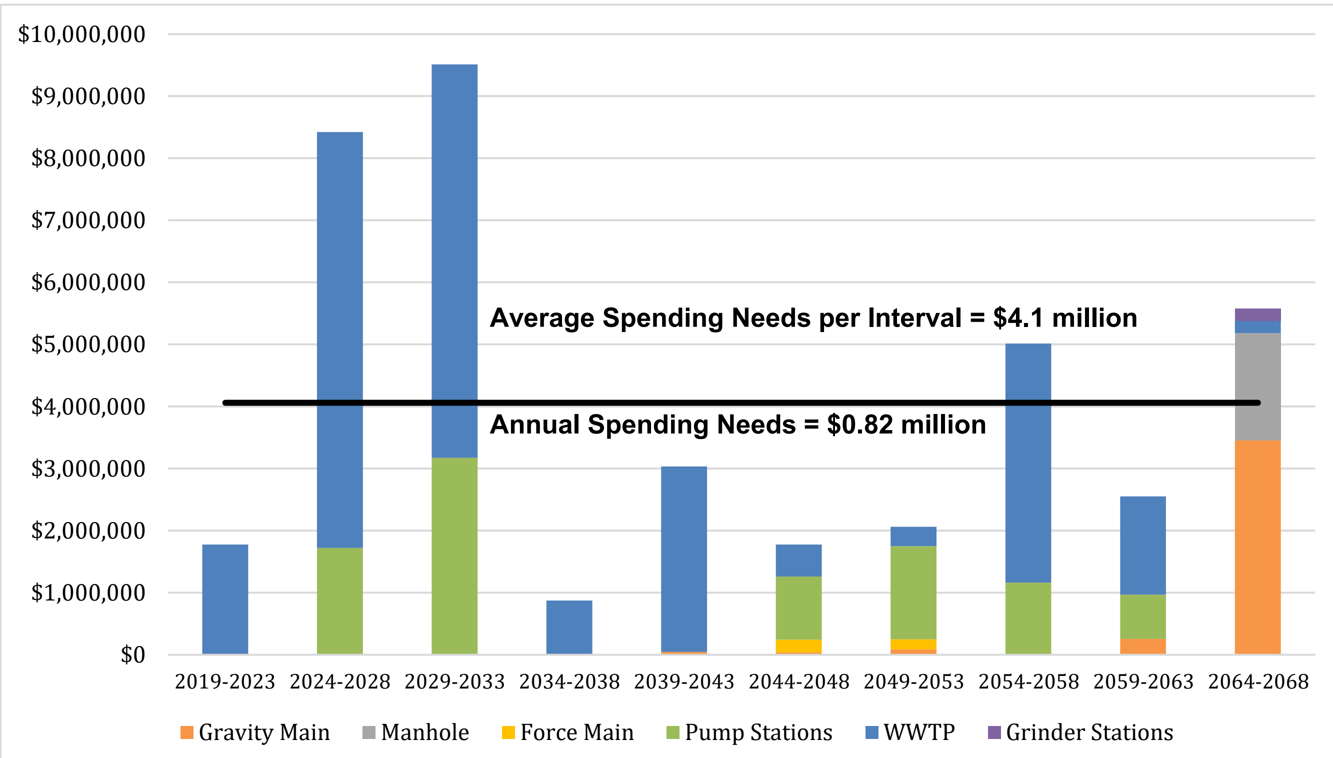

Figure ES-2. Replacement Cost by Year at End of EEL for 50 Years

The 20-year CIP in Table ES-4 averages $0.860 million annually. Preventative maintenance may lower these costs and extend the life of existing assets beyond what is assumed. Likewise, unforeseen events could occur that increase these costs.

Future Steps

As part of the NPDES Permit, the Township will continue to submit annual reports by August 1st including information on the asset management actions completed in the previous year and future planned actions regarding what capital improvement projects were completed, how much was spent on sewer cleaning,

preventative maintenance, and other measures. Four previous reports were submitted between 2016 and 2020. The Lucity™ AMS is designed to provide detailed reports regarding specific performance measures which will make it easier to complete the annual EGLE reporting requirements.

This AMP, inclusive of the GIS model of the sewer system and Lucity™ AMS, are intended to be worked as a unit to assist Township staff in operating, maintaining and upgrading the Township's wastewater infrastructure efficiently and cost effectively. It will be a living set of documents that will require an on-going process of recording information to help the decision makers best manage the needs of the Township's wastewater infrastructure.

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ACRONYMS/ABBREVIATIONS

Acronyms/Abbreviations	Definition
AMP	Asset Management Plan
AMS	Asset Management Software
BOD	Biochemical Oxygen Demand
BRE	Business Risk Exposure
CA	Condition Assessment
CCTV	Closed Circuit Television Video
CI	Cast Iron Pipe
CIP	Capital Improvement Plan
CIPP	Cured in Place Pipe
COF	Consequence of Failure
CS	Collection System
DIP	Ductile Iron Pipe
DS	Downstream
ECR	Engineer's Condition Rating
EEL	Estimated Effective Life
EGLE	Environment, Great Lakes and Energy
ESRI	Environmental Systems Research Institute
FEMA	Federal Emergency Management Agency
FOG	Fats, Oils, and Grease
GIS	Geographic Information System
GPM	Gallons per Minute
HDPE	High-density Polyethylene
I/I	Inflow and Infiltration
KPI	Key Performance Indicator
LF	Lineal Feet
MACP	Manhole Assessment Certification Program
MCC	Motor Control Center
MDOT	Michigan Department of Transportation
MGD	Million Gallons per Day
MH	Manhole
NASSCO	National Association of Sewer Service Companies
NH_3-N	Ammonia Nitrogen
NPDES	National Pollutant Discharge Elimination System

Acronyms/Abbreviations	Definition
NRCP	Non-Reinforced Concrete Pipe
O&M	Operations and Maintenance
PACP	Pipeline Assessment Certification Program
POF	Probability of Failure
PVC	Polyvinyl Chloride
RCP	Reinforced Concrete Pipe
R	Redundancy Factor
RUL	Remaining Useful Life
SAW	Stormwater, Asset Management, and Wastewater
SCADA	Supervisory Control and Data Acquisition
SSO	Sanitary Sewer Overflow
US	Upstream
VCP	Vitrified Clay Pipe
VFD	Variable Frequency Drive
WL GS	Whitmore Lake Road Grinder Station
WWTP	Wastewater Treatment Plant

1.0 INTRODUCTION

1.1 SERVICE AREA

Northfield Township is located in the northeastern corner of Washtenaw County and is home to 8,728 residents (2018 census). The Township consists of approximately 36 square miles of incorporated area. The Township provides wastewater collection and treatment services within a designated service area, which includes portions of Northfield Township and Green Oak Township. Sewers serve the area along the North Territorial Road/US-23 interchange, as well as a majority of the residential areas around Horseshoe Lake, Whitmore Lake, and Wildwood Lake. In addition, the wastewater from the rest stop south of Northfield Church Road is also treated at the Northfield Township Wastewater Treatment Plant (WWTP). Approximately 3,294 households and commercial/industrial customers are served.

1.2 PURPOSE AND INTENT

In 2017, Northfield Township was awarded a Stormwater, Asset Management and Wastewater (SAW) grant by the Michigan Department of Environmental Quality (MDEQ), which is now referred to as the Michigan Department of Environment, Great Lakes and Energy (EGLE), to conduct management and design services for the sanitary sewer system and WWTP. The Township's SAW grant provided financial assistance for the further development of the Asset Management Plan (AMP), which was originally developed in 2015 to comply with National Pollutant Discharge Elimination System (NPDES) Permit requirements. The Township currently utilizes a geographic information system (GIS) where most of the information that details the assets that comprise the wastewater system are stored. Additionally, old drawings, studies, or the institutional knowledge of the system operators were used to collect information. This AMP includes both the collection system and WWTP. Best practices suggest an AMP should include five core elements, including:

1. Asset Inventory and Condition Assessment
2. Level of Service
3. Criticality of Assets
4. Operation and Maintenance (O&M) Strategy and Revenue Structure
5. Capital Improvement Planning

When fully implemented, this AMP will allow the Township to spend money and resources on projects that will do the most good for their system. By addressing critical assets before major failures, the Township can become more proactive than reactive in maintenance and improve efficiencies in their operations. In addition to further developing this AMP report, it is anticipated that the Township will utilize the SAW grant funding to execute sanitary sewer collection system and WWTP improvement projects.

1.3 EXISTING OPERATIONS

Northfield Township's wastewater infrastructure is maintained by the Township's WWTP staff. The WWTP staff is headquartered at the Township's WWTP located at 11500 Lemen Road, Whitmore Lake, Michigan 48189. The department consists of five staff persons. The Department is led by a Plant Superintendent, a position currently held by Dan Willis.

The sanitary sewer budget is an enterprise budget with revenues and costs allocated exclusively for the operation of the wastewater collection and treatment system.

The Township intends to utilize this plan to enhance existing operations and provide for sustainable options to continue providing a high level of customer service. The WWTP staff is proactive in their response to customer complaints and performs quality maintenance and repair work, which has resulted in very few recurring issues.

1.4 EXISTING COLLECTION SYSTEM OVERVIEW

The Township's collection system is primarily gravity sewer with several standard (submersible, dry pit and ejector) and grinder pump stations, as well as force main runs conveying flows to different sections of the collection system before being routed to the WWTP. The system is an entirely separate sanitary sewer (i.e., no catch basins or other stormwater collection infrastructure are known to be connected to the sanitary sewer). The gravity sewers and pump stations are concentrated around two lakes: Whitmore and Horseshoe, where a large contingent of Township residents reside. The natural geographical layout of the two lakes (Whitmore to the north and Horseshoe to the south) divides the Township's collection system into a north "half" and a south "half" with the north "half" containing most of the gravity sewers and pump stations in the system. In general, the collection system assets around Whitmore Lake were constructed in the late 1960's with revisions to pump stations near Whitmore Lake occurring in the late 1970's. Collection system assets around Horseshoe Lake were constructed in the late 1970's. Various extensions to the system, including the Barker and North Territorial Roads extensions, were constructed in the 1990's. Additional collection system assets at the edges of the system, especially those in new developments, were constructed in the 2000's.

There are approximately 42 miles of sewer in the collection system including force mains. The collection sewers range in diameter from 8 to 12 inches. The interceptor system has pipes between 15 and 30 inches in diameter. The sewers within the system are predominantly vitrified clay (VCP) and polyvinyl chloride (PVC). However, reinforced concrete pipe (RCP) and ductile iron (DI) pipe are also present. Manholes within the system total approximately 780 with manhole diameters being predominately 4 feet in diameter. Manholes within the collection system are constructed of concrete and block.

The Township also has 25 pump stations located throughout the collection system. Thirteen of the pump stations are of the submersible, dry pit or ejector type serving regions while the remaining 12 are of the grinder type serving individual buildings. The overall collection system can be seen in Figure 1-1. A 24 x 36-inch index map and 11 x 17-inch map book that includes the entire collection system with manhole asset IDs, pipe diameters, and flow directions is provided in Appendix A of this report.

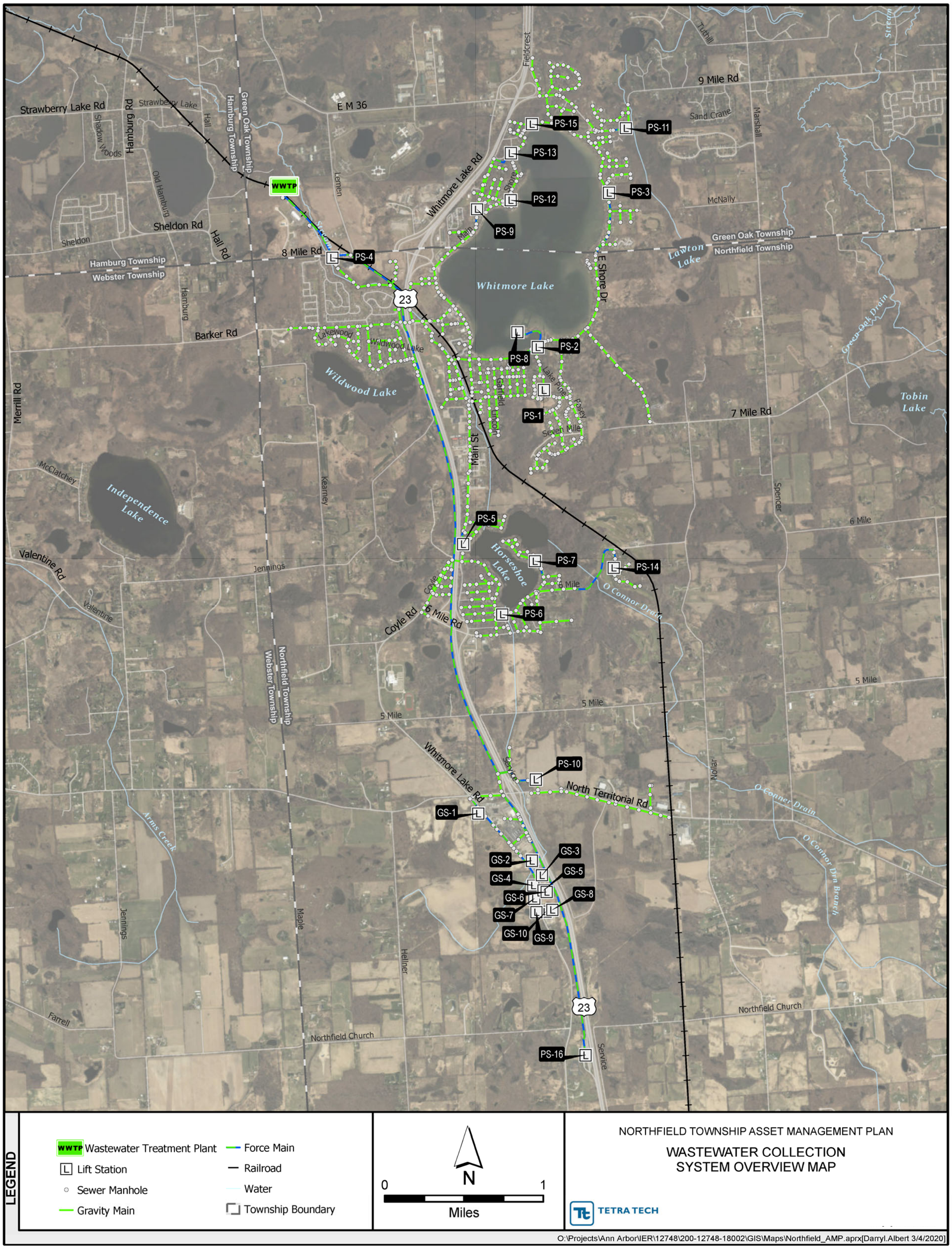

Figure 1-1. Collection System Overview Map

1.5 EXISTING WASTEWATER SYSTEM OVERVIEW

The collection system has an 8-inch force main and a 12-inch force main that convey the Township's sanitary sewage flow to the headworks of the WWTP. The 8-inch force main serves a property east of the WWTP that is currently named the Woodland Correctional Center. The 12-inch force main from the 8 Mile Pump Station carries the majority of the flow to the WWTP.

The Township's Wastewater Treatment Plant (WWTP) is located just north of Northfield Township in Livingston County and was constructed in 1964 to serve portions of Green Oak and Northfield Townships. The northern portion of Whitmore Lake extends into Green Oak Township and the sewer system serves the Green Oak Township area around the lake. Major WWTP expansions were completed in 1978 and 1997. Few improvements to the WWTP have been implemented within the last 23 years. The facility has a design flow rate of 1.3 million gallons per day (MGD) and a peak sustained treatment rate of 2.5 MGD. The current average daily flow is 0.8 MGD.

A schematic showing the WWTP processes can be found in Figure 1-2. An aerial view of the WWTP is provided in Figure 1-3. Influent raw sewage passes through a mechanical fine screen to remove large solids and rags that may damage downstream equipment. Flow then passes through the grit tank to remove small grit material. The next steps are the primary settling tanks, trickling filter, intermediate settling tank, aeration tanks, and final clarifier tanks. The secondary effluent flow then continues to the tertiary filters and chlorination before being discharged into the Horseshoe Lake Drain. The plant biosolids are thickened in a gravity tank before being pumped to digester tanks. The digested biosolids are then stored and land applied by a licensed contractor.

Treated wastewater is discharged in accordance with the limits and monitoring requirements of NPDES Permit No. MI0023701, which was put into effect on August 1, 2014 by MDEQ (now EGLE). A copy of the current permit is included in Appendix B.

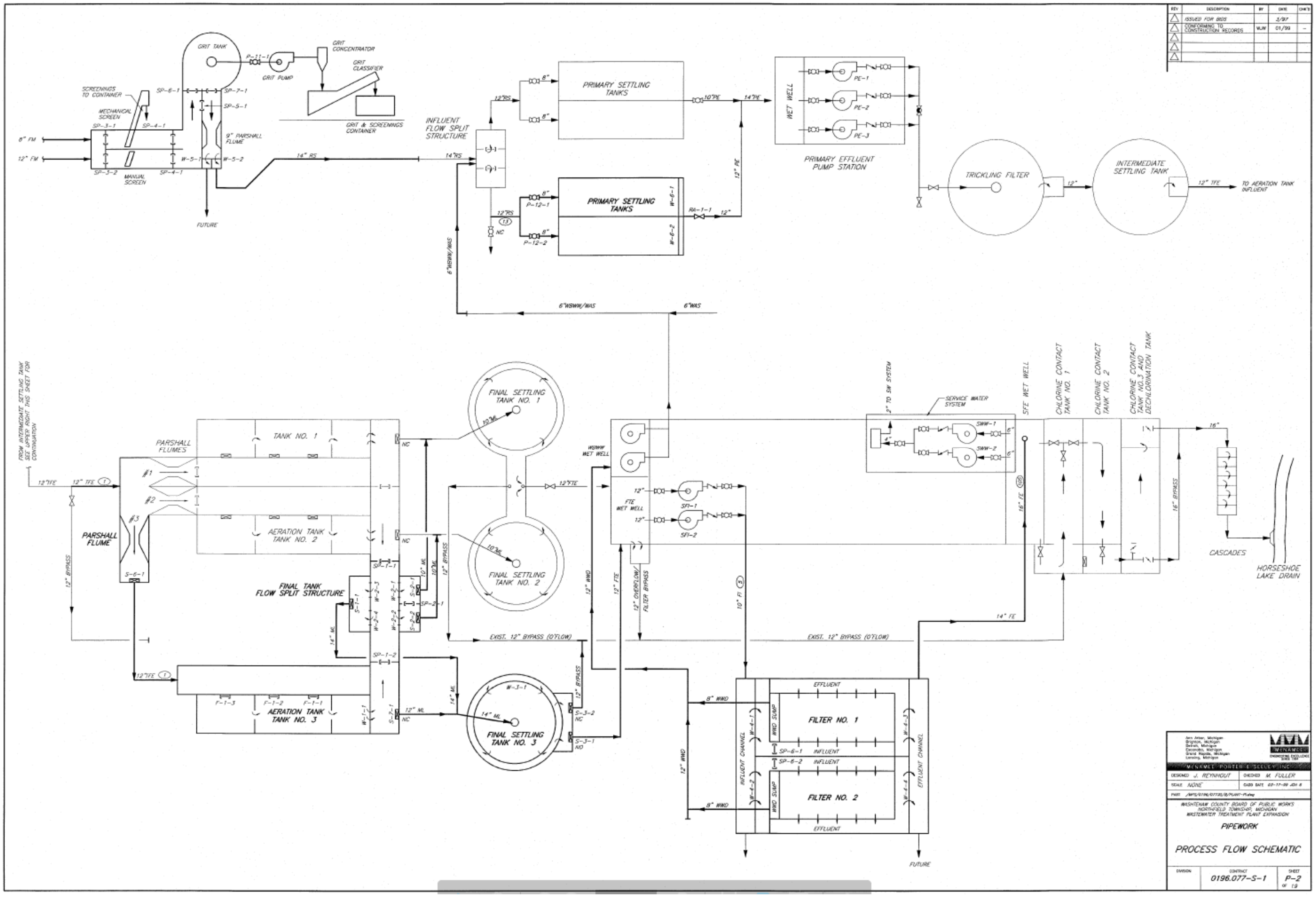

Figure 1-2. WWTP Schematic

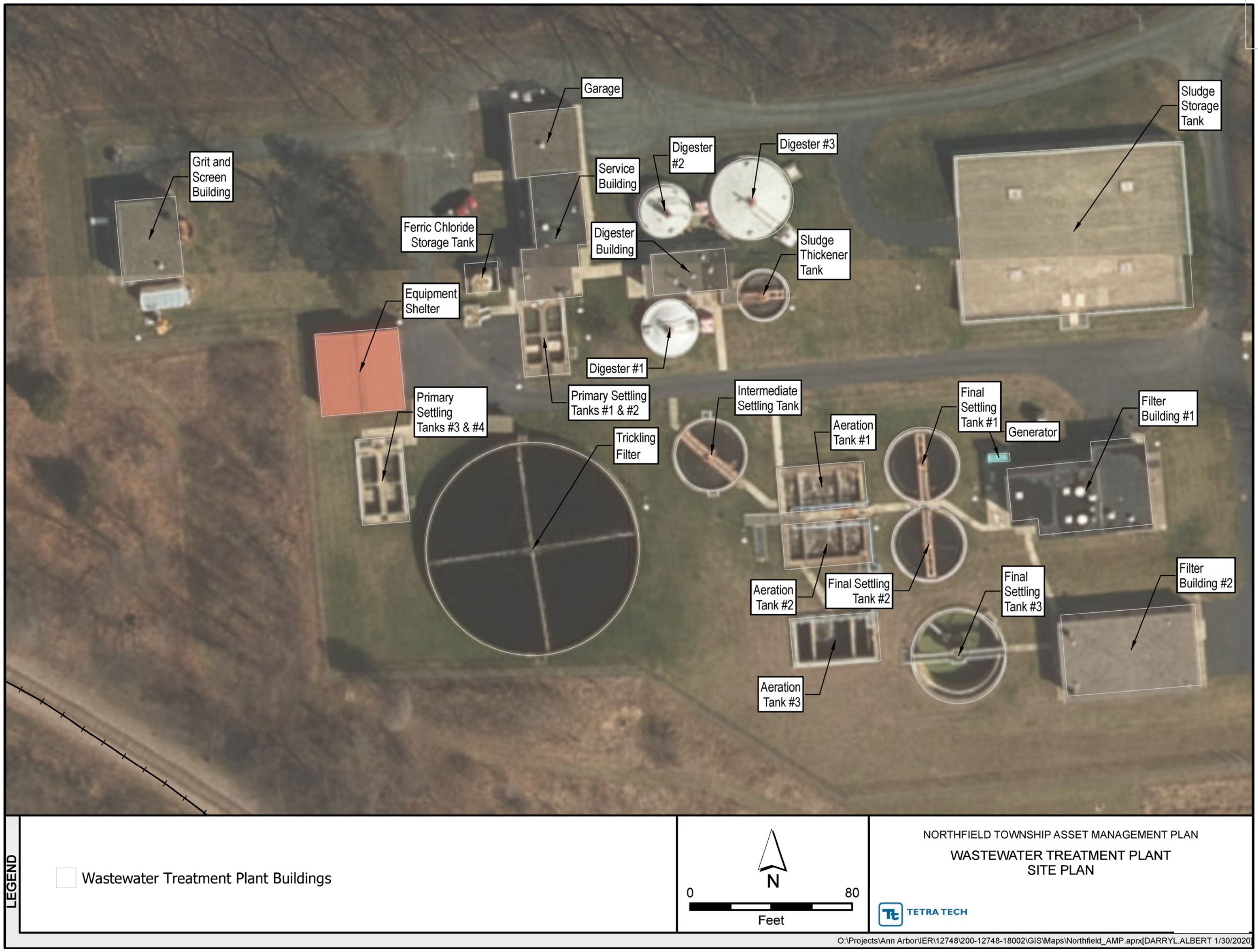

Figure 1-3. Aerial View of Northfield Township WWTP

1.6 PLAN COMPONENTS

Below is a detailed explanation of the seven core components of the AMP.

1.6.1 Asset Inventory

Linear assets (sewer collection system) and vertical assets (WWTP) were evaluated for this AMP. These two elements of the system were isolated due to the difference in organizing the information in the inventories. The collection system asset group has been categorized by sewer (gravity) mains, manholes, force mains and pump stations. The WWTP inventory has been grouped by treatment process.

The inventory must include the following information for all operations-related fixed assets in the collection system and WWTP:

- Description of asset, capacity, redundancy and tag number, if applicable
- Unique ID
- Location
- Year installed
- Present condition
- Depreciated value for given year
- Current replacement cost

The AMP was developed to maximize the capabilities of the selected software and be fully compliant with the SAW Grant requirements. The Township's existing GIS system was enhanced with data collected as part of this report and was used to compile the collection system inventory. Both the collection system and WWTP assets are listed in spreadsheets. All of the documented assets have been imported into the Lucity™ software.

1.6.2 Condition Assessment

A condition assessment was performed in 2019 as part of this project to assist with determining which assets were the most likely to fail. For the collection system full inspections of 262 manholes, closed-circuit television video (CCTV) inspection of approximately 90,000 feet of sewer main, and individual site inspections of each of the system's pump stations were completed. All accessible equipment in the WWTP inventory was inspected and assigned a condition. Inspection results were used to provide condition assessments for all assets inspected, and a basis for assumptions used to estimate the condition of the remaining assets.

1.6.3 Level of Service

The level of service element encompasses those wastewater treatment and collection system goals that the Township will attempt to maintain throughout the implementation of the AMP. These goals include providing a system that meets their permitted regulatory standards, communicating these goals with residents, and maintaining the WWTP in a manner to reduce overflows in the future.

1.6.4 Critical Assets

Once the assets were cataloged in the inventory, the criticality of the assets was evaluated. Some assets are highly critical to operations, while others are not. Some asset groups may be critical in one location, and not critical in another. Criticality is assessed by looking at both the probability that an asset may fail (POF) and the consequences in the event of failure (COF).

The consequence of failure was assessed separately. The collection system COF review utilizes the GIS map to evaluate impacts on the asset's location and function. For the WWTP, each fixed asset was evaluated for its impact on the overall processes, operations of the facility, and safety to assign a score.

Redundancy of process assets and pumps at pump stations were reviewed based on the firm capacity provided according to the WWTP Operation and Maintenance Manual. The information was incorporated in determining the overall criticality of these assets.

1.6.5 Revenue Structure

The SAW grant requires that the grantee's revenue structure generate sufficient funds to cover the operations, maintenance, and equipment replacement expenses. The Township's revenue structure is presented in Section 7.0 of this report and it meets the SAW grant requirements.

1.6.6 Capital Improvement Plan

Condition assessments were compiled and reviewed against similar assets to identify projected dates at which these assets would require replacement or rehabilitation. These data were also included in the inventory. The criticality assessments were used to create a prioritize asset replacement. This prioritized asset "needs list" was used as the basis for the capital improvement plan, as presented in Section 8.0 of this report, which allows the Township to meet their Level of Service Goals

1.6.7 Hardware and Software

This plan will rely on working with the asset management software (AMS), Lucity™ that the Township has selected to help optimize daily operations by augmenting the way in which work orders to perform O&M are created and managed. The Township will be responsible for providing detailed reports to the State as part of their NPDES Permit that shows they are operating in a responsible and efficient manner as stated in this plan. The Lucity™ software is designed to provide the WWTP staff with the tools to help create a seamless workflow from call center to field crews while simultaneously creating detailed documentation of all annual maintenance, repairs, and expenditures.

The grant allowed for the purchase of hardware to support the selected software and as part of this project a tablet was purchased to be used by the WWTP staff in support of the AMP.

2.0 ASSET INVENTORY

The AMP has been separated into discussions on the collection system and the wastewater treatment system.

2.1 COLLECTION SYSTEM INVENTORY

The primary goal of the inventory was to provide a complete listing of all major assets. The collection system includes all of the publicly-owned and maintained gravity sewer mains, associated manholes, and force mains. Pump stations have been included and are broken down to smaller components including individual pumps and valves.

2.1.1 Collection System Map

The collection system map was updated to display the assets and is included in Appendix A. This map includes the following assets as specified in the NPDES Permit:

- All sanitary sewer lines and related manholes
- All outfalls, including the treatment plant outfall and any known sanitary sewer overflows
- All pump stations and force mains
- The wastewater treatment facilities, including all treatment processes
- All surface waters (labeled)
- Other appurtenances, such as inverted siphons and air release valves
- A numbering system that uniquely identifies manholes and regulators
- The scale and a north arrow
- The pipe diameter, date of installation, type of material, distance between manholes, and the direction of flow
- The manhole interior material, global positioning system coordinates (optional), rim elevation and invert elevations

Assets associated with combined sewer systems were omitted, as the Northfield Township collection system contains only sanitary sewer. The methodology for obtaining this information is summarized below.

2.1.2 Base Information

This AMP for the collection system was developed in part using the Environmental Systems Research Institute (ESRI®) ArcGIS system the Township maintains for the sanitary sewer collection system and modifying the data structure to accommodate the SAW grant and NPDES Permit requirements as stated above in this report.

The first step was to review the data contained for each asset in the Township's GIS database, including asset type, asset size, construction material, installation date, and depth (if applicable). In some cases, key attribute information such as construction materials, installation dates, and depths were missing. To help close these gaps in the data, system-wide inventory was generated, as well as select sewer televising. The discussion below clarifies some of the methods and assumptions made during this gap analysis. A core piece of information needed to establish an asset in the system is the initial installation date. The GIS was populated with the installation date based on a limited set of record drawings and made assumptions where no records were available.

2.1.3 Work Order History

The Township currently uses a work order system consisting of handwritten tickets that are distributed to crews as they are compiled. As part of this project, the Township intends to begin generating and tracking work orders in the Lucity™ software. This information will be linked to specific assets in the GIS, providing direct documentation for the work performed on the asset. Over time these work orders will accumulate and as a history develops, trends will be identified and used as a factor in assessing various assets. With few existing work order records to begin with, the current dataset of information is too small to be of any significant value for this analysis. Moving forward, this factor will be used to help reduce the amount of corrective and preventative maintenance spending by identifying assets that require permanent correction through capital improvements.

2.1.4 Incomplete Attribute Information

2.1.4.1 Collection System Asset Attribute Assumptions

In some cases, collection system assets were missing attribute information due to a lack of information available in GIS, record documents and field investigations. When this information was unavailable, Tetra Tech made assumptions to fill voids in asset data. Manholes and sewer runs were the most likely asset types to be missing attribute information. Within these asset types, diameter and material attributes for sewer runs were most often missing. In order to populate these attribute categories, Tetra Tech made the following assumptions:

- Sewer runs and manholes missing diameter values were assumed to be the same diameter as both the immediate upstream and downstream runs of sewer or manhole when the upstream and downstream run diameters were identical. When the downstream sewer run or manhole was larger in diameter than the upstream sewer run or manhole, the sewer run or manhole missing a diameter value was assumed to be the same size as the upstream run or manhole if it was apparent from the collection system layout that the run or manhole missing a diameter value was part of a branch feeding the downstream run or manhole. When the run or manhole missing a diameter value was determined to be fed by the immediate upstream run, the run or manhole missing a diameter value was assigned the same diameter as the downstream run or manhole. When none of these conditions could be met, sewer runs or manholes missing diameter information were assumed to be 8 inches or 48 inches in diameter, respectively, as these are the most common diameters found throughout the system.
- Sewer runs and manholes missing material values were assumed to be the same as both the immediate upstream and downstream runs of sewer and manholes when the upstream and downstream run or manhole diameters were identical. When the upstream run or manhole differed from the downstream run or manhole, it was assumed that the run or manhole missing material information was the same as the upstream run or manhole if it was apparent from the collection system layout that the run or manhole missing a material was part of a branch feeding the downstream run or manhole. When the run or manhole missing a material was determined to be fed by the immediate upstream run, the run or manhole missing a material was assigned the same material as the downstream run or manhole. When it was not possible to determine sewer run or manhole material based on the upstream and downstream runs and manholes, the sewers and manholes in the immediate vicinity were used as reference for a determination of material. When none of the above conditions could be met, VCP was assumed as the material for sewer runs and brick was assumed as the material for manholes, as these are the most common materials found throughout the system.
- Relative depth information was available for sewers that were inventoried and measured. In order to fully calculate depths for scoring consequence of failure, upstream and downstream assets were used for a comparative basis and ranking factor.

- Some assets were not visible or in operation at time of inspection. Assumptions were made on their condition. Examples are valves and pumps that were submerged in tanks. Condition ratings for these were based on staff input and similar assets on site.
- When pump station discharge force main length, diameter and material were unknown, Tetra Tech assumed a length, diameter and material based upon the original installation date, station type and relative proximity to downstream collection sewers. Stations without force main material information available that were constructed in the 1960's and 1970's were assumed to have cast iron force mains, while stations constructed in the 1990's or later were assumed to have ductile iron force mains. Assumed force main lengths were determined on a case-by-case basis.

2.1.5 Replacement Cost Data

Replacement cost data were developed for the assets to provide the Township with information to assist in managing the system and project future cost. The costs were all based on replacement of the asset in kind, though some assets could possibly be replaced with different technology or processes. For the purposes of the AMP it was deemed that equipment should be replaced with "as equal".

The replacement costs were developed from multiple sources including; previous purchases, previous project data, manufacturer furnished quotes, and engineer best practice experience. The costs furnished include the equipment cost, contractor mark-up, installation, and engineering, legal and administration contingencies.

All costs are reported in 2019 dollars (Engineering News-Record cost index of 11311, September 2019).

2.1.5.1 Collection System Cost Assumptions

The following assumptions were used when developing replacement costs:

- Materials – Various pipe materials exist within the collection system including, clay, metal, and concrete. The maximum diameter pipeline in the system is 30 inches. PVC was assumed for the replacement material for sewer in all cases except for the force mains. All new manholes are assumed to be replaced with precast concrete structures and it is assumed that any rehabilitated sewer main will receive a cured-in-place pipe liner.
- Depth – The depth of a pipe can result in differing installation costs primarily due to additional excavation and backfill, or changes in the strength requirements of the pipe. In some cases, deeper assets could exceed the ability of the Wastewater Department to complete the repairs themselves. Three depth categories were assumed for the sanitary sewer system: Shallow (less than or equal to 20 feet), medium (20 to 25 feet), and deep (greater than 25 feet). Assumptions for the pipe trench size for each depth were used to determine the additional cost. The depth of pipe was calculated using the GIS inventory.
- Pavement Costs –Based on the trench width established by the depth assumptions above, a pavement removal and restoration cost were defined. Costs included the removal and construction of a new roadway and base. The process for determining if a pipe is or is not in a road is based on the GIS data.
- Equipment Costs – These costs are based on cost opinions for contractors to both furnish and install equipment. The costs are intended to provide a baseline for budgeting. If the work is not performed by contractors but rather by Township personnel, applicable reductions to these costs may be made.
- Additional Costs – An additional factor of approximately 20% was used to represent engineering, legal, and contingency costs.
- Accounting for Inflation – In the detailed CIP estimates, the total project costs were expressed in 2019 dollars, but can be projected out to the mid-year point of the year in which they are recommended to be completed. This process can be done using both the current ENR and the projected ENR for the year in which the project is recommended for completion.

2.1.6 Inventory Results

2.1.6.1 Gravity Mains

This asset group includes approximately 33 miles of gravity sewers maintained by the Township. Table 2-1 summarizes the collection system gravity mains by key attributes such as material, diameter, and installation year. The full gravity main inventory can be found in Appendix C.

Table 2-1. Gravity Main Summary

PIPE MATERIAL		
Pipe Material	**Length (Feet)**	**% of System**
DI	3,440	1.9%
PVC	58,909	33.6%
RCP	1,761	1.0%
VCP	111,375	63.5%
Grand Total	**175,485**	**100%**
PIPE DIAMETER		
Diameter	**Length (Feet)**	**% of System**
8 inch - 12 inch	160,944	91.7%
15 inch - 30 inch	14,540	8.3%
Grand Total	**175,485**	**100%**
PIPE AGE		
Year	**Length (Feet)**	**% of System**
1965-1980	118,974	67.8%
1981 - 2000	30,062	17.1%
2001 - Present	26,449	15.1%
Grand Total	**175,485**	**100%**

Replacement costs for the gravity sewers were developed as part of the AMP. Unit replacement costs were developed for this purpose. This information has been incorporated in the Lucity™ software to provide the Township with the ability to rapidly compare the capital renewal cost for asset replacement. Table 2-2 summarizes the current baseline system replacement costs for gravity mains.

Table 2-2. Potential Replacement Costs for Gravity Mains

Asset	Quantity	Baseline System Replacement Cost
Gravity Mains	175,485 feet	$13,036,000

2.1.6.2 Manhole Inventory

Northfield Township's WWTP staff completed a manhole inventory which included visiting select structures, surveying the location and elevation of the structure rims, and inspecting each structure using the National

Association of Sewer Service Companies (NASSCO) Manhole Assessment and Certification Program (MACP) framework as required by the SAW grant.

This asset group includes 781 manholes maintained by the Township, with 776 manholes on the gravity sewers and 5 located on the force main. Manholes within the Township's collection system are predominantly 4 feet in diameter. Table 2-3 summarizes the collection system manholes by key attributes. More detailed manhole inventory information is included in Appendix C.

Table 2-3. Manhole Summary

MANHOLE MATERIAL		
MH Material	**Count (Each)**	**% of System**
Precast	219	27.3%
Block	562	72.7%
Grand Total	781	100%
MANHOLE AGE		
Year Installed	**Count (Each)**	**% of System**
1965-1980	516	66.2%
1981-2000	174	21.6%
2001 - Present	91	12.2%
Grand Total	781	100%

Out of a total of approximately 781 public manholes that were originally identified in the system, 34% were successfully inventoried (many Township-owned manholes are buried in wooded areas and below gravel roads). The Township will integrate the inspection results of non-inventoried structures into the database as these structures are encountered for future work. Adjacent structure data were used as a basis for populating the basic asset attributes for the non-inventoried structures.

Replacement costs for the manholes were developed for the Northfield Township collection system based on a unit cost of $10,000 per manhole. This information has been incorporated in the AMS to provide the Township with the ability to rapidly compare the capital renewal cost for asset replacement. Table 2-4 summarizes the baseline replacement and costs for manholes.

Table 2-4. Potential Replacement Costs for Manholes

Asset	Quantity	Baseline System Replacement Cost
Manholes	781	$7,810,000

The force main manholes identified during the project were included in the count above. However, the cost does not include any equipment or piping replacement related to the manhole.

2.1.6.3 Force Mains

In total, this asset group includes approximately 9 miles of force mains within the service area. However, much of this footage is attributed to the North Territorial Road pump station discharge force main (maintained by the Township and included in Table 2-3), the Whitmore Lake Road low pressure force main (collects discharge from the Whitmore Lake Road grinder stations) and the Michigan Department of Transportation (MDOT) rest area pump station (not maintained by the Township and not included in this AMP Report) along US-23. Table 2-5 summarizes the collection system force mains associated with the pump stations maintained by the Township. Additional force main inventory information can be found in Appendix C.

Table 2-5. Pump Station Discharge Force Main Summary

Pump Station	Force Main		
	Diameter (in)	Material	Length (ft)
Eagle Gardens	10	Ductile Iron	10
East Shore 1	6	Ductile Iron	561
East Shore 2	6	Ductile Iron	2,207
Eight Mile Road	12	Ductile Iron	2,951
Horseshoe Lake 1	6	Cast Iron	460
Horseshoe Lake 2	6	Cast Iron	900
Horseshoe Lake 3	4	Cast Iron	827
Lake Point Drive	2	HDPE	1,265
Main Street	6	Cast Iron	787
North Territorial Road	12	Ductile Iron	13,200
Nine Mile Road	4	Cast Iron	512
North Shore 1	4	Cast Iron	67
North Shore 2	4	Cast Iron	777
Shadowoods	3	Ductile Iron	2,840
Canal (Elmcrest)	4	Cast Iron	583
Grinder Station Force Main	1.5	HDPE	1,479
		Total	**29,426**

Note: HDPE – High Density Polyethylene

Replacement costs for the force mains have been incorporated in the AMS to provide the Township with the capital renewal cost based on replacement. Table 2-6 summarizes the current baseline replacement costs for force mains maintained by the Township.

Table 2-6 Potential Replacement Cost for Force Mains

Asset	Quantity	Replacement Cost
Force Mains	29,426 feet	$2,589,000

2.1.6.4 Pump Station Inventory

There are 15 active regional sanitary sewer pump stations owned and operated by the Township. Pump stations are, by nature, critical components of a collection system since a failure could lead to significant upstream private property or environmental damage.

Each of the pump stations was reviewed with the Township to determine what types of unique equipment are located at each station, with a focus on assets that they check and maintain regularly so they could be easily integrated into the Lucity™ AMS.

Individual pump station site visits and inspections took place in 2019 and all of the unique equipment assets at each site were recorded. The pump station was also given a general condition rating and an estimated remaining useful service life. A spreadsheet was developed for each pump station to record the assessment information, track the estimated remaining service life, and calculate the recommended replacement date. These spreadsheets have been included in Appendix D of this report. Table 2-7 provides a summary of the pump station locations, capacities and installation years.

Table 2-7. Northfield Township Regional Pump Stations

GIS ID	Pump Station Name	Location	Discharge Capacity	Year Installed
PS-1	Eagle Gardens	Lake Pine Dr., Eagle Gardens Subdivision	200 gpm @ 34.5’ TDH	1995
PS-2	East Shore 1	Lake Pine Drive	760 gpm @ 46’ TDH	2007
PS-3	East Shore 2	End of Preservation Drive	300 gpm @ 25’ TDH	1969
PS-4	Eight Mile Road	Eight Mile Rd. between Emerald and Lemen	1,100 gpm @ 125’ TDH*	2001
PS-5	Horseshoe Lake 1	8082 Main Street	400 gpm @ 32’ TDH	1978
PS-6	Horseshoe Lake 2	Edmund Street	150 gpm @ 13’ TDH	1978
PS-7	Horseshoe Lake 3	Lakeshore Road	100 gpm @ 24’ TDH	1978
PS-8	Lake Point Drive	End of Lake Point Drive	12 gpm @ 24’ TDH	2004
PS-9	Main Street	11773 N. Main Street	100 gpm @ 15’ TDH	1969
PS-10	N. Territorial Road	North Territorial Road	760 gpm @ 46’ TDH	2002
PS-11	Nine Mile Road	9 Mile Road	100 gpm @ 42’ TDH	1978
PS-12	North Shore 1	Corner of Shore and North Shore Drives	100 gallons	1969
PS-13	North Shore 2	Corner of North Shore Drive and DNR Park Road	455 gpm @ 32’ TDH	1969
PS-14	Shadowoods	NW Corner of Turnberry Drive-St. Andrews Court Intersection	50 gpm @ 42’ TDH	1996
PS-15	Canal (Elmcrest)	NE Corner of Intersection of Canal Street and Elmcrest Road	100 gpm @ 17’ TDH	1978

Notes: gpm – gallons per minute

* Represents per-pump discharge capacity in a four-pump station. Information on number of pumps operating under normal conditions not available.

Replacement costs were developed for each pump station. The projected year of replacement and replacement costs are summarized in Table 2-8.

Table 2-8. Pump Station Replacement Costs

ID #	Name	Year Installed	Est. Replacement Year	Replacement Cost*
1	Eagle Gardens	1995	2045	$549,000
2	East Shore 1	2007	2058	$714,000
3	East Shore 2	1969	2030	$635,000
4	Eight Mile Road	2001	2052	$1,500,000
5	Horseshoe Lake 1	1978	2025	$650,000
6	Horseshoe Lake 2	1978	2030	$545,000
7	Horseshoe Lake 3	1978	2030	$519,000
8	Lake Point Drive	2004	2055	$176,000
9	Main Street	1969	2025	$441,000
10	N. Territorial Road	2002	2053	$987,000
11	Nine Mile Road	1978	2030	$474,000
12	North Shore 1	1969	2030	$509,000
13	North Shore 2	1969	2025	$629,000
14	Shadowoods	1996	2047	$470,000
15	Canal (Elmcrest)	1978	2030	$491,000
			Total	**$9,289,000**

Note: * All costs are provided in 2019 dollars. See CIP for details related to pump station replacement recommendations.

An important take away from this table is that the dates in the column titled estimated replacement year are estimated full station replacement dates based on a review of the condition of each system component. The pump stations in bold above are pump stations that are currently experiencing problems and are included as requiring replacement work in the next 5 years within the 20 year capital improvement plan. In most cases, pump station service life can be extended without warranting a full replacement, with key equipment such as pumps, electrical equipment, and piping being replaced over the lifecycle of a station prior to requiring full replacement. One of the three stations above (Main St.) is a dry pit station constructed of a steel valve pit and wet well, with the Horseshoe Lake 1 and North Shore 2 stations being constructed of concrete wet wells and valve vaults. The Main St. station is experiencing corrosion throughout the station, while the Horseshoe Lake 1 and North Shore 2 are experiencing infiltration and corrosion throughout. It is desirable to replace steel pump stations with submersible pumps inside concrete wet wells.

2.1.6.5 Grinder Stations

There are 10 active sanitary sewer simplex grinder pump stations along various properties on Whitmore Lake Road. These grinder pump stations are owned and operated by the Township. The Township's grinder pump stations serve one property each. Although important to the properties that they serve, the grinder pump stations are not considered critical components of the overall collection system since they only serve one property each and their failure would not result in significant upstream private property or environmental damage.

Each of the grinder pump stations was reviewed with the Township to determine what types of equipment are located at each station, with a focus on assets that they check and maintain regularly so they could be easily integrated into the Lucity™ AMS.

Individual grinder pump station site visits and inspections took place in 2019 and all of the equipment assets at each site were recorded. The grinder pump stations were also given general condition ratings and estimated remaining useful service lives. A spreadsheet was developed to summarize the grinder pump stations and to record the assessment information, track the estimated remaining service life, and calculate the recommended replacement date. This spreadsheet has been included in Appendix D of this report. Table 2-9 provides a summary of the pump station locations, capacities and installation years.

Table 2-9. Northfield Township Grinder Pump Stations

GIS ID	Pump Station Name	Location	Discharge Capacity	Year Installed
WL GS-1	Whitmore Lake Road Grinder Station No. 1	6925 Whitmore Lake Road	9 gpm @ 138' TDH	2016
WL GS-2	Whitmore Lake Road Grinder Station No. 2	6542 Whitmore Lake Road	9 gpm @ 138' TDH	2016
WL GS-3	Whitmore Lake Road Grinder Station No. 3	6480 Whitmore Lake Road	9 gpm @ 138' TDH	2016
WL GS-4	Whitmore Lake Road Grinder Station No. 4	6431 Whitmore Lake Road	9 gpm @ 138' TDH	2016
WL GS-5	Whitmore Lake Road Grinder Station No. 5	6410 Whitmore Lake Road	9 gpm @ 138' TDH	2016
WL GS-6	Whitmore Lake Road Grinder Station No. 6	6400 Whitmore Lake Road	9 gpm @ 138' TDH	2016
WL GS-7	Whitmore Lake Road Grinder Station No. 7	6371 Whitmore Lake Road	9 gpm @ 138' TDH	2016
WL GS-8	Whitmore Lake Road Grinder Station No. 8	6350 Whitmore Lake Road	9 gpm @ 138' TDH	2016
WL GS-9	Whitmore Lake Road Grinder Station No. 9	6289 Whitmore Lake Road	9 gpm @ 138' TDH	2016
WL GS-10	Whitmore Lake Road Grinder Station No. 10	6270 Whitmore Lake Road	9 gpm @ 138' TDH	2016

Note: WL GS – Whitmore Lake Road Grinder Station

Due to the similarity of the grinder pump stations, Tetra Tech estimates the replacement of each station to be approximately $20,000. It is anticipated that these stations have an expected useful life of approximately 20 years, which puts their estimated date of replacement at 2036.

2.1.6.6 Collection System Asset Inventory Summary

Table 2-10 and Figure 2-1 provide a summary of the collection system assets and replacement costs.

Table 2-10. Collection System Asset Summary

System Component	Quantity (unit)	Baseline System Replacement Cost
Gravity Mains	175,485 feet	$13,036,000
Manholes	781 each	$7,810,000
Force Mains	29,426 feet	$2,589,000
Pump Stations	25 each	$9,289,000
Grinder Stations	10 each	$200,000
	Total	**$32,924,000**

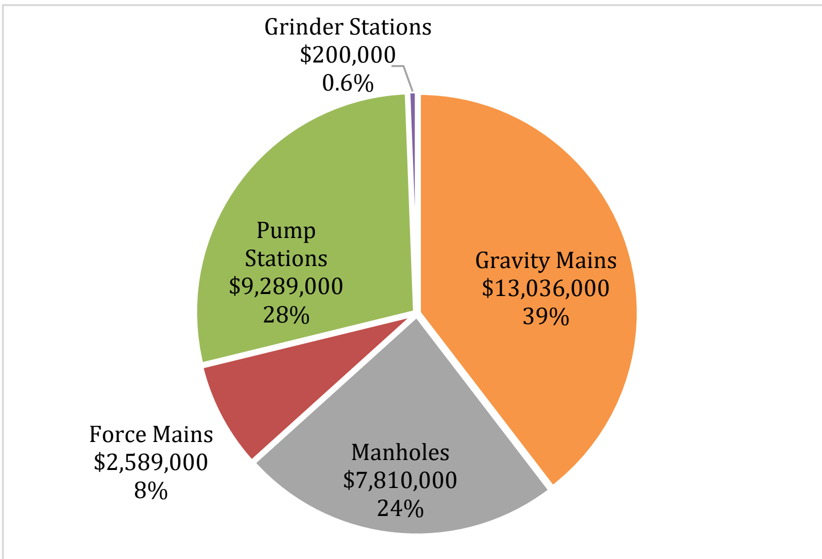

Figure 2-1. Collection System Replacement Cost Summary

2.2 WASTEWATER PLANT INVENTORY

2.2.1 Inventory Methodology

The plant staff performed the WWTP inventory using a spreadsheet developed by Tetra Tech and populated it with their plant assets. As part of the inventory, WWTP staff performed a visual inspection of the assets and were able to develop the condition assessment. For assets that could not be visually inspected due to inaccessibility, a condition was assumed based on the age of the equipment and the anticipated asset life. A summary of the major processes at the WWTP is provided in the following subsections.

At the WWTP, all large equipment was included in the analysis including pumps, motors, blowers, and other equipment. All gates and valves (4 inches and larger) were included as individual assets and smaller valves were included as part of the overall system (e.g., chemical feed system). Estimated lengths of building and yard piping are included. Building and tank structures were also evaluated. Mechanical assets included automatic dampers; boilers and heating, ventilation, and air conditioning units. Electrical assets included control panels, motor control centers (MCCs) and instrumentation.

2.2.2 Replacement Cost Data

Replacement cost data were developed for the assets to provide the Township with information to assist in managing the system and project future cost. The costs were all based on replacement of the asset in kind, though some assets could possibly be replaced with different technology or processes. For the purposes of the AMP it was deemed that equipment should be replaced with “as equal”.

The replacement costs were developed from multiple sources including; previous purchases, previous project data, manufacturer furnished quotes, and engineer best practice experience. The costs furnished include the equipment cost, contractor mark-up, installation, and engineering, legal and administration contingencies.

All costs are reported in 2019 dollars (Engineering News-Record cost index of 11311, September 2019).

2.2.3 Inventory Results

A summary of the inventory results by process area is provided below.

2.2.3.1 Preliminary Treatment

Wastewater is transported to the WWTP through two force mains. The 8-inch forcemain serves the Woodland Center Correctional Facility, located east of the WWTP, across Lemen Road. The 12-inch force main conveys the majority of flow to the WWTP. The wastewater passes through a mechanically-cleaned cylindrical fine screen to remove large, solid material. The screenings are compacted and discharged into a dumpster for disposal. A manual bar screen serves as a back-up during periods of maintenance for the fine screen.

The screened flow continues to the vortex-type grit removal device to remove sand and grit. The collected grit enters a concentrator and classifier. The dewatered grit is combined with the screenings in the dumpster. The grit removal process can be bypassed. The influent flow is metered and totalized by means of a Parshall flume.

2.2.3.2 Primary Treatment

The flow proceeds to the influent flow split structure where it is divided between the four rectangular primary settling tanks. Tanks 1 and 2 were originally constructed in 1964. Tanks 3 and 4 were constructed in 1998. Primary sludge that settles within the tank is pumped to the sludge digester or sludge thickener. Floating scum is collected in a wet well and pumped to the primary digester. Three primary effluent pumps transfer the wastewater from the primary settling tanks to the trickling filter. Three primary settling tanks are required to treat the design flow of the WWTP. The fourth unit provides firm capacity. In addition, phosphorus can be removed by feeding ferric chloride and anionic polymer into the primary settling tanks to form phosphorus precipitate, which settles and is collected as sludge.

2.2.3.3 Intermediate Treatment

The primary effluent is pumped to a trickling filter, which is the beginning of the secondary treatment process. The trickling filter is filled with plastic media on which the microorganisms grow, known as a fixed film treatment process. The wastewater is applied to the top of the tank. As it passes by the media, it provides a food source for the microorganisms and they reduce biological oxygen demand (BOD) and ammonia-nitrogen (NH_3-N). The trickling filter was constructed in 1964 and was retained when activated sludge was added to the WWTP. Microorganisms periodically slough off of the media and are settled in the intermediate settling tank. Scum is collected from the surface of the intermediate settling tank. The collected sludge is pumped to the sludge thickener.

2.2.3.4 Aeration Tanks

Wastewater from the intermediate settling tank enters a flow split chamber that distributes the flow equally to the three aeration tanks. The flow to each aeration tank is measured through Parshall flumes. The aeration tanks are in activated sludge process that uses metabolic reactions of microorganisms to remove substances exerting an oxygen demand, such as BOD and ammonia nitrogen. Three low-pressure centrifugal blowers provide air to the coarse bubble diffusers located just above the bottom of the aeration tanks. Return activated sludge (described under the Final Settling Tanks subsection) enters the aeration tanks and mixes with the microorganisms in the tank. In addition, phosphorus can be removed in the secondary process by feeding ferric chloride and anionic polymer into the aeration tanks to form phosphorus precipitate, which settles in the final settling tank to be collected as sludge.

2.2.3.5 Final Settling Tanks

The effluent from the aeration tanks enters a flow splitter chamber where the flow is directed to one of the three final settling tanks. Final Settling Tanks Nos. 1 and 2 are 30 feet in diameter. Final Settling Tank No. 3 is 40 feet in diameter. The northern settling tanks were constructed in 1977 and the southern final settling tank was constructed in 1991. Microorganisms are settled to the bottom of the tank. The sludge is collected by a mechanism arm as it rotates around the clarifier. The sludge is drawn off by five return pumps located in Filter Building No. 1 and either returned to the aeration tanks or wasted from the system. The secondary effluent flow is then combined and continues to tertiary treatment.

2.2.3.6 Tertiary Treatment

Secondary effluent flow is treated by two traveling bridge filters that provide tertiary treatment. Additional BOD, suspended solids, and total phosphorus are removed from the wastewater by the filters, which were constructed in 1998. The secondary effluent flows by gravity to the filter influent wet well. Two filter influent pumps transfer the wastewater to the top of the traveling bridge filters. The filters contain dual-media sand that removes most of the remaining suspended solids. The wastewater flows through the sand media and out the effluent port. The filters require periodic backwashing in order to continue to pass flow through the media. Traveling bridge filters are backwashed in small sections, allowing the remaining filter sections to remain in service. Two backwash pumps are provided. The water created by the backwashing process is transferred to the head of the WWTP by two washwater pumps.

2.2.3.7 Disinfection

The filter effluent is directed to the chlorine contact tank. The tank is subdivided into four sections. The first section serves as the filter effluent wet well. Chlorine gas provides disinfection. The chlorine gas is fed to the wastewater using the two chlorinators. Adequate contact time is provided in the chlorine contact tank. Residual chlorine must be removed prior to discharge, in order to comply with NPDES Permit requirements. Sulfur dioxide is passed through a sulfonator, which is fed to the end of the chlorine contact tank. Prior to discharge to the Horseshoe Drain, the wastewater passes down the cascades, which provide additional aeration to ensure that the dissolved oxygen NPDES Permit limit is met. The effluent flow is monitored by a Parshall flume.

2.2.3.8 Sludge Treatment

As described above, several processes generate settled sludge, including the primary settling tanks, intermediate settling tank and final settling tanks. The two primary sludge pumps transfer the solids from the primary settling tanks to the anaerobic digesters. Alternately, the primary sludge could be directed to the sludge thickeners. The trickling filter sludge from the intermediate settling tank is pumped to the sludge thickener. If needed, the return activated sludge pumps can also transfer the trickling filter sludge. The activated sludge from the final settling tanks that is not returned to the aeration tanks is wasted by the return activated sludge pumps to the sludge thickener. The waste activated sludge can also be pumped to the primary settling tanks for co-settling.

The gravity sludge thickener typically receives sludge from the intermediate and final settling tanks and is designed to achieve approximately six percent solids. The thickened sludge is pumped by the thickened sludge pump to the anaerobic digesters. Primary sludge from the primary settling tanks is also pumped to the anaerobic digesters. The sludge in the digesters is heated and mixed. The anaerobic microorganisms decrease the organic material and reduces it to a stable black residue. All three anaerobic digesters function as primary digesters, in that the digesters are operating in parallel, rather than in series. The digested sludge is stored in a 730,000 gallon sludge storage tank. Liquid can be decanted from the tank and returned to the head of the WWTP. The biosolids are then land applied by a licensed contractor.

Scum is skimmed from the settling tanks and held in a scum well at each location (primary, intermediary, and final settling tanks). The scum is periodically pumped to the anaerobic digesters for treatment.

2.2.3.9 Miscellaneous Assets

Of the assets assessed in the WTTP, 75 assets were inventoried in the miscellaneous category. These assets include laboratory equipment, large machinery (forklift, backhoe, service vehicles, etc.), yard piping, storage structures, and associated electrical equipment. Some of the electrical equipment, such as the MCCs, are divided into panels that serve several different processes. Rather than try to subdivide the MCCs into their component parts, the MCCs and other similar assets were placed in the Miscellaneous Assets category.

2.2.3.10 Summary of WWTP Assets

The number of assets collected from the WWTP by process area is summarized in Table 2-11. The WWTP asset inventory can be found in Appendix E.

Table 2-11. Summary of Assets

Process Location	Valve/ Gates	Pumps	Process Equip.	Mech. Equip.	Elect. & Inst.	Building/ Structure	Pipework Sections	Total No. of Assets
Preliminary Treatment	1	1	15	8	13	5	1	44
Primary Treatment	18	3	6	0	11	6	0	44
Intermediate Treatment	0	0	3	0	3	4	0	10
Aeration System	54	5	7	0	34	3	2	105
Final Settling Tanks	6	0	7	0	9	13	0	35
Tertiary Filtration/ Disinfection	11	4	13	16	45	10	0	99
Sludge Treatment	72	16	7	13	17	13	17	155
Chemical Feed System	0	2	5	12	9	5	0	33
Miscellaneous Assets	0	2	21	0	22	5	25	75
							Total	**600**

The pipework section indicates the number of pipe sections in each process area. A pipe section is defined as the length of pipe connecting one asset to another. The pipe sections vary in length as summarized in Table 2-12.

Table 2-12. Pipework by Process Location

Process Location	4" Pipe (LF)	6" Pipe (LF)	8" Pipe (LF)	10" Pipe (LF)	12" Pipe (LF)	14" Pipe (LF)	16" Pipe (LF)	Total
Preliminary Treatment	0	0	50	0	0	0	0	50
Primary Treatment	0	0	0	0	0	0	0	0
Intermediate Treatment	0	0	0	0	0	0	0	0
Aeration System	0	550	0	0	0	0	0	550
Final Settling Tanks	0	0	0	0	0	0	0	0
Tertiary Filtration/Disinfection	0	0	0	0	0	0	0	0
Sludge Treatment	300	1,510	290	0	100	0	0	2,200
Chemical Feed System	0	0	0	0	0	0	0	0
Miscellaneous Assets	0	750	275	195	1010	380	150	2,760
							Total	**5,560**

LF – Lineal feet

Replacement asset costs were developed from multiple sources including previous WWTP purchases, previous project data, manufacturer-furnished quotes and engineer best practice experience. The cost data include the replacement of the asset, contractor mark-up, project labor cost to install, and engineering, legal services administration contingencies. Table 2-13 and Figure 2-2 summarize the value of assets by WWTP process.

Table 2-13. Value of WWTP Assets

Process Location	Baseline System Replacement Cost
Preliminary Treatment	$1,136,000
Primary Treatment	$1,224,000
Intermediate Treatment	$1,881,000
Aeration System	$2,936,000
Final Settling Tanks	$1,591,000
Tertiary Filtration/ Disinfection	$3,100,000
Sludge Treatment	$7,402,000
Chemical Feed System	$1,404,000
Miscellaneous Assets	$4,457,000
Total	**$25,131,000**

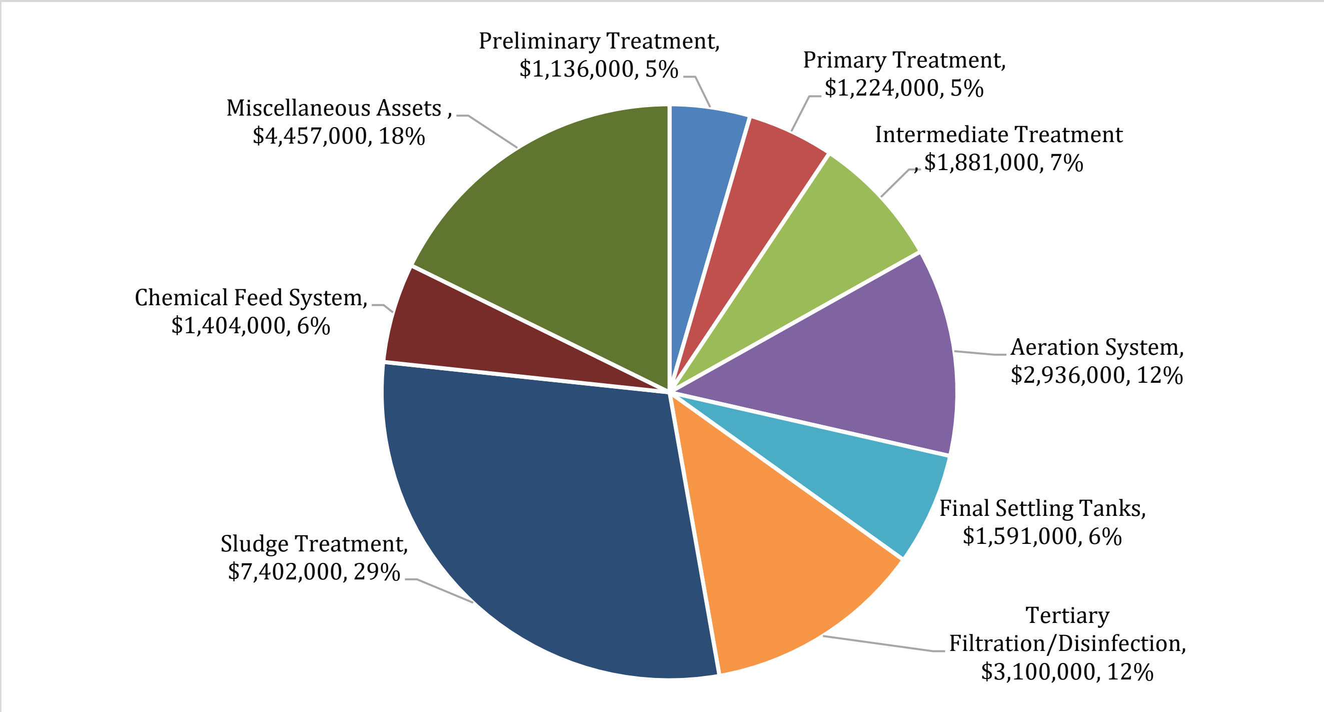

Figure 2-2. WWTP Replacement Costs by Process

2.2.4 Estimated Effective Life

The estimated effective life (EEL) is a user-defined value assigned to each asset based on the asset type, material of construction, manufacturer recommendations and other studies completed on the subject. Adjustments may be made to the EEL on an individual asset based on available information. The remaining useful life (RUL) is the difference between the EEL and the present age of the asset.

The operation, maintenance and repair cost for an asset at any time can be calculated and evaluated against the cost to replace the assets at the end of their EEL. This provides a comparison between preventative maintenance costs and the replacement costs at time of failure.

2.2.5 Estimated Effective Life

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The operation, maintenance and repair cost for an asset at any time can be calculated and evaluated against the cost to replace the assets at the end of their EEL. This provides a comparison between preventative maintenance costs and the replacement costs at time of failure.

By entering cost information to cover potential activities such as maintenance, inspection, and rehabilitation the Lucity™ AMS can be used to quickly generate an initial cost estimate given for proposed work orders to assist in day-to-day planning activities.

The remaining useful life (RUL) is the difference between the EEL and the present age of the asset.

2.2.5.1 Collection System

Collection system asset EELs considered material of construction in addition to the asset type. The EELs for collection system assets are summarized in Table 2-14.

Table 2-14. Estimated Effective Life for Collection System Assets

Collection System Assets	EEL (years)
Gravity Mains (Concrete, Vitrified Clay, Ductile Iron)	100
Gravity Mains (HDPE, PVC, Truss Pipe)	75
Gravity Mains (Corrugated Metal, Cast Iron)	50
Laterals (Vitrified Clay, Ductile Iron)	50
Laterals (PVC)	75
Pressurized Mains	75
Manholes (Brick and Concrete)	100
Pump Station – Pumps	30
Pump Stations – Electrical	25
Pump Stations - SCADA	20
Pump Stations – Mechanical (piping)	60
Pump Stations – Mechanical (valves)	30
Pump Stations – Structural	80

Adjustments may be made to the EEL on an individual asset based on available information. For example, most pipes are assumed to have an EEL of 100 years; if a 95-year-old pipe is inspected and found to be in excellent condition, the EEL could be adjusted to 125 years. Preventive maintenance can also impact the EEL. If a sewer is lined with a material that has an EEL of 75 years, the new EEL of the sewer with the liner would be 75 years from the liner installation date.

A vast majority of the installed assets in the system have useful life remaining, however, some assets within the system have already reached or surpassed their EEL. This reflects a current backlog of assets that have reached the end of their expected effective life and require either assessment or repair. Assessment of these assets should be given high priority. As condition assessments are performed, the EEL and required service dates should be adjusted accordingly.

Using the entered installation date, the GIS calculates information such as the RUL and the required service date.

Using the asset installation date and the EEL for each asset, the remaining useful life has been calculated. Table 2-15 summarizes the linear assets by various age brackets. Using the results in the table, if the majority of assets were assigned an EEL of 100 years, then none of the gravity main assets have exceeded their assumed life span.

Table 2-15. Linear Collection System Assets by Age

Asset Age (years)	0-25 years	26-50 years	51-75 years	Greater than 75 years
Gravity Mains	192	412	167	0
Manholes	221	387	173	0
Force Mains	15	10	0	0

None of the linear assets have exceeded their estimated expected life. There are 167 gravity mains that are 51 years and older, covering approximately 7.5 miles of sewer, representing approximately 23% of the overall system. There are 173 manholes that are 51 years and older, which represents nearly 22% of the overall system. Of these 173 manholes, a majority of them are block, however, none of those structures were found to have an ECR of 4 or 5. Two of the pump stations in the system have already been replaced (East Shore 1 and North Shore 2). However, the force mains had no known concerns and were not replaced as part of the projects.

2.2.5.2 WWTP

Table 2-16 shows the EEL for various assets that were used for this analysis.

Table 2-16. Estimated Effective Life for Various Asset Classes

Asset	EEL (years)
Civil (Concrete Tanks)	75
Pressure Pipework	60
Sewers	100
Pumps/Equipment	30
Valves and Gates	30
Instrumentation	15
Control Panels	20
Motor Control Centers	40
Transformers	40
Building Assets	60
Land	300
HVAC	15
Exhaust Fans	25
Unit Heaters	15
Boilers	30
Dampers	30
Process Tanks (FRP, etc.)	50
Building Roof	20
Variable Frequency Drives (VFDs)	15

WWTP staff experience and opinions were used to provide insight into the possibility of extending or shortening an asset's EEL.

Process assets that have been added within the past 20 years have remaining life, which includes Aeration Tank No. 3, Final Settling Tank No. 3, Traveling Bridge Filters and the Chlorine and Sodium Dioxide Feed Systems. Many of the other process assets are nearing or have exceeded their useful life. The majority of the mechanical and electrical assets at the WWTP have exceeded their EEL. This equipment is maintained in operating condition as a result of routine maintenance and upkeep of the assets. The RUL was extended for certain assets based on combined judgment of WWTP and Tetra Tech staff. Actual unit run times and maintenance were also taken into consideration. The RUL can be increased based on a more detailed condition assessment. Additional information on the predicted RUL can be found in the WWTP inventory tables found in Appendix E.

3.0 CONDITION ASSESSMENT

The second step after compiling the inventory list was to provide a condition assessment for each of the fixed assets in the wastewater system including those found in both the collection system and WWTP processes. The focus of the assessment is to determine the present condition of the given asset so that a remaining life can be determined and to also identify critical assets within the system. The collection system assessment and WWTP asset assessment were completed in 2019 using different methodologies, as described below.

3.1.1 Collection System Condition Assessment

This AMP for the collection system was developed in part using the ESRI® ArcGIS system the Township maintains for the sanitary sewer collection system and modifying the data structure to accommodate the SAW grant and NPDES Permit requirements as stated above in this report.

Sanitary sewer collection system assets were divided into groups (gravity mains, manholes, force mains, and pump stations), as the condition assessment and data analysis are different for each type. Each asset group is evaluated separately. Details about each asset group are discussed in this section.

Sanitary Sewer Condition Assessment in Table 3-1 describes the condition grades NASSCO assigns to certain defects. The goal is to train operators to consistently assign the same defects, meaning that the engineer receiving the reports can use the scoring to narrow down their focus, as the difference between a Grade 3 and Grade 4 defect is generally where some corrective action should be taken to address the defect.

Table 3-1. Condition Rating Description

Condition Grades	
1	Failure unlikely in foreseeable future
2	Pipe unlikely to fail for 20 years
3	Pipe may fail in 10-20 years, reinspect
4	Fail in 5-10 years, some action recommended
5	Failed or expected to fail within 5 years, immediate attention recommended

NASSCO scores sewers for both structural defects and O&M defects. Therefore, determining a single numerical rating to assign to a sewer is difficult. To further clarify, the NASSCO scoring is used to essentially “flag” defects for closer review by an engineer, who must then use responsible engineering judgment as to what type of response to issue. Therefore, Pipeline Assessment Certification Program (PACP) scores are not designed to be automatically compared against each other, meaning it is up to the reviewing engineer to determine which defects would be more critical to address. This could mean identifying certain defects as more critical to the operational status of that pipeline than others, particularly in how it may differ between Grade 5 structural and O&M defects. It is also important to review all defects prior to issuing any type of work orders in case the operator may have misidentified what was observed. Each sewer that was inspected was closely reviewed and an engineer’s condition rating (ECR) was then applied to prioritize the sewers more closely to the standard shown in Table 3-1.

An example of determining the ECR would be a case where roots are located at a joint. It will receive a Grade 4 defect and look like the photo on the left in Figure 3-1.

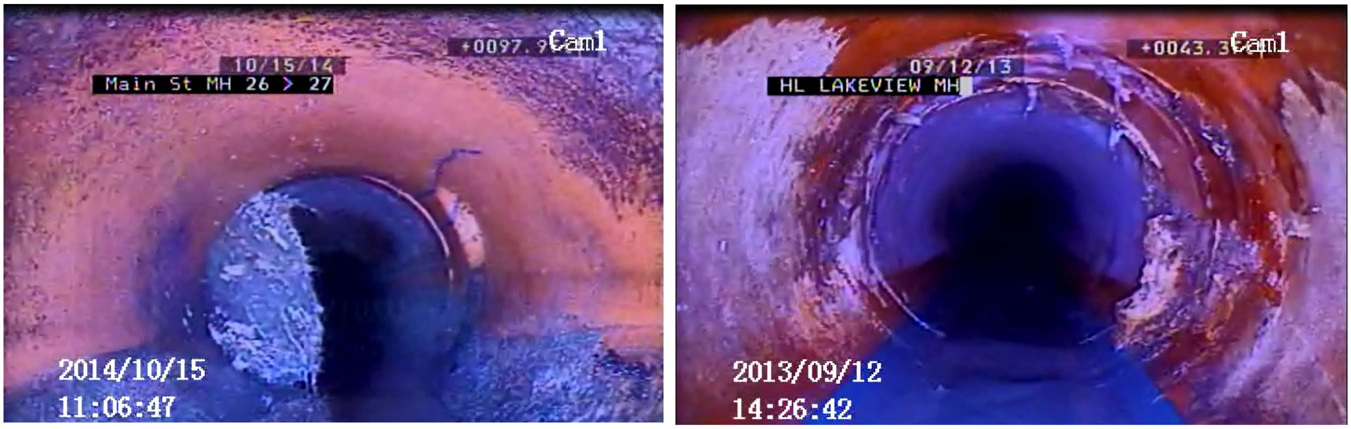


Figure 3-1. Grade 3 Defect vs. Grade 4 Structural Defect

On the other hand, the structural defect “Crack Longitudinal” was used to score the photograph on the right in Figure 3-1, which shows cracking on the crown of the pipe that received a defect Grade of 4 (according to Table 3-1). It is far more important that the cracked VCP pipe is addressed prior to the roots which, based on its location, will only cause minor impediments to flow, whereas the cracked sewer may fail.

Inspection of the entire 33 miles of gravity sewer was not feasible given the schedule and budget for this project, so the goal was to collect enough of a sampling of the existing sewer collection system to use the condition assessment results as a basis for applying assumed conditions to uninspected assets. The sewer reaches selected for the condition assessment included a range of pipe sizes, materials, and dates of installation to maximize the sample diversity. Details regarding the condition assessment findings will be further discussed in the gravity main asset category below and the Capital Improvement Plan.

The Township had 52% of the gravity mains in the system inspected covering approximately 400 unique pipe reaches totaling 90,000 feet of pipe. The inspections were conducted between 2013 and 2018 using NASSCO PACP standards. Figure 3-2 provides a summary of the results, with blue representing pipes with quick structural ratings (Qstr) and the red representing pipes with quick O&M (QOM) ratings.

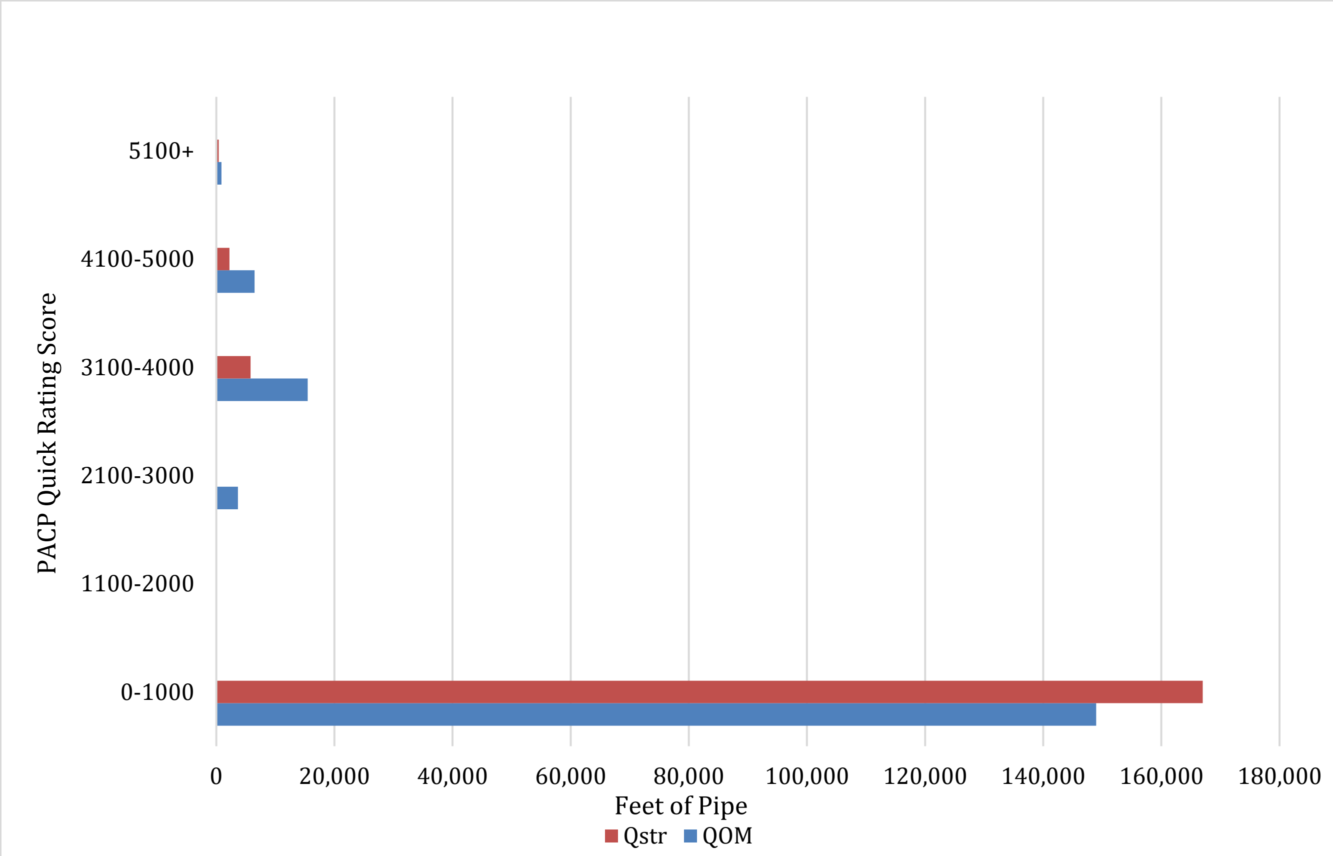
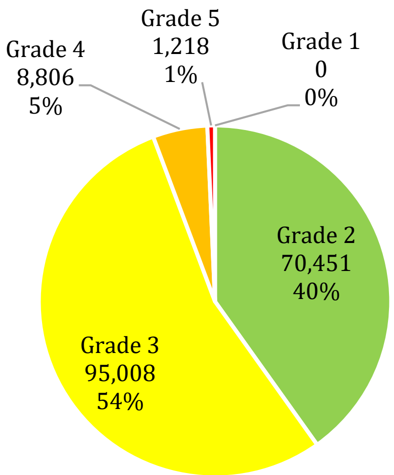


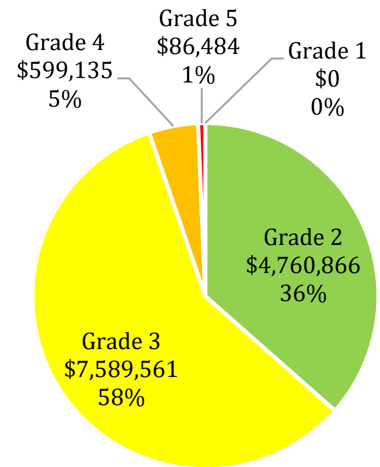
Figure 3-2. PACP Scoring Summary Results

The summary table shows that approximately 9% of the system that was inspected received a PACP Overall Quick Rating of 4100 or higher. The quick score is a way to signify the number of occurrences of the two highest rated defects observed during the inspection. For example, a pipeline with an Overall Quick Rating of 5232 means there were two Grade 5 defects and two Grade 3 defects. This is important, because NASSCO designed the PACP scoring system to serve as a general indicator to draw attention to sewer defects that may be due to a failure of the pipeline.

A summary of the ECR by sewer reach is given in Figure 3-3.



By Feet of Gravity Main



By Replacement Value

Figure 3-3. Gravity Main Inspection Summary – Engineer's Condition Rating

3.1.1.1 Sanitary Sewer Capacity Analysis

A Sanitary Sewer Capacity Analysis was completed by Tetra Tech in January 2019. This report documented the hydraulic conditions of the sanitary sewer system using flow monitoring data collected between April 2017 and June 2018. The full report is included in Appendix F for reference.

In 2017, three temporary flow meters and one temporary rain gauge were installed concurrently from March through June to collect flow and rainfall data. In 2018, the meters were re-installed with an additional two meters further upstream, for a total of five meters, and the rain gauge was replaced by two rain gauges in different locations. The five flow meters were installed in the system and located at major branches, including one on the gravity influent of the Eight Mile Road Pump Station just upstream of the WWTP. A total of 23 events occurred during the flow monitoring period, three of which were greater than one inch.

The numerical model, which included all major interceptors and sewers, was developed and calibrated to the flow monitoring data. The calibrated numerical model assesses the ability of the sewers in the collection system to convey flow during the 25-year, 24-hour design storm condition (3.90 inches), as defined by MDEQ (now EGLE). The capacity analysis considers both the peak flow rates and hydraulic grade line to project pipe capacity restrictions and manhole surcharging conditions.

A map from the modeling report representing the ratio of the design storm peak flow rate to sewer capacity and surcharging locations predicted during existing conditions is presented in Figure 3-4. The major areas where the model predicted capacity restrictions include:

- Gravity sewer between Brookside Drive and Eight Mile Road Pump Station, just upstream of the WWTP (labeled Study Segments A and B)
- Gravity sewer along the west side of Whitmore Lake (labeled Study Segment C)
- Horseshoe Lake Pump Station No. 1

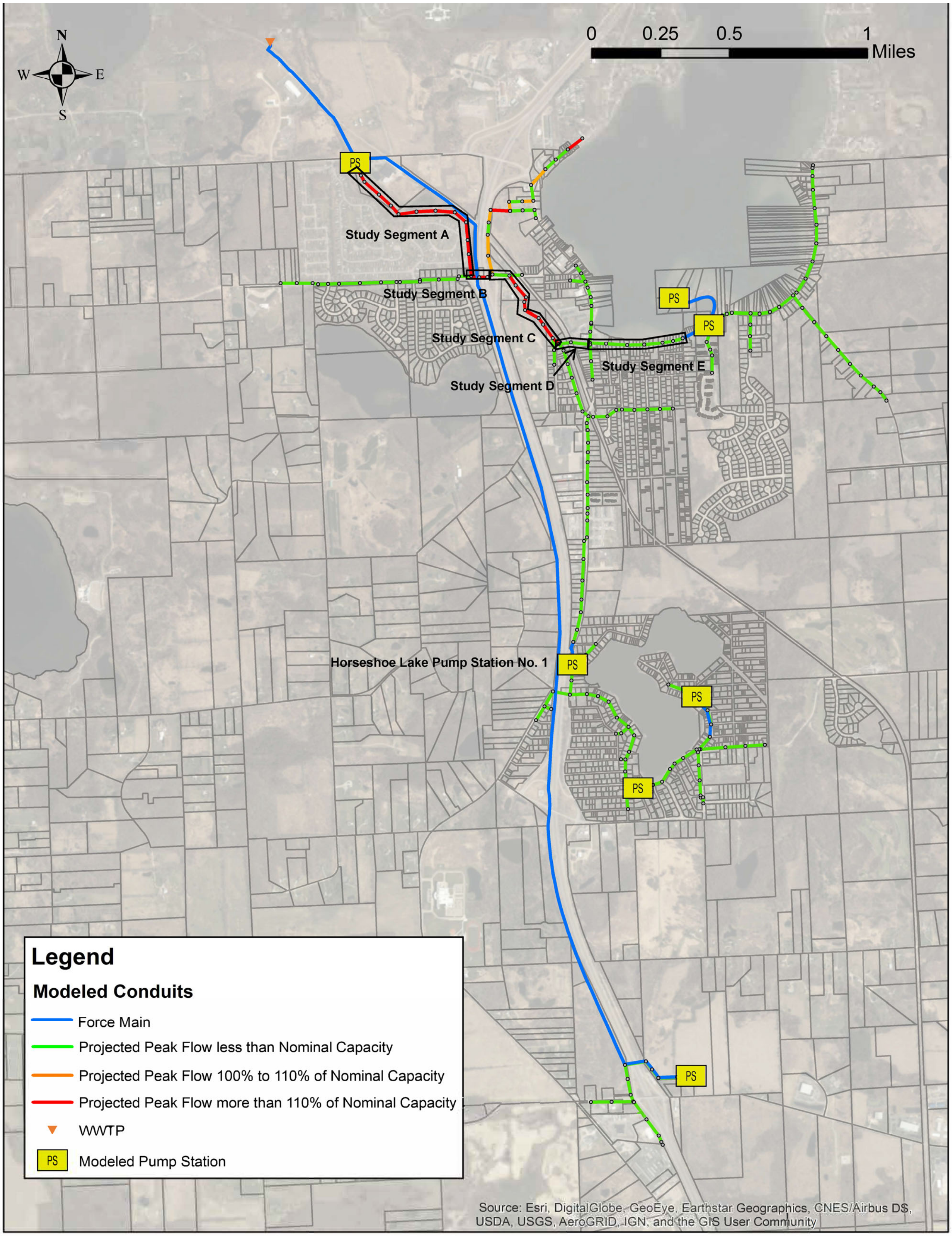


Figure 3-4. Design Storm Peak Flow Rate Relative to Pipe Capacity

3.1.1.2 Manhole Condition Assessment

The manhole inventories were completed between 2014 and 2018 and were based on the NASSCO Manhole Assessment Certification Program (MACP). A MACP Level 1 inspection consists of collecting basic information to evaluate the general condition of the manhole from the surface. A MACP Level 2 inspection includes collecting more detailed information about each individual component of the structure and assigning condition scores similar to those used for the pipeline assessment. Tetra Tech and Northfield Township utilized a modified MACP "Level 1.5" which included all of the Level 1 information, as well select information from a Level 2 assessment including using a 1 to 5 scoring methodology for each component of the manhole: cover, frame, chimney, barrel, bench and channel, as well as an overall condition score which was then used as an aggregate manhole condition rating. These condition ratings were then saved for use as a component in the criticality of the assets in the GIS attributes.

In general, the results of the manhole inspections showed that the manholes were in good condition with many having already been repaired or rehabilitated. Figure 3-5 is an example of a precast concrete manhole in good condition.

Figure 3-5. Precast Concrete Manhole

Figure 3-6 summarizes the manhole condition assessment results. It was found that the Township keeps their manholes in very good condition, as there were no assets rated higher than 3.

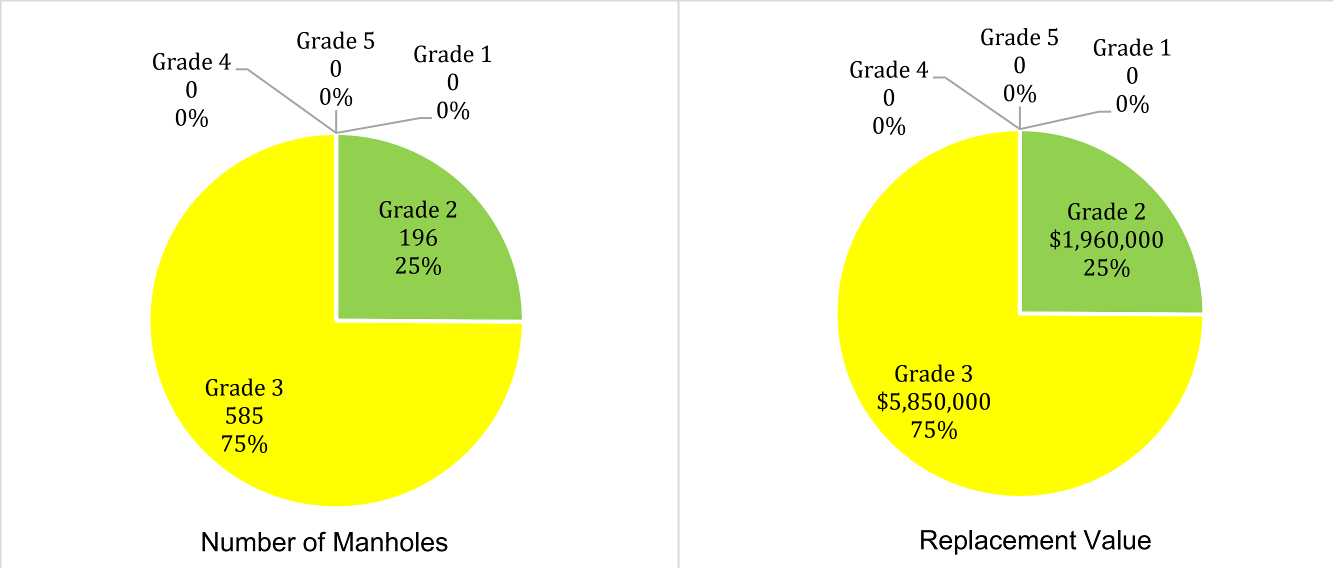


Figure 3-6. Manhole Condition Assessment

3.1.1.3 Force Main Condition Assessment

The force main condition assessment was completed utilizing the inventory data gathered from record drawings and during the site visits to the pump stations. Each of the force mains was reviewed with the Township to better determine asset characteristics. Due to the lack of access available to force mains as well as the nature of their use, it is generally not practical to conduct inspections of them. Consequently, other factors such as age, material and past records of operational issues and maintenance are used to assign force main condition. Figure 3-7 summarizes the force main condition assessment results.

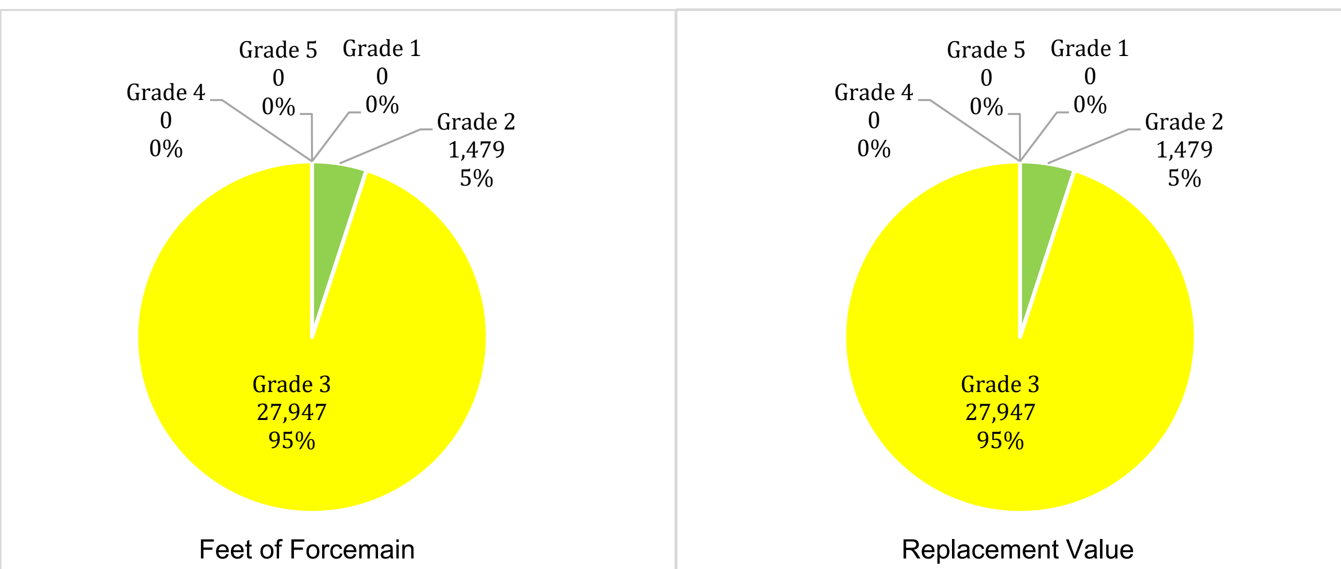


Figure 3-7. Force Main Condition Assessment

3.1.1.4 Pump Station Condition Assessment

Each of the pump stations was reviewed with the Township to determine what types of unique equipment are located at each station, with a focus on assets that they check and maintain regularly so they could be easily integrated into the Lucity™ AMS.

Individual pump station site visits and inspections were performed by Tetra Tech in 2019 and all of the unique equipment assets at each site were recorded. The pump station was also given a general condition rating based on the descriptions shown in Table 3-2. In addition, an estimated remaining useful service life was entered. A spreadsheet was developed for each pump station to record the assessment information, track the estimated remaining service life, and calculate the recommended replacement date.

Table 3-2. Condition Rating Matrix

Condition Rating	Description	Maintenance Level
1	New or Excellent Condition	Normal preventative maintenance
2	Minor Defects Only	Normal preventative maintenance, Minor corrective maintenance
3	Moderate Deterioration	Normal preventative maintenance, Major corrective maintenance
4	Significant Deterioration	Major repair, rehabilitate
5	Unserviceable	Replace

A condition summary of the 15 main pump stations is presented below.

Eagle Gardens

Pump Station PS-1 is a duplex submersible pump station with a 10-foot round precast concrete wet well that contains pumps and discharge piping. The pumps are rated for 200 gpm at 34.5 feet Total Dynamic Head (TDH). The station also incorporates a precast concrete valve vault which houses discharge piping and valves. The station is designed to service homes in the Eagle Gardens development on the south side of Whitmore Lake. The station was originally constructed in 1995 and currently discharges to an existing 10-inch sewer via a 10-inch force main. The pumps and valves are in fair condition. The controls and control cabinet are also in fair to good condition.

East Shore 1

Pump Station PS-2 is a duplex submersible pump station with a 10-foot round precast concrete wet well (buried under a wooden gazebo) that contains pumps and discharge piping. The pumps are rated for 760 gpm at 46 ft TDH. The station receives flows from the Eagle Gardens subdivision that aren’t picked up by the Eagle Gardens Pump Station (approximately 70 homes) in addition to flows discharged from the Lake Point Drive, Eagle Gardens, and East Shore 2 Pump Stations. The station was originally constructed in 1960 and replaced in 2007. The station currently discharges through an existing 6-inch force main to an existing 12-inch sewer. The pumps and valves are in good working condition. The controls and control cabinet are also in fair condition. The station’s odor control canister unit is in fair condition.

East Shore 2

Pump Station PS-3 is a duplex submersible pump station with an 8-foot round precast concrete wet well that houses the pump suction bells. The station also includes a 4-foot by approximately 8-foot steel can dry pit valve vault that houses the pumps, discharge piping and valves. The pumps are rated for 300 gpm at 25 feet TDH. The station services the developments around the northeast side of Whitmore Lake in addition to the flows discharged from the 9 Mile Road Pump Station. The station was originally constructed in 1969 and currently discharges through an existing 6-inch ductile iron force main to an existing 12-inch VCP sewer. The pumps and valves are in poor to fair condition. The controls and control cabinet are also in poor to fair condition. The wet well and valve vault are in fair condition.

Eight Mile Road

Pump Station PS-4 is a quadplex submersible pump station with a 14-foot by 16-foot rectangular concrete wet well which houses pumps, inlet gates and discharge piping. The pumps are rated for 1100 gpm at 125 ft TDH. The station receives flow from the entire Township before pumping it directly to the WWTP headworks. The station was originally constructed in 2001 and currently discharges through an existing 12-inch force main to the wastewater treatment plant. The pumps and valves are in good working condition. The controls and control cabinet are also in good condition. The inlet gates are in fair condition. The crane is in good condition. The site fence and drive are in good condition. Pumps 2 and 3 were replaced in 2012 and 2014, respectively. VFD 4 was replaced in 2019.

Horseshoe Lake 1

Pump Station PS-5 is a duplex submersible pump station with an 8-foot round precast concrete wet well that houses pumps and discharge piping. Th pumps are rated for 400 gpm at 32 ft TDH. The station also includes a precast concrete valve vault that houses discharge piping and valves. The station services developments on the west side of US-23, developments around the west half of Horseshoe Lake in addition to receiving flow from the Horseshoe Lake 2, Horseshoe Lake 3 and Shadowoods Pump Stations. The station was originally constructed in 1978 and currently discharges through an existing 6-inch force main to an existing 12-inch concrete sewer. The pumps are in fair working condition. The controls and control cabinet are also in fair condition. The discharge piping and valves appear to be corroded and in poor condition. The generator and generator controls appear to be in poor to fair condition. The pumps were replaced in 2010.

Horseshoe Lake 2

Pump Station PS-6 is a duplex submersible pump station with an 8-foot round precast concrete wet well that contains pumps and discharge piping. The pumps are rated for 150 gpm at 13 ft TDH. The station also incorporates a precast concrete valve vault, which houses discharge piping and valves. The station services homes along the south side of Horseshoe Lake in addition to receiving discharge flows from both the Horseshoe Lake 3 and Shadowoods Pump Stations. The station was originally constructed in 1978 and currently discharges to an existing 10-inch sewer via a force main. The pumps and valves are in fair working condition. The controls and control cabinet are also in fair condition.

Horseshoe Lake 3

Pump Station PS-7 is a duplex submersible pump station with an 8-foot round precast concrete wet well that contains pumps and discharge piping. The pumps are rated for 100 gpm at 24 ft TDH. The station also incorporates a precast concrete valve vault, which houses discharge piping and valves. The station services homes on Lakeshore Road north of Highland Road. The station was originally constructed in 1978 and currently discharges through a 4-inch force main to an existing 8-inch sewer. The pumps and valves are in fair working condition. The controls and control cabinet are also in fair condition. The pumps were replaced in 2010.

Lake Point Drive

Pump Station PS-8 is a duplex grinder pump station. The pumps are rated for 12 gpm at 24 TDH. The station services 4 homes on the Lake Point Drive peninsula on the south side of Whitmore Lake. The station was originally constructed in 2004 and currently discharges through a 2-inch force main to an existing 12-inch sewer. The pumps and valves are in good working condition. The controls and control cabinet are also in good condition.

Main Street

Pump Station PS-9 is a duplex dry pit pump station with an 8-foot round precast concrete wet well that houses the pump suction bells. The station also incorporates an approximate 4-foot by 8-foot steel can valve vault, which contains pumps, discharge piping, valves and controls. The pumps are rated 100 gpm at 15 ft TDH. The station services the northwest side of Whitmore Lake (area between Kenton Drive and the Department of Natural Resources boat launch) in addition to receiving discharge flows from the North Shore 1, North Shore 2 and Canal (Elmcrest) Pump Stations. The station was originally constructed in 1969 and currently discharges through a 6-inch force main to an existing 10-inch sewer. The pumps and valves are in fair to good working condition. The controls and control cabinet are also in fair condition. The pump pots were replaced in 2009.

North Territorial Road

Pump Station PS-10 is a triplex submersible pump station with a 10-foot by 12-foot rectangular precast concrete wet well that contains pumps and discharge piping. The pumps are rated for 760 gpm at 46 ft TDH. The station also incorporates a rectangular precast concrete valve vault. The station receives flows from the Michigan Department of Transportation (MDOT) Rest Area Pump Station on US-23 in addition to flows from developments along US-23 at the North Territorial Road exit and along North Territorial Road east of US-23. The station was originally constructed in 2002 and currently discharges through a 12-inch force main to the Eight Mile Road Pump Station. The pumps and valves are in fair condition. The discharge piping appears corroded and in poor condition. The controls and control cabinet are in good condition. The site fence is in good condition.

Nine Mile Road

Pump Station PS-11 is a duplex submersible pump station with an 8-foot round precast concrete wet well that contains pumps and discharge piping. The pumps are rated for 100 gpm at 42 ft TDH. The station also incorporates a precast concrete valve vault, which houses discharge piping and valves. The station services approximately 23 homes along Nine Mile Road and Lakeview Drive on the northeast side of Whitmore Lake. The station was originally constructed in 1978 and currently discharges through a 4-inch force main to an existing 8-inch sewer. The pumps and valves are in fair condition. The controls and control cabinet are in fair to good condition. Pump No. 1 was rebuilt in 2009.

North Shore 1

Pump Station PS-12 is a duplex ejector pump station with an approximate 4-foot by 8-foot steel can dry pit that contains pumps, valves, discharge piping and controls. The ejector tanks are rated for 100 gallons. The station services homes along North Shore Drive in addition to receiving flows from North Shore 2 and Canal (Elmcrest) Pump Stations. The station was originally constructed in 1969 and currently discharges through a four-inch force main to an 8-inch sewer. The pumps and valves are in fair to good condition. The controls and control cabinet are also in fair to good condition. New air/water tanks were installed in 2009.

North Shore 2

Pump Station PS-13 is a duplex submersible pump station with an 8-foot round precast concrete wet well that contains pumps and discharge piping. The pumps are rated for 455 gpm at 32 ft TDH. The station also incorporates a precast concrete valve vault. The station services approximately 15 homes on North Shore Drive and Elmcrest Road along the northwest corner of Whitmore Lake in addition to receiving flows from the Canal (Elmcrest) Pump Station. The station was originally constructed in 1969 but was replaced in 1985. The station currently discharges through a 4-inch force main to an existing 10-inch sewer. The pumps are in fair condition. The discharge piping appears to be in poor to fair condition. The wet well appears to be in poor to fair condition with some infiltration and corrosion present on the walls of the lower half of the well. The controls and control cabinet are in fair condition. The valve vault was submerged in stormwater drainage due to the recent construction on the boat launch parking area.

Shadowoods

Pump Station PS-14 is a duplex grinder pump station with an 8-foot round precast concrete wet well that contains pumps and discharge piping. The pumps are rated for 50 gpm at 42 ft TDH. The station also incorporates a precast concrete valve vault, which houses discharge piping and valves. The station services 44 homes in the Shadowoods development on Six Mile Road east of Horseshoe Lake. The station was originally constructed in 1996 and currently discharges through a 3-inch force main to an existing 8-inch sewer. The pumps and valves were replaced in 2018 and are in good working condition. The controls and control cabinet are also in good condition. The discharge piping and valves are in fair condition.

Canal (Elmcrest)

Pump Station PS-15 is a duplex submersible pump station with an 8-foot round precast concrete wet well that contains pumps and discharge piping. The pumps are rated for 100 gpm at 17 ft TDH. The station also incorporates a precast concrete valve vault, which houses discharge piping and valves. The station services homes on the north side of Whitmore Lake Road (south of Nine Mile Road) in addition to the Stilsonburg Station development and some homes along Fieldcrest Drive. The station was originally constructed in 1978 and currently discharges through a 4-inch force main to an existing 10-inch sewer. The pumps are in fair condition. The impellers and wear rings were replaced in 2018. The discharge piping and valves are in poor to fair condition. The controls and control cabinet are in fair condition.

Summary

A summary of the pump station condition is presented in Figure 3-8.

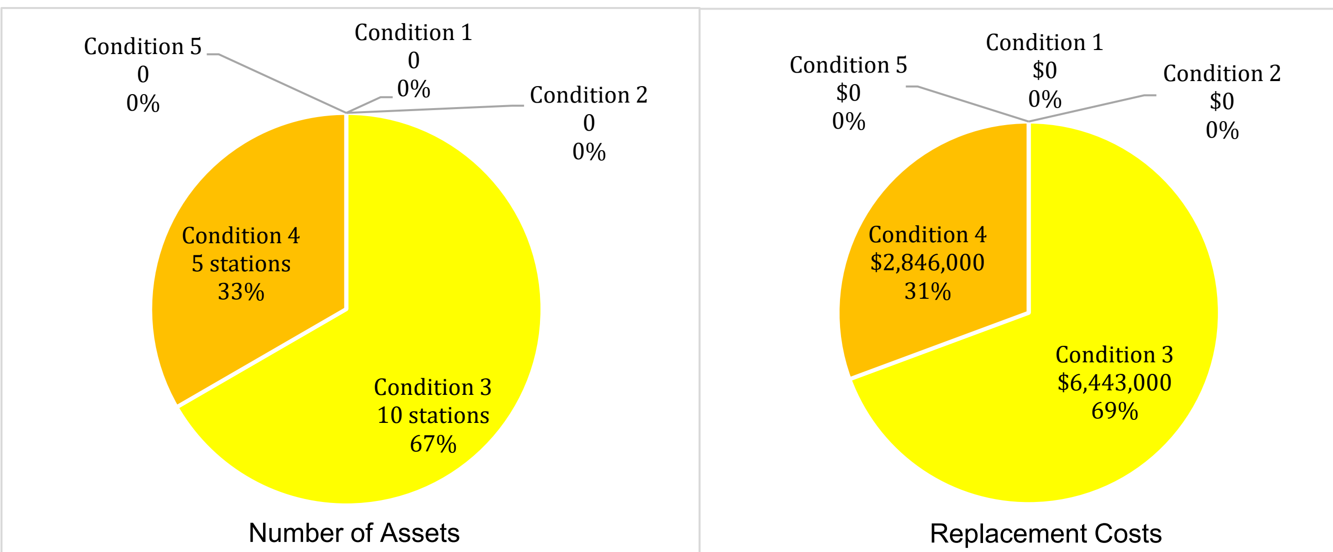


Figure 3-8. Pump Station Condition Assessment

3.1.1.5 Grinder Station Condition Assessment

The grinder pump stations along Whitmore Lake Road are simplex submersible pump stations with 2-foot round plastic wet wells that contain a pump and discharge piping. The pumps are rated for 9 gpm at 138 feet Total Dynamic Head (TDH) each. The stations are each designed to service one property along Whitmore Lake Road. The stations were originally constructed in 2016 and discharge to an existing 3-inch low pressure force main in Whitmore Lake Road via 1.5-inch service leads. The interiors of the grinder pump stations were not able to be observed since the stations were not able to be opened, but the Township has reported that the pumps and discharge piping are all in good condition. Additionally, the associated electrical equipment at each station is in good condition.

3.1.2 WWTP Condition Assessment

WWTP staff performed a condition assessment of the WWTP assets by inspecting all visible assets. In addition to the visual assessment, the WWTP staff used their experience with the equipment to assign a condition rating. Since staff are onsite with each asset over many years and have observed these assets being used and maintained, this information is invaluable for the process of determining the condition of the asset. Tetra Tech then reviewed the assessments with plant personnel. The condition ratings for the WWTP assets were developed based on the criteria in Table 3-2 presented for the pump stations, as the WWTP assets are more similar to the pump station assets than the other horizontal collection system assets.

A summary of the assets by process area is provided below.

3.1.2.1 Preliminary Treatment

The grit process equipment is mostly in fair condition apart from the grit tank. While operational, the grit tank is in poor condition. The grit pump works but has exceeded its expected useful life and is expected to need to be replaced in the next 5 years. The mechanical equipment is in fair condition. The furnace has far exceeded its expected useful life. It is recommended that the furnace be replaced to maintain efficient operations. In 2015, another heating unit was installed and is in fair condition. The remaining mechanical equipment will need to be replaced in the next 5 to 15 years as it nears and exceeds the expected useful life. The grit building is in fair condition overall but will need to have the garage door replaced and a new roof as it has exceeded the 20-year expected useful life. The influent wastewater tends to be corrosive, which typically reduces the expected useful life of equipment in the Grit and Screen Building.

3.1.2.2 Primary Treatment

The process equipment was installed between 1976 and 2017. Most of the equipment is in fair condition. The equipment installed in 1976 including some of the gate valves, ball valves, and plug valves have far exceeded the expected useful life and will need to be replaced as necessary. Two of the settling tank mechanisms were installed in 1998 and two were installed in 2007 and all remain in fair condition. Structurally, the primary tanks, scum wells, flow split structure, and primary effluent pump station are in fair operational condition. Primary Settling Tank Nos. 1 and 2 and Scum Well Nos. 1 and 2 were constructed in 1965 and are expected to need repaired or replaced in the next 10 years.

3.1.2.3 Intermediate Treatment

The trickling filter tank, installed in 1962, is in fair operational condition. The trickling filter mechanism was replaced in 1998 and remains in fair condition. The original rock media was replaced with plastic media, which provides an increased surface area for biological growth. The plastic media provides additional treatment capacity within the same original tank.

3.1.2.4 Aeration Tanks

Aeration Tank Nos. 1 and 2 were installed in 1976 and Aeration Tank 3 was installed in 1991. All are in fair condition and have remaining expected useful life but require repair on the top of the structures. The process equipment was installed between 1976 and 2018. The equipment installed in 1976, including the sluice gates, some of the industrial butterfly valves, and blowers have far exceeded their expected useful life, but remain in operational condition. Some of the valves and one blower are planned to be replaced in a near future CIP project. The intention is to replace one of the blowers and use the remaining existing blowers as back up. As the blowers are vital for plant operations, this project is important to maintain current plant operations. In addition, the coarse bubble diffusers are scheduled to be replaced with fine bubble aerators during the same project. Fine bubble diffusers are significantly more energy efficient compared to coarse bubble diffusers.

3.1.2.5 Final Settling Tanks

The final settling tank process equipment was installed between 1976 and 1998 and much of it has exceeded its expected useful life. Mechanism Nos. 1, 2, and 3 were installed in 1976, 1976, and 1998, respectively. Mechanism No. 1 has had the collection arm replaced and Mechanism No. 2 is slated to have its collection arm replaced as well. The remaining final settling tank components are mostly in fair condition and are expected to need replacement in the next 10 years. Structurally, the settling tanks are overall in fair condition and well maintained. The piers for the supports are cracked for Final Clarifier No. 1 and need to be repaired.

3.1.2.6 Tertiary Treatment

The tertiary filter process equipment is in overall fair condition. The filter influent check valves were installed in 1976 and are in poor condition. These valves will need to be replaced. The remaining process equipment was installed in 1997 and 1998 and is in good, operational condition. The filter influent pumps were rebuilt by Hydrodynamics. Traveling Bridge Filter Nos. 1 and 2 and the North Backwash Water Pump were also rebuilt. The mechanical equipment is in good condition overall. The gas unit heaters in Filter Building No. 1 and Filter Building No. 2 heaters have all exceeded their expected useful life and will need to be replaced as necessary. A new boiler was installed in 2016 and remains in excellent condition. Filter Building Nos. 1 and 2 are in good condition structurally. Filter Building No. 1 will need a new roof as it has exceeded its expected useful life and water ponds when it rains.

3.1.2.7 Disinfection

The chlorine distribution system was installed in 1997 and remains in fair, operating condition. The contact tank and channels are in fair condition. However, most WWTPs are replacing their chlorine gas systems with either sodium hypochlorite or ultraviolet disinfection due to safety concerns that might result from a chlorine gas release.

3.1.2.8 Sludge Systems

The sludge equipment was installed at various times from 1962 to 2019. The equipment is overall in fair, operational condition. The scum system is no longer used, and the equipment is abandoned in place. The equipment installed in the 1960s and 1970s has far exceeded its expected useful life and will need to be replaced as necessary as the equipment fails. Many of the valves in Filter Building No. 1 were replaced in 2019 and are in excellent condition. The pipework and mechanical equipment are in fair to poor condition overall and should be replaced as needed. The Digester Building and anaerobic digesters are in fair condition structurally and are well maintained. Updates were made to the Digester Building in 1991. The roof will need to be replaced on the Digester Building as it has exceeded the expected useful life.

3.1.2.9 Chemical Feed Equipment

The ferric chloride chemical feed process equipment is in fair to poor condition. The equipment was all installed after 1998, but with the short useful life expectancy, most of it has reached or exceeded the expected useful life. It is predicted that the equipment will need to be replaced in the next five years. The electrical equipment associated with the chemical feed system is in poor condition and has far exceeded the end of the expected useful life. This equipment will need to be replaced as it fails. The mechanical equipment overall is in fair condition and is expected to need to be replaced in the next ten years. The Service Building is in good condition overall but requires the roof be replaced in the next few years as it is in poor condition.

3.1.2.10 Miscellaneous Assets

The majority of the miscellaneous process assets are in fair condition. Many were installed in the 2000's and are still expected to have useful life remaining. The service wash water pumps in Filter Building No. 1 and the flame arrestors were installed in 1976 and have exceeded their expected useful life. The yard pipework was installed between 1978 and 1998 and is in fair condition. Most of the electrical equipment, including Motor Control Centers B and C, were installed in 1976 and are in poor condition. It is expected that this equipment will require replacement within the next 5 years.

3.1.2.11 WWTP Condition Summary

Figure 3-9 displays the condition summary of the WWTP by total number of assets and total estimated replacement value. Most of the assets (299) at the WWTP are in fair condition, accounting for approximately $11,059,554 of the replacement cost value. Just three percent of the number of assets ($12,600) are in inoperable condition. A conclusion can be drawn that most of the equipment will not require replacement in the next five to ten years.

Within the total estimated replacement value, 87 assets were not evaluated. Among these, were assets that are separately quantified, but are part of a greater system where the cost was included or decommissioned. Additionally, values were not assessed for the plant vehicles (i.e. backhoe, forklift, trucks, etc.).

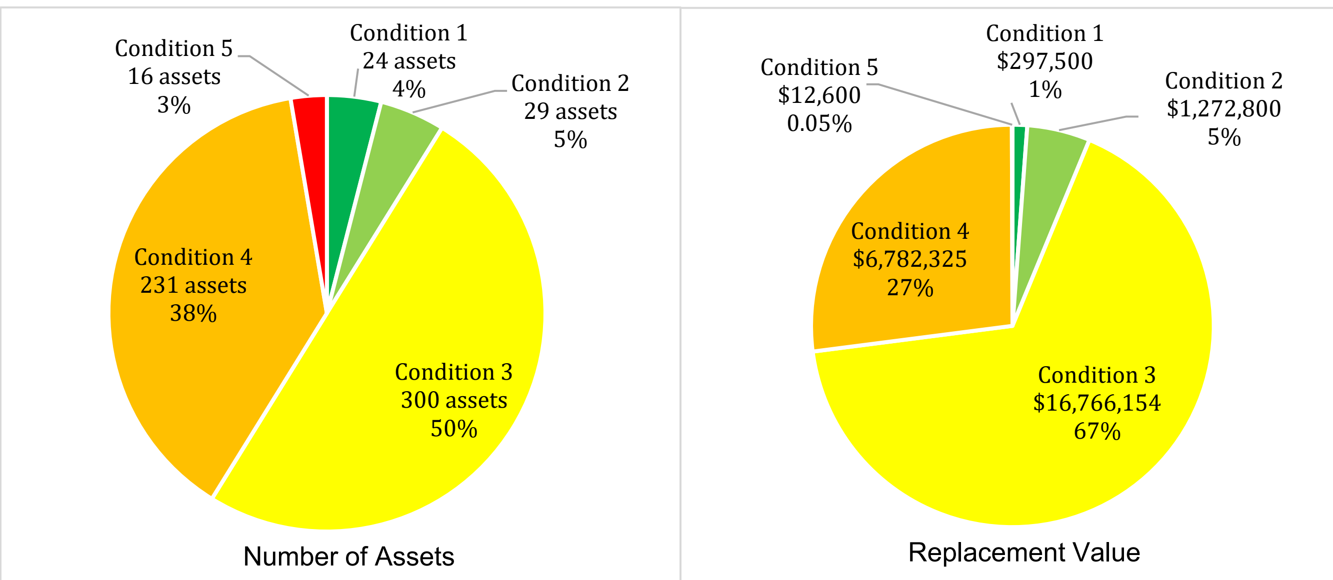


Figure 3-9. WWTP Condition Assessment

4.0 LEVEL OF SERVICE

4.1 SANITARY SEWER COLLECTION SYSTEM AND WWTP

The Level of Service is a measure of the performance of a system with respect to stated goals/targets for system operation. The Township has a good track record of controlling overflows, basement backups, and achieving effluent quality limits; all of which are typical goals for a wastewater utility. Flow monitoring confirms there is a low rate of infiltration/inflow in the collection system. This is likely due to having few residential footing drains connected to the sanitary system and the Township keeping the manholes well maintained and rehabilitated.

The Township's goals for this AMP are to operate the collection system without overflows and basement backups. In order to uphold this Level of Service, certain key performance indicators (KPIs) were identified for use in measuring the progress towards these goals. An example of a KPI is EGLE's sanitary sewer overflow policy of controlling overflows to the 10-year, 1-hour storm of 3.9 inches. The Township also has a track record of meeting NPDES permit limits for the WWTP. Continuing to meet the requirements of its NPDES permit is a goal of the Township. The KPI's for the Northfield Township sewer system are listed in Table 4-1.

Table 4-1. Current Level of Service

Level of Service Key Performance Indicators
Proposed
No basement backups
Reduce inflow and infiltration (I/I) rates and volumes
Capacity to convey EGLE design storm
Reduced odor complaints
Clean all sewers at least once in 5-year to 10-year period
Replace underperforming pump stations
Meet requirement of NPDES permit
Implement Equipment Inventory and Maintenance Tracking System

In general, the Township's collection system is meeting the proposed indicators, although in order to minimize the number of sanitary sewer overflows, the Township is planning to construct an equalization basin at the WWTP. With the exception of the equalization basin, the Township can focus primarily on rehabilitating infrastructure based on need with no new infrastructure needed to improve service.

The WWTP is consistently meeting its NPDES permit requirements with few odor complaints. Therefore, the wastewater treatment plant is meeting its level of service KPIs.

4.2 SOFTWARE SELECTION AND SETUP

One element of the SAW grant included provisions for the Township to purchase Lucity™ AMS to process the data obtained. The SAW grant also provided for computer hardware upgrades such as the purchase of new tablets and other devices used for operating the software.

Tetra Tech presented the Township with a list of qualified potential AMS vendors including information of the various features to allow the Township to narrow the list to a few vendors. Lucity™ AMS was the software chosen. The Township required some minor upgrades to their existing ESRI software portfolio in order to operate the Lucity™ software and completed those upgrades through the SAW grant.

Lucity™ uses the Township's existing GIS network as a backbone from where it is primarily used as a work management system for storing information and issuing and tracking work orders. All of the Township's collection system and WWTP assets have been loaded into the software along with some pre-set routine maintenance tracking modules that have been designed to mimic the existing annual operations and maintenance tasks carried out in both the collection system and at the WWTP. This will assist the staff in completing and documenting completed preventative maintenance tasks and corrective actions. It will also simplify preparation of the annual asset management report required by the NPDES.

The Township will use a simple work management system that includes the following:

- All call information will be sent to the Wastewater Superintendent for review and response.
- A central desktop setup at the WWTP will act as the primary workstation for the Wastewater Superintendent for reviewing, issuing, and closing all new work orders and other daily practices.

The Lucity™ system has been populated with the information generated through this AMP. The software will act as a digital filing cabinet that collects and stores a history of all work and changes made to each asset.

4.3 FUTURE UPDATING

An important part of maintaining the AMS is to establish a timeframe for updating the database Lucity™ uses to reflect the changes made to the system and other information collected. The Township's goals for its AMS included simplifying annual reporting requirements, better tracking resources expended by the department each year on wastewater related items and to aid in capital improvement planning. The reporting and tracking elements are automatically maintained through the software and can be utilized without necessarily updating the GIS database.

A capital improvement plan was prepared as part of this plan to provide a detailed look at work that should be completed over the next five years, plus a list of items that will be replaced and the year the work will be performed through the next 20 years. EGLE requires the capital improvement plan be revised annually based on the work performed and information collected each year. It is recommended that the GIS database be updated annually prior to capital improvement planning and budgeting using the information collected and stored in the Lucity™ AMS. These updates will include:

- Update asset attributes for all work done the previous year including capital improvements, preventative and corrective maintenance, and new construction.
- Incorporate all maintenance observations and condition assessments, and extend projects based on revised asset RULs.
- Recalculating criticality information for the system, focusing on assets with RUL less than 5 years.

After the above steps are completed each year, annual inspections and maintenance can focus on priority areas.

5.0 CRITICALITY

5.1 BUSINESS RISK EXPOSURE CALCULATION

After completion of the condition assessments, all of the assets were analyzed for criticality using risk analysis methods developed for each asset group. This prioritization was based on the Business Risk Evaluation (BRE), which included:

- Rating the probability of failure (POF) using condition assessment results and selected criteria such as percentage of remaining useful life and maintenance or failure history, and other factors described in more detail in the following subsections.
- Rating the criticality of the asset based on the consequence of failure (COF) for the given asset.
- Calculating the redundancy factor (R) by evaluating the additional units provided beyond the required firm capacity designed into the system.

Using these parameters, the BRE is calculated as follows:

Probability of Failure (POF) x Consequence of Failure (COF) x [1-Redundancy Factor (R)]
= Business Risk Exposure (BRE)

Each asset group was evaluated separately. Details on each asset group and how the various factors were calculated are provided below.

5.2 COLLECTION SYSTEM CRITICALITY

5.2.1 Probability of Failure

The likelihood that an asset will fail is a function of various attributes such as the asset's condition, performance, reliability and maintenance history. Within the collection system, GIS attributes associated with the probability of failure are selected, given a numeric value, and assigned a point value. Each of these factors is evaluated and assigned points for various attributes, with a maximum score of ten for the total of all factors. These scores are then used in calculating the rating. The point schedule for POF is based on the accuracy and level of confidence of the available data. Gravity sewers, manholes, force mains, and pump stations have different scoring schedules for POF, utilizing the asset-unique GIS information available for each category. Data selected for use in determining the POF for the collection system assets was based on information available in 2019 and may include the following:

- Age
- Material
- Work Order History
- Condition
- Capacity

Where there is a lack of information on the current condition, or installation date, assumptions have been made to fully populate the data set. These assumptions were detailed previously in the specific asset group sections of this report. Each asset group for the collection system may have slightly different factors that contribute to the overall POF rating. These are discussed for each asset group within this section.

5.2.2 Consequence of Failure

The COF calculations are based on a weighting process similar to the POF calculations. COF is another way of identifying critical infrastructure by providing a measure of the impact of a failing asset on the system and its surroundings. COF considers the financial, environmental or health and human safety costs resulting from asset failure. Examples of factors that might be associated with the COF include the proximity of the asset to critical facilities (e.g., hospitals, schools, government buildings), or the proximity to other infrastructure such as roads and buildings. The proximity to other infrastructure affects the COF due to the impact on repair costs (i.e., sewer pipes under roads cost more to fix than pipes under grass fields). Within GIS, attributes associated with the COF are selected, given a numeric value, and assigned a point value. The mathematics of how the scoring is applied is the same as for the POF attributes.

A list of the COF factors that may have been used for the collection system assets are included below.

- Asset Size
- Difficulty to Repair
- Surface Water Impact
- Private Property Impact
- Transportation Impact

Each asset group for the collection system may have slightly different factors that contribute to the overall COF rating. These are discussed for each asset group within this section.

5.2.3 Redundancy

Redundancy can be described as the ability of a process to continue to function despite an asset failing. That is, a redundant asset will have another similar asset or process that will continue to perform while the failed asset is being repaired. Redundancy is a critical piece of information when ranking assets since there would be less of a risk should one asset fail with a redundant asset available.

Redundancy is typically set to 0 for linear collection system assets with no system redundancy. Pump stations contain vertical assets (as opposed to horizontal assets in the sewers) and may include redundancy, particularly for the pumps. Redundancy is calculated as a percentage and in order to avoid allowing a calculated value of 0 for the BRE it is determined based on how many spare units there are out of the total. For example, if a pump station has two pumps installed and one pump is required for firm capacity, the redundancy would be 1 spare pump divided by 2 total pumps, or 50%.

5.2.4 Gravity Mains

5.2.4.1 Probability of Failure (POF)

POFs for the gravity main assets are based on:

- **Age** – The age of the asset will be used to determine the RUL of an asset.
- **Material** – The pipe or manhole material will determine the EEL as noted in Table 2-12, which is used in age calculations. Different materials also have different track records in sanitary sewer collection systems that are used to rank the material durability, or to help identify undesirable construction materials that have a local history of early failure.
- **Work Order History** – As the Township records work orders, individual assets will develop a history of maintenance or repairs and this information will be stored and used to identify assets which may require capital improvements to eliminate recurring maintenance issues.
- **Condition** – Inspections were performed, and the condition scores were assessed as described in Table 3-1.

- **Capacity** – Pipelines that were modeled to show inadequate capacity are more critical.

These five factors were selected for use based on the reliability and availability of the data stored in GIS.

In order to implement this data in a practical fashion, a scoring system was developed where each factor was assigned points to estimate their impact upon failure. The maximum number of points that could be assigned to each factor was ten. Below is an explanation of how each factor has been analyzed as part of this report and a summary explanation of how the scores were determined and applied.

Pipe Age

The pipe age factor uses the installation date data point for each asset from the GIS to identify an age, in years, for each asset. Each asset was previously assigned an EEL, which was then used to calculate a RUL for the asset. For instance, concrete sewers were assumed to have an EEL of 100 years, so a sewer built in 1976 that is 40 years old would have a remaining useful life of 60 years (100 - 40 = 60 years). For the purposes of the scoring approach, the remaining useful life is then calculated as a percentage of the EEL. Assets are assigned points based on the percentage of RUL, with assets that have less than or equal to 10% of the RUL being assigned the maximum score for that factor.

Pipe Material

The material of the pipe is used to classify the EEL. The pipe material is also used in the probability of failure calculation to assign a greater weighting factor for construction materials that are more likely to fail. Two common examples of materials that are typically highlighted for this particular factor are vitrified clay pipe (VCP) and non-reinforced concrete pipe (NRCP) pipe. VCP sewers have some variability in the durability of installation depending on field-specific factors such as subsurface soil conditions and installation techniques. (These factors are difficult data points to reliably collect.) There are many examples of VCP prematurely failing due to poor joints or accelerated structural issues. NRCP sewers are typically 8- to 10-inch diameter mains which do not include any steel reinforcement and become brittle over time. VCP and NRCP are assigned a higher point value that other pipe materials.

Work Order History

If a pipeline has a record of back-ups, previous failures or collapse, then the history of repair is useful in assessing the current condition of the remaining portion of the asset. Scoring is related to whether a sewer has had any previous repair or maintenance visits. Work orders have not historically been maintained in Northfield Township, however the implementation of the Lucity™ AMS will make tracking work orders automatic and provide important data for future analysis.

Condition

Using the results of the gravity sewer inventories and CCTV sewer inspections, the PACP inspection data were interpreted and each asset was assigned a distinct condition rating which corresponds to the NASSCO PACP condition ratings.

Capacity

Sewer metering and flow modeling have been used to identify sewers that are under capacity or show signs of surcharged conditions during a design storm event. A lack of capacity can lead to basement backups or overflows upstream in the system.

POF Scoring Summary

Table 5-1 shows each of the criteria explained above that were used to evaluate the system and the corresponding established metrics to evaluate POF.

Table 5-1. POF for Gravity Mains

Factors	Metrics - Points Assigned				Max Points
	0 Points	1 point	2 points	3 points	
Pipe Age	>50% RUL	10-50% RUL	< 10% RUL		2
Material		CI, DIP, RCP, PVC	VCP, NRCP		2
Work Order History	None	Previous work order			1
Condition*	ECR = 1 or 2; No CCTV	ECR = 3	ECR = 4	ECR = 5	3
Capacity		Capacity available/not surcharging	Under capacity/ surcharged		2
				Total	**10**

Notes: CI – Cast Iron

* Condition rating is based on a review of the PACP inspections and uses Table 3-1 as guidance for overall condition rating to reflect both structural and O&M scoring.

These individual criteria were set up as attributes in the GIS. When the GIS indicates a 2 for "POF – Pipe Age" it will translate to a pipe with ≤ 10% RUL. These scores can then be easily tallied for a "POF Score" in GIS. Pipes with no CCTV record or an ECR of 1 or 2 will score a 0 for the gravity main POF condition metric to easily identify those assets with no inspection record or a low ECR. Since different assets have unique sets of weighting factors, the weighted score is then applied to a maximum total score of 10. With maximum allowable scores of 10 for the POF and COF, the highest BRE score that can be received is 100.

Example Analysis and Results

Below are two examples of how different types of pipes are scored using the POF calculations described above.

Example 1 Asset Description: PVC pipe, (Design Life 100 years), installed in 1970 with a PACP rating of 2, no previous work orders and no capacity issues.

Factors	Metric	Score
Pipe Age	RUL = 100- (2016-1970) = 54 years/100 = 54%	0
Pipe Material	Material = PVC	1
Work Order History	No previous work orders	0
Condition	Engineers condition rating = 2	0
Capacity	Capacity available	1
	Total POF Points	**2**

Example 2 Asset Description: VCP (Design Life 100 years), installed in 1913 with a CCTV rating of 4 that has had root removals performed several times in the past, and was modeled showing surcharging in the pipe.

Factors	Metric	Score
Pipe Age	RUL = 100- (2016-1913) = -3 years/100 = 0%	2
Pipe Material	Material = VCP	1
Work Order History	(1) Previous work orders	1
Condition	Engineers condition rating = 4	2
Capacity	Capacity – surcharging	2
	Total POF Points	**8**

The POF is set up so that the owner can adjust the scoring to weight some metrics higher for certain criteria in order to better reflect the service priorities of the community. Some assets have more available data to utilize in developing these criteria. Applying the weight to a standard score provides a numerical method of prioritizing assets requiring closer inspection.

5.2.4.2 Consequence of Failure

COF calculations for the gravity mains are based on:

- **Pipe Size** – The size of a pipe or structure impacts the COF as the diameter is related to the amount of flow the system was intended to convey (reflecting the number of connected users impacted) and cost of repair and replacement materials.
- **Difficulty to Repair** – The depth of a pipe will increase the COF due to larger disruption areas impacting roads, private property and higher construction costs due to larger excavations and shoring requirements.
- **Surface Water Impact**– This factor is based on assets that cross bodies of water and/or the proximity of assets to Federal Emergency Management Agency (FEMA) floodplains. A greater score is given to a pipe found within the floodplain since a failure in this location would have a greater environmental impact during an event, such as an SSO, and proposed repairs may potentially increase permit requirements.
- **Private Property Impact** –This factor is increased for pipes in close proximity to buildings, as failure of the asset may directly impact nearby structures and can result in increased construction costs.
- **Transportation Impact** – Proximity to the roadway was determined using Transportation Act 51 attributes in the GIS, and a list of assumed right-of-way offsets used to identify typical road widths, since actual pavement extents are not available in GIS. Assets were grouped based on the following:
    - not under/near a roadway
    - under/near a minor road
    - under major road
    - under railroad.

  Sewers that were within the influence of a roadway receive a greater weight. Depending on the criticality of the road and the proximity of the pipe, failure of the asset may have a greater impact on surrounding infrastructure and lead to greater construction and traffic control considerations.

Factors for COF are typically static conditions that are generally related to asset attributes or locations with respect to other infrastructure or property.

In order to implement this data in a practical fashion, a scoring system was developed in which each factor was set up with metrics defining the number of points to assign to each factor. The result of differing metric scores for each factor was a weighted scoring system where crucial asset attributes were weighted more heavily than less crucial asset attributes. The maximum number of points that could be assigned to each factor was ten.

Pipe Size

The pipe diameter is used to identify more critical sewers in the system because larger diameter sewers typically serve a larger tributary area with a high number of users upstream that could be impacted in the event of a failure. The sewers with an interior diameter of 8 to 10 inches receive no score, as these are the most common pipe sizes in the system. Sewers 12 inches through 15 inches receive one point, and sewers greater than or equal to 18 inches in diameter receive 2 points. 6-inch sewers within the system are considered suboptimal and most standard trenchless sewer rehabilitation equipment is not designed for operating in pipes under 8 inches in diameter. For these reasons, 6-inch diameter sewers receive two points for this factor.

Difficulty to Repair

The inventory information includes measurements from the rim of the manhole to the invert of all incoming and outgoing pipes representing the depth of the pipe at that location. Since deeper sewers are more difficult to access and result in a larger area of disturbance due to excavation, the depth of the sewer can significantly increase the difficulty and cost to make repairs. In some cases, the depth of the sewer may be the difference between the Township's capability to perform a repair themselves versus having to hire a contractor to complete the job. Sewers less than 20 feet deep received no points, sewers between 20 and 25 feet deep received one point and sewers deeper than 25 feet received two points.

Surface Water Impact

Using the GIS map and aerial images, sewers were reviewed to determine whether they crossed a water body such as a river or stream. FEMA flood insurance maps were used to depict 100-year flood plain limits on the GIS map to identify sewers found in the floodplain. In either situation, planned replacement or repair work would require a United States Army Corp of Engineers Joint Permit application to the state, and failed assets can result in environmental impacts such as overflows. Sewers that cross bodies of water were assigned 2 points. Sewers found within the 100-year floodplain or within 50 feet of a river received 1 point.

Private Property Impact

Using the GIS aerial imaging, sewers were reviewed for the proximity to buildings where the failure of a sewer could result in damage to the building or require special excavation and shoring techniques that may increase the cost of replacement. Sewers that are shown as crossing beneath structures received 2 points. Sewers within a 10-foot buffer from a building were assigned one point.

Transportation Impact

This was another factor that utilized the GIS aerial image to identify sewers located beneath pavement or other transportation facilities. Sewers that are located under pavement have been assigned one point, while sewers that were found in commercial roadways, such as Main Street or pass beneath railroad tracks, received 2 points.

COF Scoring Summary

Table 5-2 summarizes the factors used to assess the pipe COF and the various metrics used to assign scoring.

Table 5-2. COF for Gravity Mains

Factors	Metrics - Criticality Points Assigned			Max Points
	0 points	1 point	2 points	
Pipe Size	Diameter = 8 to 10 inches	Diameter <15 inches	Diameter ≥ 15 inches or 6 inches	2
Difficulty to Repair	Depth < 20 feet	Depth = 20 to 25 feet	Depth > 25 feet	2
Surface Water Impact	Not near water or flood plain	Within 50 feet of river/ Within 100 year floodplain	Crossing beneath a water body	2
Private Property Impact	Further than 10 feet from a building	Within 10 feet of a building	Under a building	2
Transportation Impact	Not under pavement	Under pavement	In commercial roadway	2
			Total	10

Example Analysis and Results

Below are calculations for COF using the sample pipes from the previous POF examples.

Example 1 Asset Description:

8 inch pipe that passes 8 feet from a building footing, not in a floodplain or under pavement that is 10 feet deep.

Factors	Metric	Score
Pipe Size	Pipe diameter = 8 inches	0
Difficulty to Repair	Pipe depth = 10 feet	0
Surface Water Impact	Pipe is not near any surface water or in floodplain	0
Private Property Impact	Pipe is within 10 feet of a building	1
Transportation Impact	Pipe is not under pavement	0
	Total	**1**

Example 2 Asset Description:

18 inch pipe that is more than 10 feet from any buildings, not in a floodplain, located in a commercial roadway that is 22 feet deep.

Factors	Metric	Score
Pipe Size	Pipe diameter = 18 inches	2
Difficulty to Repair	Pipe depth > 20 feet	1
Surface Water Impact	Pipe is not near any surface water or in floodplain	0
Private Property Impact	Pipe is > 10 feet away from a building	1
Transportation Impact	Pipe is under a commercial roadway	2
	Total	**6**

5.2.4.3 Results

Using the POF and COF for each asset, the Business Risk Evaluation (BRE) associated with each asset can be calculated. The BRE scores for the two examples presented above were calculated as follows:

Example 1: 2 (POF) x 1 (COF) = 2 BRE

Example 2: 8 (POF) x 6(COF) = 48 BRE

In these examples, Example 2 has a higher BRE and would therefore receive a higher priority for further investigation and/or improvement when allocating funds.

Each asset will have a uniquely calculated risk score (BRE) that can be used by the Township to prioritize future improvements and or maintenance activities. The scores calculated above are based on primarily static information, such as pipe depths, distances to buildings, and distances to bodies of water. However, the pipe age and condition assessments will change over time. Real time data regarding asset age does not provide a significant enough change to warrant continuous updating of scores. Best practices involve making periodic updates that would include entering any new condition assessment information into the Lucity™ AMS system.

Table 5-3 and Figure 5-1, 5-2 and 5-3 summarize the POF, COF and BRE scoring for gravity mains. Figures 5-1, 5-2, and 5-3 also include POF, COF, and BRE scoring for force mains, which are further discussed in Section 5..2.6. Full asset inventory tables that include all relevant gravity main information including POF, COF and BRE is located in Appendix C. Larger maps depicting the POF, COF and BRE results are located in Appendix G.

Table 5-3. POF, COF & BRE Summary for Gravity Mains

Gravity Mains			
Attributes	**High Score**	**Low Score**	**Mean**
POF	8	2	3.3
COF	6	0	1.4
BRE	30	0	4.9

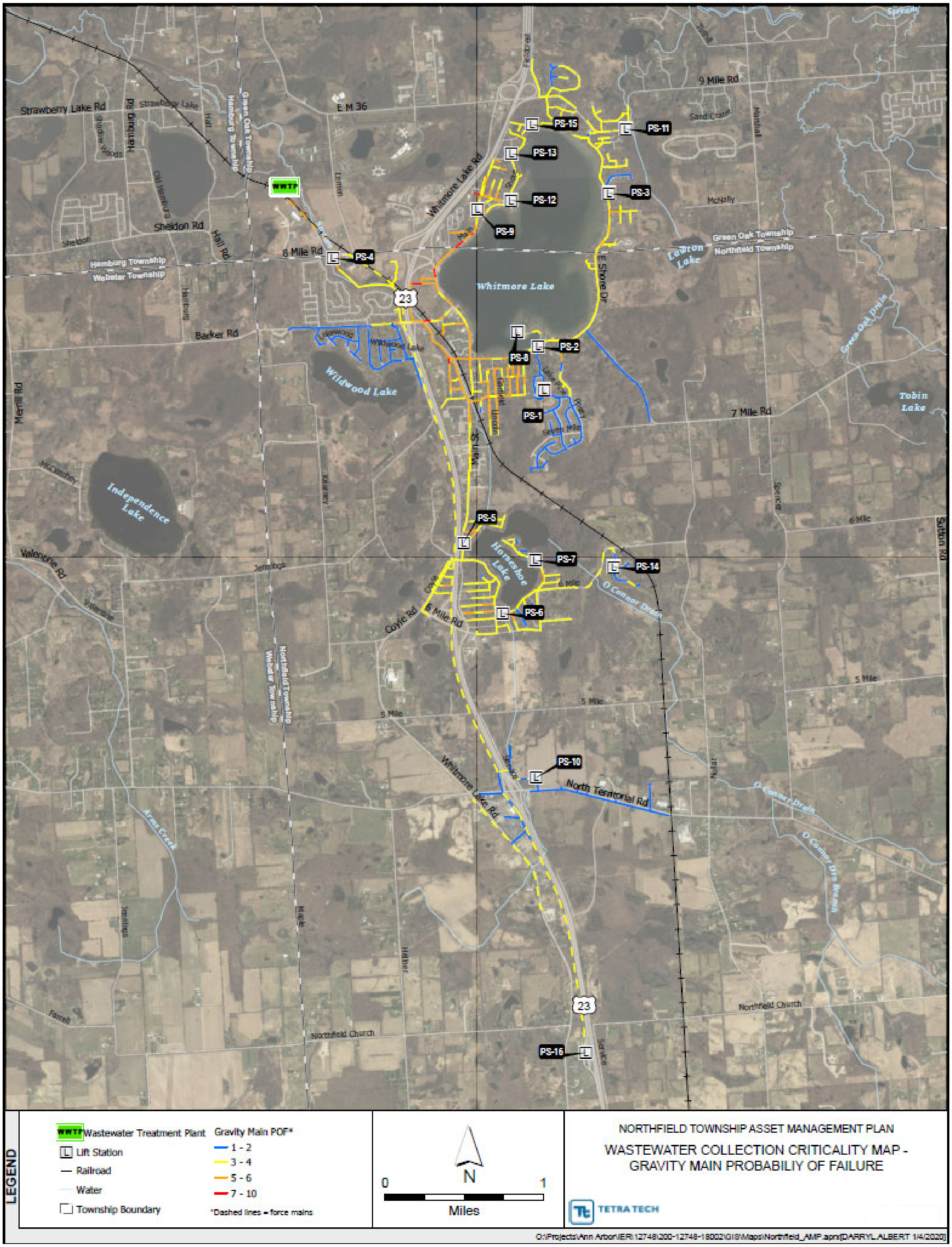


Figure 5-1. Gravity Main Probability of Failure Map

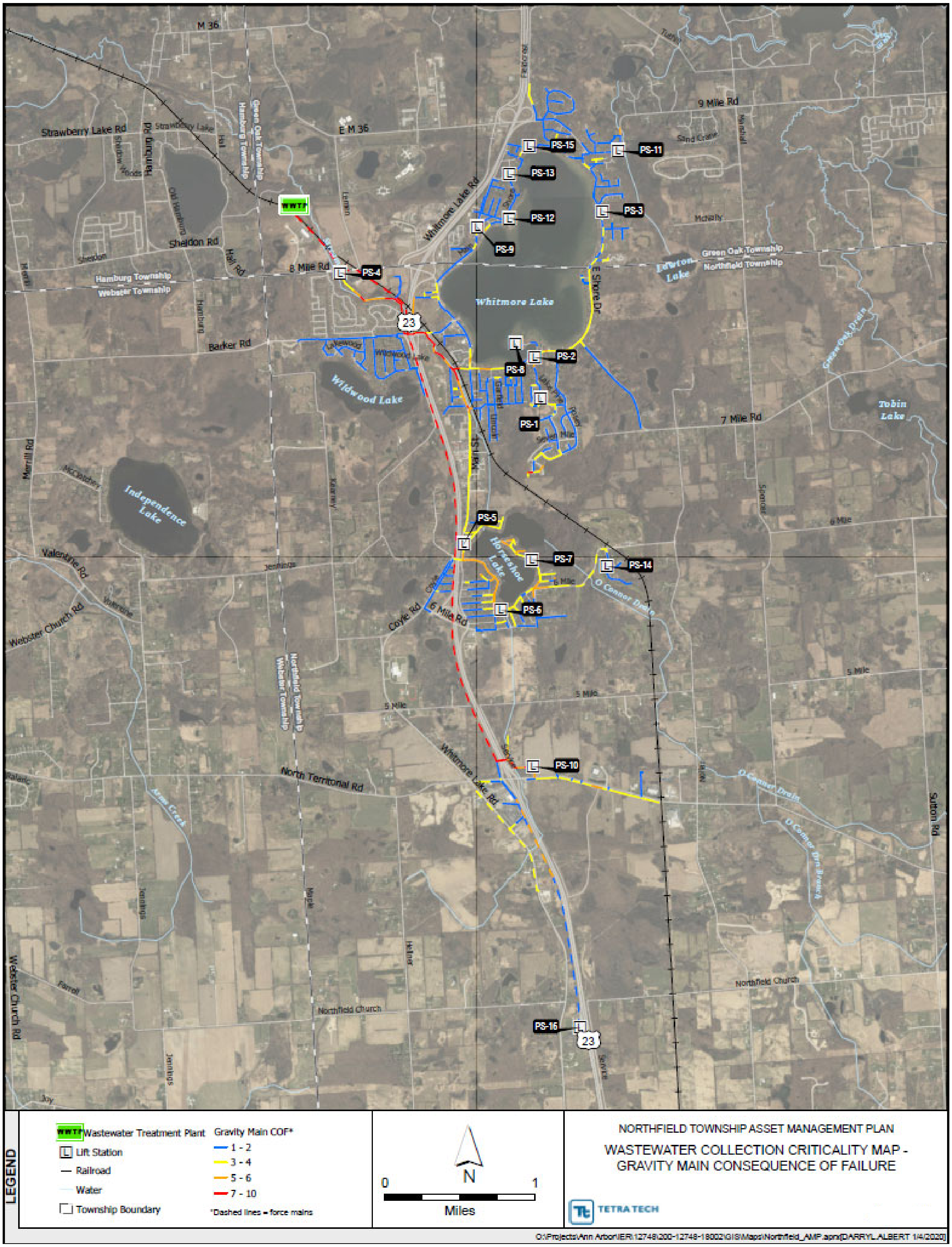


Figure 5-2. Gravity Main COF Map

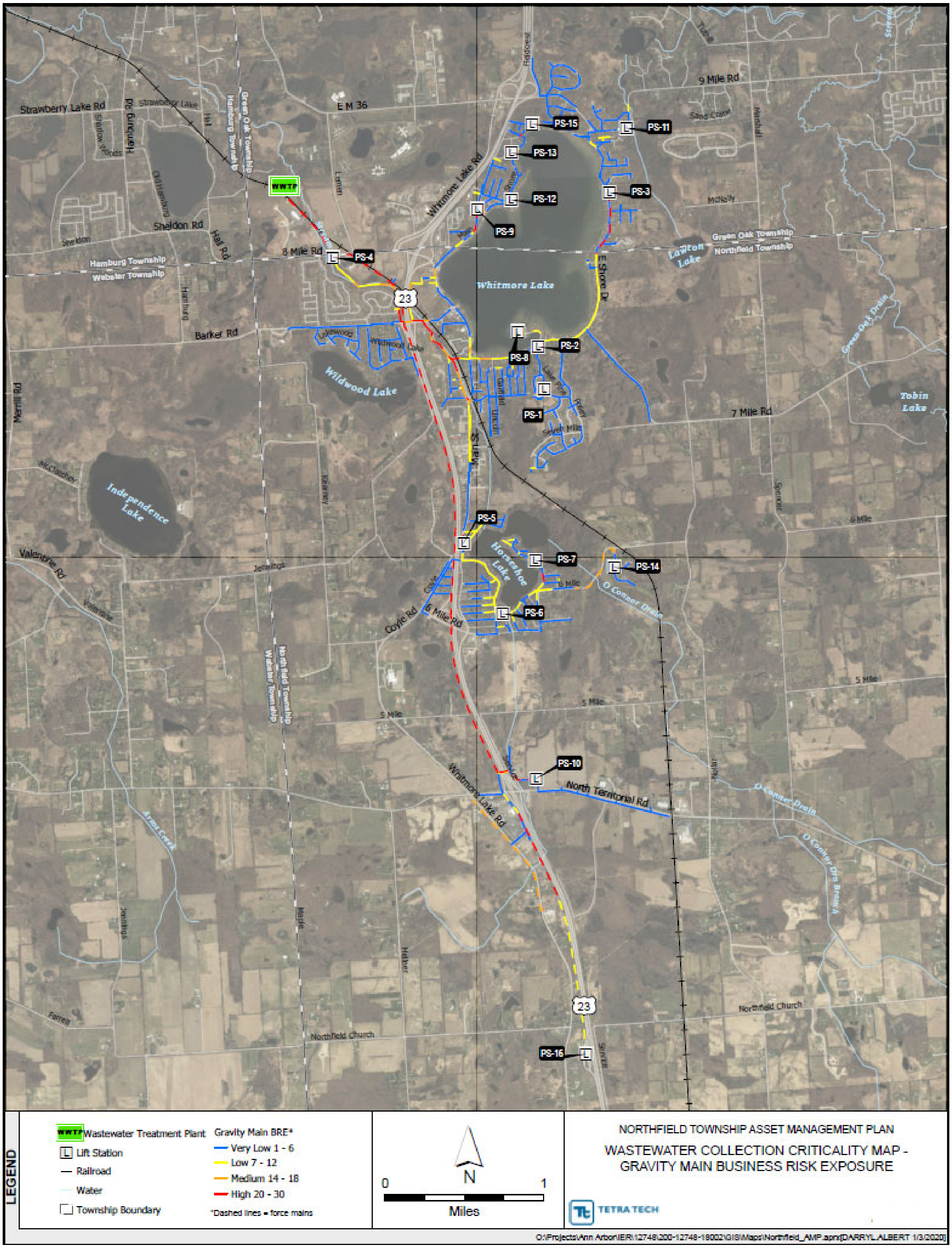


Figure 5-3. Gravity Main BRE Map

Figure 5-3 shows that the critical gravity mains include the interceptors and older pipelines located downtown.

Table 5-4 and Figure 5-4 show the gravity mains grouped by BRE Score Range. The BRE values are categorized once all data are available to make sure that the asset risk scale is adjusted correctly to ensure inclusion of all assets into each BRE Criticality level.

Table 5-4. Gravity Main BRE Scoring Summary

Gravity Mains BRE Scoring		
BRE Criticality	**BRE Score Range**	**Count**
Very Low	0 - 7	632
Low	8 - 12	103
Medium	13 - 19	21
High	20 - 100	15

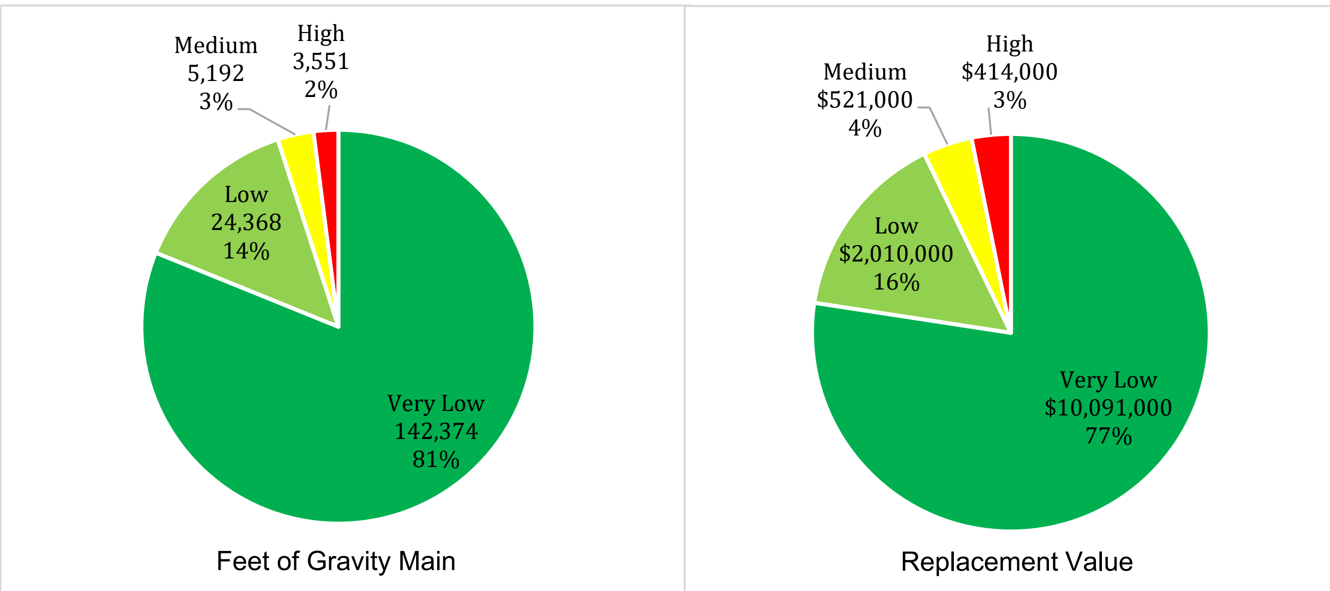


Figure 5-4. BRE Rating for Gravity Mains

Table 5-5 provides a summary of the top 15 gravity mains prioritized by BRE. The table also contains a recommendation for either a capital improvement project (explained later in this report) or to monitor the asset's performance.

Table 5-5. Top 15 Gravity Mains by BRE

Asset Id	US MH	DS MH	Install Date	Leng. (ft)	Dia. (in)	Mat.	POF	COF	BRE	CIP Project No.	Location
SP-537	MH-401	MH-406	1965	328	18	VCP	5	6	30	CS-1	Barker Road
SP-614	MH-402	MH-401	1965	220	15	VCP	5	5	25	CS-10	Barker Road
SP-617	MH-397	MH-398	1965	346	18	DIP	4	6	24	CS-5	Diamond Circle
SP-616	MH-411	MH-397	1965	269	18	DIP	4	5	20	CS-5	Diamond Circle
SP-615	MH-410	MH-41	1965	426	18	DIP	4	5	20	CS-5	Diamond Circle
SP-201	MH-409	MH-410	1965	158	18	DIP	4	5	20	CS-5	Barker Road
SP-613	MH-403	MH-402	1965	302	15	VCP	5	4	20	CS-10	S. of Barker Road along RR
SP-610	MH-404	MH-403	1965	92	15	VCP	5	4	20	CS-10	S. of Barker Road along RR
SP-608	MH-364	MH-405	1965	299	15	VCP	5	4	20	CS-10	S. of Barker Road along RR
SP-607	MH-363	MH-364	1965	149	15	VCP	5	4	20	CS-10	S. of Barker Road along RR
SP-544	MH-361	MH-360	1965	163	15	VCP	5	4	20	CS-10	Brookside Drive
SP-543	MH-359	MH-361	1965	157	15	VCP	5	4	20	Monitor	Brookside Drive
SP-542	MH-369	MH-359	1965	268	15	VCP	5	4	20	Monitor	Brookside Drive
SP-538	MH-370	MH-374	1965	142	15	VCP	5	4	20	Monitor	Jennings Road
SP-546	MH-355	MH-361	1965	233	12	VCP	5	4	20	Monitor	Brookside Drive

US – Upstream

DS –Downstream

5.2.5 Manholes

5.2.5.1 Probability of Failure

As previously discussed, POF is a measure of the likelihood of when an asset may fail. The following factors have been applied to manholes:

- Age
- Material
- Work Order History
- Condition Assessment

The only POF factor that is not used for manholes is the capacity factor, which is not meaningful for manholes. 262 of the manholes were inventoried and checked against record drawings when available.

The POF scoring methods were identical to the gravity mains for the Age, Material, and Work Order History factors, however scoring for Condition was based on the manhole inventory condition assessments. Section 3.1.1.2 described the method for converting the manhole inspection assessments into a condition score.

POF Scoring Summary

Table 5-6 shows each of the criteria explained above that were used to evaluate the system and the metrics that were established for the scoring of each factor.

Table 5-6. POF for Manholes

Factors	Metrics - Points Assigned				Max Points
	0 points	1 point	2 points	3 points	
Manhole Age		>50% RUL	10-50% RUL	< 10% RUL	3
Material		Precast concrete	Block	Brick	3
Work Order History	None	Previous work order			1
Condition*	ECR = 1 or 2; Not Found/ Inaccessible/ Not opened/ Inspected	ECR = 3	ECR = 4	ECR = 5	3
Total					10

Note: * Condition rating is based on a review of the manhole inspections and uses an aggregate of the manhole component scores obtained during the MACP inspection. Manholes that were not found, inaccessible, or not opened, and inspected received a score of zero for condition.

Example Analysis

Below are two examples of how different types of manholes would be scored using the POF calculations described above.

Example 1 Asset Description: Block manhole, (design life 75 years), installed in 1970 that was inaccessible.

Factors	Metric	Score
Manhole Age	RUL = 75- (2016-1970) = 29 years/75 = 39%	2
Material	Material = Block	2
Work Order History	No previous work orders	0
Condition	Condition assessment = Not Accessible	0
Total Points		4

Example 2 Asset Description: Brick MH (Design Life 75 years), installed in 1913 with multiple work orders and a condition assessment of 4.

Factors	Metric	Score
Manhole Age	RUL = 75- (2016-1913) = -28 years/100 = 0%	3
Material	Material = Brick	3
Work Order History	(1) Previous work order	1
Condition	Condition assessment = CA 4	2
Total Points		9

Manhole probability of failure is going to be less of a driver for action since sewage flow would not necessarily be impeded if a manhole were to have a failure. It can be useful for prioritizing miscellaneous repairs outside of major capital improvement projects or trenchless repairs in coordination with roadway projects.

5.2.5.2 Consequence of Failure

As previously discussed, COF is a measure of the criticality of the sewer, or the relative impact to the system and its surroundings if an asset were to fail. Manhole criticality scoring is similar to gravity mains with slight modifications to account for the vertical nature of the asset. The following factors have been applied to manholes:

- Manhole Size
- Difficulty to Repair
- Surface Water Impact
- Private Property Impact
- Transportation Impact

The COF factors for manholes are similar to those applied to the gravity mains.

COF Scoring Summary

Table 5-7 summarizes the factors used to assess the manhole COF and the various metrics used to assign a score.

Table 5-7. COF for Manholes

Factors	Metrics - Criticality Points Assigned			Max Points
	0 points	1 point	2 points	
Manhole Size		Diameter = 48 inches	Diameter > 48 inches	2
Difficulty to Repair	Depth < 10 feet	Depth is 10 to15 feet	Depth > 15 feet	2
Surface Water Impact		Not within 50 feet of river/ Not within 100 year floodplain	Within 50 feet of river/ Within 100 year floodplain	2
Private Property Impact		>20 feet from Building	Within 20 feet of a Building	2
Transportation Impact	Not under pavement	Under pavement	In commercial roadway	2
		Total		10

There are more criteria for the COF than POF, yet the table above still has a maximum score of 10 using a scoring system that only awards a maximum of 2 points for any given criterion. Table 5-8 was designed specifically for a sewer system the size of Northfield Township, where the maximum measured manhole size is only 48 inches and the deepest structure is located 19.75 feet underground. Current design standards will require some replacement manholes to be larger than the existing 48 inch diameter structures to accommodate larger pipe size connections or changed geometries.

Example Analysis

Below are calculations for COF using the sample manholes from the previous manhole POF example.

Example 1 Asset Description: 48 inch manhole located 18 feet from a building footing, not in a floodplain or under pavement that is 9 feet deep.

Factor	Metric	Score
Manhole Size	Manhole diameter = 48 inches	1
Difficulty to Repair	Manhole depth = 9 feet	0
Surface Water Impact	Manhole is not near any surface water or in floodplain	1
Private Property Impact	Manhole is 18 feet away from a building	2
Transportation Impact	Manhole is not under pavement	0
	Total	**4**

Example 2 Asset Description: 48 inch brick manhole that is more than 20 feet from any buildings, not in a floodplain, located in a commercial roadway that is 19 feet deep.

Factor	Metric	Score
Manhole Size	Manhole Diameter = 48 inches	1
Difficulty to Repair	Manhole depth = 19 feet	2
Surface Water Impact	Not near any surface water or in floodplain	1
Private Property Impact	> 20 feet away from a building	1
Transportation Impact	Under a commercial roadway	2
	Total	**7**

5.2.5.3 Business Risk Analysis and Results

The final BRE calculations for the two examples discussed above are as follows:

Example 1: 4 (POF) x 4 (COF) = 16 BRE
Example 2: 9 (POF) x 7 (COF) = 63 BRE

Example 2 has a higher BRE and would therefore receive a higher priority for work.

The results for the manholes were similar to those for gravity mains. Table 5-8 and Figures 5-5 through 5-7 summarize the POF, COF and BRE scoring for manholes. Full-sized maps displaying the POF, COF, and BRE results for manholes have been included in Appendix G.

Table 5-8. POF, COF & BRE Summary for Manholes

Manhole			
	High Score	Low Score	Mean
POF	6	2	3.3
COF	7	3	4.7
BRE	36	6	15.4

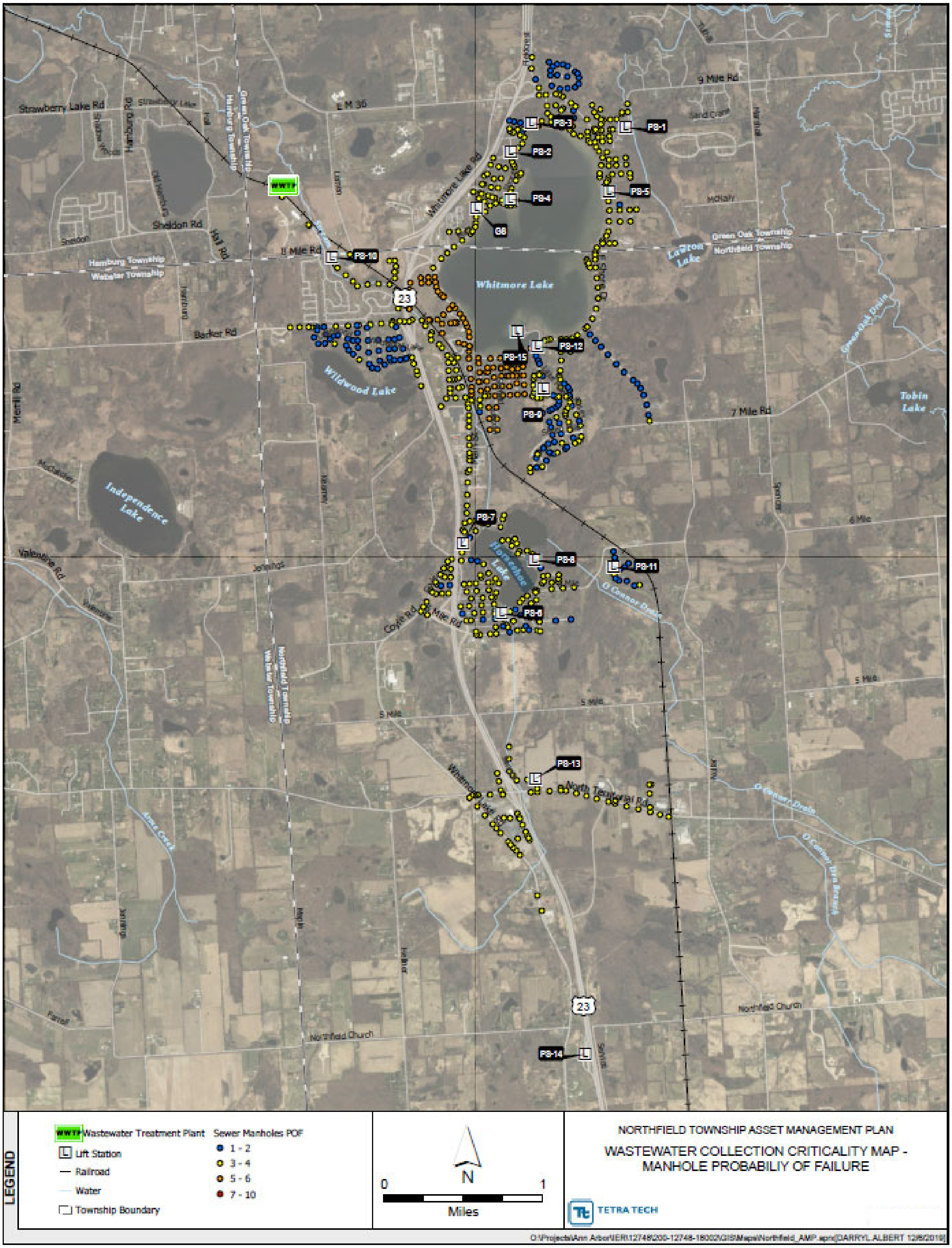


Figure 5-5. POF Summary for Manholes

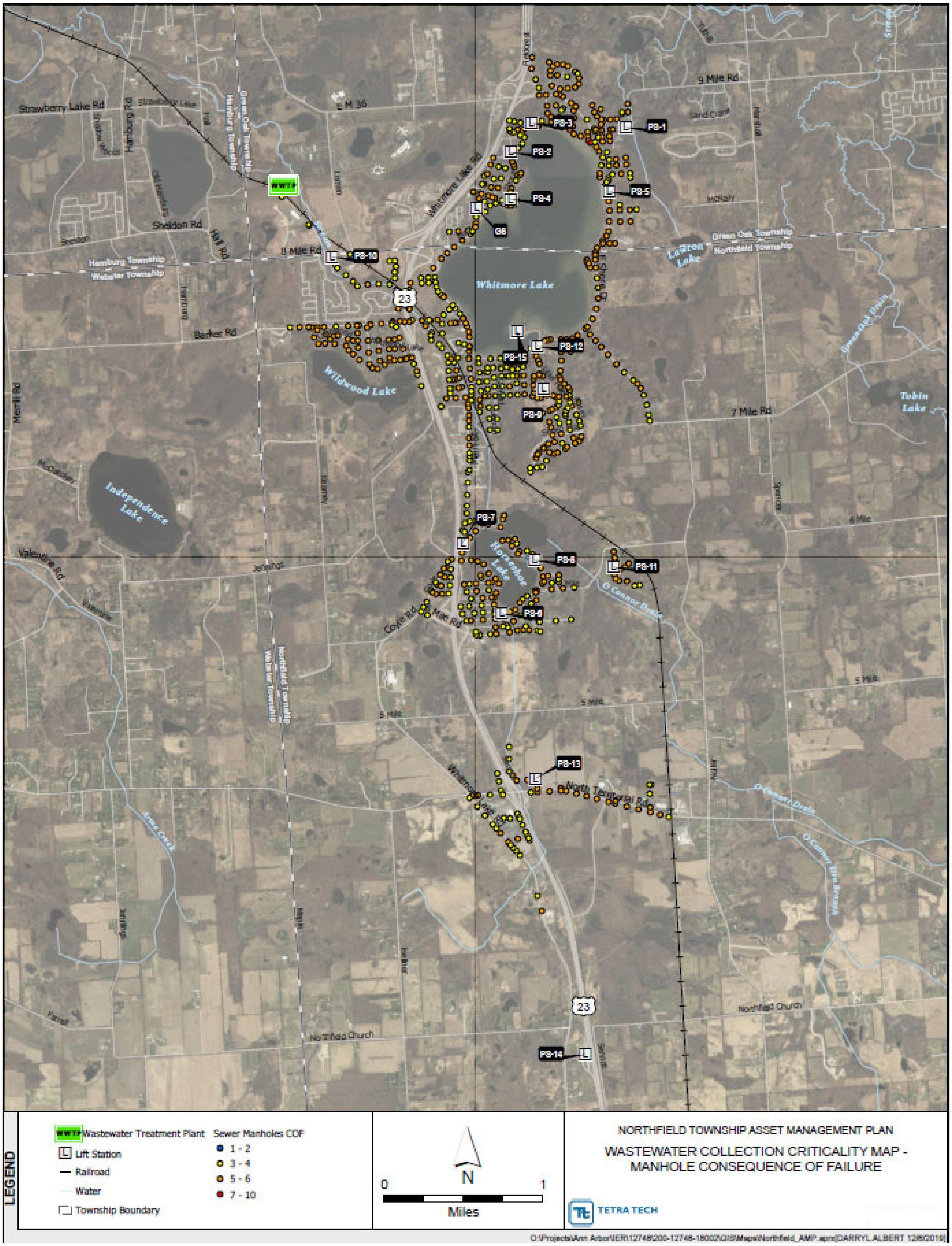


Figure 5-6. Manhole COF Map

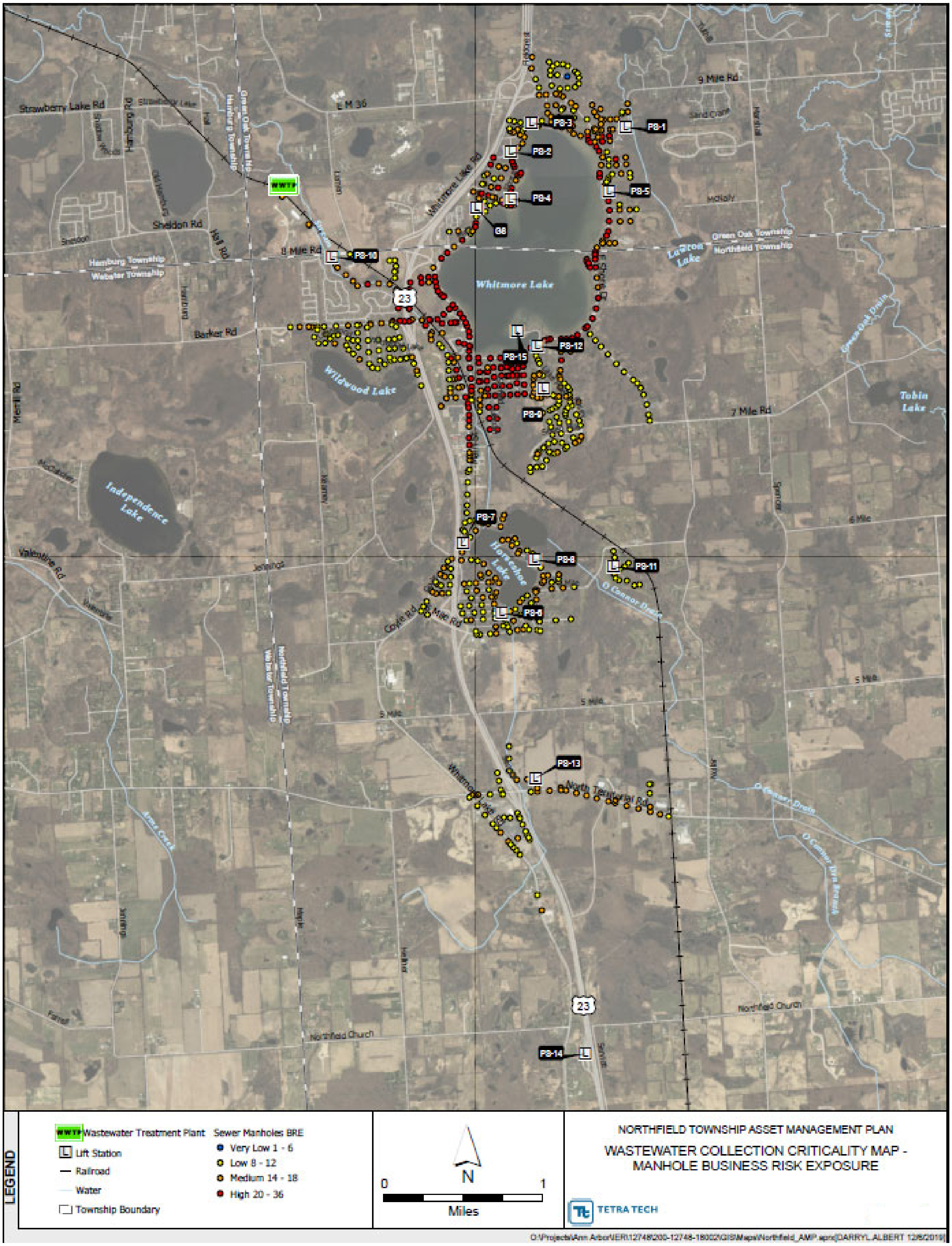


Figure 5-7. Manhole BRE Map

Figure 5-7 shows that the critical portions of the system include manholes located on the streets that lie along the southwest shoreline of Whitmore Lake.

A similar analysis was done using the BRE results to determine scoring ranges for different levels of criticality. Table 5-9 and Figure 5-8 summarize the breakdown used for BRE to define the system criticality.

Table 5-9. Manhole BRE Scoring Summary

Manhole BRE Scoring		
BRE Criticality	**BRE Score Range**	**Count**
Very Low	2 – 6	1
Low	8 – 12	314
Medium	14 - 18	283
High	19 – 36	182

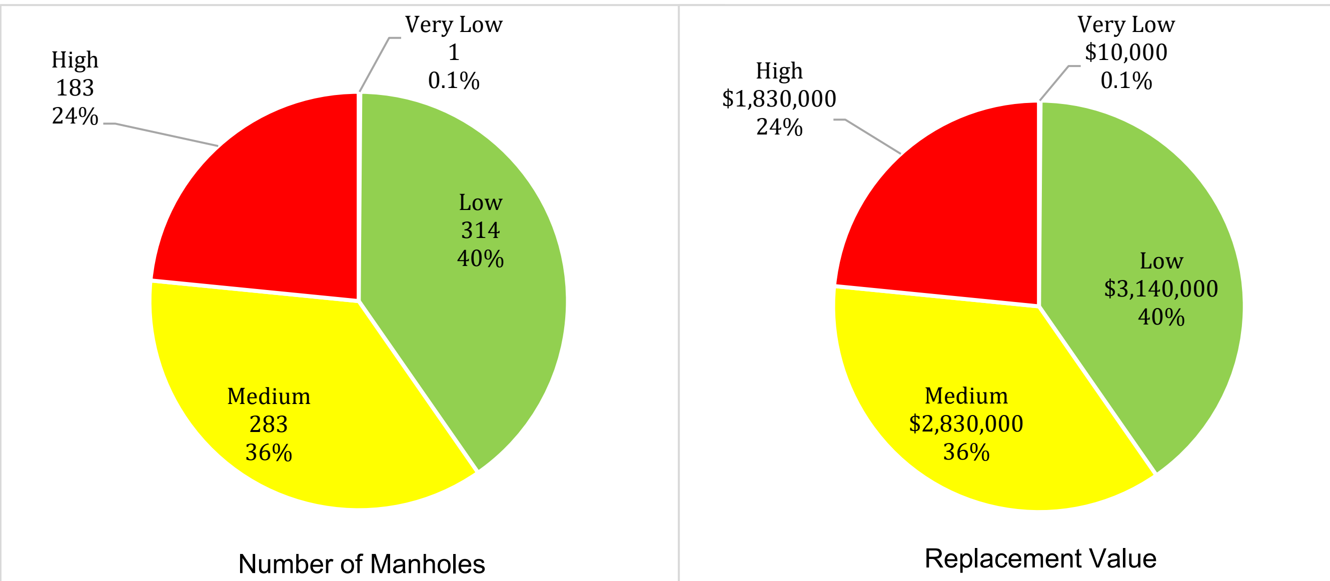


Figure 5-8. BRE Ratings for Manholes

Table 5-10 is a listing of the top 15 manholes by BRE score. The table also contains a recommendation for either a capital improvement project (explained later in this report) or to monitor the asset's performance.

Table 5-10. Top 15 Manholes by BRE

Asset ID	Install Date	Depth	Chimney Material	MH Dia. (ft)	MH Wall Material	Condition Rating	POF	COF	BRE	Location	CIP Project No.
MH-351	1965	16.8	Block	4	Block	3	6	6	36	Main Street	Monitor
MH-350	1965	15.78	Block	4	Block	3	6	6	36	Main Street	Monitor
MH-302	1965	11.06	Block	4	Block	3	6	6	36	Main Street	Monitor
MH-271	1965	8.92	Block	4	Block	3	6	5	30	E. Shore Drive	Monitor
MH-407	1965	12.6	Block	4	Block	3	6	5	30	North of Barker along US-23	Monitor
MH-357	1965	10.4	Block	4	Block	3	6	5	30	Main Street	Monitor
MH-356	1965	12.7	Block	4	Block	3	6	5	30	Main Street	Monitor
MH-354	1965	7.3	Block	4	Block	3	6	5	30	Main Street	Monitor
MH-353	1965	7.4	Block	4	Block	3	6	5	30	Main Street	Monitor
MH-352	1965	10.3	Block	4	Block	3	6	5	30	Main Street	Monitor
MH-338	1965	6.2	Block	4	Block	3	6	5	30	Grove Street	Monitor
MH-307	1965	10.8	Block	4	Block	3	6	5	30	Barker Road	Monitor
MH-304	1965	11.0	Block	4	Block	3	5	6	30	Margaret Street	Monitor
MH-303	1965	11.5	Block	4	Block	3	6	5	30	Margaret Street	Monitor
MH-301	1965	12.6	Block	4	Block	3	6	5	30	Main Street	Monitor

5.2.6 Force Mains

5.2.6.1 Probability of Failure

Force mains were originally included in the same GIS feature class as the gravity sewers, so the same data were available for use in calculating the POF and COF. One key factor missing for force mains was a condition assessment. Force mains are typically not redundant and need to stay in service at all times, so interior CCTV inspection is not feasible or cost effective. POF for the force main is based on the following factors:

- Age
- Material
- Work Order History

These factors are the same as for gravity sewers except for the pipe materials. Only a handful of different materials, like cast iron, ductile iron, and HDPE, are used as force main material in the Township. Cast iron is typically older piping and has a higher propensity to scale and corrode on the interior as opposed to ductile iron piping, which has a cementitious lining to resist corrosion. For this reason, only cast iron force mains receive a score in the material category.

The maximum number of points that could be assigned to each factor was ten. The POF scoring method for force mains was done in the same manner as gravity mains.

POF Scoring Summary

Table 5-11 shows each of the criteria explained above that were used to evaluate the system and the metrics that were established for the scoring of each factor.

Table 5-11. POF for Force Mains

Factors	Metrics - Points Assigned				Max Points
	0 points	2 point	4 points	6 points	
Pipe Age		>50% RUL	10-50% RUL	< 10% RUL	6
Material	DI, HDPE	CI			2
Work Order History	None	Previous work order			2
Total					10

These individual criteria have been set up as attributes in the GIS. The GIS database will only be populated with the scores as defined in the table above, so a 3 for the GIS attribute “POF – Pipe Age” will translate to a pipe with < 10% RUL. These scores can then be easily tallied for a “POF Score” in GIS.

5.2.6.2 Consequence of Failure

The COF calculations for force mains use the same factors as gravity mains, except for the Private Property Impact and Difficulty to Repair factors. This is because none of the 25 force mains impact any structures, and force mains are typically buried shallow, with less than eight feet of cover. This implies that force mains are relatively easy to access for replacement and repair work. A failed or ruptured force main would still have significant impacts to surface waters or if located beneath a roadway. COF for the force main assets is based on the following factors:

- Force Main Size
- Surface Water Impact
- Transportation Impact

These COF factors are static conditions related to asset size and location with respect to other infrastructure or property and have been added to the GIS.

In order to implement this data in a practical fashion a scoring system was developed in which each factor was set up with metrics defining the number of points to assign to each factor. The result of differing metric scores for each factor was a weighted scoring system where crucial asset attributes were weighted more heavily than less crucial asset attributes. The maximum number of points that could be assigned to each factor was ten. The COF scoring method for force mains was done in the same manner as gravity mains.

COF Scoring Summary

Table 5-12 summarizes the factors used to assess the pipe COF and the various metrics used to assign scoring.

Table 5-12. COF for Force Mains

Factors	Metrics - Criticality Points Assigned			Max Points
	1 point	2 points	4 points	
Pipe Size	≤ 3-inch	4-inch	6-inch	4
Surface Water Impact		Within 50 feet of river/ Within 100 year floodplain or wetland	Crossing beneath a water body	4
Transportation Impact		Crosses beneath railroad tracks		2
		Total		10

5.2.6.3 Results

The results of the BRE analysis for force mains yielded varying results. Figures 5-1, 5-2, and 5-3 included the POF, COF, and BRE values for force mains (presented in Section 5.2.4). Table 5-13 summarizes the POF, COF, and BRE values assigned to the force mains. The ten grinder pump stations were omitted from the table, as the POF, COF, and BRE for these stations were all set equal to one. Grinder stations typically serve a small number of residences, which limits their impact on the operation of the collection system.

Table 5-13. Force Main Summary

Pump Station	Force Main		
	POF	COF	BRE
Eagle Gardens	2	2	4
East Shore 1	4	4	16
East Shore 2	6	4	24
Eight Mile Rd	6	10	60
Horseshoe Lake 1	6	6	36
Horseshoe Lake 2	6	4	24

Pump Station	Force Main		
	POF	COF	BRE
Horseshoe Lake 3	6	4	24
Lake Point Drive	4	2	8
Main Street	8	4	32
North Territorial Road	4	8	32
Nine Mile Road	6	2	12
North Shore 1	6	2	12
North Shore 2	6	2	12
Shadowoods	4	4	16
Canal (Elmcrest)	6	6	36

A summary of the force main BRE scoring is shown in Table 5-14 and Figure 5-9.

Table 5-14. Force Main BRE Scoring Summary

Force Main BRE Scoring				
BRE Criticality	BRE Score Range	Count	Length (feet)	Replacement Value
Very Low	2 – 6	11	1,489	$38,100
Low	8 – 12	4	2,621	$99,000
Medium	14 - 18	2	3,401	$130,000
High	19 – 36+	8	21,915	$2,322,000

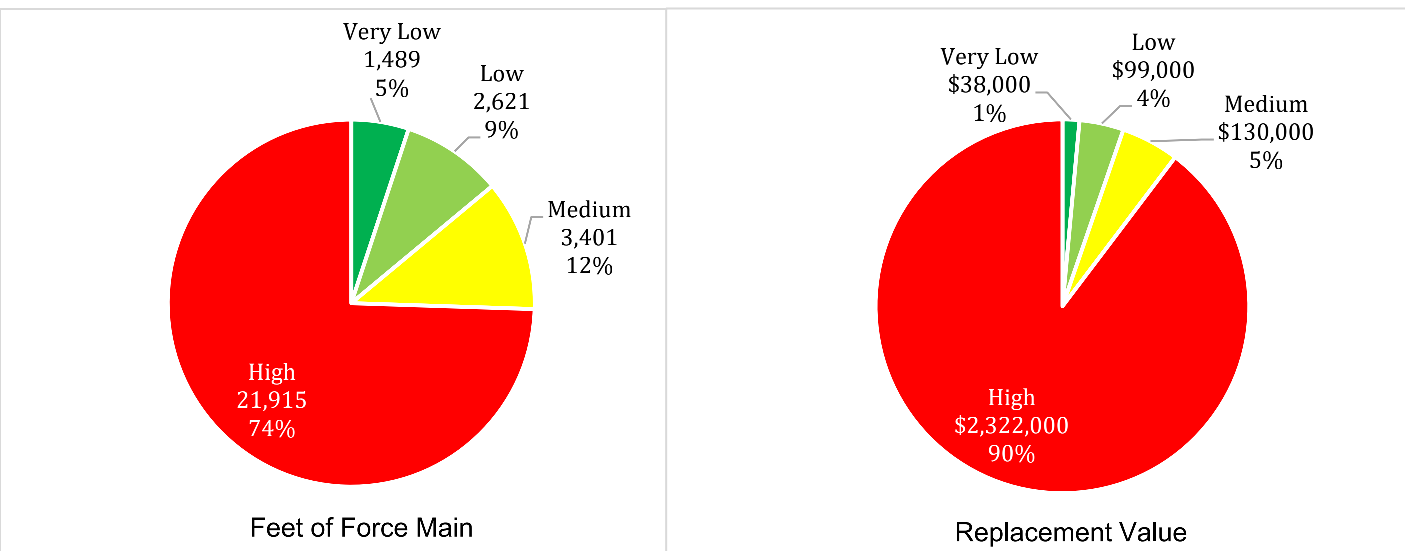


Figure 5-9. BRE Rating Summary for Force Mains

Table 5-16 is a summary of the force mains that were in the high BRE criticality category (identified in red in Figures 5-1 and 5-9). The table also contains a recommendation for either a capital improvement project (explained later in this report) or to monitor the asset's performance.

Table 5-16. Summary of Force Mains with a High BRE Criticality Rating

ID No.	Name	Year Installed	Diameter (in)	Length (ft)	Condition Rating	POF	COF	BRE	CIP Project No.
4	8 Mile Road	2001	12	2,951	3	6	10	60	Monitor
5	Horseshoe Lake 1	1978	6	460	3	6	6	36	CS-8
15	Canal (Elmcrest)	1978	4	583	3	6	6	36	Monitor
10	North Territorial Road	2002	12	13,200	3	4	8	32	Monitor
3	East Shore 2	1969	6	2,207	3	6	4	24	CS-6
6	Horseshoe Lake 2	1978	6	900	3	6	4	24	CS-13
7	Horseshoe Lake 3	1978	4	827	3	6	4	24	Monitor
9	Main Street	1969	6	787	3	6	4	24	CS-3

5.2.7 Pump Stations

Pump stations are by nature critical components of a collection system since a failure could lead to significant upstream private property or environmental damage.

5.2.7.1 Probability of Failure

The POF for pump stations is a measure of the likelihood of when a pump station may fail. Typically, the following factors are applied to determine the POF of a pump station:

- Overall Station Condition
- Work Order History
- Capacity

Northfield Township has 25 pump stations that were inventoried and checked against record drawings when available. The POF scoring methods for pump stations were similar to those used for other asset types within the system. Overall station condition was evaluated during site visits to the individual stations. Work order history was reviewed to determine whether previous work orders had been completed at the pump station. Additionally, capacity was evaluated at the station's present and projected future ability to adequately pump incoming flows based on the sanitary sewer capacity analysis study. Station age was omitted from the POF metric, as most of the pump stations contain components that have been replaced since their initial construction. As the pump stations are evaluated as individual assets, it is difficult to apply one single age to a pump station.

POF Scoring Summary

Table 5-17 shows each of the criteria explained above that were used to evaluate the system and the metrics that were established for the scoring of each factor.

Table 5-17. POF for Pump Stations

Factors	Metrics - Points Assigned				Max Points
	0 points	2 point	4 points	6 points	
Overall Station Condition	Excellent or Very Good	Good	Fair	Poor	6
Work Order History	No Previous Work Orders	Previous Work Orders			2
Capacity	No Existing or Anticipated Future Capacity Issues	Existing or Anticipated Future Capacity Issues			2
Total					10

These individual criteria have been set up as attributes in the GIS. The GIS database will only be populated with the scores as defined in the table above. These scores can then be easily tallied for a "POF Score" in GIS.

5.2.7.2 Consequence of Failure

The COF for pump stations is a measure of the consequence of their failure. Pump stations are typically integrated into collection systems as a means for sanitary flow conveyance at various points in the collection system. As such, the COF for pump stations can be evaluated as the impact that their failure would have on the portions of the collection system upstream of the stations.

COF Scoring Summary

Table 5-18 summarizes the factors used to assess the pump station COF and the metric used to assign scoring.

Table 5-18. COF for Pump Stations

Factors	Metrics - Criticality Points Assigned					Max Points
	2 Points	4 Points	6 Points	8 Points	10 Points	
Approx. Percentage of System Interrupted Upstream of Station	< 20%	21% – 40%	41% - 60%	61% to 80%	81% to 100%	10
Total						10

5.2.7.3 Redundancy

Pump station redundancy is typically indicated by the redundancy of the pumps in each station. For duplex stations, one pump is typically required and a second is installed for redundancy yielding 50% redundancy. For triplex stations, two pumps are typically required and a third is installed for redundancy yielding 33% redundancy. For a quadplex station, three pumps are typically required and a fourth is installed for redundancy yielding 25% redundancy. The 10 grinder stations installed on Whitmore Lake Road were omitted from Table 5-19, as these are simplex stations (one pump) and thus are not applicable to a redundancy evaluation (i.e., redundancy is equal to 0%). Table 5-19 below summarizes the pump redundancy by station.

Table 5-19. Redundancy for Pump Stations

Pump Station	Redundancy	
	No. Pumps	Redundancy
Eagle Gardens	2	50%
East Shore 1	2	50%
East Shore 2	2	50%
Eight Mile Road	4	33%
Horseshoe Lake 1	2	50%
Horseshoe Lake 2	2	50%
Horseshoe Lake 3	2	50%
Lake Point Drive	2	50%
Main Street	2	50%
N. Territorial Road	3	33%
Nine Mile Road	2	50%
North Shore 1	2	50%
North Shore 2	2	50%
Shadowoods	2	50%
Canal (Elmcrest)	2	50%

5.2.7.4 Results

Table 5-20 summarizes the pump stations by BRE. The table also contains a recommendation for either a capital improvement project (explained later in this report) or to monitor the asset's performance.

Table 5-20. Pump Station BRE Summary

Pump Station	Force Main			CIP Project Number
	POF	COF	BRE	
Eagle Gardens	4	2	8	Monitor
East Shore 1	4	2	8	Monitor
East Shore 2	6	2	12	CS-6
Eight Mile Road	4	10	40	Monitor
Horseshoe Lake 1	6	4	24	CS-8
Horseshoe Lake 2	4	4	16	CS-13
Horseshoe Lake 3	4	2	8	Monitor
Lake Point Drive	2	2	4	Monitor
Main Street	4	4	16	CS-3
N. Territorial Road	4	2	8	Monitor
Nine Mile Road	4	2	8	Monitor
North Shore 1	4	4	16	CS-7
North Shore 2	6	2	12	CS-11
Shadowoods	2	2	4	Monitor
Canal (Elmcrest)	4	2	8	Monitor

Table 5-21 and Figure 5-10 summarizes the BRE Scoring Summary for pump stations.

Table 5-21. Pump Station BRE Scoring Summary

Force Main BRE Scoring			
BRE Criticality	BRE Score Range	Count	Replacement Value
Very Low	2 – 6	12	$1,646,000
Low	8 – 12	8	$4,998,000
Medium	14 - 18	3	$1,495,000
High	19 – 36+	2	$2,150,000

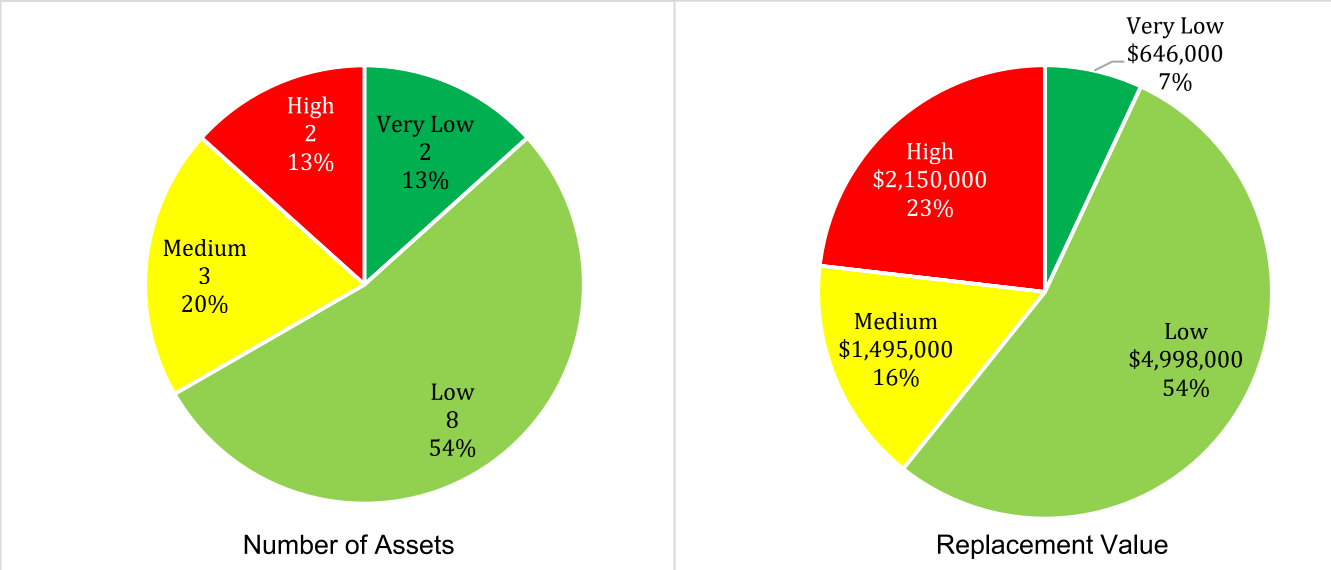


Figure 5-10. Pump Station BRE Ratings

5.2.8 Grinder Stations

The Township's grinder pump stations are not considered critical components of the collection system since failure would not lead to significant upstream private property or environmental damage. Grinder pump station BRE was generated using the same metrics as the BRE results shown above for the other pump stations in the Township. The results of the grinder pump station BRE assessment are shown in Table 5-22 below.

Table 5-22. Grinder Pump Station BRE Scoring Summary

Grinder Pump Station	Force Main			CIP Project Number
	POF	COF	BRE	
Whitmore Lake Road GS-1	2	2	4	Monitor
Whitmore Lake Road GS-2	2	2	4	Monitor
Whitmore Lake Road GS-3	2	2	4	Monitor
Whitmore Lake Road GS-4	2	2	4	Monitor
Whitmore Lake Road GS-5	2	2	4	Monitor
Whitmore Lake Road GS-6	2	2	4	Monitor
Whitmore Lake Road GS-7	2	2	4	Monitor
Whitmore Lake Road GS-8	2	2	4	Monitor
Whitmore Lake Road GS-9	2	2	4	Monitor
Whitmore Lake Road GS-10	2	2	4	Monitor

5.2.9 Summary of Asset Prioritization

This report was developed with each asset BRE being set up as a reflection of the BRE results for that asset category only, and at this time is not intended for comparison with other asset groups such as the equipment at the WWTP. In order to portray the relative criticality in the system, expressed in BRE, the percentage of each system that fits into each BRE category was identified. These results can be seen in Figure 5-11.

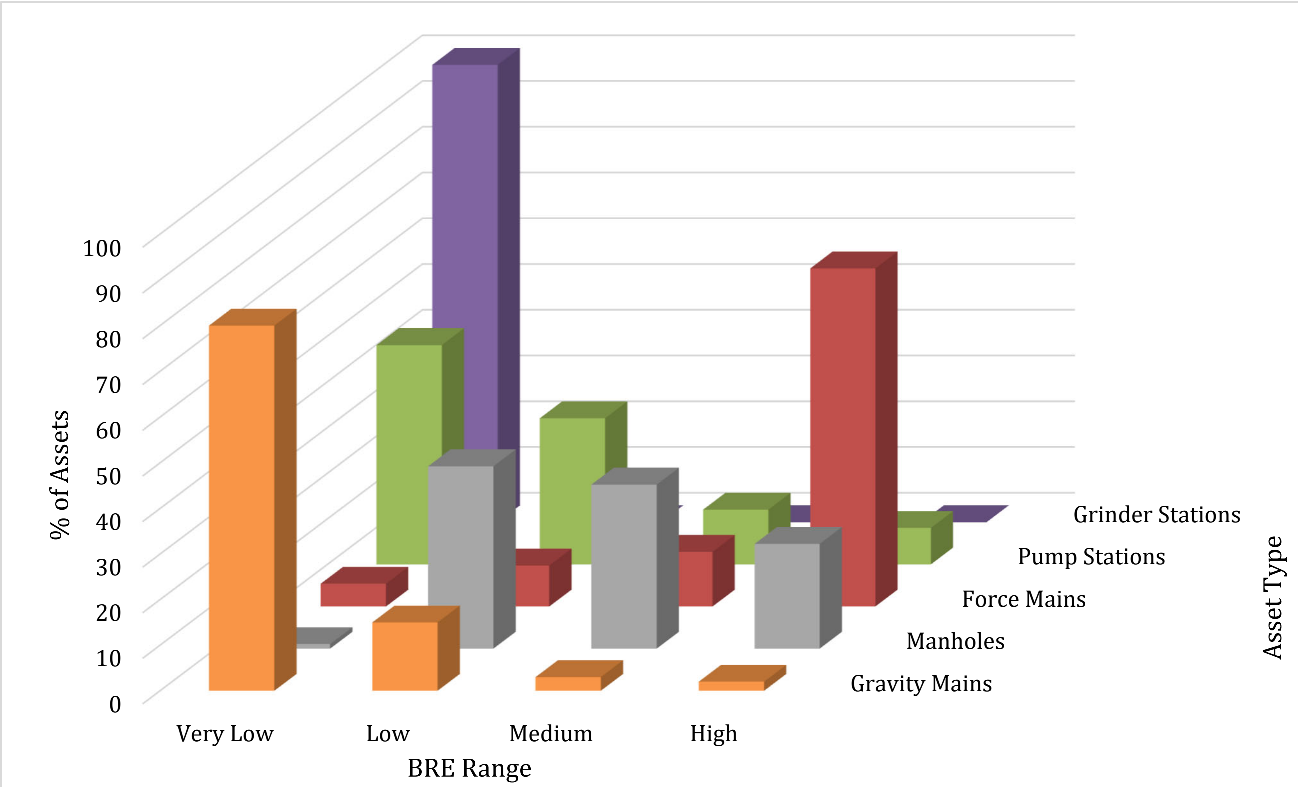


Figure 5-11. Collection System BRE Summary

5.3 WASTEWATER TREATMENT PLANT

5.3.1 Probability of Failure (POF)

As with the collection system, the likelihood that a WWTP asset will fail is a function of various attributes such as the asset's condition, life expectancy, performance, and maintenance history. Each of these factors is evaluated to determine condition of the asset. A score between 1 and 5 is then assigned to the asset, as described in Table 5-23.

Table 5-23. Probability of Failure Definition for WWTP Assets

Score	Definition
1	No possibility of asset failure
2	There is a small possibility of the asset failing
3	There is a moderate possibility of the asset failing
4	The asset is likely to fail
5	The asset has failed to meet its function and is likely to fail in very near future.

5.3.2 Consequence of Failure (COF)

The COF is treated in a similar fashion as the POF. The COF is the financial, environmental, or health and human safety cost resulting from asset failure. The failure of an asset could result in the WWTP not being able to treat flow, which could result in the discharge of untreated or partially treated wastewater to the Horseshoe Lake Drain. The COF is based on how critical the asset is to the treatment process and achieving the level of service goals of the facility. A score of 1 to 5 is assigned to the asset, as described in Table 5-24.

Table 5-24. Consequence of Failure Definition for WWTP Assets

Score	Definition
1	Not a factor in operations
2	A factor in operations to a marginal extent
3	Failure disrupts operations
4	Failure causes significant disruption in operations
5	Failure causes catastrophic operational down time, must not fail

5.3.3 Redundancy

Redundancy is a measure of backup capability for each asset. The redundancy is expressed as a percentage. If the facility requires two of an asset to meet treatment capability and facility has four of those assets, the redundancy is 50 percent. If instead there were only three of the assets, the redundancy would be 33 percent. The treatment process was reviewed to determine asset redundancy.

5.3.4 Business Risk Exposure (BRE)

Using the data and rating collected, the Business Risk Exposure is calculated for that asset. The calculation is based on Probability of Failure (POF), Consequence of Failure (COF), and Redundancy (R). The equation is provided below.

Probability of Failure (POF) x Consequence of Failure (COF) x (1 - Redundancy Factor (R))

= Business Risk Exposure (BRE)

The BRE can range from 1 to 25, with a value of zero indicating a low risk to the facility and a value of 25 posing a high risk. The BRE can be used to prioritize maintenance and the replacement of assets as part of the development of the capital improvements plan by focusing on assets with higher BRE values.

The BRE ratings were divided into risk categories, as shown in Table 5-25 and Figure 5-12.

Table 5-25. WWTP BRE Scoring Summary

WWTP BRE Scoring			
BRE Criticality	BRE Score Range	Number of Assets	Replacement Value
Very Low	1 – 3	40	$241,000
Low	4 – 6	45	$1,509,000
Average	7 – 9	200	$8,242,000
Medium-High	10 – 14	214	$13,358,000
High	15 – 25	101	$1,781,000

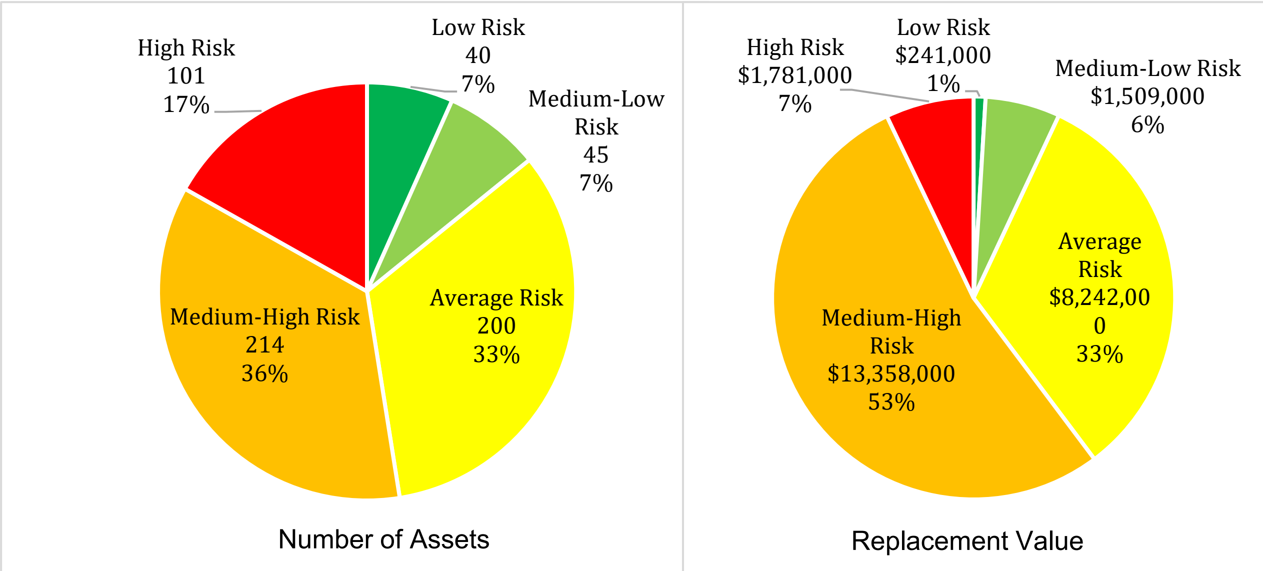


Figure 5-12. BRE Ratings for WWTP Assets

A summary of BRE scoring by number of assets in the process area is presented in Table 5-26. Replacement cost data by process area is summarized in Table 5-27. The individual asset ratings for POF, COF, and BRE are included in the WWTP asset inventory located in Appendix E.

Table 5-26. WWTP BRE Risk Categories by Process Area and Number of Assets

Number of Assets by Area	Low Risk	Medium-Low Risk	Average Risk	Medium-High Risk	High Risk
Preliminary Treatment	0	5	19	9	11
Primary Treatment	3	5	26	8	2
Intermediate Treatment	0	1	1	3	5
Aeration System	15	3	44	40	3
Final Settling Tanks	4	0	15	7	9
Tertiary Filtration/Disinfection	13	7	32	21	26
Sludge Treatment	3	6	26	101	19
Chemical Feed System	2	5	10	11	5
Miscellaneous Assets	0	13	27	14	21
Total	40	45	200	214	101

Table 5-27. WWTP BRE Risk Categories by Process Area and Replacement Value

Number of Assets by Area	Low Risk	Medium-Low Risk	Average Risk	Medium-High Risk	High Risk
Preliminary Treatment	$0	$160,000	$727,000	$142,000	$108,000
Primary Treatment	$6,000	$255,000	$852,000	$110,000	$1,000
Intermediate Treatment	$0	$350,000	$150,000	$1,327,000	$54,000
Aeration System	$106,000	$80,000	$339,000	$2,402,000	$9,000
Final Settling Tanks	$27,000	$0	$630,000	$791,000	$142,000
Tertiary Filtration/Disinfection	$55,000	$18,000	$1,390,000	$1,231,000	$406,000
Sludge Treatment	$45,000	$188,000	$1,306,000	$5,489,000	$375,000
Chemical Feed System	$2,000	$335,000	$929,000	$90,000	$47,000
Miscellaneous Assets	$0	$123,000	$1,919,000	$1,776,000	$639,000
Total	$241,000	$1,509,000	$8,242,000	$13,358,000	$1,781,000

Table 5-28 shows that the critical assets of the treatment process include assets located primarily in the Service Building and Filter Building No. 1. Critical assets are associated with the Intermediate Settling Tank, Final Settling Tank, adjacent to Filter Building No. 1, and Digester Building.

The assets listed below were deemed "critical' based on their respective BRE values (20). These assets have the highest BRE of the assets at the WWTP due to their age, high consequence of failure and lack of redundancy. The assets, all installed in 1976 or before, are not serviceable due to lack of available parts and/or general wear and tear on the equipment. They will require replacement to maintain normal plant operations.

The table also contains a recommendation for capital improvement projects (explained later in this report).

Table 5-28. Top WWTP Assets by BRE

Asset Id	Process Area	Location	Install Date	POF	COF	BRE	CIP Project Number
Final Clarifier 1 Bridge	Final Settling Tanks	Final Settling Tank	1976	5	4	20	WWTP-3
Final Clarifier 1 Handrail	Final Settling Tanks	Final Settling Tank	1976	5	4	20	WWTP-3
Intermediate Tank Bridge	Intermediate Treatment	Intermediate Tank	1962	5	4	20	WWTP-3
Intermediate Tank Handrail	Intermediate Treatment	Intermediate Tank	1962	5	4	20	WWTP-3
High Voltage Switchgear	Miscellaneous	Adjacent to Filter Building No. 1	1976	4	5	20	WWTP-6
Transformer	Miscellaneous	Adjacent to Filter Building No. 1	1976	4	5	20	WWTP-6
Generator	Miscellaneous	Adjacent to Filter Building No. 1	1976	4	5	20	WWTP-11
MCC-A	Miscellaneous	Filter Building No. 1	1976	4	5	20	WWTP-8
Automatic Transfer Switch	Miscellaneous	Filter Building No. 1	1976	4	5	20	WWTP-6
MCP	Miscellaneous	Service Building	1976	4	5	20	WWTP-5
MCC-C	Miscellaneous	Service Building	1965	4	5	20	WWTP-8
MCC-C (Solids)	Miscellaneous	Service Building	1976	4	5	20	WWTP-8
MCC-D	Sludge Systems	Digester Building	1965	4	5	20	WWTP-8
Boiler Control Panel	Sludge Systems		1998	4	5	20	WWTP-5
Power Distribution Cabinet	Tertiary Filtration and Disinfection	Filter Building 1- Next to ATS	1976	4	5	20	WWTP-6
Filter Building No. 1 Handrail	Tertiary Filtration and Disinfection	Filter Building No. 1	1976	5	4	20	WWTP-4
CP-1	Tertiary Filtration and Disinfection	Filter Building No. 1	1976	4	5	20	WWTP-5
CP-2	Tertiary Filtration and Disinfection	Filter Building No. 1	1976	4	5	20	WWTP-5

6.0 OPERATION AND MAINTENANCE

6.1 CURRENT O&M PRACTICES

Tetra Tech interviewed the wastewater staff to define the tasks that are performed for each asset group to identify routine maintenance plans that should be entered into the Lucity™ AMS. Preloading regularly scheduled maintenance plans into the AMS is a good way for the wastewater staff to more closely track expenditures for different types of repairs or actions, and aid in preparation of the mandatory asset management reporting required by EGLE. The following discussion details the existing O&M practices and expenditures for both the collection system and the WWTP, as well as recommended changes to current practices designed to achieve the Level of Service the Township desires.

6.1.1 Collection System

6.1.1.1 Overview

The wastewater staff's O&M plan for the collection system consists of scheduled as-needed tasks while also responding to emergency calls and performing typical preventative maintenance and corrective actions by area in the Township. The wastewater staff addresses both jetting and cleaning sewer lines as well as as-needed pump station maintenance and other preventative and corrective maintenance tasks. The Township has several specific tasks they manage each year. Below is a description of each of these practices.

6.1.1.2 Sewer Cleaning

The current method for sewer cleaning is to jet all of the sewers within designated areas in the system at least once a year. The crew splits the Township into specific areas (examples: the collection sewers bordering the south and west sides of Horseshoe Lake; the north end of Whitmore Lake between the 9 Mile Road Pump Station and the Main Street Pump Station) and works from west to east in each section, making progress in between emergencies and other scheduled work tasks.

The Township owns a sewer jetter and performs their own sewer cleaning and has a dedicated crew that on average spends several hours jetting each month, with additional effort in the summer months. The Township doesn't contract with outside firms to do sewer cleaning.

The current practice has been successful, as the Township has a minimal number of complaints that are due to plugged sewers. One difficulty they currently face is a lack of documentation of sewer cleaning to help determine trends and patterns that could possibly be solved using an alternative method.

Improvements and Recommendations

The implementation of the Lucity™ AMS will enhance the planning and documentation capabilities for sewer cleaning. There are likely many sewers that stay relatively clean and many others that experience sedimentation, grease, or root issues. Having a record of the sewers that require more frequent cleaning will allow for development of cleaning schedules to optimize the operations. Sewers that tend to experience sedimentation should be televised intermittently to judge the effectiveness of the cleaning methods, gauge the time required between cleanings, and potentially locate the source of excessive sediment entering the collection system.

6.1.1.3 Sewer Inspections

The Township currently owns a remotely operated robotic camera they can use when investigating sewer backup calls. The camera is inserted into a pipe to identify if an issue is within a public sewer or private lateral. The camera is designed to capture PACP coded sewer inspections. When the Township needs to CCTV a sewer, they self-perform those services. The Township performed approximately 400 sewer inspections as part of this project.

Improvements and Recommendations

The AMP requires that the Township is responsible for assessing the condition of their assets, and for gravity main assets that is best accomplished by conducting CCTV inspections. Approximately 50% of the system was inspected as part of this project for the development of the AMP. A plan to complete the condition assessment of the system has also been formulated to help the Township accomplish completing a full Township-system inspection cycle every 10 years. However, Northfield Township believes they have historically inspected using existing staff on a 5-year cycle. Tetra Tech encourages Northfield to continue using a 5-year cycle if budget allows as this will lead to a higher level of service and fewer risks.

Tetra Tech has provided a recommended schedule for the completion of the system inspection using data collected as part of this plan to prioritize areas to be inspected first. Interceptor inspections are recommended to be contracted as an individual project as pipes of that size (15 inch and above) typically require specifically designed camera equipment. Isolating the interceptors for inspection would also allow the Township to modify its scope to accommodate unique issues along the interceptor including access to manholes and potentially high pipe flows. Some of the more significant operational problems will be found in the interceptors, so it is recommended that they are inspected first. Sewers that are 6-inch diameter can also be problematic for standard inspection equipment, due to offset joints or protruding laterals. Table 6-1 shows the approximate length of pipe to be inspected annually between 2021 and 2030 to complete a system inspection cycle. Based on recent costs from CCTV contractors for cleaning and televising sewers with PACP reporting, it will cost approximately $45,000 annually to complete the system inspection. The Township may incur a lower cost as they self-perform these inspections. The cost of this work is, therefore, already included within the Township's annual labor budget.

Table 6-1. Proposed CCTV Inspection Schedule

Year	Footage by Pipe Diameter (in.)		Opinion of Cost
	8-12	15-30	
2021	16,094	1,454	$45,000
2022	16,094	1,454	$45,000
2023	16,094	1,454	$45,000
2024	16,094	1,454	$45,000
2025	16,094	1,454	$45,000
2026	16,094	1,454	$45,000
2027	16,094	1,454	$45,000
2028	16,094	1,454	$45,000
2029	16,094	1,454	$45,000
2030	16,094	1,454	$45,000
Total	**160,944**	**14,540**	**$450,000**

6.1.1.4 Root Control

The Township's current approach to dealing with root blockages is to jet them out when possible or use a root cutter to mechanically remove the roots from the sewer. The Township has also contracted root removal services in the past to address problem areas. Based on what Tetra Tech has observed in some CCTV inspections of sewers that were previously treated with a chemical root removal agent in other communities, the process appears to be successful and may be useful for addressing sewers with significant root problems. Root removal costs typically ranged from $2 to $3 per foot, depending on the diameter, with a minimum mobilization of $3,000 needed to start a work order. Tetra Tech recommends that the Township utilize root removal as needed to save on costs of repeated jetting and reduce the chances of damaged pipe joints due to root intrusions.

6.1.1.5 Fats, Oils and Grease (FOG)

The Township doesn't have a defined FOG program and, at the present time, monitors certain segments of sewer downstream of restaurants for grease blockages. There are also pump stations that are subject to grease buildup that are checked periodically for cleaning. The Township has utilized chemical grease releasing agents for several sewers in the past, but this is not something that would be needed on a consistent basis. Grease removal services are often provided by companies that specialize in root removal, and a $3,000 minimum mobilization is required to initiate a work order. Tetra Tech recommends that the Township use the AMS to track assets which are known to accumulate grease and incorporate chemical grease removal when jetting becomes inefficient.

6.1.1.6 System Renewal

During the condition assessment, a handful of brick, block and older manholes appeared to have minor defects in the cone and near the frame that were allowing some I/I to enter the system. The Township currently performs manhole rehabilitation as problems are uncovered.

Tetra Tech recommends that the Township continues this proactive approach to manhole rehabilitation by utilizing the Lucity™ AMS to define manholes in need of rehabilitation. The Township should investigate having their service crew trained in the installation of common manhole rehabilitation products to allow the Township to complete other basic system rehabilitation work in-house, which can be more efficient on a small scale than contracting out the work.

6.1.1.7 Pump Stations

With the exception of the Whitmore Lake Road grinder stations, the Township has a weekly schedule for monitoring the pump stations in the system. Minus the Whitmore Lake Road grinder stations, all of the pump stations in the system have some level of telemetry available. This primarily consists of a dialer system to report faults or failures. The stations are typically scheduled for inspection by geographic location, so as to have wastewater staff start at the south end of the system and work their way back north to the WWTP.

During each pump station inspection, the crew records the following information:

- Check power usage at the electrical meter and record in kwh
- Check each pump for run time and record in hours
- Check pumps and motors for grease

Wet wells are also opened during regular inspections and vacuumed if any grease or debris is noted. The stations with generators are also checked once per week. When generators are inspected the crew runs through the following list of items:

- Check and record fuel level
- Cycle engine

- Check oil pressure
- Record temperature at full cycle
- Record run hours

The Township performs the majority of their own maintenance on the pump stations. This typically consists of dispatching a two-man crew to perform the maintenance, repairs and wet well cleaning on the pump stations. Maintenance for the telemetry units is contracted to UIS, and they perform an inspection and calibration for all of the stations on an as-needed basis.

6.1.2 Wastewater Treatment Plant

The Township has developed preventive maintenance schedules for the assets at the WWTP. The assets are monitored, and the manufacturers' recommended maintenance is then outlined to be performed on a weekly, monthly, quarterly, and annual basis. Work lists are developed outlining the tasks to be performed and the schedule. This allows the Township to track that the preventive maintenance is performed.

With the development of the use of Lucity™ AMS the maintenance schedules will be better managed and tracked. The software will allow the Township to better document the information on the assets. The condition of the assets should be tracked, and the amount of labor hours required to maintain the asset should be recorded. This will allow the Township to track the reliability of the assets and determine when it is more cost effective for an asset to be replaced instead of maintained or vice-versa.

The AMS allows annual preventive and corrective action costs to be linked to each asset. If these costs are excessive, staff can replace the asset even if it has a low BRE. For example, if the annual maintenance costs begin to increase to where the repairs are no cost effective, the decision can be made to replace the asset and thus lower the preventative maintenance costs.

7.0 REVENUE STRUCTURE

The grant that funded this project requires that Northfield Township maintains a revenue structure that funds the operation, maintenance and equipment replacement needs of the wastewater utility. A report was prepared and is included in Appendix H that documents that Northfield Township's Wastewater Utility meets these needs.

However, Northfield Township should also consider how the capital needs identified in this report are funded. Typically, Northfield Township also pays for these projects (or debt service for bonded projects) from utility rates. The Township is currently working on a parallel project to update its rate structure to finance the capital projects identified in this report.

8.0 CAPITAL IMPROVEMENT PLAN

8.1 GOALS AND SUMMARY

A long-term capital improvement plan (CIP) that reviewed the utility's needs for a 20-year period was required as part of this AMP. The CIP has a more detailed focus over the first five years, as it is more difficult to predict specific expenditures from years 6 through 20.

EGLE has specified several criteria to be reviewed while setting up a list of capital improvement needs that must be considered:

- Needs related to future/upcoming regulations
- Needs related to major asset replacement
- Needs related to system expansion, consolidation or regionalization
- Needs related to improved technology

The CIP has been split up into collection system (CS) and wastewater treatment plant (WWTP) projects. Collection system projects were developed through a review of the sewer CCTV inspections. Pump stations that are identified for renewal are listed as replacements, as the stations are not only nearing the end of their useful service life, but their materials of construction are not suitable for extending the service life. WWTP projects were developed through the WWTP equipment assessment and through discussions with WWTP staff on elements of the plant that require greater maintenance needs. Each of the individual capital improvement projects is briefly described in Section 8.2. Table 8-1 lists the proposed collection system capital improvement projects. Bolded projects are anticipated to be completed by 2025. Opinions of probable costs can be found in Appendix I.

Table 8-1. Collection System Capital Improvement Projects

Northfield Township 20-year Capital Improvement Plan (2021-2040)			
Project Number	**Description**	**Project Year**	**Project Cost**
CS-1	**Grade 5**	**2021**	**$82,000**
CS-2	**Main Street**	**2025**	**$441,000**
CS-3	**Grade 4**	**2025-**	**$209,000**
CS-4	24-inch Cross	2030	$2,039,000
CS-5	East Shore 2	2030	$635,000
CS-6	North Shore	2030	$509,000
CS-7	Horseshoe	2030	$650,000
CS-8	Future Grade	2030	$123,000
CS-9	18-inch Cross	2035	$690,000
CS-10	North Shore	2035	$629,000
CS-11	Future Grade	2035	$313,500
CS-12	Horseshoe	2040	$ 545,000
		Subtotal	**$ 6,865,500**

Figures 8-1 thru 8-4 below show the location of the collection system capital improvement projects.

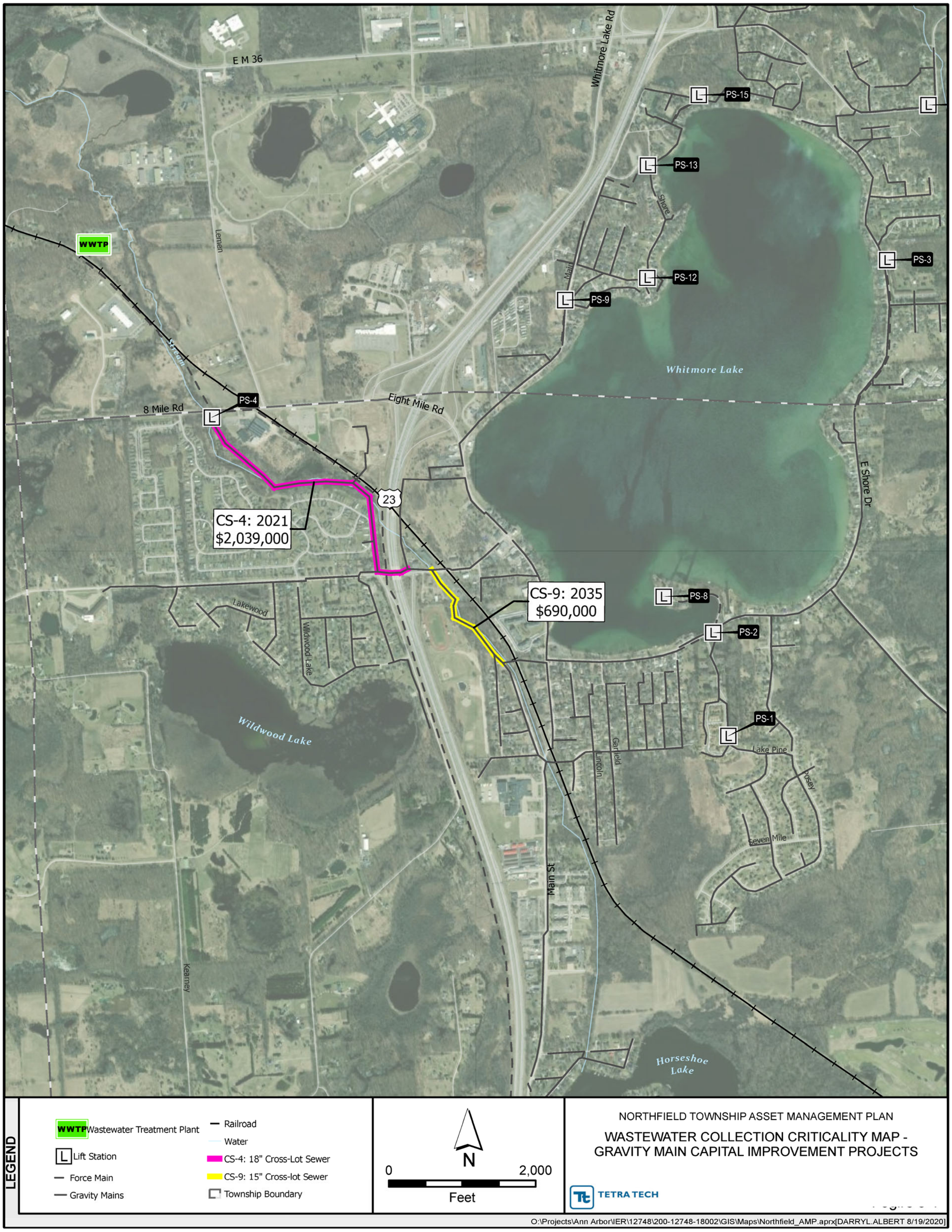


Figure 8-1. Collection System Trunk Sewer Capital Improvement Projects

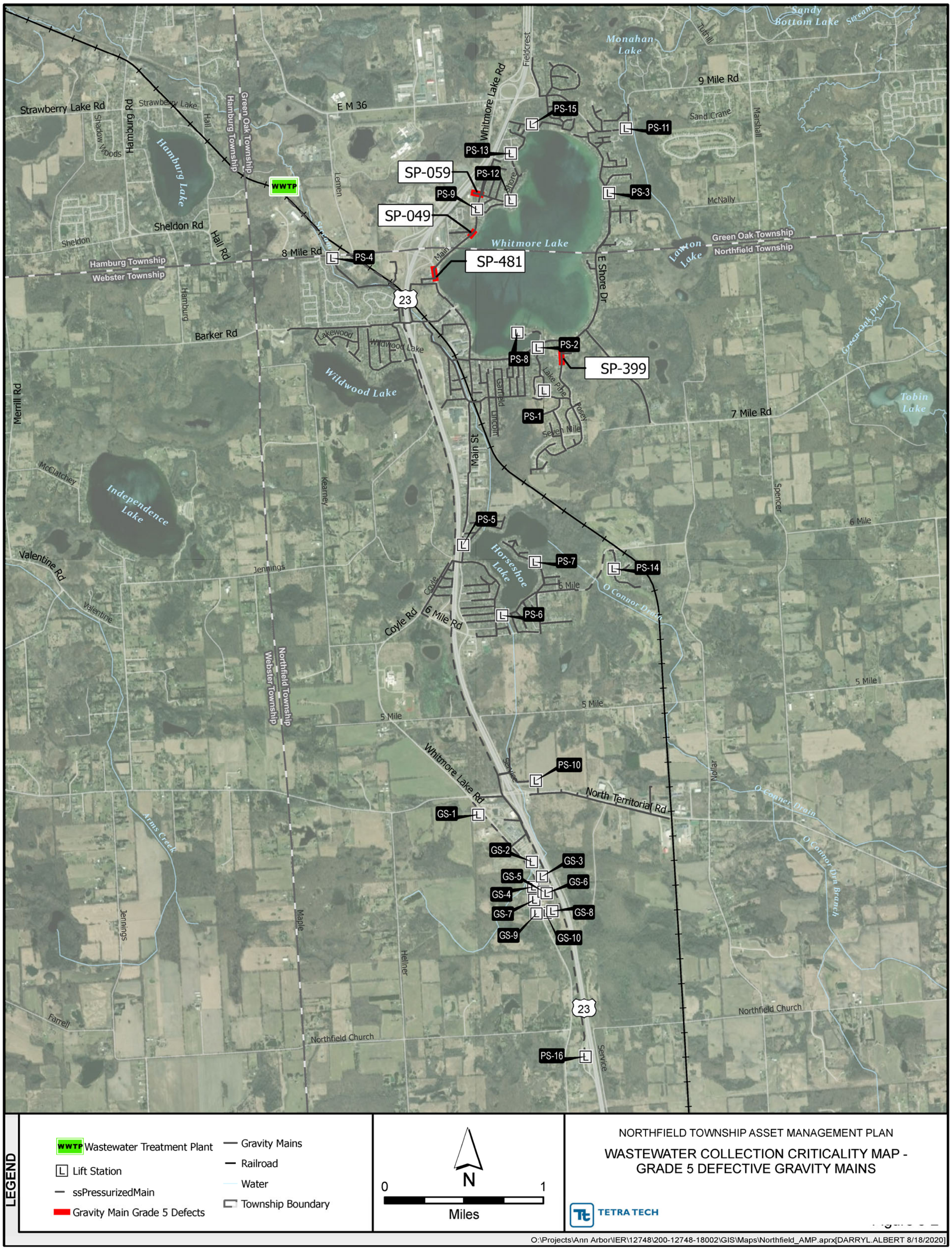


Figure 8-2. Collection System CS-2 CIP-Grade 5 Defect Repairs

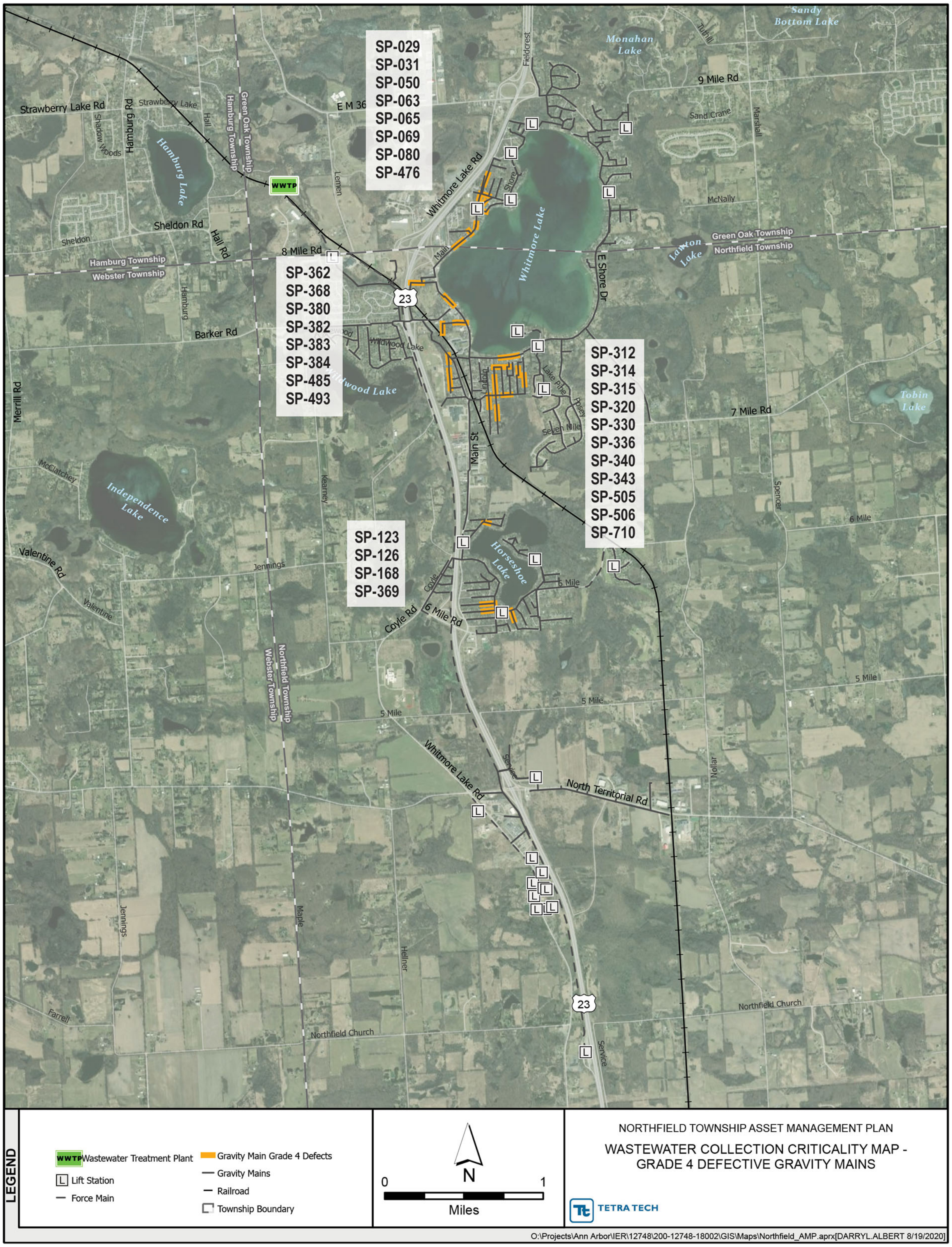


Figure 8-3. Collection System CS-4 CIP-Grade 4 Defect Repairs

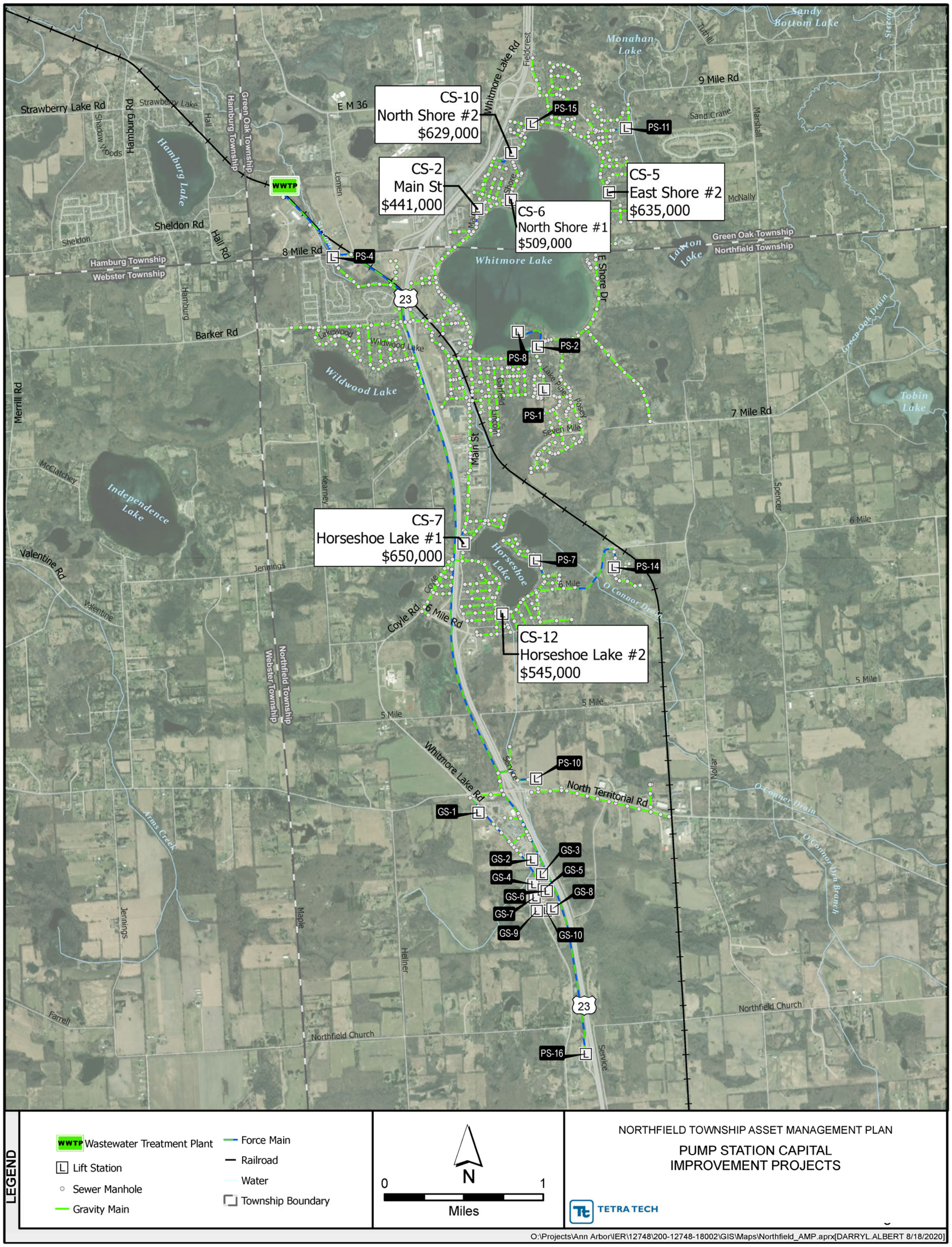


Figure 8-4. Collection System Pump Station Replacement Projects

The capital improvement projects for the WWTP are shown in Table 8-2. Bolded projects are anticipated to be completed within the next five years. Opinions of probable project costs can be found in Appendix I.

Table 8-2. WWTP Capital Improvement Projects

Northfield Township 20-Year Capital Improvement Plan (2021-2040)			
Project Number	**Description**	**Project Year**	**Project Cost**
WWTP-1	**Wet Weather Storage Tank Construction**	**2021**	**$4,662,500**
WWTP-2	**Aeration Improvements and Blower**	**2021**	**$339,000**
WWTP-3	**Secondary Settling Tanks Restoration**	**2023**	**$405,000**
WWTP-4	**Filter Building No. 1 Rehabilitation**	**2025**	**$151,000**
WWTP-5	**Controls Replacement**	**2025**	**$448,000**
WWTP-6	Primary Switchgear Replacement	2026	$528,000
WWTP-7	Miscellaneous Pump Replacement	2027	$96,000
WWTP-8	Motor Control Centers Replacement	2027	$700,000
WWTP-9	Roof Refurbishment	2030	$340,000
WWTP-10	Digester Building Improvements	2035	$649,000
WWTP-11	Generator Replacement	2037	$372,000
WWTP-12	Tertiary Filters Replacement	2040	$1,637,000
		Subtotal	$10,327,500

Figure 8-5 on the following page shows the locations for each of the WWTP capital improvement projects.

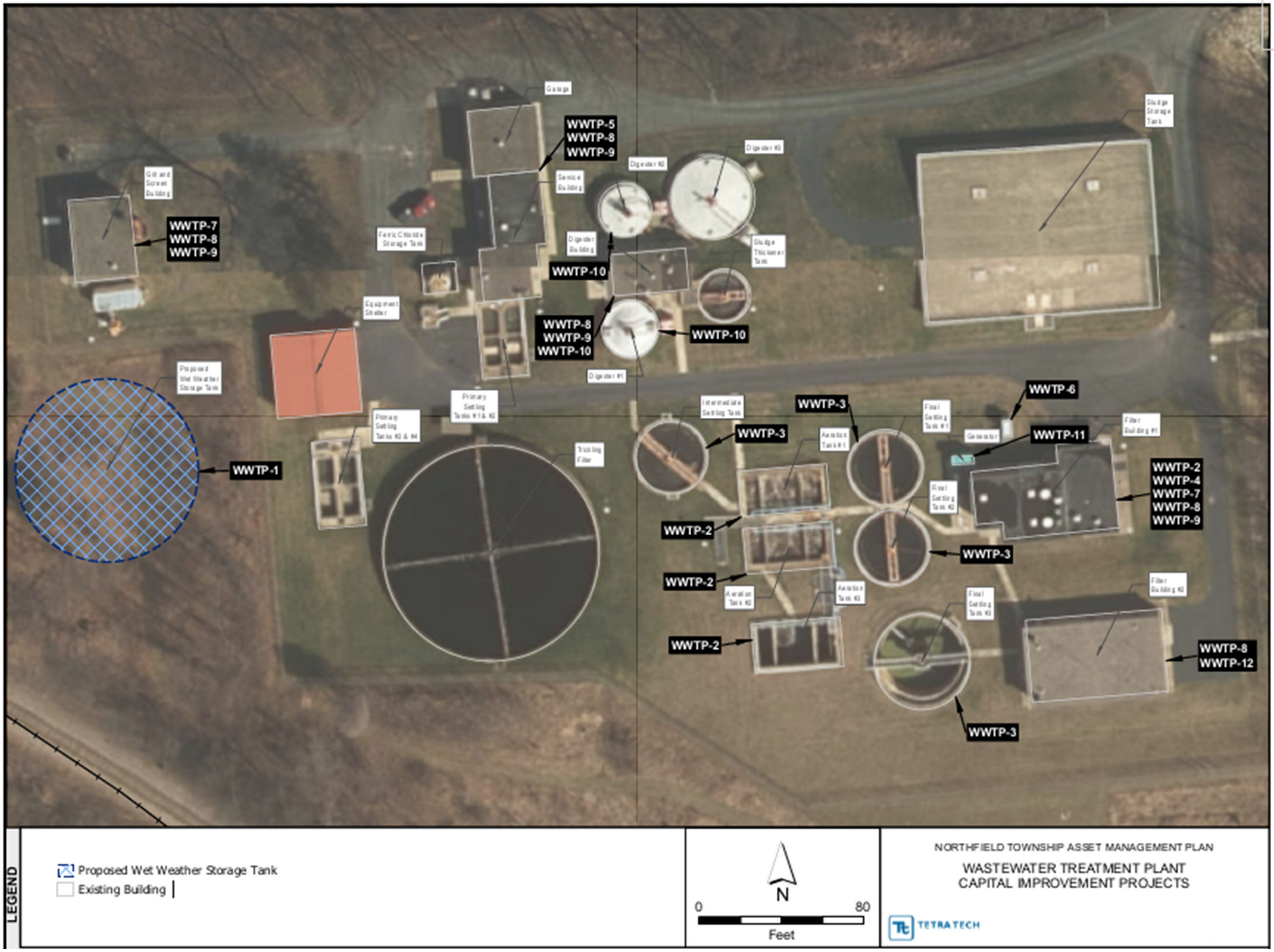


Figure 8-5. WWTP Capital Improvement Plan Project Locations

Table 8-3. is a summary of the complete Northfield Township Sanitary Sewer System 20-Year Capital Improvement Plan, which is inclusive of all WWTP and collection system projects. All project costs are presented in 2019 dollars; bold items are within the 5-year capital improvement window.

Table 8-3. Northfield Township 20-Year Capital Improvement Plan (2021-2040)

Project Number	Description	Project Year	Project Cost
WWTP-1	**Wet Weather Storage Tank Construction**	**2021**	**$4,662,500**
CS-1	**Grade 5 Defect Repairs**	**2021**	**$82,000**
WWTP-2	**Aeration Improvements and Blower Replacement**	**2021**	**$339,000**
WWTP-3	**Secondary Settling Tanks Restoration**	**2023**	**$405,000**
CS-2	**Main Street Pump Station Replacement**	**2025**	**$441,000**
WWTP-4	**Filter Building No. 1 Rehabilitation**	**2025**	**$151,000**
WWTP-5	**Controls Replacement**	**2025**	**$448,000**
CS-3	**Grade 4 Defect Repairs**	**2025-2026**	**$209,000**
WWTP-6	Primary Switchgear Replacement	2026	$528,000
WWTP-7	Miscellaneous Pump Replacement	2027	$96,000
WWTP-8	Motor Control Centers Replacement	2027	$700,000
CS-4	24-inch Cross Lot Sewer Replacement	2030	$2,039,000
CS-5	East Shore 2 Pump Station Replacement	2030	$635,000
CS-6	North Shore 1 Pump Station Replacement	2030	$509,000
CS-7	Horseshoe Lake 1 Pump Station Replacement	2030	$650,000
CS-8	Future Grade 5 Sewer Repairs	2030	$123,000
WWTP-9	Roof Refurbishment	2030	$340,000
CS-9	18-inch Cross Lot Sewer Replacement	2035	$690,000
CS-10	North Shore 2 Pump Station Replacement	2035	$629,000
CS-11	Future Grade 4 Sewer Repairs	2035	$313,500
WWTP-10	Digester Building Improvements	2035	$649,000
WWTP-11	Generator Replacement	2037	$372,000
CS-12	Horseshoe Lake 2 Pump Station Replacement	2040	$545,000
WWTP-12	Tertiary Filters Replacement	2040	$1,637,000
	CIP Projects in First 5-years	**Subtotal**	**$6,737,500**
	Remaining CIP Projects	**Subtotal**	**$10,455,500**
		Total	**$17,193,000**

8.2 PROJECT DESCRIPTIONS

8.2.1 Collection System

The collection system capital improvement plan include repairs to the sanitary sewers and pump stations. The sanitary sewer repairs focus on the sewers that have the highest engineering condition ratings of 4 or 5. Additional information on the proposed CIP projects are provided below.

CS-1 Grade 5 Sewer Repairs

The Grade 5 sewer repairs are intended to address all of the sewer defects that earned an Engineer’s Condition Rating of 5 during the AMP condition assessment. These repairs are identified as Project CS-1, and consist of root removal, grouting, full- and partial-length sewer lining and open cut spot repair project activities. Sewers that have been assigned a Grade 5 rating are pipes that have already begun to fail or are expected to fail within the next several years, indicating these are repairs that should be completed as soon as possible.

Grade 5 defects that were identified include O&M defects such as root intrusions and gushing infiltration, while the observed structural defects include broken pipe and holes in the sewer. The majority of the collection system consists of 8-inch through 16-inch vitrified clay (VCP) and PVC pipe with some 8-inch through 12-inch ductile iron (DI) and reinforced concrete pipe (RCP) present as well. Trenchless repair methods like CIPP lining is a preferred remedy for the rehabilitation of sewers that have not become deformed. However, if there are instances of a deformed pipe or other obstruction that would hinder a successful liner installation, then a spot repair is also recommended instead.

An example of a broken and deformed pipe requiring a spot repair is shown in Figure 8-6. This image is from a sewer under Barker Rd. In this case, the condition of the sewer was so severe, that it was repaired in the summer of 2020. As noted previously, the condition and POF of the gravity mains were prepared in 2019. The repair of sewer SP-389 will be incorporated in a future updated of the AMP.

Figure 8-6. Broken Sewer under Barker Road

Tetra Tech’s opinion of cost to repair the Grade 5 defects identified during the sewer condition assessment is approximately $82,000. Although none of the observed Grade 5 defects indicated complete failures of their respective sewer lines, it is recommended that each Grade 5 sewer defect be repaired as soon as feasibly possible. In order to prioritize when these repairs should take place, Tetra Tech reviewed the anticipated extent of the repair effort required for each identified Grade 5 defect in addition to the type of repair. Given the cost to complete the Grade 5 defect repairs, Tetra Tech recommends that the repairs be completed in 2021.

Identified repairs to the first grouping of sewers includes the treatment of extensive root growth followed by full-length CIPP lining in the following runs of the sewer:

- Manhole 719 to Manhole 247 (Legacy Manholes G3 to G2) in North Main Street; 86 feet of 10-inch diameter VCP
- Manhole 238 to Manhole 240 (Legacy Manholes G11 to G10) in Main St.; 230 feet of 8-inch diameter VCP

Identified repairs to the first grouping of sewers also includes partial-length CIPP lining defects in the following runs of sewer:

- Manhole 266 to Manhole 264 (Legacy Manholes 188 to 189) in Posey St.; 331 feet of 8-inch diameter PVC
- Manhole 288 to Manhole 287 (Legacy Manholes N-150 to N-149) in Main St.; 312 feet of 12-inch diameter VCP

The locations of these Grade 5 sewers were shown previously in Figure 8-2.

As part of the AMP, the Township will continue to perform inspections on the collection system with a goal of fully inspecting the collection system on a cyclical basis. Future inspections are likely to result in the discovery of additional defects requiring repairs. The costs associated with these potential repairs should also be accounted for in planning.

CS-2 Main Street Pump Station Replacement

The Main Street Pump Station was installed in 1969 on Main Street along the west side of Whitmore Lake. The station currently services the northwest side of Whitmore Lake (the area between Kenton Drive and the Department of Natural Resources boat launch) in addition to receiving discharge flows from the North Shore 1 Pump Station. The pump station consists of a concrete wet well with pumps and valves all located inside the separate steel dry pit structure. Various parts of the station are showing signs of age and corrosion, including the floor of the dry pit, the electrical enclosures and panels, the pumps, discharge piping and valves and the wet well as shown in Figure 8-7.

Figure 8-7. Main Street Pump Station Site View and Pump, Discharge Piping and Valve Corrosion

There appears to be space available adjacent to the station on the north side to allow for a new pump station that would be safer and more easily operated as a submersible pump station. Considering the available space, the new pump station can be built before taking the old one out of service, which will allow the Township to continue to provide uninterrupted service. This project is estimated to be necessary by 2025. The opinion of cost to design and construct a project to replace this pump station is approximately $441,000.

CS-3 Grade 4 Sewer Repairs

These projects are intended to address sewer defects that earned an Engineer's Condition Rating of 4 during the AMP condition assessment. The majority of these repairs consist of root removal work in addition to multiple locations that may require full- or partial-length lining as well as heavy cleaning. Sewers that have been assigned a Grade 4 rating are runs that are beginning to show signs of failure and have the potential to fail within the next several years. Most of these defects were not initially seen as an immediate threat to flow through the system.

Grade 4 defects that were identified include O&M defects such as root intrusions, gushing and dripping infiltration and high water potentially caused by blockages. Structural defects identified include cracked and fractured pipe. Full-length CIPP lining is often a preferred remedy for the rehabilitation of sewers that have become afflicted with root intrusion, infiltration, cracking and fracturing throughout or nearly throughout the entirety of the run. Partial-length lining may also be used as an alternative when a pipe run has been determined to not be deformed but exhibits related O&M defects over a small portion of the run. Examples of pipe experiencing these issues are shown in Figures 8-8 through 8-10.

Figure 8-8. Gushing Infiltration and Encrustation Under Oliver Boulevard

Figure 8-9. Root Intrusion under North Main Street

Figure 8-10. Multiple Fractures under Lakeview Drive

These defects are likely to progress, and in order to maintain the desired level of service in the collection system these defects should be addressed within the next 5 to 6 years of the 20-year capital improvement timeframe. The opinion of cost to address all of the identified Grade 4 defects is approximately $209,000. Tetra Tech recommends breaking the repair costs up by work group into two contracts, which could be executed in consecutive years. The approximate total of each defect group is shown in Table 8-4 below.

Table 8-4. Grade 4 Repairs

Group	Grade 4 Repair Cost Estimate	Anticipated Year of Construction
Full-Length Lining	$79,000	2025
Partial Lining	$29,000	2025
Subtotal	$108,000	2025
Root Removal	$54,000	2026
Heavy Cleaning	$36,000	2026
Joint and Lateral Sealing	$11,000	2026
Subtotal	$101,000	2026

CS-4 24-inch Cross-Lot Sewer Replacement (Modeling Report Study Segments A & B)

The existing 18-inch cross-lot sewer (shown boxed in red in Figure 8-11 below) that runs between Barker Road and the 8 Mile Road Pump Station has been determined to be nearing the end of its useful life. Additionally, it has also been determined by hydraulic modeling to be under capacity for conveying peak flows during a 25-year, 24-hour design storm (Modeling Report Study Segments A & B). Tetra Tech recommends the replacement of the approximately 4,900-foot section of 18-inch trunk sewer between Barker Road and the 8-Mile Road Pump Station with 24-inch sewer. The replacement of the sewer is expected to improve the overall performance of the sewer and improve hydraulic conditions in the upstream portion of the trunk sewer. This project is expected to be necessary by 2030, although development requests could accelerate this project to being needed sooner. For example, should the North Village project proceed, this sewer project would be needed prior to development.

The opinion of cost to design and construct a project to replace this sewer is approximately $2,039,000. Construction of a pump station to convey the flows in the existing 18-inch cross lot sewer may be an alternative to the replacement of the 18-inch cross lot sewer. Cost analyses performed during the generation of the Modeling Report suggest that the cost to build a pump station and force main is nearly equivalent and may be preferred if the existing 18-inch cross lot sewer is shown to be of good condition or disruption to the existing sewer alignment is not desired.

Figure 8-11. Existing 18-inch Cross-Lot Sewer between Barker Road and 8-Mile Road Pump Station

CS-5 East Shore 2 Pump Station Replacement

The East Shore 2 Pump Station was installed in 1969 at the end of Preservation Drive The station currently services the developments around the northeast side of Whitmore Lake in addition to the flows discharged from the 9 Mile Road Pump Station. The pump station consists of a steel dry pit housing the pumps, valves and discharge piping along with a concrete wet well that houses suction piping. Various parts of the station are showing signs of age and corrosion, including the pumps, discharge piping, valves, dry pit structure, the electrical enclosures and panels, as shown in Figure 8-12. There appears to be space available adjacent to the station in the grass on the south side of the driveway to allow for a new pump station that more closely meets current Township standards. Considering the available space, the new pump station can be built before taking the old one out of service, which will allow the Township to continue to provide uninterrupted service. This project is estimated to be necessary by 2030. The opinion of cost to design and construct a project to replace this pump station is approximately $635,000.

Figure 8-12. East Shore 2 Pump Station Site View and Corrosion in Dry Pit

CS-6 North Shore 1 Pump Station Replacement

The North Shore 1 Pump Station was installed in 1969 at the corner of North Shore Drive and Shore Drive The station currently services homes along North Shore Drive in addition to receiving flows from the North Shore 2 and Canal (Elmcrest) Pump Stations. The pump station consists of a concrete wet well housing suction piping along with a steel dry pit that contains pumps, discharge piping, valves and electrical equipment. Various parts of the station are showing signs of age and corrosion, including the discharge piping and electrical enclosures, as shown in Figure 8-13. Additionally, the existing pumps are ejector pumps, which are not commonly utilized in modern pump stations. To provide a more effective system, Tetra Tech recommends utilizing conventional submersible pumps. There appears to be space available adjacent to the station in the grass to allow for a new pump station that more closely meets current Township standards. Considering the available space, the new pump station can be built before taking the old one out of service, which will allow the Township to continue to provide uninterrupted service. This project is estimated to be necessary by 2030. The opinion of cost to design and construct a project to replace this pump station is approximately $509,000.

Figure 8-13. North Shore 1 Pump Station Site View and Ejector Pumps

CS-7 Horseshoe Lake 1 Pump Station Replacement

The Horseshoe Lake 1 Pump Station was installed in 1978 on Main Street on the west side of Horseshoe Lake. The station currently services developments on the west side of US-23, around the west half of Horseshoe Lake in addition to receiving discharge from the Horseshoe Lake 2, Horseshoe Lake 3 and Shadowoods Pump Stations. The pump station consists of a concrete wet well with submersible pumps and discharge piping along with a concrete valve vault. Various parts of the station are showing signs of age, infiltration and corrosion, including the wet well structure, discharge piping, generator, the electrical enclosures and panels and valves, as shown in Figure 8-14. There appears to be space available adjacent to the station on the south side to allow for a new pump station that more closely meets current Township standards. Considering the available space, the new pump station can be built before taking the old one out of service, which will allow the Township to continue to provide uninterrupted service. This project is estimated to be necessary by 2030. The opinion of cost to design and construct a project to replace this pump station is approximately $650,000.

Figure 8-14. Horseshoe Lake 1 Pump Station Site View and Corrosion/Infiltration in Wet Well

CS-8 Future Grade 5 Sewer Repairs

In order to more accurately plan for future sewer costs, the number of Grade 5 defects found in the representative sample of sewer inspections (379 gravity mains out of a total of 746 gravity mains greater than 20 years old) was reviewed. The sewer inspections completed during the AMP included areas constructed at different time periods but primarily consisted of VCP sewers (73% of the total amount of sewers inspected). The inspected VCP sewers are generally in fair to good condition but do include Grade 5 defects. Observed issues in the system's PVC sewers (22% of the total number of sewers inspected) were minimal in severity. Concrete and ductile iron sewers also exist in the system but were observed as being in good condition and minimal in quantity (1% and 4%, respectively, of the total number of sewer reaches inspected). The areas that were inspected over the last 5 years covered approximately 52% of the sewer reaches in the Township greater than 20 years old. If the remaining 48% of the sewer system has the same percentage of defective pipes, then the assumption could be made that there could be an approximately equivalent amount of work to be completed again by the time the remaining 48% of the sewer system is done being inspected. In order to prevent this potential budget shortfall, the current repair costs for the observed Grade 5 defects can be multiplied by a factor of 1 to1.5 when totaling the current and anticipated costs to complete the repair of Grade 5 defects within the entire sewer system. These costs are represented in Table 8-5 below. For purposes of CIP budgeting, Tetra Tech has assumed the upper end of the cost estimate for the Anticipated Future Grade 5 Sewer Repairs and included this value as the project cost in the other CIP tables in this report.

Table 8-5. Future Grade 5 Sewer Repair Costs

Group	Cost Estimate	Anticipated Year of Construction
Current Grade 5 Repairs	$82,000	2021
Anticipated Future Grade 5 Repairs	$82,000-123,000	2030

CS-9 18-inch Cross-Lot Sewer Replacement (Modeling Report Study Segment C)

The existing 15-inch cross-lot sewer (shown boxed in red in Figure 8-15 below) that runs between the north end of Brookside Drive and Barker Road has been determined to be nearing the end of its useful life. Additionally, it has also been determined by hydraulic modeling to be under capacity for conveying peak flows during a 25-year, 24-hour design storm (Study Segment C improvement in Modeling Report). Tetra Tech recommends the replacement of the approximately 1,700-foot section of 15-inch trunk sewer between Brookside Drive and Barker Road with 18-inch sewer. This project is expected to be necessary by 2035, although development requests from the central part of the service area could necessitate this improvement even earlier. The opinion of cost to design and construct a project to replace this sewer is approximately $690,000.

Figure 8-15. Existing 15-inch Cross-Lot Sewer between Brookside Drive and Barker Road

CS-10 North Shore 2 Pump Station Replacement

The North Shore 2 Pump Station was installed in 1969 at the corner of North Shore Drive and Department of Natural Resources Park Road The station currently services approximately 15 homes on North Shore Drive and Elmcrest Road along the northwest corner of Whitmore Lake in addition to receiving flows from the canal (Elmcrest) Pump Station. The pump station consists of a concrete wet well with submersible pumps and discharge piping along with a concrete valve vault that houses valves. Various parts of the station are showing signs of age, infiltration and corrosion, including the wet well structure, discharge piping, generator, the electrical enclosures and panels and valves, as shown in Figure 8-16. There appears to be space available adjacent to the station on the west side to allow for a new pump station. Considering the available space, the new pump station can be built before taking the old one out of service, which will allow the Township to continue to provide uninterrupted service. This project is estimated to be necessary by 2035. The opinion of cost to design and construct a project to replace this pump station is approximately $629,000.

Figure 8-16. North Shore 2 Pump Station Site View and Corrosion/Infiltration in Wet Well

CS-11 Future Grade 4 Sewer Repairs

In order to more accurately plan for future sewer costs, the number of Grade 4 defects found in the representative sample of sewer inspections (379 gravity mains out of a total of 746 gravity mains greater than 20 years old) was reviewed. The sewer inspections completed during the AMP included areas constructed at different time periods but primarily consisted of VCP sewers (73% of the total amount of sewers inspected). The inspected VCP sewers are in generally fair to good condition but do include Grade 4 defects. Observed issues in the system's PVC sewers (22% of the total number of sewers inspected) were minimal in severity. Concrete and ductile iron sewers also exist in the system but were observed as being in good condition and minimal in quantity (1% and 4%, respectively, of the total number of sewer reaches inspected). The areas that were inspected over the last 5 years covered approximately 52% of the sewer reaches in the Township greater than 20 years old. If the remaining 48% of the sewer system has the same percentage of defective pipes, then the assumption could be made that there could be an approximately equivalent amount of work to be completed again by the time the remaining 48% of the sewer system is done being inspected. In order to prevent this potential budget shortfall, the current repair costs for the observed Grade 4 defects can be multiplied by a factor of 1 to 1.5 when totaling the current and anticipated costs to complete the repair of Grade 4 defects within the entire sewer system. These costs are represented in Table 8-6 below. For purposes of CIP budgeting, Tetra Tech has assumed the upper end of the cost estimate for the Anticipated Future Grade 4 Sewer Repairs and included this value as the project cost in the other CIP tables in this report.

Table 8-6. Future Grade 4 Sewer Repair Costs

Group	Cost Estimate	Anticipated Year of Construction
Current Grade 4 Repairs	$209,000	2025-2026
Anticipated Future Grade 4 Repairs	$209,000-313,500	2034

CS-12 Horseshoe Lake 2 Pump Station Replacement

The Horseshoe Lake 2 Pump Station was installed in 1978 on Edmund Street. The station currently services homes along the south side of Horseshoe Lake in addition to receiving discharge flows from both the Horseshoe Lake 3 and Shadowoods Pump Stations. The pump station consists of a concrete wet well housing the submersible pumps and discharge piping along with a concrete valve vault that houses valves. Various parts of the station are showing signs of age, corrosion and infiltration, including the generator, wet well, valve vault, discharge piping, valves and electrical enclosures, as shown in Figure 8-17. There appears to be space available adjacent to the station in the grass to allow for a new pump station. Considering the available space, the new pump station can be built before taking the old one out of service, which will allow the Township to continue to provide uninterrupted service. This project is estimated to be necessary by 2040. The opinion of cost to design and construct a project to replace this pump station is approximately $545,000.

Figure 8-17. Horseshoe Lake 2 Site View and Wet Well Infiltration and Discharge Piping Corrosion

8.2.2 Wastewater Treatment Plant

WWTP-1 Wet Weather Storage Tank

During heavy rain events, the plant receives flows in excess of its capacity for some of the processes. The extra flow is then bypassed around the limiting processes and adversely impacts the plants overall effectiveness. As a cost-effective means of addressing these occasional increases, a wet weather storage tank will be constructed to hold these flows during peak rain events. Stored flows can then be reintroduced to the plant after the rain event so that they can be fully treated before being discharged.

The opinion of probable project cost is $4,662,500. The project is scheduled to take place in 2020.

WWTP-2 Aeration Improvements and Blower Replacement

The aeration tank blowers were installed in 1976 and have exceeded their estimated useful life. In addition, they are oversized for the requirements of the plant's operation. It should be noted that the blowers still operate well despite their age. A new blower will replace the function of the three existing blowers. The existing blowers will act serve as backups to the new blower during maintenance. In conjunction with the blower replacement, the coarse bubble diffusers in the aeration tanks will be replaced by fine bubble diffusers, which deliver and distribute the air more efficiently. The installation of the fine bubble diffusers and new blower are anticipated to result in significant energy savings at the WWTP. Figure 8-18 shows one of the existing aeration tanks and the existing blowers.

The opinion of probable project cost is $339,000. The project is scheduled to take place in 2020.

Figure 8-18. Aeration Tanks and Blowers

WWTP-3 Secondary Setting Tanks Restoration

The intermediate settling tank was constructed in 1962 and is nearing the end of its useful life. The internal collection mechanism has greatly exceeded its predicted useful life. Final Settling Tank Nos. 1 and 2 were constructed in 1976 and their collection mechanisms have exceeded their estimated useful life, though the arm was recently replaced in Final Settling Tank No. 2. Final Settling Tank No. 3 was added to the WWTP in 1991.

The mechanisms of the Intermediate Settling Tank and Final Settling Tank Nos. 1 and 2 were installed in 1962 and 1976, respectively. With an asset life of 30 years, the mechanisms are past the estimated useful life. The arm in Final Settling Tank No. 2 was recently replaced and can be reinstalled. Preventative maintenance, including painting exposed metal surfaces, will extend the useful life of the Intermediate Setting Tank and all three of the final settling tanks. Figure 8-19 shows the final settling tanks, as well as one of the mechanism drives.

The opinion of probable project cost is $405,000. The project is scheduled to take place in 2023.

Figure 8-19. Final Settling Tanks

WWTP-4 Filter Building No. 1 Rehabilitation

The Intermediate Settled Sludge Pump in Filter Building No. 1, as well as the Filter Influent Pump check valves, are beyond their estimated useful life of 30 years. These assets are shown in Figure 8-20. There are redundant systems in place so that these can be replaced or rehabilitated without interruption to plant operation. The unit heaters in Filter Building No. 1 are beyond their expected useful life and should be replaced.

The opinion of probable project cost is $151,000. The project is scheduled to take place in 2025.

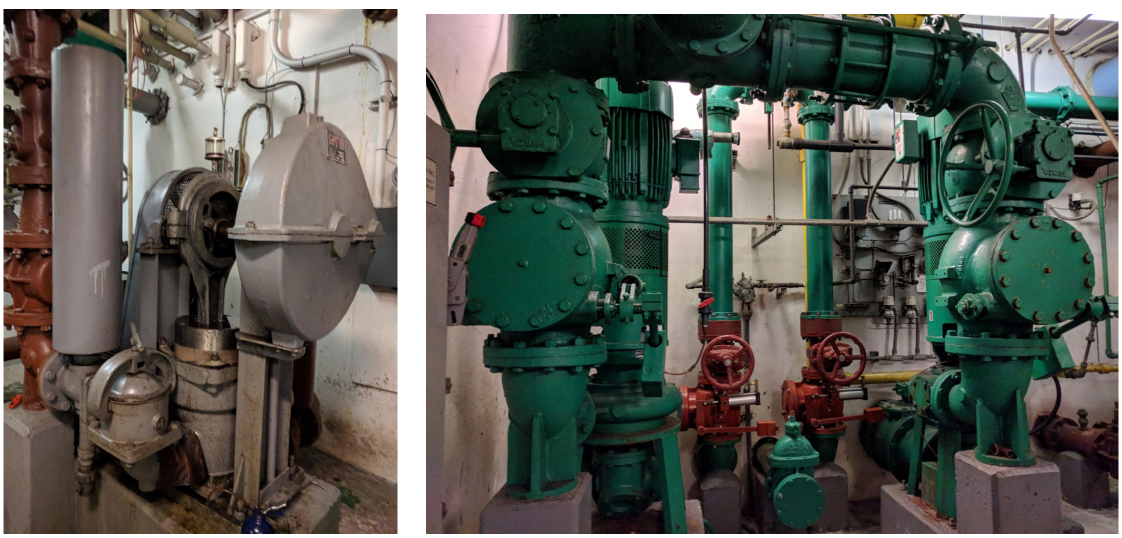


Figure 8-20. Intermediate Settled Sludge Pump and Filter Influent Pump Check Valves

WWTP-5 Controls Replacement

The existing controls system is a combination of instrumentation and controls devices with a variety of equipment ages. The existing SCADA system was layered onto these devices over the years and has little documentation of the completed modifications. The recommended useful life for instrumentation and controls equipment is 15 to 20 years or less due to the lack of replacement parts in the marketplace. The controls system should be updated with a new SCADA frontend, programmable logic controller backend and proper documentation.

The opinion of probable project cost is $448,000. The project is scheduled to take place in 2025.

WWTP-6 Primary Switchgear Replacement

The existing primary electrical switchgear equipment was installed in 1976 and should be replaced to ensure the WWTP is properly protected. The recommended useful life for this equipment is 40 years and the existing equipment is past its useful life. The replacement project should be coordinated with the replacement of the primary transformer while the standby generator is still within its useful life and deemed reliable. The primary switchgear can be seen in Figure 8-21.

The opinion of probable project cost is $528,000. The project is scheduled to take place in 2026.

Figure 8-21. Primary Switchgear

WWTP-7 Miscellaneous Pump Replacement

Many of the pumps across the WWTP are past or near their expected useful life and in need of replacement including:

- Grit Pump
- Thickener Dilution Water Pump
- Service Water System Pumps (2)

The opinion of probable project cost is $96,000. The project is scheduled to take place in 2027.

WWTP-8 Motor Control Centers Replacement

The existing electrical system includes a combination of MCCs with a variety of equipment ages, the most recent MCC was installed in 1999. The recommended useful life for an MCC is 40 years or less due to the wear of moveable parts and lack of replacement parts in the marketplace. The replacement of MCCs could be packaged as a single project to attract favorable contractors and economies-of-scale bids. MCC-F and MCC-G are shown in Figure 8-22.

The opinion of probable project cost based on replacing the MCCs at the same time is $700,000. The project is scheduled to take place in 2027.

Figure 8-22. MCC-F and MCC-G

WWTP-9 Roof Refurbishment

The roofs of the following buildings have exceeded or are nearing the end of their 30 year estimated useful life:

- Service Building
- Digester Building
- Grit & Screen Building
- Filter Building No.1

The windows and doors of the following structures have exceeded or are nearing the end of their 30 year expected useful life:

- Grit/Screen Building – Garage Door
- Digester Building – Doors and Windows
- Service Building – Doors and Windows
- Filter Building No.1 – Doors and Windows

The opinion of probable project cost is $340,000. The project is scheduled to take place in 2030.

WWTP-10 Digester Building Improvements

The internal components for Digesters Nos. 1 and 2 have exceeded their expected useful life and are critical to plant operation. Rehabilitation of the sludge pumps in the Digester Building would greatly increase their expected useful life. One of the anerobic digesters and the triplex sludge pump are shown in Figure 8-23.

The opinion of probable project cost to replace the digester components and rebuild the sludge pumps in the Digester Building is $649,000. The project is scheduled to take place in 2035.

Figure 8-23. Anaerobic Digester and Triplex Sludge Pump

WWTP-11 Generator Replacement

The existing 250kW emergency diesel generator, shown in Figure 8-24, was installed in 2008. The recommended useful life for this equipment is 25 to 30 years.

The opinion of probable project cost to replace the generator is $372,000. The project is scheduled to take place in 2037.

Figure 8-24. Generator

WWTP-12 Tertiary Filters Replacement

The traveling bridge filters were installed in 1998 and require periodic maintenance. They were last serviced in 2015 when the sand and wear strips were replaced. One of the traveling bridge filters is shown in Figure 8-25. At the end of the filters expected useful life, it is suggested that the traveling bridge filters be replaced with cloth media filters. Two units will be required to provide firm capacity, as the whole filter would be backwashed at one time. The existing channels in Filter Building No. 2 could be modified to accommodate the cloth media filters.

The opinion of probable project cost to replace the tertiary filters is $1,637,000. The project is scheduled to take place in 2040.

Figure 8-25. Existing Traveling Bridge Filter

8.3 FUTURE CIP PLANNING

This AMP only includes potential projects that may be needed over the next 20 years. The information stored for each of the assets can be used to project the expected end of useful life, and subsequent replacement date over a longer time period. Figure 8-26 below is a visual display of the potential replacement cost if each asset in the system were run to failure and required replacement at the end of the expected useful life.

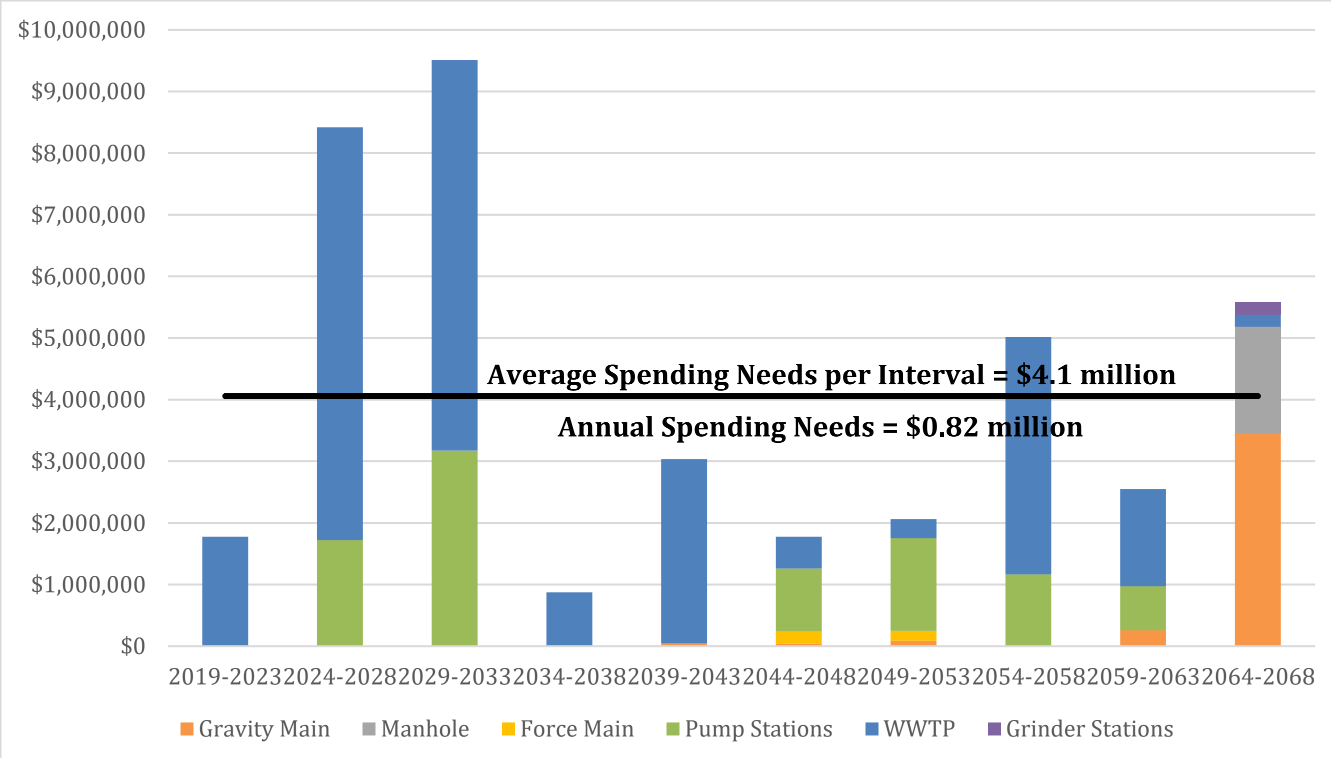


Figure 8-26. Replacement Cost by Year at End of EEL for 50 Years

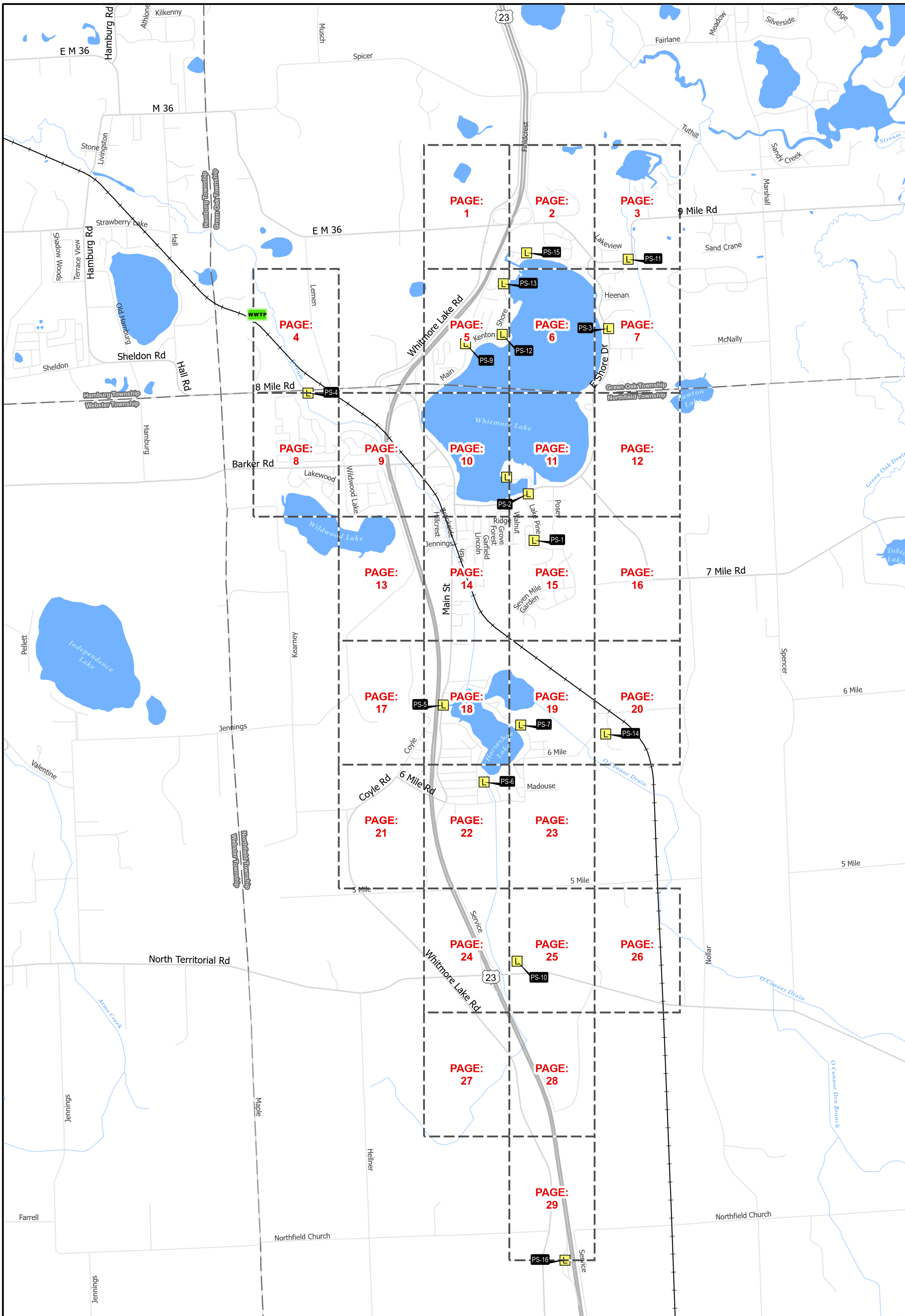
Figure 8-26 shows the projected replacement costs over 5-year intervals for the next 50 years and reveals that there are some intervals in which significant amounts of work may be expected. The replacement cost values are in 2019 dollars. This information can be used to begin planning to fund this future work in advance. Figure 8-26 shows that over the next 50 years there may be up to $41 million of infrastructure improvements to be made. This is an average of approximately $4.1 million spent every 5 years, or $0.81 million annually. $0.81 million annually represents a maintenance budget of approximately 1.4% of the system's value each year. A value of 2 to 3% for a consolidated collection system and treatment system is common. Therefore, Northfield Township may be wise to budget amounts even higher than those budgeted in this plan.

The 20-year CIP in Table 8-3 averages $0.860 million annually. Preventative maintenance may lower these costs and extend the life of the assets.

9.0 ANNUAL PERMIT REPORT UPDATE

Northfield Township is required to provide an annual report to EGLE as part of the existing NPDES Permit. The most recent annual report was submitted on July 17, 2019. Annual reports submitted to date, as well as a template for annual reports is included in Appendix J.

APPENDIX A: COLLECTION SYSTEM MAP



LEGEND

L Lift Station	Roads
WWTP Wastewater Treatment Plant	Freeways
Railroad	Major Roads
	Minor Roads
Water	
WaterPoly	
Map Pages	
Township Boundary	

N

0 4,000

Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Index Map

Source: Northfield Township; Tetra Tech, Inc.; ESRI

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LEGEND

Manhole Wall Material
- Concrete

Gravity Main Material
- Vitrified
- Township Boundary

N

0 400
Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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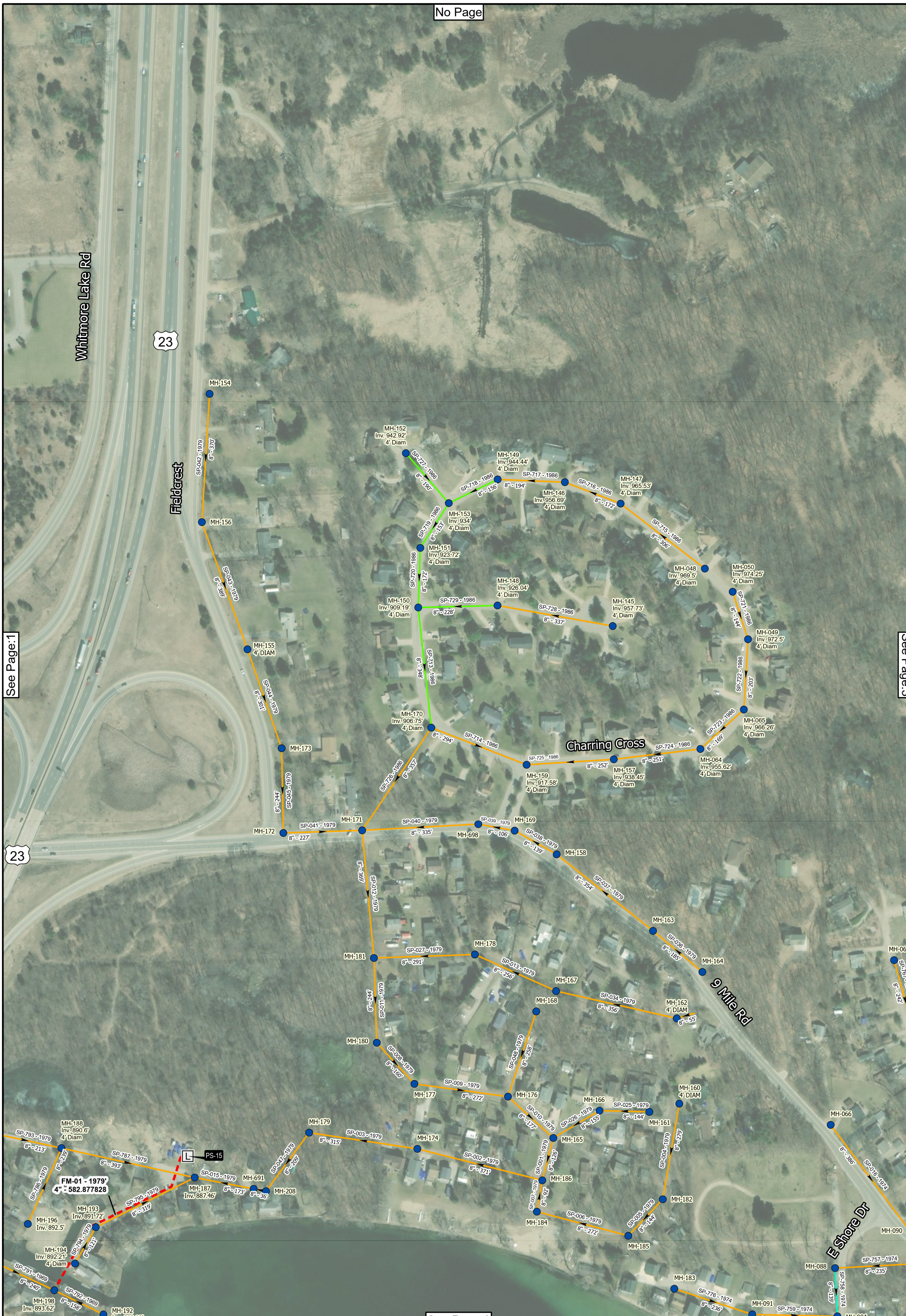

LEGEND

L Lift Station

Manhole Wall Material
- Concrete

Gravity Main Material
- DIP
- PVC
- Vitrified

Force Main Material
- Unknown

Township Boundary

N

0 400

Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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LEGEND

- Lift Station
- Water

Manhole Wall Material
- Concrete

Gravity Main Material
- Vitrified

Force Main Material
- Liner Material
- Township Boundary

N

0 400

Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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LEGEND

L Lift Station

WWTP Wastewater Treatment Plant

Water

Manhole Wall Material
- Concrete

Gravity Main Material
- Vitrified

Force Main Material
- Cast Iron
- Railroad
- Township Boundary

N

0 400
Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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LEGEND

L Lift Station

WaterPoly

Manhole Wall Material
- Concrete
- Precast Concrete

Gravity Main Material
- Cast Iron
- NCPI
- PVC
- Vitrified

Force Main Material
- Concrete
- Cast Iron
- Unknown
- Township Boundary

N

0 400

Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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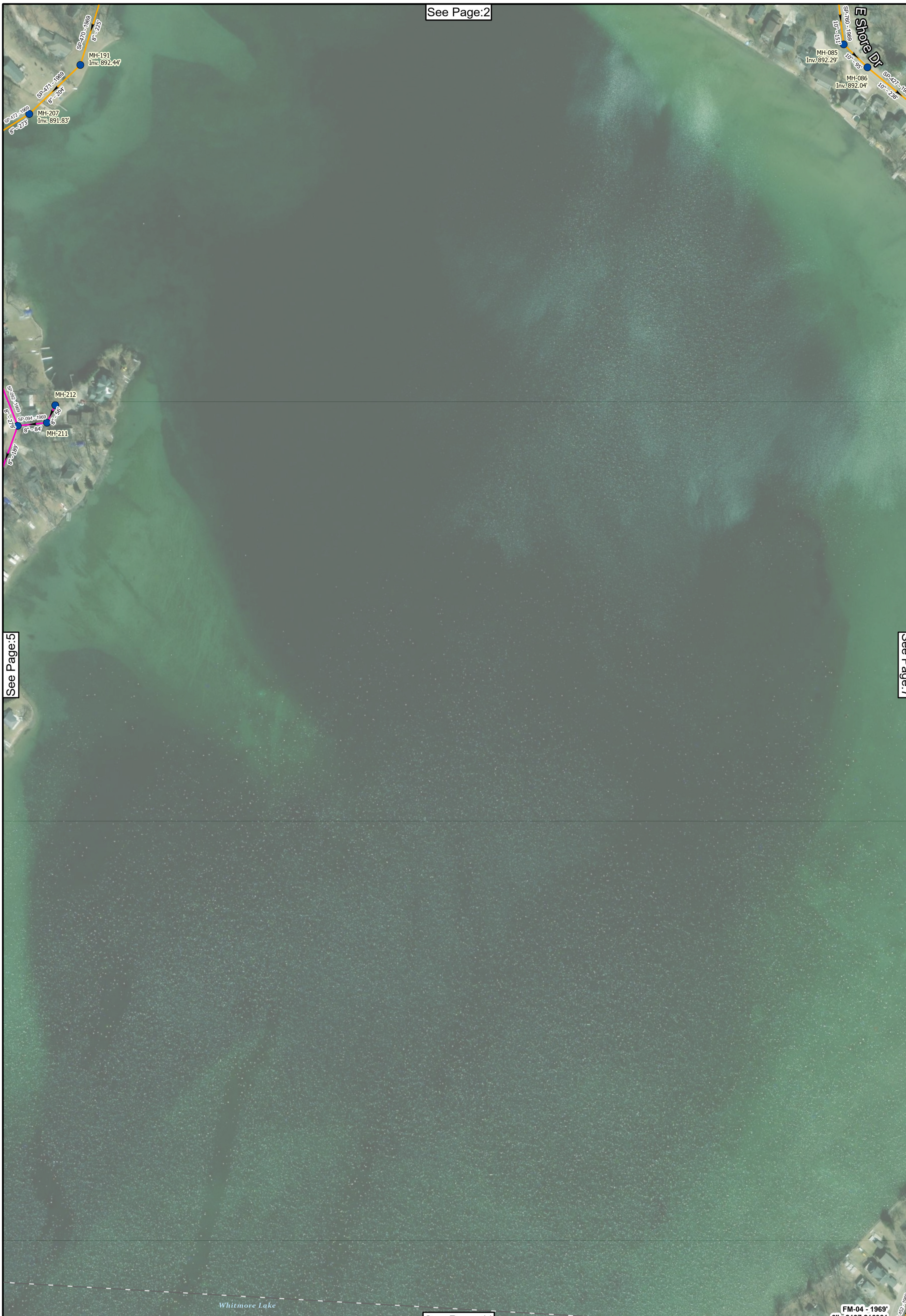

LEGEND

WaterPoly

Manhole Wall Material
- Concrete

Gravity Main Material
- NCPI
- Vitrified

Force Main Material
- Concrete
- Township Boundary

N

0 400

Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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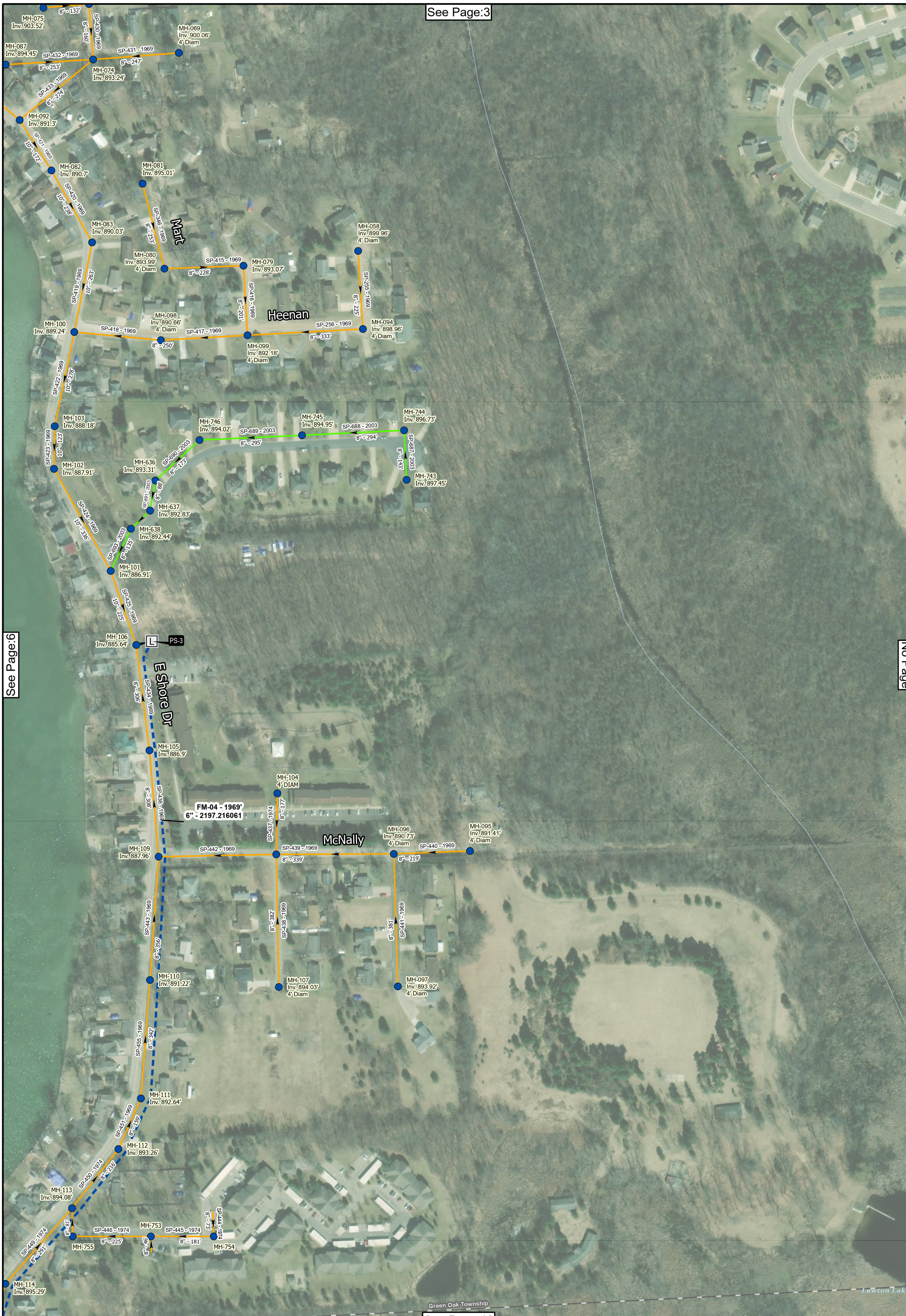

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No Page

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LEGEND

L Lift Station	Manhole Wall Material	Vitrified
WaterPoly	Concrete	Force Main Material
Water	Gravity Main Material	Concrete
	Concrete	Township Boundary
	PVC	

N

0 400
Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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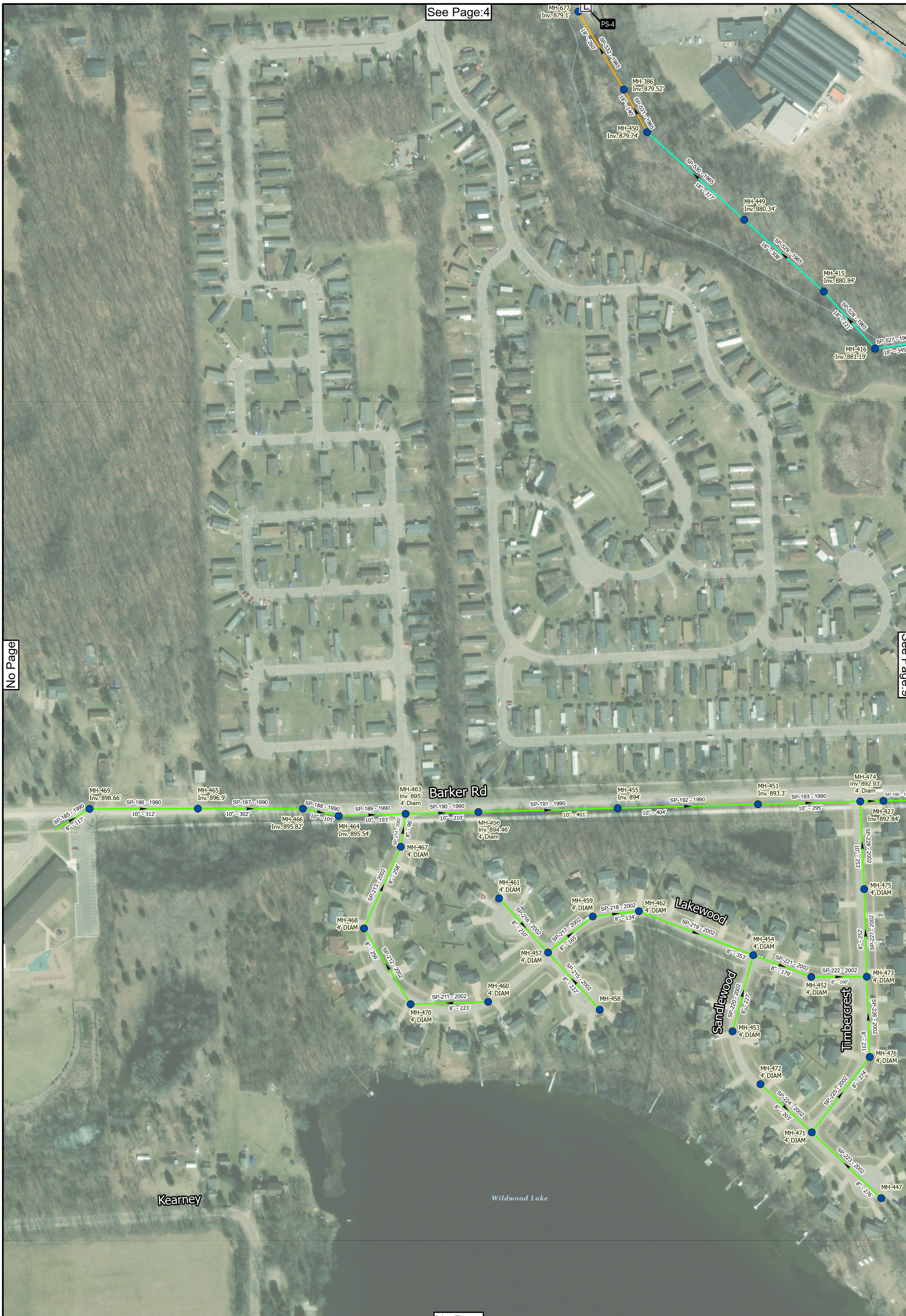

LEGEND

- Lift Station
- WaterPoly
- Water

Manhole Wall Material
- Concrete

Gravity Main Material
- DIP
- PVC

- Vitrified

Force Main Material
- Cast Iron
- Railroad
- Township Boundary

N

0 400

Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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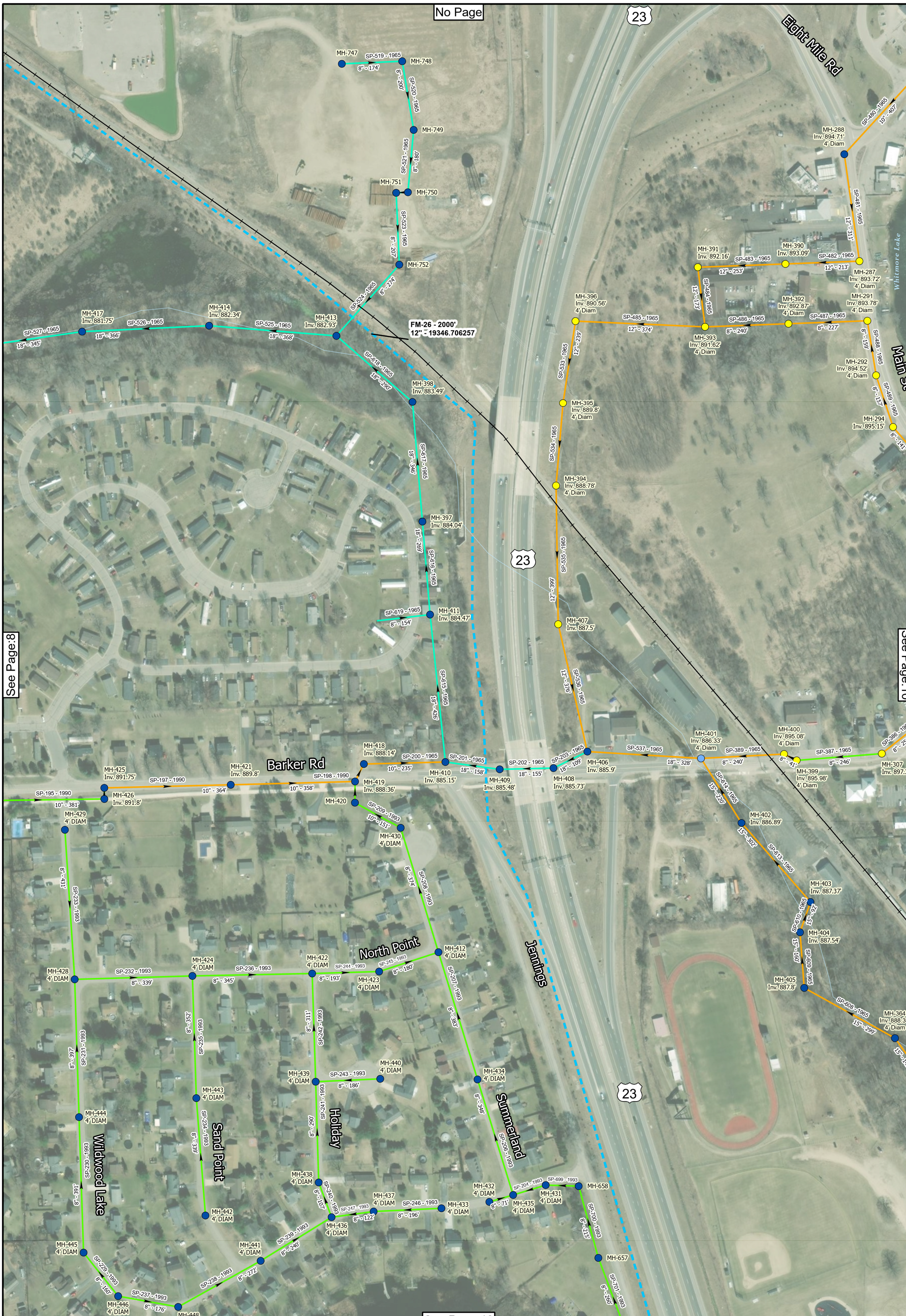

WaterPoly	Block	Force Main Material	
Water	Gravity Main Material	Cast Iron	
Manhole Wall Material	DIP	Railroad	
Concrete	PVC	Township Boundary	
Precast Concrete	Vitrified		

LEGEND

N

0 400

Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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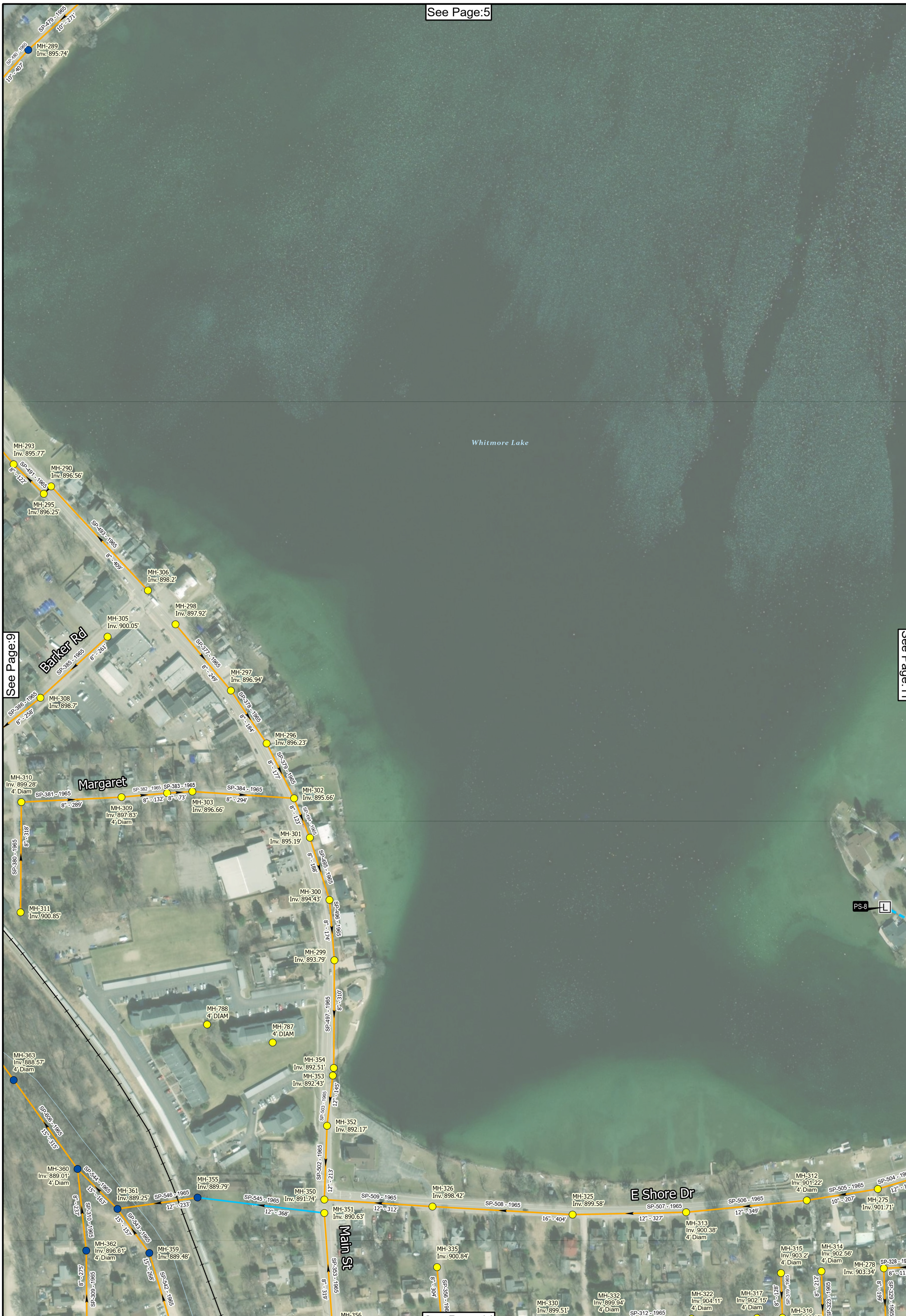

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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See Page:15

LEGEND

- Lift Station
- WaterPoly

Manhole Wall Material
- Concrete
- Block

Gravity Main Material
- DIP
- PVC
- Vitrified
- Unknown

Force Main Material
- Concrete
- Cast Iron
- Unknown
- Township Boundary

N

0 400
Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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LEGEND

WaterPoly

Manhole Wall Material
- Concrete

Gravity Main Material
- Vitrified
- Unknown

Township Boundary

N

0 400
Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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LEGEND

WaterPoly

Manhole Wall Material
- Concrete

Gravity Main Material
- PVC
- Vitrified

Force Main Material
- Cast Iron
- Township Boundary

N

0 400

Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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LEGEND Water Manhole Wall Material ● Concrete ● Block	Gravity Main Material Concrete PVC Vitrified	Force Main Material Cast Iron Railroad Township Boundary	N 0 400 Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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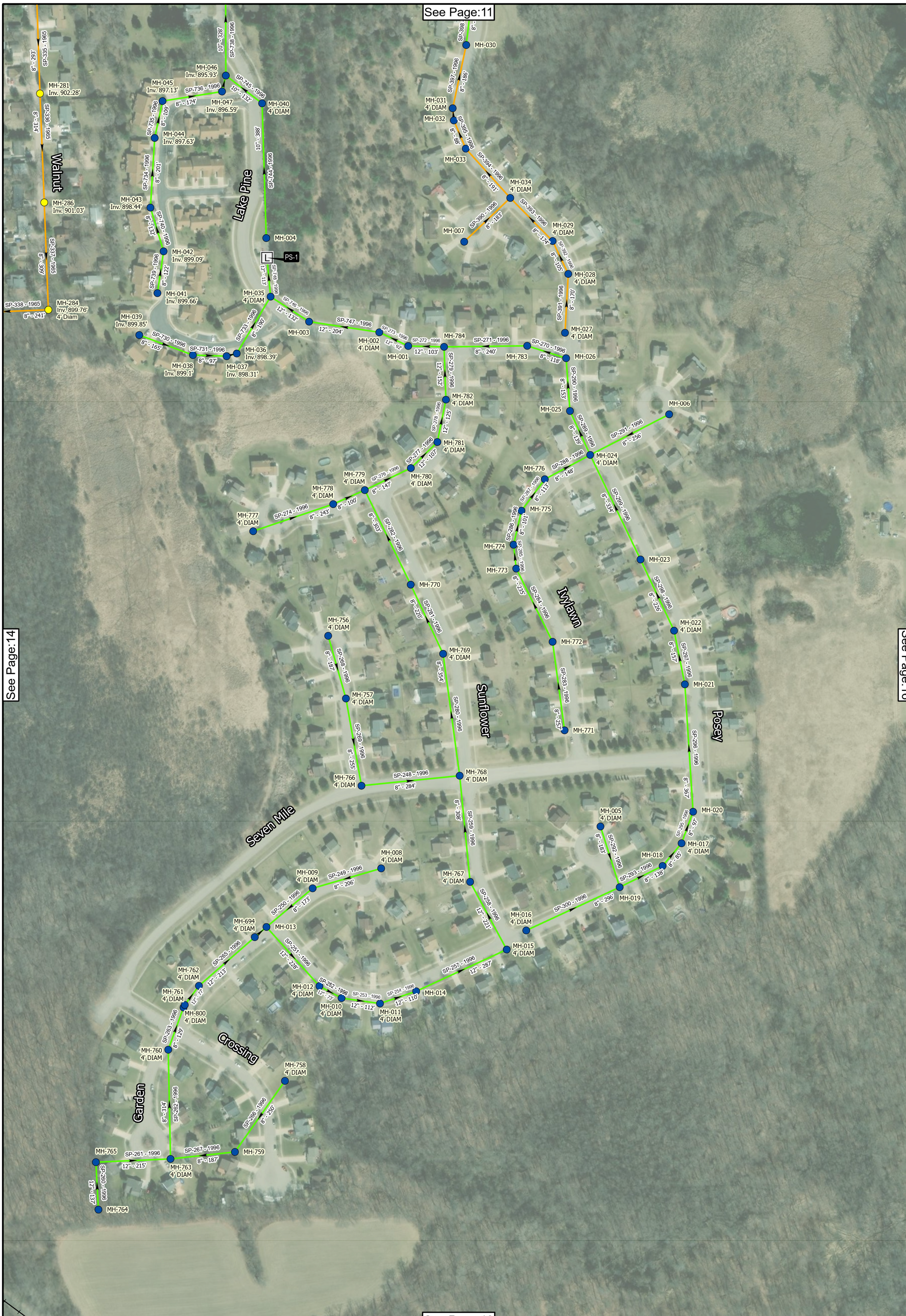

LEGEND

- Lift Station
- Manhole Wall Material
  - Concrete
- Block
- Gravity Main Material
  - PVC
- Vitrified
- Railroad
- Township Boundary

N

0 400

Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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See Page:12

See Page:15

No Page

See Page:20

LEGEND

Manhole Wall Material
- Concrete

Gravity Main Material
- Unknown
- Township Boundary

N

0 400
Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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See Page:13

See Page:21

LEGEND

Manhole Wall Material
- Concrete

Gravity Main Material
- DIP
- Vitrified
- Township Boundary

N

0 400
Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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LEGEND

Lift Station
WaterPoly
Water
Manhole Wall Material
Concrete

Gravity Main Material
Concrete
DIP
RCP
Vitrified

Force Main Material
Cast Iron
Unknown
Township Boundary

N
0 400
Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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See Page:15

See Page:18

See Page:20

See Page:23

LEGEND

Lift Station
WaterPoly
Water

Manhole Wall Material
Concrete

Gravity Main Material
DIP
Vitrified

Force Main Material
Unknown
Railroad
Township Boundary

N

0 400
Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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See Page:16

See Page:19

No Page

No Page

LEGEND

Lift Station

Water

Manhole Wall Material

Concrete

Gravity Main Material

RCP

PVC

Force Main Material

Unknown

Railroad

Township Boundary

N

0 400

Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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See Page:17

See Page:22

No Page

LEGEND

Manhole Wall Material
- Concrete

Gravity Main Material
- Vitrified
- Township Boundary

N

0 400
Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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See Page:19

See Page:22

No Page

See Page:25

LEGEND

Manhole Wall Material
- Concrete

Gravity Main Material
- DIP
- PVC
- Vitrified
- Township Boundary

N

0 400
Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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LEGEND

Lift Station
Water

Manhole Wall Material
Concrete

Gravity Main Material
PVC

Force Main Material
Cast Iron
Unknown
Township Boundary

N

0 400
Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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See Page:28

LEGEND

- Lift Station
- Water

Manhole Wall Material
- Concrete

Gravity Main Material
- RCP
- PVC

Force Main Material
- Cast Iron
- Township Boundary

N

0 400
Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

O:\Projects\Ann Arbor\IER\12748\200-12748-17001\GIS\Maps\Report_Figures\Storm [DARRYL.ALBERT 9/4/2020]

LEGEND

Water

Manhole Wall Material

Concrete

Gravity Main Material

RCP

PVC

Railroad

Township Boundary

N

0 400

Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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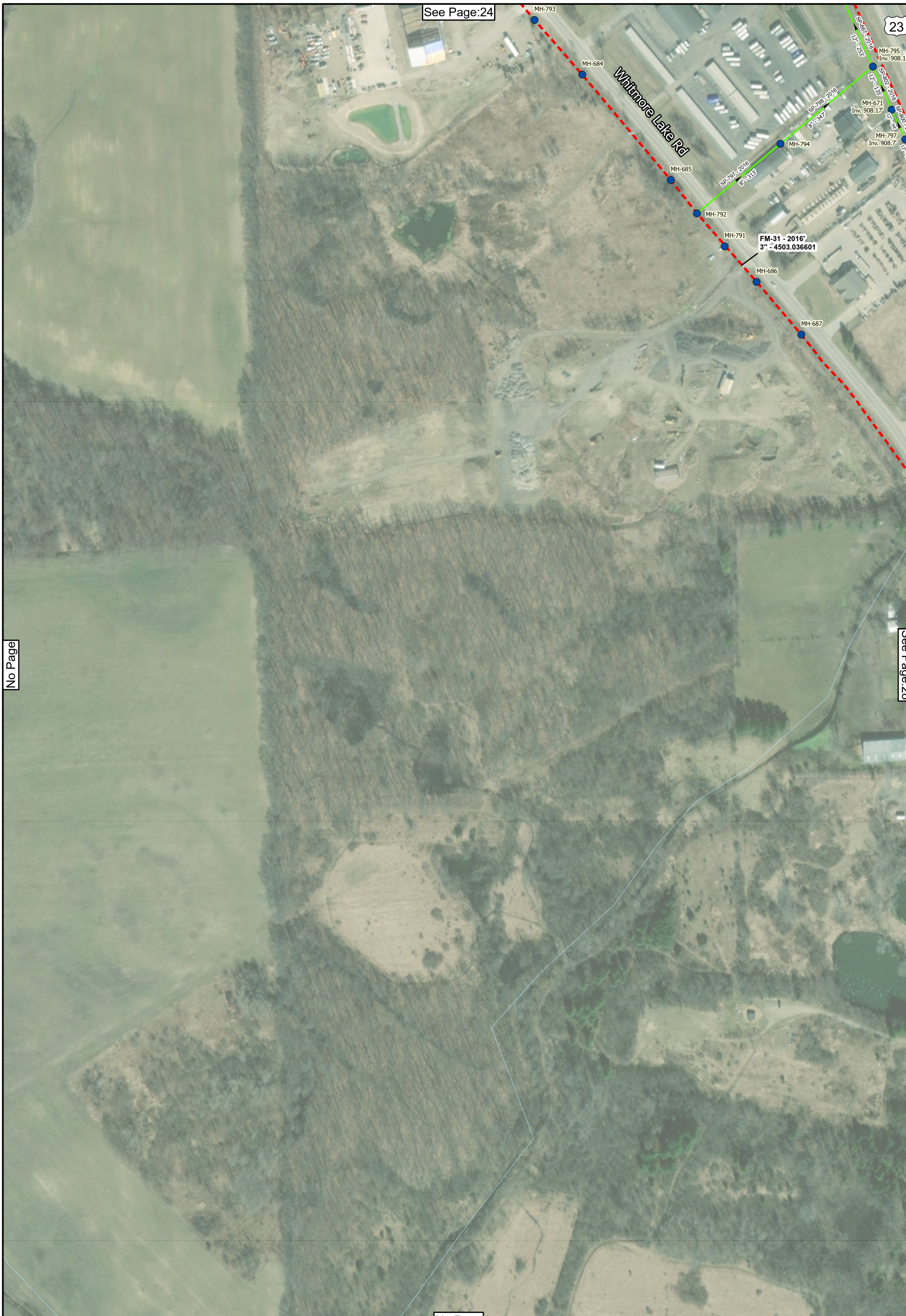

LEGEND

Water

Manhole Wall Material
- Concrete

Gravity Main Material
- PVC

Force Main Material
- Unknown

Township Boundary

N

0 400
Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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See Page:27

No Page

See Page:29

LEGEND

Lift Station
Water

Manhole Wall Material
Concrete

Gravity Main Material
PVC

Force Main Material
Cast Iron
Unknown
Township Boundary

N

0 400
Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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LEGEND

L Lift Station

Force Main Material

Cast Iron

Township Boundary

N

0 400

Feet

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION SYSTEM OVERVIEW

Friday, September 4, 2020

TETRA TECH

Source: City of Brigthon, ESRI

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APPENDIX B: NORTHFIELD TOWNSHIP NPDES PERMIT NO. MI0023710

PERMIT NO. MI0023710

STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act (33 U.S.C. 1251 *et seq*., as amended; the "Federal Act"); Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended (NREPA); Part 41, Sewerage Systems, of the NREPA; and Michigan Executive Order 2011-1,

Northfield Township
8350 Main Street, Suite A
Whitmore Lake, Michigan 48189

is authorized to discharge from the **Northfield Township Wastewater Treatment Plant** located at

11500 Lemen Road
Whitmore Lake, Michigan 48189

designated as **Northfield Twp WWTP**

to Horseshoe Lake Drain (receiving water) in accordance with effluent limitations, monitoring requirements, and other conditions set forth in this permit.

This permit is based on a complete application submitted on February 26, 2013, as amended through March 13, 2014.

This permit takes effect on August 1, 2014. The provisions of this permit are severable. After notice and opportunity for a hearing, this permit may be modified, suspended, or revoked in whole or in part during its term in accordance with applicable laws and rules. On its effective date this permit shall supersede NPDES Permit No. MI0023710, expiring October 1, 2013.

This permit and the authorization to discharge shall expire at midnight, **October 1, 2018**. In order to receive authorization to discharge beyond the date of expiration, the permittee shall submit an application which contains such information, forms, and fees as are required by the Department of Environmental Quality (Department) by **April 4, 2018**.

Issued July 1, 2014

Original Permit Signed by Philip Argiroff
Philip Argiroff, Chief
Permits Section
Water Resources Division

PERMIT FEE REQUIREMENTS

In accordance with Section 324.3120 of the NREPA, the permittee shall make payment of an annual permit fee to the Department for each October 1 the permit is in effect regardless of occurrence of discharge. The permittee shall submit the fee in response to the Department's annual notice. The fee shall be postmarked by January 15 for notices mailed by December 1. The fee is due no later than 45 days after receiving the notice for notices mailed after December 1.

Annual Permit Fee Classification: Municipal Minor, 1 MGD to less than 10 MGD (IP)

In accordance with Section 324.3118 of the NREPA, the permittee shall make payment of an annual storm water fee to the Department for each January 1 the permit is in effect regardless of occurrence of discharge. The permittee shall submit the fee in response to the Department's annual notice. The fee shall be postmarked by March 15 for notices mailed by February 1. The fee is due no later than 45 days after receiving the notice for notices mailed after February 1.

In accordance with Section 324.3132 of the NREPA, the permittee shall make payment of an annual biosolids land application fee to the Department if the permittee land applies biosolids. In response to the Department's annual notice, the permittee shall submit the fee, which shall be postmarked no later than January 31 of each year.

CONTACT INFORMATION

Unless specified otherwise, all contact with the Department required by this permit shall be made to the Lansing District Supervisor of the Water Resources Division. The Lansing District Office is located at Constitution Hall, 1st Floor-South, 525 West Allegan, P.O. Box 30242, Lansing, Michigan 48909-7742,
Telephone: 517-284-6651, Fax: 517-241-3571.

CONTESTED CASE INFORMATION

Any person who is aggrieved by this permit may file a sworn petition with the Michigan Administrative Hearing System within the Michigan Department of Licensing and Regulatory Affairs, c/o the Michigan Department of Environmental Quality, setting forth the conditions of the permit which are being challenged and specifying the grounds for the challenge. The Department of Licensing and Regulatory Affairs may reject any petition filed more than 60 days after issuance as being untimely.

PART I

Section A. Limitations and Monitoring Requirements

1. Final Effluent Limitations, Monitoring Point 001A

During the period beginning on the effective date of this permit and lasting until the completion of the facility upgrade, the permittee is authorized to discharge treated municipal wastewater from Monitoring Point 001A through Outfall 001. Outfall 001 discharges to Horseshoe Lake Drain. Such discharge shall be limited and monitored by the permittee as specified below.

	Maximum Limits for Quantity or Loading				Maximum Limits for Quality or Concentration					
Parameter	**Monthly**	**7-Day**	**Daily**	**Units**	**Monthly**	**7-Day**	**Daily**	**Units**	**Monitoring Frequency**	**Sample Type**
Flow	(report)	---	(report)	MGD	---	---	---	---	Daily	Report Total Daily Flow
Carbonaceous Biochemical Oxygen Demand (CBOD5)	43	108	---	lbs/day	4.0	---	10	mg/l	5×Weekly	24-Hr Composite
Total Suspended Solids	108	163	---	lbs/day	10	15	---	mg/l	5×Weekly	24-Hr Composite
Ammonia Nitrogen (as N)										
May 1- Oct. 31	5.4	22	---	lbs/day	0.5	---	2.0	mg/l	5×Weekly	24-Hr Composite
Nov. 1 - Nov. 30	91	98	---	lbs/day	8.4	---	9.0	mg/l	5×Weekly	24-Hr Composite
Dec. 1 – Mar. 31	123	---	---	lbs/day	11	---	---	mg/l	5×Weekly	24-Hr Composite
Apr. 1 - Apr. 30	73	98	---	lbs/day	6.7	---	9.0	mg/l	5×Weekly	24-Hr Composite
Total Phosphorus(as P)	2.0	---	---	lbs/day	0.4	---	---	mg/l	5×Weekly	24-Hr Composite
Total Selenium	---	---	0.06	lbs/day	---	---	5.2	µg/l	Monthly	24-Hr Composite
Fecal Coliform Bacteria	---	---	---	---	---	100	---	cts/100 ml	5×Weekly	Grab
Total Residual Chlorine	---	---	---	---	---	---	0.038	mg/l	5×Weekly	Grab
2,4,6-Trichlorophenol	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
3,3-Dichlorobenzidine	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
4-chloro-3-methylphenol	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Acrylonitrile	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Azobenzene	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Benzidine	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Fluoranthene	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Hexachlorobenzene	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Hexachlorobutadiene	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Hexachloroethane	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Pentachlorophenol	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Phenanthrene	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab

PART I

Section A. Limitations and Monitoring Requirements

	Maximum Limits for Quantity or Loading				Maximum Limits for Quality or Concentration					
Parameter	**Monthly**	**7-Day**	**Daily**	**Units**	**Monthly**	**7-Day**	**Daily**	**Units**	**Monitoring Frequency**	**Sample Type**
Total Copper	---	---	---	---	---	---	(report)	µg/l	2×Annually	24-Hr Composite
Total Mercury	(report)	---	---	lbs/day	(report)	---	---	ng/l	Quarterly	Grab
					Minimum Daily					
pH	---	---	---	---	6.5	---	9.0	S.U.	5×Weekly	Grab
Dissolved Oxygen										
May 1 - Oct. 31	---	---	---	---	6.0	---	---	mg/l	5×Weekly	Grab
Nov. 1 - Apr. 30	---	---	---	---	5.0	---	---	mg/l	5×Weekly	Grab

The following design flow was used in determining the above limitations, but is not to be considered a limitation or actual capacity: 1.3 MGD.

a. Narrative Standard
The receiving water shall contain no turbidity, color, oil films, floating solids, foams, settleable solids, or deposits as a result of this discharge in unnatural quantities which are or may become injurious to any designated use.

b. Sampling Locations
Samples for $CBOD_5$, Total Suspended Solids, Ammonia Nitrogen, and Total Phosphorus shall be taken prior to disinfection. Samples for Dissolved Oxygen, Fecal Coliform Bacteria, Total Residual Chlorine, and pH shall be taken after disinfection. Samples for Total Selenium, Total Copper, Benzidine, 3,3-Dichlorobenzidine, Hexachlorobenzene, Hexachlorobutadiene, Pentachlorophenol, Acrylonitrile, 2,4,6-Trichlorophenol, Azobenzene, 4-chloro-3-methylphenol, Fluoranthene, Phenanthrene, Hexachloroethane, and Total Mercury shall be taken prior to discharge to Horseshoe Lake Drain. The Department may approve alternate sampling locations which are demonstrated by the permittee to be representative of the effluent.

c. Quarterly Monitoring
Quarterly samples shall be taken during the months of January, April, July, and October. If the facility does not discharge during these months, the permittee shall sample the next discharge occurring during that quarter. If the facility does not discharge during a quarter, a sample is not required for that quarter. For any month in which a sample is not taken, the permittee shall enter "*G" on the Discharge Monitoring Report.

d. Total Residual Chlorine
Compliance with the Total Residual Chlorine limit shall be determined on the basis of one or more grab samples. If more than one (1) sample per day is taken, the additional samples shall be collected in near equal intervals over at least eight (8) hours. The samples shall be analyzed immediately upon collection and the average reported as the daily concentration. Samples shall be analyzed in accordance with Part II.B.2. of this permit.

e. Analytical Methods and Quantification Levels for Effluent Parameters Specified Below
The sampling procedures, preservation and handling, and analytical protocol for compliance monitoring for the parameters listed below shall be as follows:

PART I

Section A. Limitations and Monitoring Requirements

Parameter	Analytical Method	Quantification Level (µg/L)
2,4,6-Trichlorophenol	EPA Method 625	5.0
3,3-Dichlorobenzidine	EPA Method 605	2.0
4-chloro-3-methylphenol	EPA Method 625	5.0
Acrylonitrile	EPA Method 603	1.0
Azobenzene	EPA Method 625	5.0
Benzidine	EPA Method 605	0.8
Fluoranthene	EPA Method 625	1.0
Hexachlorobenzene	EPA Method 612	0.01
Hexachlorobutadiene	EPA Method 612	0.01
Hexachloroethane	EPA Method 625	5.0
Pentachlorophenol	EPA Method 604	5.0
Phenanthrene	EPA Method 625	1.0
Total Copper	EPA Approved	1.0

The quantification levels shall be as indicated above, unless a higher level is appropriate because of sample matrix interference. Justification for higher quantification levels shall be submitted to the Department within 30 days of such determination. Upon approval of the Department, the permittee may use alternate analytical methods (for parameters with methods specified in 40 CFR 136, the alternate methods are restricted to those listed in 40 CFR 136).

f. Monitoring Frequency Reduction for Effluent Parameters Specified Above
After the submittal of 1 year of data, the permittee may request, in writing, Department approval of a reduction in monitoring frequency for 2,4,6-Trichlorophenol, 3,3-Dichlorobenzidine, 4-chloro-3-methylphenol, Acrylonitrile, Azobenzene, Benzidine, Fluoranthene, Hexachlorobenzene, Hexachlorobutadiene, Hexachloroethane, Pentachlorophenol, or Phenanthrene. Monitoring of a parameter may be reduced only if the analytical results are non-detect in all of that parameter's samples. Upon receipt of written approval and consistent with such approval, the permittee may reduce the monitoring frequency indicated in Part I.A.1. of this permit. The monitoring frequency for 2,4,6-Trichlorophenol, 3,3-Dichlorobenzidine, 4-chloro-3-methylphenol, Acrylonitrile, Azobenzene, Benzidine, Fluoranthene, Hexachlorobenzene, Hexachlorobutadiene, Hexachloroethane, Pentachlorophenol, or Phenanthrene shall not be reduced to less than Annual. The Department may revoke the approval for reduced monitoring at any time upon notification to the permittee.

g. Total Mercury Testing Requirements
The analytical protocol for total mercury shall be in accordance with EPA Method 1631, Revision E, "Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry." The quantification level for total mercury shall be 0.5 ng/l, unless a higher level is appropriate because of sample matrix interference. Justification for higher quantification levels shall be submitted to the Department within 30 days of such determination.

The use of clean technique sampling procedures is required unless the permittee can demonstrate to the Department that an alternative sampling procedure is representative of the discharge. Guidance for clean technique sampling is contained in EPA Method 1669, *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (Sampling Guidance)*, EPA-821-R96-001, July 1996. Information and data documenting the permittee's sampling and analytical protocols and data acceptability shall be submitted to the Department upon request.

1) If, at any time during the life of the permit, the final effluent concentration exceeds 5 ng/l, the permittee shall notify the Department with its next regular monthly monitoring report, and shall develop and implement the Pollutant Minimization Program for Total mercury contained in Part 1.A.3 of this permit.

PART I

Section A. Limitations and Monitoring Requirements

2. Final Effluent Limitations, Monitoring Point 001A

During the period beginning on the completion of the facility upgrade and lasting until the expiration date of this permit, the permittee is authorized to discharge treated municipal wastewater from Monitoring Point 001A through Outfall 001. Outfall 001 discharges to Horseshoe Lake Drain. Such discharge shall be limited and monitored by the permittee as specified below.

	Maximum Limits for Quantity or Loading				Maximum Limits for Quality or Concentration					
Parameter	Monthly	7-Day	Daily	Units	Monthly	7-Day	Daily	Units	Monitoring Frequency	Sample Type
Flow	(report)	---	(report)	MGD	---	---	---	---	Daily	Report Total Daily Flow
Carbonaceous Biochemical Oxygen Demand (CBOD5)	100	250	---	lbs/day	4.0	---	10	mg/l	5×Weekly	24-Hr Composite
Total Suspended Solids	250	380	---	lbs/day	10	15	---	mg/l	5×Weekly	24-Hr Composite
Ammonia Nitrogen (as N)										
May 1- Oct. 31	13	50	---	lbs/day	0.5	---	2.0	mg/l	5×Weekly	24-Hr Composite
Nov. 1 - Nov. 30	210	230	---	lbs/day	8.4	---	9.0	mg/l	5×Weekly	24-Hr Composite
Dec. 1 – Mar. 31	280	---	---	lbs/day	11	---	---	mg/l	5×Weekly	24-Hr Composite
Apr. 1 - Apr. 30	170	230	---	lbs/day	6.7	---	9.0	mg/l	5×Weekly	24-Hr Composite
Total Phosphorus(as P)	5.0	---	---	lbs/day	0.4	---	---	mg/l	5×Weekly	24-Hr Composite
Total Selenium	---	---	0.13	lbs/day	---	---	5.2	µg/l	Monthly	24-Hr Composite
Fecal Coliform Bacteria	---	---	---	---	---	100	---	cts/100 ml	5×Weekly	Grab
Total Residual Chlorine	---	---	---	---	---	---	0.038	mg/l	5×Weekly	Grab
2,4,6-Trichlorophenol	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
3,3-Dichlorobenzidine	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
4-chloro-3-methylphenol	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Acrylonitrile	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Azobenzene	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Benzidine	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Fluoranthene	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Hexachlorobenzene	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Hexachlorobutadiene	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Hexachloroethane	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Pentachlorophenol	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab
Phenanthrene	---	---	(report)	lbs/day	---	---	(report)	µg/l	Quarterly	Grab

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Parameter	Maximum Limits for Quantity or Loading: Monthly	7-Day	Daily	Units	Maximum Limits for Quality or Concentration: Monthly	7-Day	Daily	Units	Monitoring Frequency	Sample Type
Total Copper	---	---	---	---	---	---	(report)	µg/l	2×Annually	24-Hr Composite
Total Mercury	(report)	---	---	lbs/day	(report)	---	---	ng/l	Quarterly	Grab
					Minimum Daily					
pH	---	---	---	---	6.5	---	9.0	S.U.	5×Weekly	Grab
Dissolved Oxygen										
May 1 - Oct. 31	---	---	---	---	6.0	---	---	mg/l	5×Weekly	Grab
Nov. 1 - Apr. 30	---	---	---	---	5.0	---	---	mg/l	5×Weekly	Grab

The following design flow was used in determining the above limitations, but is not to be considered a limitation or actual capacity: 3.0 MGD.

a. Narrative Standard
The receiving water shall contain no turbidity, color, oil films, floating solids, foams, settleable solids, or deposits as a result of this discharge in unnatural quantities which are or may become injurious to any designated use.

b. Sampling Locations
Samples for $CBOD_5$, Total Suspended Solids, Ammonia Nitrogen, and Total Phosphorus shall be taken prior to disinfection. Samples for Dissolved Oxygen, Fecal Coliform Bacteria, Total Residual Chlorine, and pH shall be taken after disinfection. Samples for Total Selenium, Total Copper, Benzidine, 3,3-Dichlorobenzidine, Hexachlorobenzene, Hexachlorobutadiene, Pentachlorophenol, Acrylonitrile, 2,4,6-Trichlorophenol, Azobenzene, 4-chloro-3-methylphenol, Fluoranthene, Phenanthrene, Hexachloroethane, and Total Mercury shall be taken prior to discharge to Horseshoe Lake Drain. The Department may approve alternate sampling locations which are demonstrated by the permittee to be representative of the effluent.

c. Quarterly Monitoring
Quarterly samples shall be taken during the months of January, April, July, and October. If the facility does not discharge during these months, the permittee shall sample the next discharge occurring during that quarter. If the facility does not discharge during a quarter, a sample is not required for that quarter. For any month in which a sample is not taken, the permittee shall enter "*G" on the Discharge Monitoring Report.

d. Total Residual Chlorine
Compliance with the Total Residual Chlorine limit shall be determined on the basis of one or more grab samples. If more than one (1) sample per day is taken, the additional samples shall be collected in near equal intervals over at least eight (8) hours. The samples shall be analyzed immediately upon collection and the average reported as the daily concentration. Samples shall be analyzed in accordance with Part II.B.2. of this permit.

e. Analytical Methods and Quantification Levels for Effluent Parameters Specified Below
The sampling procedures, preservation and handling, and analytical protocol for compliance monitoring for the parameters listed below shall be as follows:

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Parameter	Analytical Method	Quantification Level (µg/L)
2,4,6-Trichlorophenol	EPA Method 625	5.0
3,3-Dichlorobenzidine	EPA Method 605	2.0
4-chloro-3-methylphenol	EPA Method 625	5.0
Acrylonitrile	EPA Method 603	1.0
Azobenzene	EPA Method 625	5.0
Benzidine	EPA Method 605	0.8
Fluoranthene	EPA Method 625	1.0
Hexachlorobenzene	EPA Method 612	0.01
Hexachlorobutadiene	EPA Method 612	0.01
Hexachloroethane	EPA Method 625	5.0
Pentachlorophenol	EPA Method 604	5.0
Phenanthrene	EPA Method 625	1.0
Total Copper	EPA Approved	1.0

The quantification levels shall be as indicated above, unless a higher level is appropriate because of sample matrix interference. Justification for higher quantification levels shall be submitted to the Department within 30 days of such determination. Upon approval of the Department, the permittee may use alternate analytical methods (for parameters with methods specified in 40 CFR 136, the alternate methods are restricted to those listed in 40 CFR 136).

f. Monitoring Frequency Reduction for Effluent Parameters Specified Above
After the submittal of 1 year of data, the permittee may request, in writing, Department approval of a reduction in monitoring frequency for 2,4,6-Trichlorophenol, 3,3-Dichlorobenzidine, 4-chloro-3-methylphenol, Acrylonitrile, Azobenzene, Benzidine, Fluoranthene, Hexachlorobenzene, Hexachlorobutadiene, Hexachloroethane, Pentachlorophenol, or Phenanthrene. Monitoring of a parameter may be reduced only if the analytical results are non-detect in all of that parameter's samples. Upon receipt of written approval and consistent with such approval, the permittee may reduce the monitoring frequency indicated in Part I.A.1. of this permit. The monitoring frequency for 2,4,6-Trichlorophenol, 3,3-Dichlorobenzidine, 4-chloro-3-methylphenol, Acrylonitrile, Azobenzene, Benzidine, Fluoranthene, Hexachlorobenzene, Hexachlorobutadiene, Hexachloroethane, Pentachlorophenol, or Phenanthrene shall not be reduced to less than Annual. The Department may revoke the approval for reduced monitoring at any time upon notification to the permittee.

g. Total Mercury Testing Requirements
The analytical protocol for total mercury shall be in accordance with EPA Method 1631, Revision E, "Mercury in Water by Oxidation, Purge and Trap, and Cold Vapor Atomic Fluorescence Spectrometry." The quantification level for total mercury shall be 0.5 ng/l, unless a higher level is appropriate because of sample matrix interference. Justification for higher quantification levels shall be submitted to the Department within 30 days of such determination.

The use of clean technique sampling procedures is required unless the permittee can demonstrate to the Department that an alternative sampling procedure is representative of the discharge. Guidance for clean technique sampling is contained in EPA Method 1669, *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria Levels (Sampling Guidance)*, EPA-821-R96-001, July 1996. Information and data documenting the permittee's sampling and analytical protocols and data acceptability shall be submitted to the Department upon request.

1) If, at any time during the life of the permit, the final effluent concentration exceeds 5 ng/l, the permittee shall notify the Department with its next regular monthly monitoring report, and shall develop and implement the Pollutant Minimization Program for Total mercury contained in Part 1.A.3 of this permit.

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3. Additional Monitoring Requirements

As a condition of this permit, the permittee shall monitor the discharge from Monitoring Point 001A for the constituents listed below. This monitoring is an application requirement of 40 CFR 122.21(j), effective December 2, 1999. Testing shall be conducted in <u>October 2014</u>, <u>May 2015</u>, <u>March 2016</u>, and <u>August 2017</u>. Grab samples shall be taken for total mercury, available cyanide, total phenols, and parameters listed under Volatile Organic Compounds. For all other parameters, 24-hour composite samples shall be taken.

Test species for whole effluent toxicity monitoring shall include fathead minnow **and** *Ceriodaphnia dubia*. If the permittee has received Department approval to conduct chronic toxicity testing using the more sensitive species identified in the toxicity database, the first three (3) tests required above may be performed using the more sensitive species. The last (4^{th}) test shall be conducted using both species. Testing and reporting procedures shall follow procedures contained in EPA600/4-91/002, “Short-term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms (Fourth Edition).” When the effluent ammonia nitrogen (as N) concentration is greater than 3 mg/l, the pH of the toxicity test shall be maintained at a pH of 8 Standard Units. Acute and chronic toxicity data shall be included in the reporting for the toxicity test results. Toxicity test data acceptability is contingent upon the validation of the test method by the testing laboratory. Such validation shall be submitted to the Department upon request.

The results of such monitoring shall be submitted with the application for reissuance (see the cover page of this permit for the application due date). The permittee shall notify the Department <u>within 14 days</u> of completing the monitoring for each month specified above in accordance with Part II.C.5. Additional reporting requirements are specified in Part II.C.11. The permittee shall report to the Department any whole effluent toxicity test results greater than 1.0 TU_A or 1.0 TU_C <u>within five (5) days</u> of becoming aware of the result. If, upon review of the analysis, it is determined that additional requirements are needed to protect the receiving waters in accordance with applicable water quality standards, the permit may then be modified by the Department in accordance with applicable laws and rules.

The permittee is not required to report parameters that have been struck through.

<u>Whole Effluent Toxicity</u>

acute toxicity	chronic toxicity

<u>Hardness</u>

calcium carbonate

<u>Metals (Total Recoverable), Cyanide and Total Phenols (Quantification levels in parentheses)</u>

antimony (1 µg/l)	arsenic (1 µg/l)	available cyanide (2 µg/l) using Method OIA – 1677	
barium (5 µg/l)	beryllium (1 µg/l)	boron (20 µg/l)	cadmium (0.2 µg/l)
chromium (5 µg/l)	copper (1 µg/l)	lead (1 µg/l)	nickel (5 µg/l)
selenium (1 µg/l)	silver (0.5 µg/l)	thallium (1 µg/l)	zinc (5 µg/l)
~~mercury (0.5 ng/l) using Method 1631 Revision E~~		total phenolic compounds	

<u>Volatile Organic Compounds</u>

acrolein	~~acrylonitrile~~	benzene	bromoform
carbon tetrachloride	chlorobenzene	chlorodibromomethane	chloroethane
2-chloroethylvinyl ether	chloroform	dichlorobromomethane	1,1-dichloroethane
1,2-dichloroethane	trans-1,2-dichloroethylene	1,1-dichloroethylene	1,2-dichloropropane
1,3-dichloropropylene	ethylbenzene	methyl bromide	methyl chloride
methylene chloride	1,1,2,2,-tetrachloroethane	tetrachloroethylene	toluene
1,1,1-trichloroethane	1,1,2-trichloroethane	trichloroethylene	vinyl chloride

<u>Acid-Extractable Compounds</u>

~~4-Chloro,3-Methylphenol~~	2-chlorophenol	2,4-dichlorophenol	2,4-dimethylphenol
4,6-dinitro-o-cresol	2,4-dinitrophenol	2-nitrophenol	4-nitrophenol
~~Pentachlorophenol~~	phenol	2,4,6-trichlorophenol	

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<u>Base/Neutral Compounds</u>

acenaphthene	acenaphthylene	anthracene	~~benzidine~~
benzo(a)anthracene	benzo(a)pyrene	3,4-benzofluoranthene	benzo(ghi)perylene
benzo(k)fluoranthene	bis(2-chloroethoxy)methane	bis(2-chloroethyl)ether	bis(2-chloroisopropyl)ether
bis(2-ethylhexyl)phthalate	4-bromophenyl phenyl ether	butyl benzyl phthalate	2-chloronaphthalene
4-chlorophenyl phenyl ether	chrysene	di-n-butyl phthalate	di-n-octyl phthalate
dibenzo(a,h)anthracene	1,2-dichlorobenzene	1,3-dichlorobenzene	1,4-dichlorobenzene
~~3,3'-dichlorobenzidine~~	diethyl phthalate	dimethyl phthalate	2,4-dinitrotoluene
2,6-dinitrotoluene	1,2-diphenylhydrazine	~~fluoranthene~~	fluorene
~~Hexachlorobenzene~~	~~hexachlorobutadiene~~	hexachlorocyclo-pentadiene	~~hexachloroethane~~
indeno(1,2,3-cd)pyrene	isophorone	naphthalene	nitrobenzene
n-nitrosodi-n-propylamine	n-nitrosodimethylamine	n-nitrosodiphenylamine	~~phenanthrene~~
pyrene	1,2,4-trichlorobenzene		

4. Pollutant Minimization Program for Total Mercury

This condition is required, upon written notification by the Department or if the permittee notifies the Department that the final effluent concentration of total mercury has exceeded 5 ng/l, as specified in Part I.A.1.g.1). The goal of the Pollutant Minimization Program is to maintain the effluent concentration of total mercury at or below 1.3 ng/l. <u>Within 180 days</u> of the written notification by the Department that the final effluent concentration of total mercury has exceeded 5 ng/l, the permittee shall submit to the Department an approvable Pollutant Minimization Program for mercury designed to proceed toward the goal. The Pollutant Minimization Program shall include the following:

a. an annual review and semiannual monitoring of potential sources of mercury entering the wastewater collection system

b. a program for quarterly monitoring of influent and periodic monitoring of sludge for mercury, and

c. implementation of reasonable cost-effective control measures when sources of mercury are discovered. Factors to be considered include significance of sources, economic considerations, and technical and treatability considerations.

The Pollutant Minimization Program shall be implemented upon approval by the Department.

On or before <u>March 31 of each year</u> following approval of the Pollutant Minimization Program, the permittee shall submit a status report for the previous calendar year to the Department that includes 1) the monitoring results for the previous year, 2) an updated list of potential mercury sources, and 3) a summary of all actions taken to reduce or eliminate identified sources of mercury.

Any information generated as a result of the Pollutant Minimization Program set forth in this permit may be used to support a request to modify the approved program or to demonstrate that the Pollutant Minimization Program requirement has been completed satisfactorily.

A request for modification of the approved program and supporting documentation shall be submitted in writing to the Department for review and approval. The Department may approve modifications to the approved program (approval of a program modification does not require a permit modification), including a reduction in the frequency of the requirements under items a. & b.

This permit may be modified in accordance with applicable laws and rules to include additional mercury conditions and/or limitations as necessary.

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Section A. Limitations and Monitoring Requirements

5. Untreated or Partially Treated Sewage Discharge Reporting and Testing Requirements

In accordance with Section 324.3112a of the NREPA, if untreated sewage, including sanitary sewer overflows (SSO) and combined sewer overflows (CSO), or partially-treated sewage is directly or indirectly discharged from a sewer system onto land or into the waters of the state, the entity responsible for the sewer system shall immediately, but not more than 24 hours after the discharge begins, notify, by telephone, the Department, local health departments, a daily newspaper of general circulation in the county in which the permittee is located, and a daily newspaper of general circulation in the county or counties in which the municipalities whose waters may be affected by the discharge are located that the discharge is occurring.

The permittee shall also annually contact municipalities, including the superintendent of a public drinking water supply with potentially affected intakes, whose waters may be affected by the permittee's discharge of combined sewage, and if those municipalities wish to be notified in the same manner as specified above, the permittee shall provide such notification. Such notification shall also include a daily newspaper in the county of the affected municipality.

At the conclusion of the discharge, written notification shall be submitted in accordance with and on the “Report of Discharge Form” available via the internet at: http://www.deq.state.mi.us/csosso/ or, alternatively for combined sewer overflow discharges, in accordance with notification procedures approved by the Department.

In addition, in accordance with Section 324.3112a of the NREPA, each time a discharge of untreated sewage or partially treated sewage occurs, the permittee shall test the affected waters for *Escherichia coli* to assess the risk to the public health as a result of the discharge and shall provide the test results to the affected local county health departments and to the Department. The testing shall be done at locations specified by each affected local county health department, but shall not exceed ten (10) tests for each separate discharge event. The affected local county health department may waive this testing requirement if it determines that such testing is not needed to assess the risk to the public health as a result of the discharge event. The results of this testing shall be submitted with the written notification required above or, if the results are not yet available, submit them as soon as they become available. This testing is not required if the testing has been waived by the local health department or if the discharge(s) did not affect surface waters.

Permittees accepting sanitary or municipal sewage from other sewage collection systems are encouraged to notify the owners of those systems of the above reporting and testing requirements.

6. Facility Contact

The “Facility Contact” was specified in the application. The permittee may replace the facility contact at any time, and shall notify the Department in writing <u>within 10 days</u> after replacement (including the name, address, and telephone number of the new facility contact).

a. The facility contact shall be (or a duly authorized representative of this person):
- for a corporation, a principal executive officer of at least the level of vice president, or a designated representative, if the representative is responsible for the overall operation of the facility from which the discharge described in the permit application or other NPDES form originates,
- for a partnership, a general partner,
- for a sole proprietorship, the proprietor, or
- for a municipal, state, or other public facility, either a principal executive officer, the mayor, village president, city or village manager, or other duly authorized employee.

b. A person is a duly authorized representative only if:
- the authorization is made in writing to the Department by a person described in paragraph a. of this section; and

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- the authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity such as the position of plant manager, operator of a well or a well field, superintendent, position of equivalent responsibility, or an individual or position having overall responsibility for environmental matters for the facility (a duly authorized representative may thus be either a named individual or any individual occupying a named position).

Nothing in this section obviates the permittee from properly submitting reports and forms as required by law.

7. Monthly Operating Reports

Part 41 of Act 451 of 1994 as amended, specifically Section 324.4106 and associated Rule 299.2953, requires that the permittee file with the Department, on forms prescribed by the Department, reports showing the effectiveness of the treatment facility operation and the quantity and quality of liquid wastes discharged into waters of the state.

Since this permit includes modifications to the monitoring requirements in the previously-issued permit, the previously-approved treatment facility monitoring program shall be revised. Within thirty (30) days of the effective date of this permit, the permittee shall submit to the Department a revised treatment facility monitoring program to meet this requirement. Upon approval by the Department, the permittee shall implement the revised treatment facility monitoring program. The reporting forms and guidance are available on the DEQ Web site at http://www.michigan.gov/deq/0,1607,7-135-3313_44117---,00.html. The permittee may use alternative operating forms if they are consistent with the approved monitoring program. These forms shall be maintained on site and shall be provided to the Department for review upon request. These treatment facility monitoring records shall be maintained for a minimum of three years.

8. Asset Management

The permittee shall at all times properly operate and maintain all facilities (i.e., the sewer system and treatment works as defined in Part 41 of the NREPA), and control systems installed or used by the permittee to operate the sewer system and treatment works, and achieve and maintain compliance with the conditions of this permit (also see Part II.D.3 of this permit). The requirements of an Asset Management Program function to achieve the goals of effective performance, adequate funding, and adequate operator staffing and training. Asset management is a planning process for ensuring that optimum value is gained for each asset and financial resources are available to rehabilitate and replace those assets when necessary. Asset management is centered on a framework of five (5) core elements: the current state of the assets; the required sustainable level of service; the assets critical to sustained performance; the minimum life-cycle costs; and the best long-term funding strategy.

a. Asset Management Program Requirements
On or before February 1, 2015, the permittee shall submit to the Department an Asset Management Plan for review and approval. An approvable Asset Management Plan shall contain a schedule for the development and implementation of an Asset Management Program that meets the requirements outlined below in 1) – 4). A copy of any Asset Management Program requirements already completed by the permittee should be submitted as part of the Asset Management Plan. Upon approval by the Department, the permittee shall implement the Asset Management Plan. (The permittee may choose to include the Operation and Maintenance Manual required under Part II.C.14. of this permit as part of their Asset Management Program.)

1) Maintenance Staff. The permittee shall provide an adequate staff to carry out the operation, maintenance, repair, and testing functions required to ensure compliance with the terms and conditions of this permit. The level of staffing needed shall be determined by taking into account the work involved in operating the sewer system and treatment works, planning for and conducting maintenance, and complying with this permit.
2) Collection System Map**.** The permittee shall complete a map of the sewer collection system it owns and operates. The map shall be of sufficient detail and at a scale to allow easy interpretation. The collection system information shown on the map shall be based on current conditions and shall be kept up-to-date and available for review by the Department. **Note: Items below referencing**

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combined sewer systems are not applicable to separate sewer systems. Such map(s) shall include, but not be limited to, the following:

a) all sanitary sewer lines and related manholes

b) all combined sewer lines, related manholes, catch basins, and CSO regulators

c) all known or suspected connections between the sanitary sewer or combined sewer and storm drain systems

d) all outfalls, including the treatment plant outfall(s), combined sewer treatment facility outfalls, untreated CSOs, and any known SSOs

e) all pump stations and force mains

f) the wastewater treatment facility(ies), including all treatment processes

g) all surface waters (labeled)

h) other major appurtenances, such as inverted siphons and air release valves

i) a numbering system that uniquely identifies manholes, catch basins, overflow points, regulators, and outfalls

j) the scale and a north arrow

k) the pipe diameter, date of installation, type of material, distance between manholes, and the direction of flow, and

l) the manhole interior material, GPS coordinates (optional), rim elevation, and invert elevations.

3) Inventory and assessment of fixed assets. The permittee shall complete an inventory and assessment of operations-related fixed assets. Fixed assets are assets that are normally stationary (e.g., pumps, blowers, and buildings). The inventory and assessment shall be based on current conditions and shall be kept up-to-date and available for review by the Department.

a) The fixed asset inventory shall include the following:

(1) a brief description of the fixed asset, its required capacity (e.g., pump: 120 gallons per minute), its level of redundancy, and its tag number if applicable

(2) the location of the fixed asset

(3) the year the fixed asset was installed

(4) the present condition of the fixed asset (e.g., excellent, good, fair, poor)

(5) the depreciated value of the fixed asset in dollars for year specified in accordance with approved schedules, and

(6) the current fixed asset (replacement) cost in dollars for year specified in accordance with approved schedules

b) The fixed asset assessment shall include a “Business Risk Evaluation” that combines the probability of failure of the fixed asset and the criticality of the fixed asset, as follows:

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(1) Rate the probability of failure of the fixed asset on a scale of 1-5 (low to high), using criteria such as maintenance history, failure history, and remaining percentage of useful life (or years remaining)

(2) Rate the criticality of the fixed asset on a scale of 1-5 (low to high), based on the consequence of failure versus the desired level of service for the facility, and

(3) Compute the Business Risk Factor of the fixed asset by multiplying the failure rating from (1) by the criticality rating from (2).

4) Operation, Maintenance, and Replacement (OM&R) Budget and Rate Sufficiency for the Sewer System and Treatment Works. The permittee shall complete an assessment of its user rates and replacement fund, including the following:

a) beginning and ending dates of fiscal year

b) name of the department, committee, board, or other organization that sets rates for the operation of the sewer system and treatment works

c) amount in the permittee's replacement fund in dollars for year specified in accordance with approved schedules

d) replacement fund of all assets with a useful life of 20 years or less

e) expenditures for maintenance, corrective action, and capital improvement taken during the fiscal year

f) OM&R budget for the fiscal year, and

g) rate calculation demonstrating sufficient revenues to cover OM&R expenses or, alternatively, an implementation schedule for rate adjustments to ensure sufficient revenues to cover OM&R expenses. Schedule shall not extend past the expiration date of this permit.

b. Reporting
The permittee shall develop a written report that summarizes asset management activities completed during the previous year and planned for the upcoming year. The written report shall be submitted to the Department on or before <u>August 1 of each year</u>. The written report shall include:

1) a description of the staffing levels maintained during the year

2) a description of inspections and maintenance activities conducted and corrective actions taken during the previous year

3) expenditures for collection system maintenance activities, treatment works maintenance activities, corrective actions, and capital improvement during the previous year

4) a summary of assets/areas identified for inspection/action (including capital improvement) in the upcoming year based on the five (5) core elements and the Business Risk Factors

5) a maintenance budget and capital improvement budget for the upcoming year that take into account implementation of an effective Asset Management Program that meets the five (5) core elements

6) an updated asset inventory based on the original submission, and

7) an updated OM&R report with updated rate schedule.

PART I

Section B. Storm Water Pollution Prevention Plan

1. Final Effluent Limitations and Monitoring Requirements

The permittee is authorized to discharge storm water associated with industrial activity as defined under 40 CFR 122.26(b)(14)(i-ix). Such discharge shall be limited and monitored by the permittee as specified below.

a. Narrative Standard
The receiving water shall contain no turbidity, color, oil films, floating solids, foams, settleable solids, suspended solids, or deposits as a result of this discharge in unnatural quantities which are or may become injurious to any designated use.

b. Visual Assessment of Discharges
To ensure storm water discharges from the facility do not violate the narrative standard in the receiving waters, storm water discharges shall be visually assessed by the Industrial Storm Water Certified Operator. The Industrial Storm Water Certified Operator shall conduct visual assessments of storm water discharges in accordance with this permit.

c. Implementation of Storm Water Pollution Prevention Plan
The permittee shall implement an acceptable Storm Water Pollution Prevention Plan (SWPPP) as required by this permit.

d. Certified Operator
The permittee shall have an Industrial Storm Water Certified Operator who has supervision over the facility's storm water treatment and control measures included in the SWPPP.

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Section B. Storm Water Pollution Prevention Plan

The Storm Water Pollution Prevention Plan (SWPPP) is a written procedure to reduce the exposure of storm water to significant materials and to reduce the amount of significant materials in the storm water discharge. An acceptable SWPPP shall identify potential sources of contamination and describe the controls necessary to reduce their impacts in accordance with Part I.B.2. through Part I.B.8. of this permit.

2. Source Identification

To identify potential sources of significant materials that can pollute storm water and subsequently be discharged from the facility, the SWPPP shall, at a minimum, include the following:

a. A site map identifying:

1) buildings and other permanent structures

2) storage or disposal areas for significant materials

3) secondary containment structures and descriptions of the significant materials contained within the primary containment structures

4) storm water discharge points (which include outfalls and points of discharge), numbered or otherwise labeled for reference

5) location of storm water and non-storm water inlets (numbered or otherwise labeled for reference) contributing to each discharge point

6) location of NPDES-permitted discharges other than storm water

7) outlines of the drainage areas contributing to each discharge point

8) structural controls or storm water treatment facilities

9) areas of vegetation (with brief descriptions such as lawn, old field, marsh, wooded, etc.)

10) areas of exposed and/or erodible soils and gravel lots

11) impervious surfaces (e.g., roofs, asphalt, concrete, etc.)

12) name and location of receiving water(s), and

13) areas of known or suspected impacts on surface waters as designated under Part 201 (Environmental Response) of the NREPA.

b. A list of all significant materials that could pollute storm water. For each material listed, the SWPPP shall include each of the following descriptions:

1) the ways in which each type of significant material has been, or has reasonable potential to become, exposed to storm water (e.g., spillage during handling; leaks from pipes, pumps, and vessels; contact with storage piles, contaminated materials, or soils; waste handling and disposal; deposits from dust or overspray; etc.)

2) identification of the discharge point(s) and the inlet(s) contributing the significant material to each discharge point through which the significant material may be discharged if released, and

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3) an evaluation of the reasonable potential for contribution of significant materials to storm water from at least the following areas or activities:

a) loading, unloading, and other significant material-handling operations

b) outdoor storage, including secondary containment structures

c) outdoor manufacturing or processing activities

d) significant dust- or particulate-generating processes

e) discharge from vents, stacks, and air emission controls

f) on-site waste disposal practices

g) maintenance and cleaning of vehicles, machines, and equipment

h) areas of exposed and/or erodible soils

i) Sites of Environmental Contamination listed under Part 201 (Environmental Response) of the NREPA

j) areas of significant material residues

k) areas where animals (wild or domestic) congregate and deposit wastes, and

l) other areas where storm water may come into contact with significant materials.

c. A listing of significant spills and significant leaks of polluting materials that occurred in areas that are exposed to precipitation or that discharge to a point source at the facility. The listing shall include spills that occurred over the three (3) years prior to the effective date of a permit authorizing discharge. The listing shall include the date, volume, and exact location of the release, and the action taken to clean up the material and/or prevent exposure to storm water or contamination of surface waters of the state. Any release that occurs after the SWPPP has been developed shall be controlled in accordance with the SWPPP and is cause for the SWPPP to be updated as appropriate <u>within 14 calendar days</u> of obtaining knowledge of the spill or loss.

d. A determination as to whether its facility discharges storm water to a water body for which an EPA-approved Total Maximum Daily Load (TMDL) has been established. If so, the permittee shall assess whether the TMDL requirements for the facility's discharge are being met through the existing SWPPP controls or whether additional control measures are necessary. The permitee's assessment of whether the TMDL requirements are being met shall focus on the effectiveness, adequacy, and implementation of the permitee's SWPPP controls.

e. A summary of existing storm water discharge sampling data (if available), describing pollutants in storm water discharges at the facility. This summary shall be accompanied by a description of the suspected source(s) of the pollutants detected.

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Section B. Storm Water Pollution Prevention Plan

3. Nonstructural Controls

To prevent significant materials from contacting storm water at the source, the SWPPP shall, at a minimum, include each of the following nonstructural controls:

a. Written procedures and a schedule for routine preventive maintenance. Preventive maintenance procedures shall describe routine inspections and maintenance of storm water management and control devices (e.g., cleaning of oil/water separators and catch basins, routine housekeeping activities, etc.), as well as inspecting and testing plant equipment and systems to uncover conditions that could cause breakdowns or failures resulting in discharges of pollutants to the storm sewer system or the surface waters of the state. The routine inspection shall include areas of the facility in which significant materials have the reasonable potential to contaminate storm water. A written report of the inspection and corrective actions shall be retained in accordance with Record Keeping, below.

b. Written procedures and a schedule for good housekeeping to maintain a clean, orderly facility. Good housekeeping procedures shall include routine inspections that focus on the areas of the facility that have a reasonable potential to contaminate storm water entering the property. The routine housekeeping inspections may be combined with the routine inspections for the preventive maintenance program. A written report of the inspection and corrective actions shall be retained in accordance with Record Keeping, below.

c. Written procedures and a schedule for **quarterly** comprehensive site inspections, to be conducted by the Industrial Storm Water Certified Operator. At a minimum, one inspection shall be performed within each of the following quarters: January-March, April-June, July-September, and October-December. The comprehensive site inspections shall include, but not be limited to, inspection of structural controls in use at the facility, and the areas and equipment identified in the routine preventive maintenance and good housekeeping procedures. These inspections shall also include a review of the routine preventive maintenance reports, good housekeeping inspection reports, and any other paperwork associated with the SWPPP. The permittee may request Department approval of an alternate schedule for comprehensive site inspections. A written report of the inspection and corrective actions shall be retained in accordance with Record Keeping, below, and the following shall be included on the comprehensive inspection form/report:

    1) Date of the inspection.

    2) Name(s), title(s), and certification number(s) of the personnel conducting the inspection.

    3) Precipitation information (i.e., a description of recent rainfall/snowmelt events).

    4) All observations relating to the implementation of control measures. Items to include if applicable:

        a) updates on corrective actions implemented due to previously identified pollutant and/or discharge issues

        b) any evidence of, or the potential for, pollutants to discharge to the drainage system or receiving waters and the condition of and around the discharge point, including flow dissipation measures needing maintenance or repairs

        c) any control measures needing maintenance or repairs, and

        d) any additional control measures needed to comply with permit requirements.

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5) Any required revisions to the SWPPP resulting from the inspection.

6) A written certification stating the facility is in compliance with this permit and the SWPPP or, if there are instances of noncompliance, they are identified.

7) Written procedures and a schedule for **quarterly** visual assessments of storm water discharges from each discharge point identified under Source Identification, above. At a minimum, one inspection shall be performed within each of the following quarters: January-March, April-June, July-September, and October-December. These assessments shall be conducted by the Industrial Storm Water Certified Operator as part of the comprehensive site inspection and shall be conducted within one month of control measure observations made in accordance with 4), above. If the Department has approved an alternate schedule for the comprehensive site inspection, the visual assessment may likewise be performed according to the same approved alternate schedule. The following are the requirements of the visual assessment:

a) A representative storm water sample shall be collected from each discharge point. Samples shall be:

(1) collected in a clean, clear glass or plastic container

(2) collected within the first 30 minutes of the start of a discharge from a storm event and on discharges that occur at least 72 hours (3 days) from the previous discharge. If it is not possible to collect the sample within the first 30 minutes of discharge, the sample shall be collected as soon thereafter as practicable but not exceeding 60 minutes. In the case of snowmelt, samples shall be collected during a period with measurable discharge from the site, and

(3) examined in a well-lit area and visually inspected for conditions that could cause a violation of water quality standards as defined in Water Quality Standards, below.

b) Visual assessments shall be documented. This documentation shall be retained in accordance with Record Keeping, below, and shall include the following:

(1) sampling location(s) at the discharge point(s) identified on the site map (see Source Identification, above)

(2) storm event information (i.e., length of event expressed in hours, approximate size of event expressed in inches of precipitation, duration of time since previous event that caused a discharge, and date and time the discharge began)

(3) sample collection date and time, and visual assessment date and time for each sample

(4) name(s), title(s), and Industrial Storm Water Certified Operator number(s) of the personnel collecting the sample and performing the visual assessment

(5) nature of the discharge (i.e., rainfall or snowmelt)

(6) observations made of the storm water discharge

(7) probable sources of any observed storm water contamination

(8) if applicable, an explanation for why it was not possible to take samples within the first 30 minutes of discharge, and

(9) photographic evidence of the sample against a white background, to be maintained along with the written report.

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Section B. Storm Water Pollution Prevention Plan

c) When adverse weather conditions prevent the collection of samples during the quarter, a substitute sample shall be taken during the next qualifying storm event. Documentation of the rationale for no visual assessment during a quarter shall be included with the SWPPP records as described in Record Keeping, below. Adverse conditions are those that are dangerous or create inaccessibility for personnel, such as local flooding, high winds, electrical storms, or situations that otherwise make sampling impractical such as drought or extended frozen conditions.

d) If the facility has two or more discharge points that are believed to discharge substantially identical storm water effluents, the facility may conduct visual assessments of the discharge at just one of the discharge points and report that the results also apply to the other substantially identical discharge point(s). The determination of substantially identical discharge points is to be based on the significant material evaluation conducted under Source Identification, above, and shall be clearly documented in the SWPPP. Visual assessments shall be performed on a rotating basis of each substantially identical discharge point throughout the period of coverage under this permit.

e) Within six (6) months of the effective date of this permit, the permittee shall develop procedures for conducting the visual assessment, and incorporate them into the SWPPP. The first visual assessment shall be conducted in conjunction with the next occurring comprehensive inspection. If changes resulting in altered drainage patterns occur at the facility, the permittee shall modify the procedures for conducting the visual assessment in accordance with the requirements of Keeping SWPPPs Current, below, and these modifications shall be incorporated into the SWPPP prior to conducting the next visual assessment.

d. A description of material handling procedures and storage requirements for significant materials. Equipment and procedures for cleaning up spills shall be identified in the SWPPP and made available to the appropriate personnel. The procedures shall identify measures to prevent spilled materials or material residues from contaminating storm water entering the property. The SWPPP shall include language describing what a reportable spill or release is and the appropriate reporting requirements in accordance with Part II.C.6. and Part II.C.7. The SWPPP may include, by reference, requirements of either a Pollution Incident Prevention Plan (PIPP) prepared in accordance with the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code); a Hazardous Waste Contingency Plan prepared in accordance with 40 CFR 264 and 265 Subpart D, as required by Part 111 of the NREPA; or a Spill Prevention Control and Countermeasure (SPCC) plan prepared in accordance with 40 CFR 112.

e. Identification of areas which, due to topography, activities, or other factors, have a high potential for significant soil erosion. Gravel lots shall be included. The SWPPP shall also identify measures used to control soil erosion and sedimentation.

f. A description of the employee training program that will be implemented on an annual basis to inform appropriate personnel at all levels of their responsibility as it relates to the components and goals of the SWPPP. The SWPPP shall identify periodic dates for the employee training program. Records of the employee training program shall be retained in accordance with Record Keeping, below.

g. Identification of actions to limit the discharge of significant materials in order to comply with TMDL requirements, if applicable.

h. Identification of significant materials expected to be present in storm water discharges following implementation of nonstructural preventive measures and source controls.

PART I

Section B. Storm Water Pollution Prevention Plan

4. Structural Controls

Where implementation of the measures required by Nonstructural Controls, above, does not control storm water discharges in accordance with Water Quality Standards, below, the SWPPP shall provide a description of the location, function, design criteria, and installation/construction schedule of structural controls for prevention and treatment. Structural controls may be necessary:

a. to prevent uncontaminated storm water from contacting, or being contacted by, significant materials, or

b. if preventive measures are not feasible or are inadequate to keep significant materials at the site from contaminating storm water. Structural controls shall be used to treat, divert, isolate, recycle, reuse, or otherwise manage storm water in a manner that reduces the level of significant materials in the storm water and provides compliance with water quality standards as identified in Water Quality Standards, below.

5. Keeping SWPPPs Current

a. The permittee and/or the Industrial Storm Water Certified Operator shall review the SWPPP annually after it is developed and maintain a written report of the review in accordance with Record Keeping, below. Based on the review, the permittee or the Industrial Storm Water Certified Operator shall amend the SWPPP as needed to ensure continued compliance with the terms and conditions of this permit. The written report shall be submitted to the Department on or before January 10th of each year.

b. The SWPPP developed under the conditions of a previous permit shall be amended as necessary to ensure compliance with this permit.

c. The SWPPP shall be updated or amended whenever changes at the facility have the potential to increase the exposure of significant materials to storm water, significant spills occur at the facility, or when the SWPPP is determined by the permittee or the Department to be ineffective in achieving the general objectives of controlling pollutants in storm water discharges associated with industrial activity. Updates based on increased activity or spills at the facility shall include a description of how the permittee intends to control any new sources of significant materials, or respond to and prevent spills in accordance with the requirements of this permit (see Source Identification; Nonstructural Controls; and Structural Controls, above).

d. The Department may notify the permittee at any time that the SWPPP does not meet minimum requirements of this permit. Such notification shall identify why the SWPPP does not meet minimum requirements of this permit. The permittee shall make the required changes to the SWPPP within 30 days after such notification from the Department or authorized representative and shall submit to the Department a written certification that the requested changes have been made.

e. Amendments to the SWPPP shall be signed and retained on-site with the SWPPP pursuant to Signature and SWPPP Review, below.

6. Industrial Storm Water Certified Operator Update

If the Industrial Storm Water Certified Operator is changed or an Industrial Storm Water Certified Operator is added, the permittee shall provide the name and certification number of the new Industrial Storm Water Certified Operator to the Department. If a facility has multiple Industrial Storm Water Certified Operators, the names and certification numbers of all shall be included in the SWPPP.

PART I

Section B. Storm Water Pollution Prevention Plan

7. Signature and SWPPP Review

a. The SWPPP shall be reviewed and signed by the Industrial Storm Water Certified Operator(s) and by either the permittee or an authorized representative in accordance with 40 CFR 122.22. The SWPPP and associated records shall be retained on-site at the facility that generates the storm water discharge.

b. The permittee shall make the SWPPP, reports, log books, storm water discharge sampling data (if collected), and items required by Record Keeping, below, available upon request to the Department. The Department makes the non-confidential business portions of the SWPPP available to the public.

8. Record Keeping

The permittee shall maintain records of all SWPPP-related inspection and maintenance activities. Records shall also be kept describing incidents such as spills or other discharges that can affect the quality of storm water. All such records shall be retained for three (3) years. The following records are required by this permit (see Nonstructural Controls; and Keeping SWPPPs Current, above):

a. routine preventive maintenance inspection reports

b. routine good housekeeping inspection reports

c. comprehensive site inspection reports

d. documentation of visual assessments

e. employee training records, and

f. written summaries of the annual SWPPP review.

9. Water Quality Standards

At the time of discharge, there shall be no violation of water quality standards in the receiving waters as a result of the storm water discharge. This requirement includes, but is not limited to, the following conditions:

a. In accordance with R 323.1050 of the Part 4 Rules promulgated pursuant to Part 31 of the NREPA, the receiving waters shall not have any of the following unnatural physical properties as a result of this discharge in quantities which are, or may become, injurious to any designated use: turbidity, color, oil films, floating solids, foams, settleable solids, suspended solids, or deposits.

b. Any unusual characteristics of the discharge (i.e., unnatural turbidity, color, oil film, floating solids, foams, settleable solids, suspended solids, or deposits) shall be reported <u>within 24 hours</u> to the Department, followed by a written report <u>within five (5) days</u> detailing the findings of the investigation and the steps taken to correct the condition.

c. Any pollutant for which a level of control is specified to meet a TMDL established by the Department shall be controlled at the facility so that its discharge is reduced by/to the amount specified in the TMDL.

PART I

Section B. Storm Water Pollution Prevention Plan

10. Prohibition of Non-Storm Water Discharges

Discharges of material other than storm water shall be in compliance with an NPDES permit issued for the discharge. Storm water shall be defined to include all of the following non-storm water discharges, provided pollution prevention controls for the non-storm water component are identified in the SWPPP:

a. discharges from fire hydrant flushing

b. potable water sources, including water line flushing

c. water from fire system testing and fire-fighting training without burned materials or chemical fire suppressants

d. irrigation drainage

e. lawn watering

f. routine building wash-down that does not use detergents or other compounds

g. pavement wash waters where contamination by toxic or hazardous materials has not occurred (unless all contamination by toxic or hazardous materials has been removed) and where detergents are not used

h. uncontaminated condensate from air conditioners, coolers, and other compressors and from the outside storage of refrigerated gases or liquids

i. springs

j. uncontaminated groundwater

k. foundation or footing drains where flows are not contaminated with process materials such as solvents, and

l. discharges from fire-fighting activities. Discharges from fire-fighting activities are exempted from the requirement to be identified in the SWPPP.

11. Tracer Dye Discharges

This permit does not authorize the discharge of tracer dyes without approval from the Department. Requests to discharge tracer dyes shall be submitted to the Department in accordance with Rule 1097 (R 323.1097 of the Michigan Administrative Code).

PART I

Section C. Industrial Waste Pretreatment Program

1. Industrial Waste Pretreatment Program

It is understood that the permittee does not receive the discharge of any type or quantity of substance which may cause interference with the operation of the treatment works; and, therefore, the permittee is not required to immediately develop an industrial pretreatment program in accordance with Section 307 of the Federal Act. The permittee is required to comply with Section 307 of the Federal Act upon accepting any such discharge for treatment. The permittee is required to notify the Department <u>within thirty days</u> if any user discharges or proposes to discharge such wastes to the permittee for treatment.

Under no circumstances shall the permittee allow introduction of the following wastes into the waste treatment system:

a. pollutants which cause pass through or interference

b. pollutants which create a fire hazard or explosion hazard in the sewerage system, including, but not limited to, wastestreams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 261.21

c. pollutants which will cause corrosive structural damage to the sewerage system; but in no case, discharges with pH less than 5.0, unless the works is specifically designed to accommodate such discharges

d. solid or viscous pollutants in amounts which will cause obstruction to the flow in the sewerage system resulting in interference

e. any pollutant, including oxygen demanding pollutants (BOD, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the treatment plant

f. heat in amounts which will inhibit biological activity in the treatment plant resulting in interference; but in no case, heat in such quantities that the temperature at the treatment plant exceeds 40 degrees Centigrade (104 degrees Fahrenheit) unless the Department, upon request of the permittee, approves alternate temperature limits

g. pollutants which result in the presence of toxic gases, vapors or fumes within the sewerage system in a quantity that may cause acute worker health and safety problems, and

h. any trucked or hauled pollutants, except at discharge points designated by the permittee.

If information is gained by the Department that the permittee receives or is about to receive industrial wastes, then this permit may be modified in accordance with applicable laws and rules to incorporate the requirements of Section 307 of the Federal Act.

PART I

Section D. Residuals Management Program

1. Residuals Management Program for Land Application of Biosolids

The permittee is authorized to land apply bulk biosolids or prepare bulk biosolids for land application in accordance with the permittee's approved Residuals Management Program (RMP) approved on November 6, 2000, and approved modifications thereto, in accordance with the requirements established in R323.2401 through R323.2418 of the Michigan Administrative Code (Part 24 Rules). The approved RMP, and any approved modifications thereto, are enforceable requirements of this permit. Incineration, landfilling, and other residual disposal activities shall be conducted in accordance with Part II.D.7. of this permit. The Part 24 Rules can be obtained via the internet (http://www.michigan.gov/deq/; and on the left side of the screen click on Water, Biosolids & Industrial Pretreatment, Biosolids; then click on Biosolids laws and Rules Information, which is under the Laws & Rules banner in the center of the screen).

a. Annual Report
On or before October 30 of each year, the permittee shall submit to the Biosolids Program, Water Resources Division, Department of Environmental Quality, P.O. Box 30458, Lansing, Michigan 48909-7958 for the previous fiscal year of October 1 through September 30. At a minimum, the report shall contain:

1) a certification that current residuals management practices are in accordance with the approved RMP, or a proposal for modification to the approved RMP and

2) a completed Biosolids Annual Report Form, which can be obtained via the internet (http://www.michigan.gov/deq/; and on the left side of the screen click on Water, Biosolids & Industrial Pretreatment, Biosolids; then click on Biosolids Annual Report Form, which is under the Downloads banner in the center of the screen) or from the Department.

b. Modifications to the Approved RMP
Prior to implementation of modifications to the RMP, the permittee shall submit proposed modifications to the Department for approval. The approved modification shall become effective upon the date of approval. Upon written notification, the Department may impose additional requirements and/or limitations to the approved RMP as necessary to protect public health and the environment from any adverse effect of a pollutant in the biosolids.

c. Record Retention
Records required by the Part 24 Rules shall be kept for a minimum of five years. However, the records documenting cumulative loading for sites subject to cumulative pollutant loading rates shall be kept as long as the site receives biosolids.

d. Contact Information
RMP-related submittals to the Department shall be to the Lansing District Supervisor of the Water Resources Division. The Lansing District Office is located at Constitution Hall, 1st Floor-South, 525 West Allegan, P.O. Box 30242, Lansing, Michigan 48909-7742 Telephone: 517-284-6651, Fax: 517-241-3571.

PART II

Part II may include terms and /or conditions not applicable to discharges covered under this permit.

Section A. Definitions

Acute toxic unit (TU_A) means $100/LC_{50}$ where the LC_{50} is determined from a whole effluent toxicity (WET) test which produces a result that is statistically or graphically estimated to be lethal to 50% of the test organisms.

Annual monitoring frequency refers to a calendar year beginning on January 1 and ending on December 31. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Bioaccumulative chemical of concern (BCC) means a chemical which, upon entering the surface waters, by itself or as its toxic transformation product, accumulates in aquatic organisms by a human health bioaccumulation factor of more than 1000 after considering metabolism and other physiochemical properties that might enhance or inhibit bioaccumulation. The human health bioaccumulation factor shall be derived according to R 323.1057(5). Chemicals with half-lives of less than 8 weeks in the water column, sediment, and biota are not BCCs. The minimum bioaccumulation concentration factor (BAF) information needed to define an organic chemical as a BCC is either a field-measured BAF or a BAF derived using the biota-sediment accumulation factor (BSAF) methodology. The minimum BAF information needed to define an inorganic chemical as a BCC, including an organometal, is either a field-measured BAF or a laboratory-measured bioconcentration factor (BCF). The BCCs to which these rules apply are identified in Table 5 of R 323.1057 of the Water Quality Standards.

Biosolids are the solid, semisolid, or liquid residues generated during the treatment of sanitary sewage or domestic sewage in a treatment works. This includes, but is not limited to, scum or solids removed in primary, secondary, or advanced wastewater treatment processes and a derivative of the removed scum or solids.

Bulk biosolids means biosolids that are not sold or given away in a bag or other container for application to a lawn or home garden.

Certificate of Coverage (COC) is a document, issued by the Department, which authorizes a discharge under a general permit.

Chronic toxic unit (TU_C) means 100/MATC or $100/IC_{25}$, where the maximum acceptable toxicant concentration (MATC) and IC_{25} are expressed as a percent effluent in the test medium.

Class B biosolids refers to material that has met the Class B pathogen reduction requirements or equivalent treatment by a Process to Significantly Reduce Pathogens (PSRP) in accordance with the Part 24 Rules. Processes include aerobic digestion, composting, anaerobic digestion, lime stabilization and air drying.

Combined sewer system is a sewer system in which storm water runoff is combined with sanitary wastes.

Daily concentration is the sum of the concentrations of the individual samples of a parameter divided by the number of samples taken during any calendar day. If the parameter concentration in any sample is less than the quantification limit, regard that value as zero when calculating the daily concentration. The daily concentration will be used to determine compliance with any maximum and minimum daily concentration limitations (except for pH and dissolved oxygen). When required by the permit, report the maximum calculated daily concentration for the month in the “MAXIMUM” column under “QUALITY OR CONCENTRATION” on the Discharge Monitoring Reports (DMRs).

For pH, report the maximum value of any *individual* sample taken during the month in the “MAXIMUM” column under “QUALITY OR CONCENTRATION” on the DMRs and the minimum value of any *individual* sample taken during the month in the “MINIMUM” column under “QUALITY OR CONCENTRATION” on the DMRs. For dissolved oxygen, report the minimum concentration of any *individual* sample in the “MINIMUM” column under “QUALITY OR CONCENTRATION” on the DMRs.

PART II

Section A. Definitions

Daily loading is the total discharge by weight of a parameter discharged during any calendar day. This value is calculated by multiplying the daily concentration by the total daily flow and by the appropriate conversion factor. The daily loading will be used to determine compliance with any maximum daily loading limitations. When required by the permit, report the maximum calculated daily loading for the month in the "MAXIMUM" column under "QUANTITY OR LOADING" on the DMRs.

Daily monitoring frequency refers to a 24-hour day. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Department means the Michigan Department of Environmental Quality.

Detection level means the lowest concentration or amount of the target analyte that can be determined to be different from zero by a single measurement at a stated level of probability.

Discharge means the addition of any waste, waste effluent, wastewater, pollutant, or any combination thereof to any surface water of the state.

Discharge event is a discrete occurrence during which effluent is discharged to the surface water up to 10 days of a consecutive 14 day period.

Discharge point is the location where the point source discharge is directed to surface waters of the state or to a separate storm sewer. It includes the location of all point source discharges where storm water exits the facility, including *outfalls* which discharge directly to surface waters of the state, and *points of discharge* which discharge directly into separate storm sewer systems.

EC_{50} means a statistically or graphically estimated concentration that is expected to cause 1 or more specified effects in 50% of a group of organisms under specified conditions.

Fecal coliform bacteria monthly
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – Fecal coliform bacteria monthly is the geometric mean of all daily concentrations determined during a discharge event. Days on which no daily concentration is determined shall not be used to determine the calculated monthly value. The calculated monthly value will be used to determine compliance with the maximum monthly fecal coliform bacteria limitations. When required by the permit, report the calculated monthly value in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR. If the period in which the discharge event occurred was partially in each of two months, the calculated monthly value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – Fecal coliform bacteria monthly is the geometric mean of all daily concentrations determined during a reporting month. Days on which no daily concentration is determined shall not be used to determine the calculated monthly value. The calculated monthly value will be used to determine compliance with the maximum monthly fecal coliform bacteria limitations. When required by the permit, report the calculated monthly value in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR.

PART II

Section A. Definitions

Fecal coliform bacteria 7-day
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – Fecal coliform bacteria 7-day is the geometric mean of the daily concentrations determined during any 7 consecutive days of discharge during a discharge event. If the number of daily concentrations determined during the discharge event is less than 7 days, the number of actual daily concentrations determined shall be used for the calculation. Days on which no daily concentration is determined shall not be used to determine the value. The calculated 7-day value will be used to determine compliance with the maximum 7-day fecal coliform bacteria limitations. When required by the permit, report the maximum calculated 7-day geometric mean value for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. If the 7-day period was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – Fecal coliform bacteria 7-day is the geometric mean of the daily concentrations determined during any 7 consecutive days of discharge in a reporting month. If the number of daily concentrations determined during the discharge is less than 7 days, the actual number of daily concentrations determined shall be used for the calculation. Days on which no daily concentration is determined shall not be used to determine the value. The calculated 7-day value will be used to determine compliance with the maximum 7-day fecal coliform bacteria limitations. When required by the permit, report the maximum calculated 7-day geometric mean for the month in the "MAXIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs. The first calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

Flow-proportioned sample is a composite sample with the sample volume proportional to the effluent flow.

General permit means a National Pollutant Discharge Elimination System permit issued authorizing a category of similar discharges.

Geometric mean is the average of the logarithmic values of a base 10 data set, converted back to a base 10 number.

Grab sample is a single sample taken at neither a set time nor flow.

IC_{25} means the toxicant concentration that would cause a 25% reduction in a nonquantal biological measurement for the test population.

Individual permit means a site-specific NPDES permit.

Inlet means a catch basin, roof drain, conduit, drain tile, retention pond riser pipe, sump pump, or other point where storm water or wastewater enters into a closed conveyance system prior to discharge off site or into waters of the state.

Interference is a discharge which, alone or in conjunction with a discharge or discharges from other sources, both: 1) inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and 2) therefore, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or, of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent state or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including Title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including state regulations contained in any state sludge management plan prepared pursuant to Subtitle D of the SWDA), the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act. [This definition does not apply to sample matrix interference].

Land application means spraying or spreading biosolids or a biosolids derivative onto the land surface, injecting below the land surface, or incorporating into the soil so that the biosolids or biosolids derivative can either condition the soil or fertilize crops or vegetation grown in the soil.

PART II

Section A. Definitions

LC_{50} means a statistically or graphically estimated concentration that is expected to be lethal to 50% of a group of organisms under specified conditions.

Maximum acceptable toxicant concentration (MATC) means the concentration obtained by calculating the geometric mean of the lower and upper chronic limits from a chronic test. A lower chronic limit is the highest tested concentration that did not cause the occurrence of a specific adverse effect. An upper chronic limit is the lowest tested concentration which did cause the occurrence of a specific adverse effect and above which all tested concentrations caused such an occurrence.

MGD means million gallons per day.

Monthly concentration is the sum of the daily concentrations determined during a discharge event divided by the number of daily concentrations determined. The calculated monthly concentration will be used to determine compliance with any maximum monthly concentration limitations. Days with no discharge shall not be used to determine the value. When required by the permit, report the calculated monthly concentration in the "AVERAGE" column under "QUALITY OR CONCENTRATION" on the DMR. If the seven day period was partially in each of two months, the monthly average shall be reported on the DMR of the month in which the last day of discharge occurred.

For minimum percent removal requirements, the monthly influent concentration and the monthly effluent concentration shall be determined. The calculated monthly percent removal, which is equal to 100 times the quantity [1 minus the quantity (monthly effluent concentration divided by the monthly influent concentration)], shall be reported in the "MINIMUM" column under "QUALITY OR CONCENTRATION" on the DMRs.

Monthly loading is the sum of the daily loadings of a parameter divided by the number of daily loadings determined during a discharge event. The calculated monthly loading will be used to determine compliance with any maximum monthly loading limitations. Days with no discharge shall not be used to determine the value. When required by the permit, report the calculated monthly loading in the "AVERAGE" column under "QUANTITY OR LOADING" on the DMR. If the seven day period was partially in each of two months, the monthly average shall be reported on the DMR of the month in which the last day of discharge occurred..

Monthly monitoring frequency refers to a calendar month. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

National Pretreatment Standards are the regulations promulgated by or to be promulgated by the Federal Environmental Protection Agency pursuant to Section 307(b) and (c) of the Federal Act. The standards establish nationwide limits for specific industrial categories for discharge to a POTW.

No observed adverse effect level (NOAEL) means the highest tested dose or concentration of a substance which results in no observed adverse effect in exposed test organisms where higher doses or concentrations result in an adverse effect.

Noncontact cooling water is water used for cooling which does not come into direct contact with any raw material, intermediate product, by-product, waste product or finished product.

Nondomestic user is any discharger to a POTW that discharges wastes other than or in addition to water-carried wastes from toilet, kitchen, laundry, bathing or other facilities used for household purposes.

Outfall is the location of a point source discharge where storm water or treated wastewater is discharged directly to the surface waters of the state.

Partially treated sewage is any sewage, sewage and storm water, or sewage and wastewater, from domestic or industrial sources that is treated to a level less than that required by the permittee's National Pollutant Discharge Elimination System permit, or that is not treated to national secondary treatment standards for wastewater, including discharges to surface waters from retention treatment facilities.

PART II

Section A. Definitions

Point of discharge is the location of a point source discharge where storm water is discharged directly into a separate storm sewer system.

Point source discharge means a discharge from any discernible, confined, discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, or rolling stock. Changing the surface of land or establishing grading patterns on land will result in a point source discharge where the runoff from the site is ultimately discharged to waters of the state.

Polluting material means any material, in solid or liquid form, identified as a polluting material under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code).

POTW is a publicly owned treatment works.

Pretreatment is reducing the amount of pollutants, eliminating pollutants, or altering the nature of pollutant properties to a less harmful state prior to discharge into a public sewer. The reduction or alteration can be by physical, chemical, or biological processes, process changes, or by other means. Dilution is not considered pretreatment unless expressly authorized by an applicable National Pretreatment Standard for a particular industrial category.

Quantification level means the measurement of the concentration of a contaminant obtained by using a specified laboratory procedure calculated at a specified concentration above the detection level. It is considered the lowest concentration at which a particular contaminant can be quantitatively measured using a specified laboratory procedure for monitoring of the contaminant.

Quarterly monitoring frequency refers to a three month period, defined as January through March, April through June, July through September, and October through December. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

Regional Administrator is the Region 5 Administrator, U.S. EPA, located at R-19J, 77 W. Jackson Blvd., Chicago, Illinois 60604.

Secondary containment structure means a unit, other than the primary container, in which significant materials are packaged or held, which is required by State or Federal law to prevent the escape of significant materials by gravity into sewers, drains, or otherwise directly or indirectly into any sewer system or to the surface or ground waters of this state.

Separate storm sewer system means a system of drainage, including, but not limited to, roads, catch basins, curbs, gutters, parking lots, ditches, conduits, pumping devices, or man-made channels, which is not a combined sewer where storm water mixes with sanitary wastes, and is not part of a POTW.

Significant industrial user is a nondomestic user that: 1) is subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N; or 2) discharges an average of 25,000 gallons per day or more of process wastewater to a POTW (excluding sanitary, noncontact cooling and boiler blowdown wastewater); contributes a process waste stream which makes up five (5) percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the permittee as defined in 40 CFR 403.12(a) on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's treatment plant operation or violating any pretreatment standard or requirement (in accordance with 40 CFR 403.8(f)(6)).

PART II

Section A. Definitions

Significant materials Significant Materials means any material which could degrade or impair water quality, including but not limited to: raw materials; fuels; solvents, detergents, and plastic pellets; finished materials such as metallic products; hazardous substances designated under Section 101(14) of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (see 40 CFR 372.65); any chemical the facility is required to report pursuant to Section 313 of Emergency Planning and Community Right-to-Know Act (EPCRA); polluting materials as identified under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code); Hazardous Wastes as defined in Part 111 of the NREPA; fertilizers; pesticides; and waste products such as ashes, slag, and sludge that have the potential to be released with storm water discharges.

Significant spills and significant leaks means any release of a polluting material reportable under the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code).

Stoichiometric means the quantity of a reagent calculated to be necessary and sufficient for a given chemical reaction.

Storm water means storm water runoff, snow melt runoff, surface runoff and drainage, and non-storm water included under the conditions of Part I.D.3.

SWPPP means the Storm Water Pollution Prevention Plan prepared in accordance with Part I.C. of this permit.

Tier I value means a value for aquatic life, human health or wildlife calculated under R 323.1057 of the Water Quality Standards using a tier I toxicity database.

Tier II value means a value for aquatic life, human health or wildlife calculated under R 323.1057 of the Water Quality Standards using a tier II toxicity database.

Total maximum daily loads (TMDLs) are required by the Federal Act for waterbodies that do not meet Water Quality Standards. TMDLs represent the maximum daily load of a pollutant that a waterbody can assimilate and meet Water Quality Standards, and an allocation of that load among point sources, nonpoint sources, and a margin of safety.

Toxicity reduction evaluation (TRE) means a site-specific study conducted in a stepwise process designed to identify the causative agents of effluent toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in effluent toxicity.

Water Quality Standards means the Part 4 Water Quality Standards promulgated pursuant to Part 31 of the NREPA, being R 323.1041 through R 323.1117 of the Michigan Administrative Code.

Weekly monitoring frequency refers to a calendar week which begins on Sunday and ends on Saturday. When required by this permit, an analytical result, reading, value or observation shall be reported for that period if a discharge occurs during that period.

WWSL is a wastewater stabilization lagoon.

3-portion composite sample is a sample consisting of three equal-volume grab samples collected at equal intervals over an 8-hour period.

PART II

Section A. Definitions

7-day concentration
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – The 7-day concentration is the sum of the daily concentrations determined during any 7 consecutive days of discharge during a discharge event divided by the number of daily concentrations determined. If the number of daily concentrations determined during the discharge event is less than 7 days, the number of actual daily concentrations determined shall be used for the calculation. The calculated 7-day concentration will be used to determine compliance with any maximum 7-day concentration limitations. When required by the permit, report the maximum calculated 7-day concentration for the discharge event in the “MAXIMUM” column under “QUALITY OR CONCENTRATION” on the DMR. If the discharge event was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred.

FOR ALL OTHER DISCHARGES – The 7-day concentration is the sum of the daily concentrations determined during any 7 consecutive days of discharge in a reporting month divided by the number of daily concentrations determined. If the number of daily concentrations determined during the discharge is less than 7 days, the actual number of daily concentrations determined shall be used for the calculation. The calculated 7-day concentration will be used to determine compliance with any maximum 7-day concentration limitations in the reporting month. When required by the permit, report the maximum calculated 7-day concentration for the month in the “MAXIMUM” column under “QUALITY OR CONCENTRATION” on the DMR. The first 7-day calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

7-day loading
FOR WWSLs THAT COLLECT AND STORE WASTEWATER AND ARE AUTHORIZED TO DISCHARGE ONLY IN THE SPRING AND/OR FALL ON AN INTERMITTENT BASIS – The 7-day loading is the sum of the daily loadings determined during any 7 consecutive days of discharge during a discharge event divided by the number of daily loadings determined. If the number of daily loadings determined during the discharge event is less than 7 days, the number of actual daily loadings determined shall be used for the calculation. The calculated 7-day loading will be used to determine compliance with any maximum 7-day loading limitations. When required by the permit, report the maximum calculated 7-day loading for the discharge event in the “MAXIMUM” column under “QUANTITY OR LOADING” on the DMR. If the discharge event was partially in each of two months, the value shall be reported on the DMR of the month in which the last day of discharge occurred

FOR ALL OTHER DISCHARGES – The 7-day loading is the sum of the daily loadings determined during any 7 consecutive days of discharge in a reporting month divided by the number of daily loadings determined. If the number of daily loadings determined during the discharge is less than 7 days, the actual number of daily concentrations determined shall be used for the calculation. The calculated 7-day loading will be used to determine compliance with any maximum 7-day loading limitations in the reporting month. When required by the permit, report the maximum calculated 7-day loading for the month in the “MAXIMUM” column under “QUANTITY OR LOADING” on the DMR. The first 7-day calculation shall be made on day 7 of the reporting month, and the last calculation shall be made on the last day of the reporting month.

24-hour composite sample is a flow-proportioned composite sample consisting of hourly or more frequent portions that are taken over a 24-hour period. A time-proportioned composite sample may be used upon approval of the Department if the permittee demonstrates it is representative of the discharge.

PART II

Section B. Monitoring Procedures

1. Representative Samples

Samples and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge.

2. Test Procedures

Test procedures for the analysis of pollutants shall conform to regulations promulgated pursuant to Section 304(h) of the Federal Act (40 CFR Part 136 – Guidelines Establishing Test Procedures for the Analysis of Pollutants), unless specified otherwise in this permit. **Test procedures used shall be sufficiently sensitive to determine compliance with applicable effluent limitations**. Requests to use test procedures not promulgated under 40 CFR Part 136 for pollutant monitoring required by this permit shall be made in accordance with the Alternate Test Procedures regulations specified in 40 CFR 136.4. These requests shall be submitted to the Chief of the Permits Section, Water Resources Division, Michigan Department of Environmental Quality, P.O. Box 30273, Lansing, Michigan, 48909-7773. The permittee may use such procedures upon approval.

The permittee shall periodically calibrate and perform maintenance procedures on all analytical instrumentation at intervals to ensure accuracy of measurements. The calibration and maintenance shall be performed as part of the permittee's laboratory Quality Control/Quality Assurance program.

3. Instrumentation

The permittee shall periodically calibrate and perform maintenance procedures on all monitoring instrumentation at intervals to ensure accuracy of measurements.

4. Recording Results

For each measurement or sample taken pursuant to the requirements of this permit, the permittee shall record the following information: 1) the exact place, date, and time of measurement or sampling; 2) the person(s) who performed the measurement or sample collection; 3) the dates the analyses were performed; 4) the person(s) who performed the analyses; 5) the analytical techniques or methods used; 6) the date of and person responsible for equipment calibration; and 7) the results of all required analyses.

5. Records Retention

All records and information resulting from the monitoring activities required by this permit including all records of analyses performed and calibration and maintenance of instrumentation and recordings from continuous monitoring instrumentation shall be retained for a minimum of three (3) years, or longer if requested by the Regional Administrator or the Department.

PART II

Section C. Reporting Requirements

1. Start-up Notification

If the permittee will not discharge during the first 60 days following the effective date of this permit, the permittee shall notify the Department within 14 days following the effective date of this permit, and then 60 days prior to the commencement of the discharge.

2. Submittal Requirements for Self-Monitoring Data

Part 31 of the NREPA, specifically Section 324.3110(3) and R 323.2155(2) of Part 21, allows the Department to specify the forms to be utilized for reporting the required self-monitoring data. Unless instructed on the effluent limitations page to conduct "Retained Self-Monitoring" the permittee shall submit self-monitoring data via the Department's Electronic Environmental Discharge Monitoring Reporting (e2-DMR) system.

The permittee shall utilize the information provided on the e2-Reporting website at https://secure1.state.mi.us/e2rs/ to access and submit the electronic forms. Both monthly summary and daily data shall be submitted to the Department no later than the 20th day of the month following each month of the authorized discharge period(s). The permittee may be allowed to submit the electronic forms after this date if the Department has granted an extension to the submittal date.

3. Retained Self-Monitoring Requirements

If instructed on the effluent limits page (or otherwise authorized by the Department in accordance with the provisions of this permit, to conduct retained self-monitoring, the permittee shall maintain a year-to-date log of retained self-monitoring results and, upon request, provide such log for inspection to the staff of the Department. Retained self-monitoring results are public information and shall be promptly provided to the public upon request.

The permittee shall certify, in writing, to the Department, on or before January 10th (April 1st for animal feeding operation facilities) of each year, that: 1) all retained self-monitoring requirements have been complied with and a year-to-date log has been maintained; and 2) the application on which this permit is based still accurately describes the discharge. With this annual certification, the permittee shall submit a summary of the previous year's monitoring data. The summary shall include maximum values for samples to be reported as daily maximums and/or monthly maximums and minimum values for any daily minimum samples.

Retained self-monitoring may be denied to a permittee by notification in writing from the Department. In such cases, the permittee shall submit self-monitoring data in accordance with Part II.C.2., above. Such a denial may be rescinded by the Department upon written notification to the permittee. Reissuance or modification of this permit or reissuance or modification of an individual permittee's authorization to discharge shall not affect previous approval or denial for retained self-monitoring unless the Department provides notification in writing to the permittee.

4. Additional Monitoring by Permittee

If the permittee monitors any pollutant at the location(s) designated herein more frequently than required by this permit, using approved analytical methods as specified above, the results of such monitoring shall be included in the calculation and reporting of the values required in the Discharge Monitoring Report. Such increased frequency shall also be indicated.

Monitoring required pursuant to Part 41 of the NREPA or Rule 35 of the Mobile Home Park Commission Act (Act 96 of the Public Acts of 1987) for assurance of proper facility operation shall be submitted as required by the Department.

PART II

Section C. Reporting Requirements

5. Compliance Dates Notification

Within 14 days of every compliance date specified in this permit, the permittee shall submit a *written* notification to the Department indicating whether or not the particular requirement was accomplished. If the requirement was not accomplished, the notification shall include an explanation of the failure to accomplish the requirement, actions taken or planned by the permittee to correct the situation, and an estimate of when the requirement will be accomplished. If a written report is required to be submitted by a specified date and the permittee accomplishes this, a separate written notification is not required.

6. Noncompliance Notification

Compliance with all applicable requirements set forth in the Federal Act, Parts 31 and 41 of the NREPA, and related regulations and rules is required. All instances of noncompliance shall be reported as follows:

a. 24-Hour Reporting
Any noncompliance which may endanger health or the environment (including maximum and/or minimum daily concentration discharge limitation exceedances) shall be reported, verbally, within 24 hours from the time the permittee becomes aware of the noncompliance. A written submission shall also be provided within five (5) days.

b. Other Reporting
The permittee shall report, in writing, all other instances of noncompliance not described in a. above at the time monitoring reports are submitted; or, in the case of retained self-monitoring, within five (5) days from the time the permittee becomes aware of the noncompliance.

Written reporting shall include: 1) a description of the discharge and cause of noncompliance; and 2) the period of noncompliance, including exact dates and times, or, if not yet corrected, the anticipated time the noncompliance is expected to continue, and the steps taken to reduce, eliminate and prevent recurrence of the noncomplying discharge.

7. Spill Notification

The permittee shall immediately report any release of any polluting material which occurs to the surface waters or groundwaters of the state, unless the permittee has determined that the release is not in excess of the threshold reporting quantities specified in the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code), by calling the Department at the number indicated on the second page of this permit, or if the notice is provided after regular working hours call the Department's 24-hour Pollution Emergency Alerting System telephone number, 1-800-292-4706 (calls from **out-of-state** dial 1-517-373-7660).

Within ten (10) days of the release, the permittee shall submit to the Department a full written explanation as to the cause of the release, the discovery of the release, response (clean-up and/or recovery) measures taken, and preventative measures taken or a schedule for completion of measures to be taken to prevent reoccurrence of similar releases.

PART II

Section C. Reporting Requirements

8. Upset Noncompliance Notification

If a process "upset" (defined as an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee) has occurred, the permittee who wishes to establish the affirmative defense of upset, shall notify the Department by telephone within 24 hours of becoming aware of such conditions; and within five (5) days, provide in writing, the following information:

a. that an upset occurred and that the permittee can identify the specific cause(s) of the upset;

b. that the permitted wastewater treatment facility was, at the time, being properly operated and maintained (note that an upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation); and

c. that the permittee has specified and taken action on all responsible steps to minimize or correct any adverse impact in the environment resulting from noncompliance with this permit.

No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

In any enforcement proceedings, the permittee, seeking to establish the occurrence of an upset, has the burden of proof.

9. Bypass Prohibition and Notification

a. Bypass Prohibition
Bypass is prohibited, and the Department may take an enforcement action, unless:

1) bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

2) there were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass; and

3) the permittee submitted notices as required under 9.b. or 9.c. below.

b. Notice of Anticipated Bypass
If the permittee knows in advance of the need for a bypass, it shall submit prior notice to the Department, if possible at least ten (10) days before the date of the bypass, and provide information about the anticipated bypass as required by the Department. The Department may approve an anticipated bypass, after considering its adverse effects, if it will meet the three (3) conditions listed in 9.a. above.

c. Notice of Unanticipated Bypass
The permittee shall submit notice to the Department of an unanticipated bypass by calling the Department at the number indicated on the second page of this permit (if the notice is provided after regular working hours, use the following number: 1-800-292-4706) as soon as possible, but no later than 24 hours from the time the permittee becomes aware of the circumstances.

PART II

Section C. Reporting Requirements

d. Written Report of Bypass
A written submission shall be provided within five (5) working days of commencing any bypass to the Department, and at additional times as directed by the Department. The written submission shall contain a description of the bypass and its cause; the period of bypass, including exact dates and times, and if the bypass has not been corrected, the anticipated time it is expected to continue; steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass; and other information as required by the Department.

e. Bypass Not Exceeding Limitations
The permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, but only if it also is for essential maintenance to ensure efficient operation. These bypasses are not subject to the provisions of 9.a., 9.b., 9.c., and 9.d., above. This provision does not relieve the permittee of any notification responsibilities under Part II.C.11. of this permit.

f. Definitions

1) Bypass means the intentional diversion of waste streams from any portion of a treatment facility.

2) Severe property damage means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

10. Bioaccumulative Chemicals of Concern (BCC)

Consistent with the requirements of R 323.1098 and R 323.1215 of the Michigan Administrative Code, the permittee is prohibited from undertaking any action that would result in a lowering of water quality from an increased loading of a BCC unless an increased use request and antidegradation demonstration have been submitted and approved by the Department.

11. Notification of Changes in Discharge

The permittee shall notify the Department, in writing, as soon as possible but no later than 10 days of knowing, or having reason to believe, that any activity or change has occurred or will occur which would result in the discharge of: 1) detectable levels of chemicals on the current Michigan Critical Materials Register, priority pollutants or hazardous substances set forth in 40 CFR 122.21, Appendix D, or the Pollutants of Initial Focus in the Great Lakes Water Quality Initiative specified in 40 CFR 132.6, Table 6, which were not acknowledged in the application or listed in the application at less than detectable levels; 2) detectable levels of any other chemical not listed in the application or listed at less than detection, for which the application specifically requested information; or 3) any chemical at levels greater than five times the average level reported in the complete application (see the first page of this permit, for the date(s) the complete application was submitted). Any other monitoring results obtained as a requirement of this permit shall be reported in accordance with the compliance schedules.

PART II

Section C. Reporting Requirements

12. Changes in Facility Operations

Any anticipated action or activity, including but not limited to facility expansion, production increases, or process modification, which will result in new or increased loadings of pollutants to the receiving waters must be reported to the Department by a) submission of an increased use request (application) and all information required under R 323.1098 (Antidegradation) of the Water Quality Standards or b) by notice if the following conditions are met: 1) the action or activity will not result in a change in the types of wastewater discharged or result in a greater quantity of wastewater than currently authorized by this permit; 2) the action or activity will not result in violations of the effluent limitations specified in this permit; 3) the action or activity is not prohibited by the requirements of Part II.C.10.; and 4) the action or activity will not require notification pursuant to Part II.C.11. Following such notice, the permit or, if applicable, the facility's COC may be modified according to applicable laws and rules to specify and limit any pollutant not previously limited.

13. Transfer of Ownership or Control

In the event of any change in control or ownership of facilities from which the authorized discharge emanates, the permittee shall submit to the Department 30 days prior to the actual transfer of ownership or control a written agreement between the current permittee and the new permittee containing: 1) the legal name and address of the new owner; 2) a specific date for the effective transfer of permit responsibility, coverage and liability; and 3) a certification of the continuity of or any changes in operations, wastewater discharge, or wastewater treatment.

If the new permittee is proposing changes in operations, wastewater discharge, or wastewater treatment, the Department may propose modification of this permit in accordance with applicable laws and rules.

14. Operations and Maintenance Manual

For wastewater treatment facilities that serve the public (and are thus subject to Part 41 of the NREPA), Section 4104 of Part 41 and associated Rule 2957 of the Michigan Administrative Code allow the Department to require an Operations and Maintenance (O&M) Manual from the facility. An up-to-date copy of the O&M Manual shall be kept at the facility and shall be provided to the Department upon request. The Department may review the O&M Manual in whole or in part at its discretion and require modifications to it if portions are determined to be inadequate.

At a minimum, the O&M Manual shall include the following information: permit standards; descriptions and operation information for all equipment; staffing information; laboratory requirements; record keeping requirements; a maintenance plan for equipment; an emergency operating plan; safety program information; and copies of all pertinent forms, as-built plans, and manufacturer's manuals.

Certification of the existence and accuracy of the O&M Manual shall be submitted to the Department at least sixty days prior to start-up of a new wastewater treatment facility. Recertification shall be submitted sixty days prior to start-up of any substantial improvements or modifications made to an existing wastewater treatment facility.

PART II

Section C. Reporting Requirements

15. Signatory Requirements

All applications, reports, or information submitted to the Department in accordance with the conditions of this permit, that require a signature shall be signed and certified as described in the Federal Act and the NREPA.

The Federal Act provides that any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

The NREPA (Section 3115(2)) provides that a person who at the time of the violation knew or should have known that he or she discharged a substance contrary to this part, or contrary to a permit, COC, or order issued or rule promulgated under this part, or who intentionally makes a false statement, representation, or certification in an application for or form pertaining to a permit or COC or in a notice or report required by the terms and conditions of an issued permit or COC, or who intentionally renders inaccurate a monitoring device or record required to be maintained by the Department, is guilty of a felony and shall be fined not less than $2,500.00 or more than $25,000.00 for each violation. The court may impose an additional fine of not more than $25,000.00 for each day during which the unlawful discharge occurred. If the conviction is for a violation committed after a first conviction of the person under this subsection, the court shall impose a fine of not less than $25,000.00 per day and not more than $50,000.00 per day of violation. Upon conviction, in addition to a fine, the court in its discretion may sentence the defendant to imprisonment for not more than 2 years or impose probation upon a person for a violation of this part. With the exception of the issuance of criminal complaints, issuance of warrants, and the holding of an arraignment, the circuit court for the county in which the violation occurred has exclusive jurisdiction. However, the person shall not be subject to the penalties of this subsection if the discharge of the effluent is in conformance with and obedient to a rule, order, permit, or COC of the Department. In addition to a fine, the attorney general may file a civil suit in a court of competent jurisdiction to recover the full value of the injuries done to the natural resources of the state and the costs of surveillance and enforcement by the state resulting from the violation.

16. Electronic Reporting

Upon notice by the Department that electronic reporting tools are available for specific reports or notifications, the permittee shall submit electronically all such reports or notifications as required by this permit.

PART II

Section D. Management Responsibilities

1. Duty to Comply

All discharges authorized herein shall be consistent with the terms and conditions of this permit. The discharge of any pollutant identified in this permit, more frequently than, or at a level in excess of, that authorized, shall constitute a violation of the permit.

It is the duty of the permittee to comply with all the terms and conditions of this permit. Any noncompliance with the Effluent Limitations, Special Conditions, or terms of this permit constitutes a violation of the NREPA and/or the Federal Act and constitutes grounds for enforcement action; for permit or Certificate of Coverage (COC) termination, revocation and reissuance, or modification; or denial of an application for permit or COC renewal.

It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

2. Operator Certification

The permittee shall have the waste treatment facilities under direct supervision of an operator certified at the appropriate level for the facility certification by the Department, as required by Sections 3110 and 4104 of the NREPA. Permittees authorized to discharge storm water shall have the storm water treatment and/or control measures under direct supervision of a storm water operator certified by the Department, as required by Section 3110 of the NREPA.

3. Facilities Operation

The permittee shall, at all times, properly operate and maintain all treatment or control facilities or systems installed or used by the permittee to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance includes adequate laboratory controls and appropriate quality assurance procedures.

4. Power Failures

In order to maintain compliance with the effluent limitations of this permit and prevent unauthorized discharges, the permittee shall either:

a. provide an alternative power source sufficient to operate facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit; or

b. upon the reduction, loss, or failure of one or more of the primary sources of power to facilities utilized by the permittee to maintain compliance with the effluent limitations and conditions of this permit, the permittee shall halt, reduce or otherwise control production and/or all discharge in order to maintain compliance with the effluent limitations and conditions of this permit.

5. Adverse Impact

The permittee shall take all reasonable steps to minimize or prevent any adverse impact to the surface waters or groundwaters of the state resulting from noncompliance with any effluent limitation specified in this permit including, but not limited to, such accelerated or additional monitoring as necessary to determine the nature and impact of the discharge in noncompliance.

PART II

Section D. Management Responsibilities

6. Containment Facilities

The permittee shall provide facilities for containment of any accidental losses of polluting materials in accordance with the requirements of the Part 5 Rules (R 324.2001 through R 324.2009 of the Michigan Administrative Code). For a Publicly Owned Treatment Work (POTW), these facilities shall be approved under Part 41 of the NREPA.

7. Waste Treatment Residues

Residuals (i.e. solids, sludges, biosolids, filter backwash, scrubber water, ash, grit, or other pollutants or wastes) removed from or resulting from treatment or control of wastewaters, including those that are generated during treatment or left over after treatment or control has ceased, shall be disposed of in an environmentally compatible manner and according to applicable laws and rules. These laws may include, but are not limited to, the NREPA, Part 31 for protection of water resources, Part 55 for air pollution control, Part 111 for hazardous waste management, Part 115 for solid waste management, Part 121 for liquid industrial wastes, Part 301 for protection of inland lakes and streams, and Part 303 for wetlands protection. Such disposal shall not result in any unlawful pollution of the air, surface waters or groundwaters of the state.

8. Right of Entry

The permittee shall allow the Department, any agent appointed by the Department, or the Regional Administrator, upon the presentation of credentials and, for animal feeding operation facilities, following appropriate biosecurity protocols:

a. to enter upon the permittee's premises where an effluent source is located or any place in which records are required to be kept under the terms and conditions of this permit; and

b. at reasonable times to have access to and copy any records required to be kept under the terms and conditions of this permit; to inspect process facilities, treatment works, monitoring methods and equipment regulated or required under this permit; and to sample any discharge of pollutants.

9. Availability of Reports

Except for data determined to be confidential under Section 308 of the Federal Act and Rule 2128 (R 323.2128 of the Michigan Administrative Code), all reports prepared in accordance with the terms of this permit, shall be available for public inspection at the offices of the Department and the Regional Administrator. As required by the Federal Act, effluent data shall not be considered confidential. Knowingly making any false statement on any such report may result in the imposition of criminal penalties as provided for in Section 309 of the Federal Act and Sections 3112, 3115, 4106 and 4110 of the NREPA.

10. Duty to Provide Information

The permittee shall furnish to the Department, within a reasonable time, any information which the Department may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or the facility's COC, or to determine compliance with this permit. The permittee shall also furnish to the Department, upon request, copies of records required to be kept by this permit.

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or information.

PART II

Section E. Activities Not Authorized by This Permit

1. Discharge to the Groundwaters

This permit does not authorize any discharge to the groundwaters. Such discharge may be authorized by a groundwater discharge permit issued pursuant to the NREPA.

2. POTW Construction

This permit does not authorize or approve the construction or modification of any physical structures or facilities at a POTW. Approval for the construction or modification of any physical structures or facilities at a POTW shall be by permit issued under Part 41 of the NREPA.

3. Civil and Criminal Liability

Except as provided in permit conditions on "Bypass" (Part II.C.9. pursuant to 40 CFR 122.41(m)), nothing in this permit shall be construed to relieve the permittee from civil or criminal penalties for noncompliance, whether or not such noncompliance is due to factors beyond the permittee's control, such as accidents, equipment breakdowns, or labor disputes.

4. Oil and Hazardous Substance Liability

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee may be subject under Section 311 of the Federal Act except as are exempted by federal regulations.

5. State Laws

Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation under authority preserved by Section 510 of the Federal Act.

6. Property Rights

The issuance of this permit does not convey any property rights in either real or personal property, or any exclusive privileges, nor does it authorize violation of any federal, state or local laws or regulations, nor does it obviate the necessity of obtaining such permits, including any other Department of Environmental Quality permits, or approvals from other units of government as may be required by law.

APPENDIX C: COLLECTION SYSTEM INVENTORY TABLES

Northfield Township Asset Management Plan
Gravity Main Asset Inventory

Asset ID Information				Asset Inventory Information												Inspection Data				Criticality			Asset Renewal Cost			
OBJECT ID	Facility ID	US MH	DS MH	Install Date	Street	CCTV Length	Length	Diameter	Material	US RIM	DS RIM	US Depth	DS Depth	US I.E.	DS I.E.	PACP QStr	PAPC QOM	PACP QOverall	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost	Rehab $/Ft	Rehabilitation Cost
1	SP-001	MH-165	MH-186	1979	Grove	114	126.03	8	VCP	904.360	902.07					0	0	0	2	3	1	3	$65	$8,192	$45	$5,671
2	SP-002	MH-186	MH-174	1979	Grove	396	396.00	8	VCP	902.071	900.27					0	0	0	2	3	1	3	$65	$25,740	$45	$17,820
3	SP-003	MH-174	MH-179	1979	Grove	292	315.14	8	VCP	900.268	901.06					0	3100	3100	3	4	1	4	$65	$20,484	$45	$14,181
4	SP-004	MH-160	MH-182	1979	Hickory	274	279.15	8	VCP	935.926	911.08					0	0	0	2	3	1	3	$65	$18,145	$45	$12,562
5	SP-005	MH-182	MH-185	1979	Hickory	142	144.39	8	VCP	911.079	904.03					0	0	0	2	3	1	3	$65	$9,386	$45	$6,498
6	SP-006	MH-185	MH-184	1979	Hickory	252	272.39	8	VCP	904.029	902.02					0	0	0	2	3	1	3	$65	$17,705	$45	$12,257
7	SP-007	MH-184	MH-186	1979	Grove	91	91.51	8	VCP	902.019	902.07					0	0	0	2	3	1	3	$65	$5,948	$45	$4,118
8	SP-008	MH-180	MH-177	1979	Cedarcrest	82	160.39	8	VCP	905.415	899.96					0	0	0	2	3	1	3	$65	$10,425	$45	$7,217
9	SP-009	MH-177	MH-176	1979	Cedarcrest	277	277.00	8	VCP	899.958	905.58					0	0	0	2	3	1	3	$65	$18,005	$45	$12,465
10	SP-010	MH-176	MH-165	1979	Cedarcrest	181	181.00	8	VCP	905.579	904.36					0	0	0	2	3	1	3	$65	$11,765	$45	$8,145
11	SP-011	MH-181	MH-180	1979	Cedarcrest	241	244.01	8	VCP	907.978	905.42					3100	0	3100	2	3	1	3	$65	$15,861	$45	$10,981
12	SP-012	MH-171	MH-181	1979	Cedarcrest	361	368.78	8	VCP	913.625	907.98					0	0	0	2	3	1	3	$65	$23,971	$45	$16,595
13	SP-013	MH-167	MH-178	1979	Greenwood	252	256.31	8	VCP	947.225	939.68					0	0	0	2	3	1	3	$65	$16,660	$45	$11,534
15	SP-015	MH-691	MH-187	1979	Elmcrest	211	211.00	8	VCP	901.707	901.38		13.92		887.46	0	0	0	2	3	1	3	$65	$13,715	$45	$9,495
16	SP-016	MH-066	MH-090	1974	Nine Mile	389	389.00	8	VCP	941.723	929.82					0	0	0	2	3	1	3	$65	$25,285	$45	$17,505
17	SP-017	MH-090	MH-093	1974	Nine Mile	57	61.31	8	VCP	929.819	928.06					0	0	0	2	3	1	3	$65	$3,985	$45	$2,759
18	SP-018	MH-077	MH-093	1974	Nine Mile	105	105.00	8	VCP	925.577	928.06					0	0	0	2	3	1	3	$65	$6,825	$45	$4,725
19	SP-019	MH-093	MH-089	1974		0	70.47	8	VCP	928.062	925.64					0	0	0	3	3	1	3	$65	$4,581	$45	$3,171
20	SP-020	MH-076	MH-077	1974	Nine Mile	104	118.36	8	VCP	923.669	925.58					0	0	0	2	3	1	3	$65	$7,693	$45	$5,326
21	SP-021	MH-078	MH-076	1974	Lakeview	202	202.00	8	VCP	936.312	923.67					0	0	0	2	3	1	3	$65	$13,130	$45	$9,090
22	SP-022	MH-072	MH-057	1974	9 Mile	398	398.00	8	VCP	920.115	900.81					0	0	0	2	3	1	3	$65	$25,870	$45	$17,910
23	SP-023	MH-071	MH-076	1974	Nine Mile	279	297.22	8	VCP	921.908	923.67					0	0	0	2	3	1	3	$65	$19,319	$45	$13,375
25	SP-025	MH-161	MH-166	1979	Cedarcrest	133	143.50	8	VCP	931.864	913.55					0	0	0	2	3	1	3	$65	$9,328	$45	$6,458
26	SP-026	MH-166	MH-165	1979	Cedarcrest	130	154.53	8	VCP	913.555	904.36					0	0	0	2	3	1	3	$65	$10,045	$45	$6,954
27	SP-027	MH-178	MH-181	1979	Greenwood	277	291.14	8	VCP	939.678	907.98					0	0	0	2	3	1	3	$65	$18,924	$45	$13,101
28	SP-028	MH-247	MH-253	1969	N Main	348	352.92	10	VCP	909.651	909.72	9.65	10.77	900.00	898.95	0	0	0	2	5	1	5	$75	$26,469	$50	$17,646
29	SP-029	MH-253	MH-254	1969	N Main	349	349.21	10	VCP	909.723	908.19	10.77	10.41	898.95	897.78	0	4232	4232	4	7	1	7	$75	$26,191	$50	$17,461
30	SP-030	MH-254	MH-256	1965	N Main	297	306.04	10	VCP	908.187	908.42	10.41	11.54	897.78	896.88	0	2200	2200	2	5	1	5	$75	$22,953	$50	$15,302
31	SP-031	MH-248	MH-247	1969	Fulton	120	120.86	8	VCP	910.541	909.65	9.84	9.65	900.70	900.00	0	4133	4133	4	6	1	6	$65	$7,856	$45	$5,439
32	SP-032	MH-252	MH-248	1969	Fulton	328	332.96	8	VCP	913.611	910.54	11.55	9.84	902.06	900.70	0	3200	3200	3	5	1	5	$65	$21,642	$45	$14,983
33	SP-033	MH-255	MH-252	1969	Fulton	229	300.40	8	VCP	915.262	913.61	10.80	11.55	904.46	902.06	0	3100	3100	3	5	1	5	$65	$19,526	$45	$13,518
34	SP-034	MH-162	MH-167	1979	Greenwood	362	362.00	8	VCP	959.904	947.22					0	0	0	2	3	1	3	$65	$23,530	$45	$16,290
35	SP-035		MH-162	1979		0	54.52	8	VCP		959.90					0	0	0	3	3	1	3	$65	$3,544	$45	$2,453
36	SP-036	MH-164	MH-163	1979	Nine Mile	130	184.81	8	VCP	963.567	957.48					0	0	0	2	3	1	3	$65	$12,012	$45	$8,316
37	SP-037	MH-163	MH-158	1979	Nine Mile	348	354.37	8	VCP	957.478	935.08					0	0	0	2	3	1	3	$65	$23,034	$45	$15,947
38	SP-038	MH-158	MH-169	1979	Nine Mile	111	138.80	8	VCP	935.084	927.22					0	0	0	2	3	1	3	$65	$9,022	$45	$6,246
39	SP-039	MH-169	MH-698	1979	Nine Mile	96	106.44	8	VCP	927.223	922.78					0	0	0	2	3	1	3	$65	$6,919	$45	$4,790
40	SP-040	MH-698	MH-171	1979	Nine Mile	332	334.92	8	VCP	922.780	913.63					0	0	0	2	3	1	3	$65	$21,770	$45	$15,071
41	SP-041	MH-172	MH-171	1979	Nine Mile	220	227.02	8	VCP	911.091	913.63					0	0	0	2	3	1	3	$65	$14,756	$45	$10,216
42	SP-042	MH-154	MH-156	1979	Fieldcrest	319	370.43	8	VCP	926.296	923.71					0	0	0	2	3	2	6	$65	$24,078	$45	$16,669
43	SP-043	MH-156	MH-155	1979	Fieldcrest	380	388.64	8	VCP	923.709	917.35					0	0	0	2	3	2	6	$65	$25,262	$45	$17,489
44	SP-044	MH-155	MH-173	1979	Fieldcrest	298	301.28	8	VCP	917.350	910.32					0	0	0	2	3	1	3	$65	$19,583	$45	$13,557
45	SP-045	MH-173	MH-172	1979	Fieldcrest	230	244.40	8	VCP	910.321	911.09					0	0	0	2	3	1	3	$65	$15,886	$45	$10,998
46	SP-046	MH-190	MH-189	1979	Elmcrest	157	160.58	8	VCP	918.512	901.36	7.41	9.76	911.10	891.60	0	0	0	2	3	1	3	$65	$10,438	$45	$7,226
47	SP-047	MH-179	MH-208	1979	Elmcrest	200	209.34	8	VCP	901.062	900.56					0	0	0	2	3	0	0	$65	$13,607	$45	$9,420
48	SP-048	MH-168	MH-176	1979	Cedarcrest	157	258.29	8	VCP	939.708	905.58					0	0	0	2	3	2	6	$65	$16,789	$45	$11,623
49	SP-049	MH-719	MH-247	1969	N Main	86	104.58	10	VCP	908.834	909.65	8.56	9.65	900.27	900.00	5141	3222	5141	5	7	1	7	$75	$7,844	$50	$5,229
50	SP-050	MH-720	MH-250	1969	Main St	91	117.55	8	VCP	909.772	909.87	13.29		896.48		0	4131	4131	4	6	1	6	$65	$7,641	$45	$5,290
51	SP-051	MH-250	MH-249	1969	Main St	209	214.83	8	VCP	909.867	898.60		3.42		895.18	0	0	0	2	4	1	4	$65	$13,964	$45	$9,667
52	SP-052	MH-249	MH-251	1969	Main St	255	264.73	8	VCP	898.599	906.25	3.42	12.09	895.18	894.16	0	0	0	2	4	1	4	$65	$17,207	$45	$11,913
53	SP-053	MH-251	MH-717	1969		0	18.12	8	VCP	906.246		12.09		894.16		0	0	0	3	4	1	4	$65	$1,178	$45	$815
54	SP-054		MH-717	1969		0	64.28	10	VCP					889.90		0	0	0	3	4	1	4	$75	$4,821	$50	$3,214
55	SP-055	MH-721		1969		0	46.56	8	VCP	901.366		11.29		890.08	889.09	0	0	0	3	4	1	4	$65	$3,027	$45	$2,095

Northfield Township Asset Management Plan
Gravity Main Asset Inventory

Asset ID Information				Asset Inventory Information												Inspection Data				Criticality			Asset Renewal Cost			
OBJECT ID	Facility ID	US MH	DS MH	Install Date	Street	CCTV Length	Length	Diameter	Material	US RIM	DS RIM	US Depth	DS Depth	US I.E.	DS I.E.	PACP QStr	PAPC QOM	PACP QOverall	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost	Rehab $/Ft	Rehabilitation Cost
56	SP-056	MH-240	MH-241	1969	Main St	272	272.00	8	VCP	913.410	910.454	9.67	10.45	903.74	900.00	4100	0	0	4	6	1	6	$65	$17,680	$45	$12,240
57	SP-057	MH-241	MH-242	1969	Main St	208	321.45	8	VCP	910.454	905.914	10.45	10.14	900.00	895.77	0	0	0	2	4	1	4	$65	$20,894	$45	$14,465
58	SP-058	MH-242	MH-717	1969		0	18.05	8	VCP	905.914		10.14		895.77		0	0	0	3	4	1	4	$65	$1,173	$45	$812
59	SP-059	MH-238	MH-240	1969	Main St	230	231.30	8	VCP	915.587	913.410	10.36	9.67	905.23	903.74	0	5132	5132	5	7	1	7	$65	$15,034	$45	$10,408
60	SP-060	MH-239	MH-240	1969	Main St	299	308.26	8	VCP	914.270	913.410	9.33	9.67	904.94	903.74	0	2200	2200	2	4	1	4	$65	$20,037	$45	$13,872
61	SP-061	MH-228	MH-239	1969	Main St	296	296.00	8	VCP	915.421	914.270	9.28	9.33	906.14	904.94	0	2300	2300	2	4	0	0	$65	$19,240	$45	$13,320
62	SP-062	MH-237	MH-244	1969	Crestview	296	296.67	10	VCP	911.030	906.626	11.98	9.83	899.05	896.80	0	0	0	2	4	1	4	$75	$22,250	$50	$14,834
63	SP-063	MH-244		1969	Crestview	321	321.00	10	VCP	906.626		9.83		896.80	889.84	3100	4234	4235	4	6	1	6	$75	$24,075	$50	$16,050
64	SP-064	MH-236	MH-237	1969	Todd's Lane	132	145.07	10	VCP	912.542	911.030	12.90	11.98	899.64	899.05	0	0	0	2	4	1	4	$75	$10,880	$50	$7,253
65	SP-065	MH-245	MH-236	1969	Todd's Lane	158	233.48	8	VCP	912.866	912.542	12.53	12.90	900.34	899.64	3100	4100	4131	4	6	1	6	$65	$15,176	$45	$10,507
66	SP-066	MH-233	MH-237	1969	Todds Lane	92	92.00	8	VCP	911.349	911.030	11.72	11.98	899.63	899.05	3100	2100	3121	3	5	1	5	$65	$5,980	$45	$4,140
67	SP-067	MH-221	MH-223	1969	Dort	281	281.00	8	VCP	914.312	916.863	9.64	13.44	904.67	903.42	0	0	0	2	4	1	4	$65	$18,265	$45	$12,645
68	SP-068	MH-229	MH-245	1969	Main St E side	340	340.00	10	VCP	914.844	912.866	13.42	12.53	901.42	900.34	0	0	0	2	4	1	4	$75	$25,500	$50	$17,000
69	SP-069	MH-230	MH-229	1969	Main St E side	337	349.33	10	VCP	915.537	914.844	13.10	13.42	902.44	901.42	0	4100	0	4	6	1	6	$75	$26,200	$50	$17,467
70	SP-070	MH-223	MH-230	1969	Main St E side	312	328.48	10	VCP	916.863	915.537	13.44	13.10	903.42	902.44	0	0	0	2	4	1	4	$75	$24,636	$50	$16,424
71	SP-071	MH-222	MH-223	1969		0	245.14	10	VCP	917.601	916.863	10.36	13.44	907.24	903.42	0	0	0	3	4	1	4	$75	$18,386	$50	$12,257
72	SP-072	MH-203	MH-221	1969	Dort	242	242.00	8	VCP	913.865	914.312	8.22	9.64	905.65	904.67	3100	3100	3200	3	5	1	5	$65	$15,730	$45	$10,890
73	SP-073	MH-224	MH-227	1969	Mapledale	300	300.00	8	VCP	911.995	911.759	9.90	10.86	902.10	900.90	0	3100	3100	2	4	1	4	$65	$19,500	$45	$13,500
74	SP-074	MH-227	MH-236	1969	Mapledale	300	300.00	8	VCP	911.759	912.542	10.86	12.90	900.90	899.64	0	3300	3300	3	5	1	5	$65	$19,500	$45	$13,500
75	SP-075	MH-225	MH-233	1969	Elmdale	347	349.43	8	VCP	912.027	911.349	10.96	11.72	901.07	899.63	3100	0	3100	3	5	1	5	$65	$22,713	$45	$15,724
76	SP-076	MH-226	MH-225	1969	Elmdale	337	337.00	8	VCP	912.404	912.027	9.97	10.96	902.43	901.07	0	0	0	2	4	1	4	$65	$21,905	$45	$15,165
77	SP-077	MH-232	MH-231	1969		0	224.45	8	VCP	907.997	899.486	11.99	4.36	896.01	895.13	0	0	0	3	4	1	4	$65	$14,589	$45	$10,100
78	SP-078	MH-231	MH-235	1969	Kenton	215	215.00	8	VCP	899.486	898.842	4.36	5.80	895.13	893.04	0	0	0	2	4	1	4	$65	$13,975	$45	$9,675
79	SP-079	MH-235	MH-246	1969	Kenton	254	254.00	8	PVC	898.842	898.175	5.80	7.14	893.04	891.03	0	0	0	2	3	2	6	$65	$16,510	$45	$11,430
80	SP-080	MH-246	MH-721	1969	Kenton		224.65	8	VCP	898.175	901.366	7.14	11.29	891.03	890.08	0	4100	4100	4	6	3	18	$65	$14,602	$45	$10,109
81	SP-081	MH-217	MH-216	1969		0	78.39	8	VCP	910.533	910.733	8.38	10.22	902.15	900.51	0	0	0	3	4	1	4	$65	$5,095	$45	$3,528
82	SP-082	MH-216	MH-232	1969		0	86.09	8	VCP	910.733	907.997	10.22	11.99	900.51	896.01	0	0	0	3	4	1	4	$65	$5,596	$45	$3,874
83	SP-083	MH-722	MH-234	1969	Todds Lane	205	208.76	8	VCP	913.180	910.398	10.12	8.90	903.06	901.50	0	0	0	2	4	1	4	$65	$13,570	$45	$9,394
84	SP-084	MH-234	MH-233	1969	Todds Lane	212	247.58	8	VCP	910.398	911.349	8.90	11.72	901.50	899.63	0	3200	3200	3	5	1	5	$65	$16,093	$45	$11,141
86	SP-086	MH-219	MH-722	1969	Todds Lane	215	215.00	8	VCP	916.911	913.180	11.53	10.12	905.38	903.06	0	0	0	2	4	2	8	$65	$13,975	$45	$9,675
87	SP-087	MH-210	MH-213	1969	Northshore	306	306.00	8	VCP	900.909	905.886	7.69	13.89	893.22	892.00	0	0	0	2	4	1	4	$65	$19,890	$45	$13,770
88	SP-088	MH-213	MH-220	1969	Northshore	123	129.00	8	VCP	905.886	908.767	13.89	17.28	892.00	891.49	0	0	0	2	4	1	4	$65	$8,385	$45	$5,805
89	SP-089	MH-220	MH-218	1969	Northshore	197	202.15	8	VCP	908.767	909.698	17.28	19.20	891.49	890.50	3100	0	3100	3	5	1	5	$65	$13,139	$45	$9,097
90	SP-090	MH-218	MH-716	1969		0	33.12	8	VCP	909.698		19.20		890.50		0	0	0	3	4	1	4	$65	$2,153	$45	$1,491
91	SP-091	MH-209	MH-210	1969	Northshore	187	189.37	8	VCP	905.269	900.909	11.29	7.69	893.98	893.22	0	0	0	2	4	1	4	$65	$12,309	$45	$8,522
92	SP-092	MH-201	MH-209	1969	Northshore	271	278.66	8	VCP	908.056	905.269	12.96	11.29	895.10	893.98	0	3100	3100	2	4	1	4	$65	$18,113	$45	$12,540
93	SP-093	MH-202	MH-204	1969	Northshore	122	122.00	8	VCP	909.370	911.240	12.53	14.88	896.84	896.36	0	0	0	2	4	1	4	$65	$7,930	$45	$5,490
94	SP-094	MH-211	MH-209	1969	Northshore	105	105.00	8	VCP	901.518	905.269		11.29		893.98	0	0	0	2	4	1	4	$65	$6,825	$45	$4,725
95	SP-095	MH-204	MH-205	1969	Northshore	111	134.26	8	VCP	911.240	913.124	14.88	17.20	896.36	895.92	0	0	0	2	4	1	4	$65	$8,727	$45	$6,042
96	SP-096	MH-545	MH-546	1976	Beachway	166	176.16	8	VCP	904.814	906.079	7.09	9.06	897.72	897.02	0	0	0	2	3	2	6	$65	$11,450	$45	$7,927
97	SP-097	MH-546	MH-540	1976	Beachway	221	221.00	8	VCP	906.079	907.622	9.06	11.46	897.02	896.16	0	0	0	2	3	1	3	$65	$14,365	$45	$9,945
98	SP-098	MH-540	MH-538	1976	Beachway	399	416.17	8	VCP	907.622	907.266	11.46	12.87	896.16	894.40	0	0	0	2	4	1	4	$65	$27,051	$45	$18,728
99	SP-099	MH-538	MH-518	1976	Beachway	90	101.62	12	RCP	907.266	903.486	12.87	9.29	894.40	894.20	0	3100	0	2	3	3	9	$85	$8,638	$50	$5,081
100	SP-100	MH-518	MH-516	1976	Beachway	203	203.00	12	RCP	903.486	899.792	9.29	6.04	894.20	893.75	0	0	0	2	3	3	9	$85	$17,255	$50	$10,150
101	SP-101	MH-537	MH-538	1976	Grove	261	291.84	12	RCP	907.908	907.266		12.87		894.40	0	3100	0	2	3	2	6	$85	$24,806	$50	$14,592
102	SP-102	MH-542	MH-537	1976	Grove	121	121.00	12	RCP	903.868	907.908					0	0	0	2	2	3	6	$85	$10,285	$50	$6,050
103	SP-103	MH-547	MH-541	1976	Delaware	310	332.19	10	VCP	909.326	911.430					0	3400	3400	3	4	1	4	$75	$24,914	$50	$16,609
104	SP-104	MH-541	MH-539	1976	Delaware	189	407.53	8	VCP	911.430	905.415					0	0	0	2	3	1	3	$65	$26,490	$45	$18,339
105	SP-105	MH-539	MH-538	1976	Shady Ln	250	250.95	8	VCP	905.415	907.266		12.87		894.40	0	0	0	2	4	1	4	$65	$16,312	$45	$11,293
106	SP-106	MH-599	MH-598	1976	6mile	101	100.31	8	PVC	911.097	910.444	9.50		901.60		0	3200	3200	3	3	1	3	$65	$6,520	$45	$4,514
107	SP-107	MH-598	MH-597	1976	6mile	105	115.77	8	VCP	910.444	908.324		7.69		900.63	0	0	0	2	3	1	3	$65	$7,525	$45	$5,210
108	SP-108	MH-597	MH-596	1976	6mile	346	347.31	8	DI	908.324	908.123	7.69	8.87	900.63	899.25	0	3100	3100	3	3	1	3	$65	$22,575	$45	$15,629
109	SP-109	MH-596	MH-589	1976	6mile	196	196.20	8	VCP	908.123	910.292	8.87	11.99	899.25	898.30	0	0	0	2	3	1	3	$65	$12,753	$45	$8,829

Northfield Township Asset Management Plan
Gravity Main Asset Inventory

Asset ID Information				Asset Inventory Information												Inspection Data				Criticality			Asset Renewal Cost			
OBJECT ID	Facility ID	US MH	DS MH	Install Date	Street	CCTV Length	Length	Diameter	Material	US RIM	DS RIM	US Depth	DS Depth	US I.E.	DS I.E.	PACP QStr	PAPC QOM	PACP QOverall	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost	Rehab $/Ft	Rehabilitation Cost
110	SP-110	MH-589	MH-588	1976	Shady Beach	229	229.00	10	VCP	910.292	911.899	11.99	14.28	898.30	897.62	0	0	0	2	4	1	4	$75	$17,175	$50	$11,450
111	SP-111	MH-584	MH-583	1976	Edmund	150	168.58	8	VCP	911.866	909.003	10.47	9.31	901.40	899.69	0	0	0	2	3	1	3	$65	$10,957	$45	$7,586
112	SP-112	MH-583	MH-582	1976	Edmund	103	103.00	8	VCP	909.003	903.029	9.31	3.79	899.69	899.24	0	0	0	2	3	1	3	$65	$6,695	$45	$4,635
113	SP-113	MH-582	MH-590	1976	Edmund	164	164.00	8	VCP	903.029	912.322	3.79	13.58	899.24	898.74	0	0	0	2	3	2	6	$65	$10,660	$45	$7,380
114	SP-114	MH-590	MH-588	1976	Edmund	191	245.42	8	VCP	912.322	911.899	13.58	14.28	898.74	897.62	0	0	0	2	4	2	8	$65	$15,952	$45	$11,044
115	SP-115	MH-588	MH-587	1976	Shady Beach	255	279.29	10	VCP	911.899	910.239	14.28	13.38	897.62	896.86	0	0	0	2	4	1	4	$75	$20,947	$50	$13,965
116	SP-116	MH-585	MH-591	1976	Edmund	152	162.51	8	VCP	905.925	901.959		11.19		890.77	0	0	0	2	3	1	3	$65	$10,563	$45	$7,313
117	SP-117	MH-587	MH-586	1976	Shady Beach	35	165.97	12	DI	910.239	905.569	13.38	9.24	896.86	896.33	0	0	0	2	3	2	6	$85	$14,108	$50	$8,299
118	SP-118	MH-605	MH-606	1976		0	151.00	8	VCP	911.711	915.594	7.21	11.68	904.50	903.91	0	0	0	3	3	1	3	$65	$9,815	$45	$6,795
119	SP-119	MH-606	MH-600	1976	Dartmoor	77	402.67	8	VCP	915.594	913.407	11.68	11.10	903.91	902.31	0	0	0	2	3	1	3	$65	$26,174	$45	$18,120
120	SP-120	MH-600	MH-587	1976	Shady Beach	388	402.67	8	VCP	913.407	910.239	11.10	13.38	902.31	896.86	0	0	0	2	4	1	4	$65	$26,174	$45	$18,120
121	SP-121	MH-603	MH-594	1976	Fairmont	391	398.64	8	VCP	909.046	910.702	5.75	8.82	903.30	901.88	3100	3100	3200	3	6	1	6	$65	$25,912	$45	$17,939
122	SP-122	MH-594	MH-595	1976	Fairmont	280	286.90	8	VCP	910.702	909.106	8.82	9.98	901.88	899.13	0	0	0	2	3	1	3	$65	$18,648	$45	$12,910
123	SP-123	MH-595	MH-580	1976	Fairmount	217	395.62	8	VCP	909.106	904.538	9.98	8.31	899.13	896.23	4100	4100	4200	4	6	2	12	$65	$25,715	$45	$17,803
124	SP-124	MH-604	MH-602	1976	Glenmoor	299	299.00	8	PVC	907.093	910.794	3.11	8.59	903.98	902.20	0	3100	3100	3	3	1	3	$65	$19,435	$45	$13,455
125	SP-125	MH-602	MH-593	1976	Glenmoor	405	418.77	8	VCP	910.794	908.934	8.59	9.33	902.20	899.60	0	0	0	2	3	1	3	$65	$27,220	$45	$18,845
126	SP-126	MH-593	MH-579	1976	Glenmoor	280	412.65	8	VCP	908.934	902.471	9.33	6.64	899.60	895.83	0	4100	0	4	5	2	10	$65	$26,822	$45	$18,569
127	SP-127	MH-601	MH-592	1976	Maplegrove	373	382.56	8	VCP	909.587	913.739	7.59	13.19	902.00	900.55	0	0	0	2	3	1	3	$65	$24,866	$45	$17,215
128	SP-128	MH-592	MH-607	1976	Maplegrove	295	294.39	8	VCP	913.739	905.286	13.19	8.63	900.55	896.66	0	0	0	2	4	2	8	$65	$19,135	$45	$13,247
129	SP-129	MH-607	MH-578	1976	Maplegrove	56	83.55	8	VCP	905.286	901.578	8.63	6.07	896.66	895.51	0	0	0	2	4	2	8	$65	$5,431	$45	$3,760
130	SP-130	MH-478	MH-477	1976		0	107.31	8	VCP	914.784	916.001	6.70	7.94	908.08	908.06	0	0	0	3	3	3	9	$65	$6,975	$45	$4,829
131	SP-131	MH-477	MH-479	1976		0	230.39	8	VCP	916.001	915.797	7.94	8.03	908.06	907.77	0	0	0	3	3	1	3	$65	$14,976	$45	$10,368
132	SP-132	MH-479	MH-485	1976		0	311.48	8	VCP	915.797	901.673	8.03	4.86	907.77	896.81	0	0	0	3	3	2	6	$65	$20,246	$45	$14,017
133	SP-133	MH-480	MH-489	1976		0	367.45	8	VCP	901.924	902.035	4.06	5.38	897.86	896.66	0	0	0	3	3	2	6	$65	$23,884	$45	$16,535
134	SP-134	MH-489	MH-487	1976		0	159.78	8	VCP	902.035	900.451	5.38	4.45	896.66	896.00	0	0	0	3	3	2	6	$65	$10,386	$45	$7,190
135	SP-135	MH-511	MH-502	1976		0	361.99	8	VCP	900.664	903.632	6.10	10.50	894.56	893.13	0	0	0	3	3	3	9	$65	$23,530	$45	$16,290
136	SP-136	MH-502	MH-515	1976		0	330.63	8	VCP	903.632	900.675	10.50	8.99	893.13	891.68	0	0	0	3	3	2	6	$65	$21,491	$45	$14,878
137	SP-137	MH-515	MH-483	1976		0	398.97	8	VCP	900.675	901.301	8.99	11.30	891.68	890.00	0	0	0	3	3	2	6	$65	$25,933	$45	$17,954
138	SP-138	MH-483	MH-482	1976		0	165.31	8	VCP	901.301	899.985	11.30	10.76	890.00	889.23	0	0	0	3	3	2	6	$65	$10,745	$45	$7,439
139	SP-139	MH-728	MH-481	1976		0	56.44	8	VCP		899.988		9.34		890.65	0	0	0	3	3	2	6	$65	$3,668	$45	$2,540
140	SP-140	MH-513	MH-515	1978		0	97.05	8	VCP	901.815	900.675	9.55	8.99	892.26	891.68	0	0	0	3	3	3	9	$65	$6,308	$45	$4,367
141	SP-141	MH-514	MH-513	1978		0	251.97	8	VCP	898.383	901.815	4.88	9.55	893.50	892.26	0	0	0	3	2	3	6	$65	$16,378	$45	$11,339
142	SP-142	MH-484	MH-482	1978		0	210.64	8	VCP	898.818	899.985	8.54	10.76	890.28	889.23	0	0	0	3	2	2	4	$65	$13,692	$45	$9,479
143	SP-143	MH-503	MH-502	1978		0	255.22	8	VCP	900.055	903.632	5.98	10.50	894.08	893.13	0	0	0	3	3	2	6	$65	$16,589	$45	$11,485
144	SP-144	MH-504	MH-503	1978		0	228.47	8	VCP	902.098	900.055	7.11	5.98	894.99	894.08	0	0	0	3	3	3	9	$65	$14,851	$45	$10,281
145	SP-145	MH-505	MH-503	1978		0	170.56	8	VCP	899.915	900.055	5.05	5.98	894.86	894.08	0	0	0	3	2	2	4	$65	$11,086	$45	$7,675
146	SP-146	MH-481	MH-488	1976		0	292.87	8	VCP	899.988	899.253	9.34	5.53	890.65	893.72	0	0	0	3	3	2	6	$65	$19,037	$45	$13,179
147	SP-147	MH-488	MH-487	1976		0	284.19	8	VCP	899.253	900.451	5.53	4.45	893.72	896.00	0	0	0	3	3	2	6	$65	$18,473	$45	$12,789
148	SP-148	MH-487	MH-486	1976		0	178.38	8	VCP	900.451	902.216	4.45	5.47	896.00	896.75	0	0	0	3	3	2	6	$65	$11,595	$45	$8,027
149	SP-149	MH-486	MH-485	1976		0	80.83	8	VCP	902.216	901.673	5.47	4.86	896.75	896.81	0	0	0	3	3	2	6	$65	$5,254	$45	$3,637
150	SP-150	MH-485	MH-554	1976		0	313.36	10	VCP	901.673	900.580	4.86	5.18	896.81	895.40	0	0	0	3	3	3	9	$75	$23,502	$50	$15,668
151	SP-151	MH-566	MH-563	1976		0	315.95	8	VCP	912.238	913.864		9.63		904.23	0	0	0	3	3	1	3	$65	$20,537	$45	$14,218
152	SP-152	MH-549	MH-552	1976		0	505.90	8	VCP	910.588	913.552	2.50	7.44	908.09	906.11	0	0	0	3	3	1	3	$65	$32,883	$45	$22,765
153	SP-153	MH-552	MH-563	1979		0	545.56	8	VCP	913.552	913.864	7.44	9.63	906.11	904.23	0	0	0	3	3	1	3	$65	$35,461	$45	$24,550
154	SP-154	MH-563	MH-562	1976	6mile	83	117.58	8	VCP	913.864	914.052	9.63	10.34	904.23	903.71	0	0	0	2	3	1	3	$65	$7,642	$45	$5,291
155	SP-155	MH-562	MH-561	1976		0	45.30	8	VCP	914.052	913.979	10.34	10.47	903.71	903.51	0	0	0	3	3	1	3	$65	$2,945	$45	$2,039
156	SP-156	MH-561	MH-565	1976	6mile	41	42.29	8	DI	913.979	913.885	10.47	10.57	903.51	903.32	0	0	0	2	2	1	2	$65	$2,749	$45	$1,903
157	SP-157	MH-573	MH-565	1995	Weinger	238	244.02	8	PVC	913.692	913.885	9.36	10.57	904.33	903.32	0	3100	3100	3	3	1	3	$65	$15,862	$45	$10,981
158	SP-158	MH-565	MH-558	1976	6mile	292	292.00	8	VCP	913.885	914.766	10.57	12.60	903.32	902.17	3100	0	3100	3	4	1	4	$65	$18,980	$45	$13,140
159	SP-159	MH-560	MH-559	1976	Leonard	188	198.77	8	PVC	911.622	913.891	8.47	11.59	903.15	902.30	0	0	0	2	2	1	2	$65	$12,920	$45	$8,945
160	SP-160	MH-559	MH-558	1976	Leonard	90	99.57	8	PVC	913.891	914.766	11.59	12.60	902.30	902.17	0	0	0	2	2	2	4	$65	$6,472	$45	$4,480
161	SP-161	MH-558	MH-557	1976		0	285.85	8	VCP	914.766	915.753	12.60	14.34	902.17	901.41	0	0	0	3	3	1	3	$65	$18,580	$45	$12,863
162	SP-162	MH-557	MH-556	1976		0	254.50	8	VCP	915.753	903.404	14.34	5.34	901.41	898.06	0	0	0	3	3	3	9	$65	$16,543	$45	$11,453

Northfield Township Asset Management Plan
Gravity Main Asset Inventory

Asset ID Information				Asset Inventory Information												Inspection Data				Criticality			Asset Renewal Cost			
OBJECT ID	Facility ID	US MH	DS MH	Install Date	Street	CCTV Length	Length	Diameter	Material	US RIM	DS RIM	US Depth	DS Depth	US I.E.	DS I.E.	PACP QStr	PAPC QOM	PACP QOverall	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost	Rehab $/Ft	Rehabilitation Cost
163	SP-163	MH-553	MH-554	2000		0	28.18	8	PVC	902.311	900.580	6.91	5.18	895.40	895.40	0	0	0	3	3	3	9	$65	$1,832	$45	$1,268
164	SP-164	MH-564	MH-572	1976	6mile	275	280.86	8	VCP	908.851	912.398	6.80	11.46	902.06	900.94	0	0	0	2	3	1	3	$65	$18,256	$45	$12,639
165	SP-165	MH-572	MH-571	1976	Six Mile	182	188.25	8	VCP	912.398	918.387	11.46	18.21	900.94	900.18	0	0	0	2	3	1	3	$65	$12,236	$45	$8,471
166	SP-166	MH-571	MH-575	1976	Six Mile	50	203.35	8	VCP	918.387	911.763	18.21	14.17	900.18	897.59	0	0	0	2	3	1	3	$65	$13,218	$45	$9,151
167	SP-167	MH-575	MH-574	1976		0	336.07	8	VCP	911.763	901.803	14.17	8.13	897.59	893.67	0	0	0	3	3	2	6	$65	$21,844	$45	$15,123
168	SP-168	MH-574	MH-576	1976	Oliver	380	380.00	8	VCP	901.803	898.505	8.13	6.46	893.67	892.04	0	4100	4100	4	5	2	10	$65	$24,700	$45	$17,100
169	SP-169	MH-625	MH-626	1978	6mile	243	243.95	8	VCP	906.591	908.409	4.37	7.30	902.22	901.11	0	0	0	2	3	1	3	$65	$15,857	$45	$10,978
170	SP-170	MH-626	MH-693	1978	Coyle	164	170.33	8	VCP	908.409	908.672	7.30	8.28	901.11	900.39	0	0	0	2	3	1	3	$65	$11,072	$45	$7,665
171	SP-171	MH-624	MH-623	1978	Coyle	384	384.00	8	VCP	907.109	908.913	7.54	11.05	899.57	897.86	0	0	0	2	3	1	3	$65	$24,960	$45	$17,280
172	SP-172	MH-615	MH-621	1978		0	216.18	8	VCP	905.073	910.201	4.52	10.30	900.55	899.90	0	0	0	3	3	1	3	$65	$14,052	$45	$9,728
173	SP-173	MH-621	MH-620	1978		0	205.75	8	VCP	910.201	909.584	10.30	10.66	899.90	898.92	0	0	0	3	3	1	3	$65	$13,373	$45	$9,259
174	SP-174	MH-620	MH-623	1978	Delaware	127	127.00	8	VCP	909.584	908.913	10.66	11.05	898.92	897.86	0	0	0	2	3	2	6	$65	$8,255	$45	$5,715
175	SP-175	MH-623	MH-617	1978	Coyle	298	305.19	8	VCP	908.913	910.469	11.05	13.53	897.86	896.94	0	0	0	2	3	1	3	$65	$19,837	$45	$13,733
176	SP-176	MH-614	MH-618	1978	Beachway	299	298.59	8	VCP	907.097	908.008	8.00	10.23	899.10	897.78	3100	3200	3300	3	5	1	5	$65	$19,408	$45	$13,436
177	SP-177	MH-618	MH-617	1978	Beachway	137	143.20	8	VCP	908.008	910.469	10.23	13.53	897.78	896.94	0	0	0	2	3	1	3	$65	$9,308	$45	$6,444
178	SP-178	MH-617	MH-611	1978	Coyle	335	336.61	8	VCP	910.469	912.013	13.53	16.05	896.94	895.96	0	0	0	2	4	1	4	$65	$21,880	$45	$15,147
179	SP-179	MH-613	MH-612	1978	Elm	204	204.00	8	VCP	907.710	909.508	6.84	10.87	900.87	898.64	0	0	0	2	3	1	3	$65	$13,260	$45	$9,180
180	SP-180	MH-612	MH-611	1978	Elm	95	98.11	8	VCP	909.508	912.013	10.87	16.05	898.64	895.96	0	0	0	2	4	1	4	$65	$6,377	$45	$4,415
181	SP-181	MH-611	MH-608	1978	Coyle	300	310.85	8	VCP	912.013	912.112	16.05	17.07	895.96	895.04	0	0	0	2	4	1	4	$65	$20,205	$45	$13,988
182	SP-182	MH-627	MH-608	1978	Grove	161	161.00	8	VCP	909.526	912.112	4.47	17.07	905.06	895.04	0	0	0	2	3	1	3	$65	$10,465	$45	$7,245
183	SP-183	MH-608	MH-544	1978	Coyle	321	325.60	8	VCP	912.112	912.056	17.07	17.92	895.04	894.14	0	0	0	2	4	1	4	$65	$21,164	$45	$14,652
184	SP-184	MH-544	MH-543	1978	Coyle	308	328.77	10	DI	912.056	905.276	17.92	15.57	894.14	889.71	0	0	0	2	3	2	6	$75	$24,658	$50	$16,438
185	SP-185		MH-469	1990		0	117.06	8	PVC		906.015		7.35	899.53	898.66	0	0	0	3	2	1	2	$65	$7,609	$45	$5,268
186	SP-186	MH-469	MH-465	1990		0	311.99	10	PVC	906.015	907.971	7.35	11.07	898.66	896.90	0	0	0	3	2	1	2	$75	$23,400	$50	$15,600
187	SP-187	MH-465	MH-466	1990		0	302.43	10	PVC	907.971	907.097	11.07	11.28	896.90	895.82	0	0	0	3	2	1	2	$75	$22,682	$50	$15,121
188	SP-188	MH-466	MH-464	1990		0	105.21	10	PVC	907.097	906.763	11.28	11.22	895.82	895.54	0	0	0	3	2	1	2	$75	$7,890	$50	$5,260
189	SP-189	MH-464	MH-463	1990		0	192.77	10	PVC	906.763	906.126	11.22	11.13	895.54	895.00	0	0	0	3	2	1	2	$75	$14,458	$50	$9,639
190	SP-190	MH-463	MH-456	1990		0	209.83	10	PVC	906.126	905.155	11.13	10.70	895.00	894.46	0	0	0	3	2	1	2	$75	$15,737	$50	$10,491
191	SP-191	MH-456	MH-455	1990		0	401.29	10	PVC	905.155	903.117	10.70	9.12	894.46	894.00	0	0	0	3	2	1	2	$75	$30,097	$50	$20,064
192	SP-192	MH-455	MH-451	1990		0	404.13	10	PVC	903.117	907.209	9.12	13.91	894.00	893.30	0	0	0	3	2	1	2	$75	$30,310	$50	$20,207
193	SP-193	MH-451	MH-474	1990		0	294.77	10	PVC	907.209	905.606	13.91	12.68	893.30	892.93	0	0	0	3	2	1	2	$75	$22,108	$50	$14,739
194	SP-194	MH-474	MH-427	1990		0	66.89	10	PVC	905.606	904.808	12.68	11.97	892.93	892.84	0	0	0	3	2	1	2	$75	$5,017	$50	$3,345
195	SP-195	MH-427	MH-426	1990		0	381.04	10	PVC	904.808	904.148	11.97	12.35	892.84	891.80	0	0	0	3	2	1	2	$75	$28,578	$50	$19,052
196	SP-196	MH-426	MH-425	1990		0	31.93	10	PVC	904.148	905.136	12.35	13.39	891.80	891.75	0	0	0	3	2	1	2	$75	$2,395	$50	$1,597
197	SP-197	MH-425	MH-421	1990		0	364.26	10	PVC	905.136	905.469	13.39	15.67	891.75	889.80	0	0	0	3	3	1	3	$75	$27,319	$50	$18,213
198	SP-198	MH-421	MH-419	1990		0	358.27	10	PVC	905.469	907.086	15.67	18.73	889.80	888.36	0	0	0	3	3	1	3	$75	$26,870	$50	$17,913
199	SP-199	MH-419	MH-418	1990		0	56.31	10	PVC	907.086	906.765	18.73	18.63	888.36	888.14	0	0	0	3	3	1	3	$75	$4,223	$50	$2,816
200	SP-200	MH-418	MH-410	1965		0	234.81	10	VCP	906.765	906.616	18.63	21.47	888.14	885.15	0	0	0	3	5	1	5	$75	$17,611	$50	$11,741
201	SP-201	MH-409	MH-410	1965		0	157.81	18	VCP	899.824	906.616	14.34	21.47	885.48	885.15	0	0	0	3	4	5	20	$135	$21,304	$85	$13,414
202	SP-202	MH-408	MH-409	1965		0	154.96	18	VCP	897.845	899.824	12.11	14.34	885.73	885.48	0	0	0	3	4	4	16	$135	$20,920	$85	$13,172
203	SP-203	MH-406	MH-408	1965		0	108.60	18	VCP	898.860	897.845	12.96	12.11	885.90	885.73	0	0	0	3	4	4	16	$135	$14,661	$85	$9,231
204	SP-204	MH-431	MH-435	1993	Wild Wood	98	98.03	8	PVC	907.983	908.529					0	0	0	2	2	1	2	$65	$6,372	$45	$4,411
205	SP-205	MH-432	MH-435	1993	Wild Wood	67	71.32	8	PVC	907.951	908.529					0	0	0	2	2	1	2	$65	$4,636	$45	$3,210
206	SP-206	MH-435	MH-434	1993	Summerland	347	347.91	8	PVC	908.529	908.879					0	0	0	2	2	1	2	$65	$22,614	$45	$15,656
207	SP-207	MH-434	MH-412	1993	Summerland	378	383.02	8	PVC	908.879	909.371					0	0	0	2	2	1	2	$65	$24,897	$45	$17,236
208	SP-208	MH-412	MH-430	1993	Summerland	373	374.03	8	PVC	909.371	907.767					0	0	0	2	2	1	2	$65	$24,312	$45	$16,831
209	SP-209	MH-430	MH-420	1993		0	150.63	10	PVC	907.767	906.208					0	0	0	3	2	0	0	$75	$11,297	$50	$7,531
210	SP-210	MH-420	MH-419	1993		0	60.96	10	PVC	906.208	907.086		18.73		888.36	0	0	0	3	2	1	2	$75	$4,572	$50	$3,048
211	SP-211	MH-460	MH-470	2002		0	223.39	8	PVC	910.786	909.257					0	0	0	3	2	1	2	$65	$14,520	$45	$10,052
212	SP-212	MH-470	MH-468	2002		0	256.20	8	PVC	909.257	911.898					0	0	0	3	2	1	2	$65	$16,653	$45	$11,529
213	SP-213	MH-468	MH-467	2002		0	257.57	8	PVC	911.898	907.725					0	0	0	3	2	1	2	$65	$16,742	$45	$11,591
214	SP-214	MH-467	MH-463	2002		0	96.32	8	PVC	907.725	906.126		11.13		895.00	0	0	0	3	2	1	2	$65	$6,261	$45	$4,334
215	SP-215	MH-458	MH-457	2002	Amber	160	222.02	8	VCP	908.181	908.907					0	0	0	2	2	1	2	$65	$14,431	$45	$9,991

Northfield Township Asset Management Plan
Gravity Main Asset Inventory

Asset ID Information				Asset Inventory Information												Inspection Data				Criticality			Asset Renewal Cost			
OBJECT ID	Facility ID	US MH	DS MH	Install Date	Street	CCTV Length	Length	Diameter	Material	US RIM	DS RIM	US Depth	DS Depth	US I.E.	DS I.E.	PACP QStr	PAPC QOM	PACP QOverall	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost	Rehab $/Ft	Rehabilitation Cost
216	SP-216	MH-461	MH-457	2002	Lakewood	165	210.22	8	PVC	908.452	908.907					0	0	0	2	2	1	2	$65	$13,664	$45	$9,460
217	SP-217	MH-457	MH-459	2002	Lakewood	226	226.00	8	PVC	908.907	906.736					0	0	0	2	2	1	2	$65	$14,690	$45	$10,170
218	SP-218	MH-459	MH-462	2002	Lakewood	136	136.00	8	PVC	906.736	906.415					0	0	0	2	2	1	2	$65	$8,840	$45	$6,120
219	SP-219	MH-462	MH-454	2002	Lakewood	348	352.81	8	PVC	906.415	906.226					0	0	0	2	2	1	2	$65	$22,933	$45	$15,877
220	SP-220	MH-453	MH-454	2002	Lakewood	223	227.23	8	PVC	907.972	906.226					0	0	0	2	2	1	2	$65	$14,770	$45	$10,226
221	SP-221	MH-454	MH-452	2002	Lakewood	170	178.52	8	PVC	906.226	907.358					0	0	0	2	2	1	2	$65	$11,604	$45	$8,033
222	SP-222	MH-452	MH-473	2002	Lakewood	153	159.82	8	PVC	907.358	907.931					0	0	0	2	2	1	2	$65	$10,388	$45	$7,192
223	SP-223	MH-447	MH-471	2002	Saddlewood	273	275.60	8	PVC	908.059	908.514					0	0	0	2	2	1	2	$65	$17,914	$45	$12,402
224	SP-224	MH-472	MH-471	2002	Saddlewood	200	202.62	8	PVC	908.579	908.514					0	0	0	2	2	1	2	$65	$13,170	$45	$9,118
225	SP-225	MH-471	MH-476	2002	Timbercrest	272	273.66	8	PVC	908.514	909.234					0	0	0	2	2	1	2	$65	$17,788	$45	$12,315
226	SP-226	MH-476	MH-473	2002	Timbercrest	221	231.20	8	PVC	909.234	907.931					0	0	0	2	2	1	2	$65	$15,028	$45	$10,404
227	SP-227	MH-473	MH-475	2002	Timbercrest	250	252.19	8	PVC	907.931	906.322					0	0	0	2	2	1	2	$65	$16,392	$45	$11,348
228	SP-228	MH-475	MH-474	2002		0	253.26	10	PVC	906.322	905.606		12.68		892.93	0	0	0	3	2	1	2	$75	$18,995	$50	$12,663
229	SP-229	MH-446	MH-445	1993	Wild Wood	155	160.07	8	PVC	908.828	910.218					0	0	0	2	2	1	2	$65	$10,405	$45	$7,203
230	SP-230	MH-445	MH-444	1993	Wild Wood	385	390.69	8	PVC	910.218	908.931					0	0	0	2	2	1	2	$65	$25,395	$45	$17,581
231	SP-231	MH-444	MH-428	1993	Wild Wood	396	396.55	8	PVC	908.931	906.959					0	0	0	2	2	1	2	$65	$25,776	$45	$17,845
232	SP-232	MH-428	MH-424	1993	Northpointe	337	339.16	8	PVC	906.959	906.896					0	0	0	2	2	1	2	$65	$22,045	$45	$15,262
233	SP-233	MH-429	MH-428	1993	Wild Wood	435	435.00	8	PVC	904.697	906.959					0	0	0	2	2	1	2	$65	$28,275	$45	$19,575
234	SP-234	MH-442	MH-443	1993	Sandpointe	329	338.75	8	PVC	908.045	908.248					0	0	0	2	2	1	2	$65	$22,019	$45	$15,244
235	SP-235	MH-443	MH-424	1993	Sandpointe	352	351.76	8	PVC	908.248	906.896					0	0	0	2	2	1	2	$65	$22,864	$45	$15,829
236	SP-236	MH-424	MH-422	1993	Northpoint	337	345.07	8	PVC	906.896	908.739					0	0	0	2	2	1	2	$65	$22,429	$45	$15,528
237	SP-237	MH-446	MH-448	1993	Wild Wood	170	175.70	8	PVC	908.828	907.707					0	0	0	2	2	1	2	$65	$11,420	$45	$7,906
238	SP-238	MH-448	MH-441	1993	Wild Wood	280	280.00	8	PVC	907.707	907.075					0	0	0	2	2	1	2	$65	$18,200	$45	$12,600
239	SP-239	MH-441	MH-436	1993	Wild Wood	234	240.08	8	PVC	907.075	907.786					0	0	0	2	2	1	2	$65	$15,605	$45	$10,804
240	SP-240	MH-436	MH-438	1993	Holiday	307	307.00	8	PVC	907.786	907.000					0	0	0	2	2	1	2	$65	$19,955	$45	$13,815
241	SP-241	MH-438	MH-439	1993	Holiday	286	290.08	8	PVC	907.000	908.906					0	0	0	2	2	1	2	$65	$18,855	$45	$13,054
242	SP-242	MH-439	MH-422	1993	Holliday	306	311.45	8	PVC	908.906	908.739					0	0	0	2	2	1	2	$65	$20,244	$45	$14,015
243	SP-243	MH-440	MH-439	1993	Holiday	183	186.12	8	PVC	908.615	908.906					0	0	0	2	2	1	2	$65	$12,098	$45	$8,375
244	SP-244	MH-422	MH-423	1993	Northpointe	191	192.89	8	PVC	908.739	909.329					0	0	0	2	2	1	2	$65	$12,538	$45	$8,680
245	SP-245	MH-423	MH-412	1993	Northpoint	176	179.71	8	PVC	909.329	909.371					0	0	0	2	2	1	2	$65	$11,681	$45	$8,087
246	SP-246	MH-433	MH-437	1993	Wild Wood	196	195.55	8	PVC	907.450	907.933					0	0	0	2	2	1	2	$65	$12,711	$45	$8,800
247	SP-247	MH-437	MH-436	1993	Wild Wood	120	122.20	8	PVC	907.933	907.786					0	0	0	2	2	1	2	$65	$7,943	$45	$5,499
248	SP-248	MH-766	MH-768	1996	7 Mile	273	284.36	8	PVC	909.114	909.990					0	0	0	2	2	1	2	$65	$18,483	$45	$12,796
249	SP-249	MH-008	MH-009	1996	Garden	236	236.00	8	PVC	907.977	909.652					0	0	0	2	2	1	2	$65	$15,340	$45	$10,620
250	SP-250	MH-009	MH-013	1996	Garden	140	173.42	8	PVC	909.652	910.131					0	0	0	2	2	1	2	$65	$11,272	$45	$7,804
251	SP-251	MH-013	MH-012	1996		0	228.43	12	PVC	910.131	911.570					0	0	0	3	2	2	4	$85	$19,416	$50	$11,421
252	SP-252	MH-012	MH-010	1996		0	72.55	12	PVC	911.570	911.869					0	0	0	3	2	2	4	$85	$6,167	$50	$3,628
253	SP-253	MH-010	MH-011	1996		0	111.79	12	PVC	911.869	912.919					0	0	0	3	2	2	4	$85	$9,502	$50	$5,589
254	SP-254	MH-011	MH-014	1996		0	109.97	12	PVC	912.919	913.505					0	0	0	3	2	2	4	$85	$9,348	$50	$5,499
255	SP-255	MH-058	MH-094	1969	Heenan	231	231.00	8	VCP	910.288	910.986	10.33	12.03	899.96	898.96	0	0	0	2	4	1	4	$65	$15,015	$45	$10,395
256	SP-256	MH-094	MH-099	1969	Heenan	335	335.00	8	VCP	910.986	906.282	12.03	14.10	898.96	892.18	0	0	0	2	4	1	4	$65	$21,775	$45	$15,075
257	SP-257	MH-014	MH-015	1996		0	287.14	12	PVC	913.505	913.755					0	0	0	3	2	2	4	$85	$24,407	$50	$14,357
258	SP-258	MH-015	MH-767	1996		0	221.50	12	PVC	913.755	912.089					0	0	0	3	2	2	4	$85	$18,827	$50	$11,075
259	SP-259	MH-767	MH-768	1996	Sunflower	323	323.00	8	PVC	912.089	909.990					0	0	0	2	2	1	2	$65	$20,995	$45	$14,535
260	SP-260	MH-764	MH-765	1996		0	136.62	12	PVC	911.599	911.897					0	0	0	3	2	2	4	$85	$11,613	$50	$6,831
261	SP-261	MH-765	MH-763	1996		0	215.20	12	PVC	911.897	911.420					0	0	0	3	2	4	8	$85	$18,292	$50	$10,760
262	SP-262	MH-763	MH-760	1996	Crossing	183	314.32	8	PVC	911.420	910.282					0	0	0	2	2	1	2	$65	$20,431	$45	$14,144
263	SP-263	MH-760	MH-761	1996	Crossing	74	129.21	8	PVC	910.282	910.850					0	0	0	2	2	1	2	$65	$8,398	$45	$5,814
264	SP-264	MH-761	MH-762	1996	Tulip	151	151.00	12	PVC	910.850	910.070					0	0	0	2	2	2	4	$85	$12,835	$50	$7,550
265	SP-265	MH-762	MH-694	1996	Tulip	201	213.36	12	PVC	910.070	910.006					0	0	0	2	2	2	4	$85	$18,136	$50	$10,668
266	SP-266	MH-758	MH-759	1996		0	250.16	8	PVC	909.955	912.308					0	0	0	3	2	3	6	$65	$16,260	$45	$11,257
267	SP-267	MH-759	MH-763	1996	Crossing	84	186.57	8	PVC	912.308	911.420					0	0	0	2	2	2	4	$65	$12,127	$45	$8,396
268	SP-268	MH-756	MH-757	1996	Apple Blossom	183	187.42	8	PVC	911.693	909.888					0	0	0	2	2	1	2	$65	$12,182	$45	$8,434

Northfield Township Asset Management Plan
Gravity Main Asset Inventory

Asset ID Information				Asset Inventory Information												Inspection Data				Criticality			Asset Renewal Cost			
OBJECT ID	Facility ID	US MH	DS MH	Install Date	Street	CCTV Length	Length	Diameter	Material	US RIM	DS RIM	US Depth	DS Depth	US I.E.	DS I.E.	PACP QStr	PAPC QOM	PACP QOverall	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost	Rehab $/Ft	Rehabilitation Cost
269	SP-269	MH-757	MH-766	1996	Apple Blossom	265	265.00	8	PVC	909.888	909.114					0	0	0	2	2	1	2	$65	$17,225	$45	$11,925
270	SP-270	MH-026	MH-783	1996		0	117.59	8	PVC	908.560	908.820					0	0	0	3	2	1	2	$65	$7,643	$45	$5,292
271	SP-271	MH-783	MH-784	1996		0	239.52	8	PVC	908.820	909.379					0	0	0	3	2	1	2	$65	$15,568	$45	$10,778
272	SP-272	MH-784	MH-001	1996		0	103.20	12	PVC	909.379	908.156					0	0	0	3	2	2	4	$85	$8,772	$50	$5,160
273	SP-273	MH-001	MH-002	1996		0	92.21	12	PVC	908.156	907.201					0	0	0	3	2	2	4	$85	$7,838	$50	$4,611
274	SP-274	MH-777	MH-778	1996		0	243.29	8	PVC	910.032	911.317					0	0	0	3	2	1	2	$65	$15,814	$45	$10,948
275	SP-275	MH-778	MH-779	1996	Waterlilly	99	99.59	8	PVC	911.317	911.931					0	0	0	2	2	1	2	$65	$6,473	$45	$4,481
276	SP-276	MH-779	MH-780	1996	Waterlilly	153	153.00	8	PVC	911.931	911.555					0	0	0	2	2	1	2	$65	$9,945	$45	$6,885
277	SP-277	MH-780	MH-781	1996		0	106.89	12	PVC	911.555	910.788					0	0	0	3	2	2	4	$85	$9,086	$50	$5,345
278	SP-278	MH-781	MH-782	1996		0	124.70	12	PVC	910.788	910.103					0	0	0	3	2	1	2	$85	$10,599	$50	$6,235
279	SP-279	MH-782	MH-784	1996		0	152.47	12	PVC	910.103	909.379					0	0	0	3	2	2	4	$85	$12,960	$50	$7,623
280	SP-280	MH-768	MH-769	1996	Sunflower	337	353.87	8	PVC	909.990	911.799					0	0	0	2	2	1	2	$65	$23,002	$45	$15,924
281	SP-281	MH-769	MH-770	1996	Sunflower	198	219.74	8	PVC	911.799	912.302					0	0	0	2	2	0	0	$65	$14,283	$45	$9,889
282	SP-282	MH-770	MH-779	1996	Sunflower	283	302.50	8	PVC	912.302	911.931					0	0	0	2	2	1	2	$65	$19,663	$45	$13,613
283	SP-283	MH-771	MH-772	1996		0	257.05	8	PVC	913.223	912.858					0	0	0	3	2	0	0	$65	$16,708	$45	$11,567
284	SP-284	MH-772	MH-773	1996		0	235.23	8	PVC	912.858	911.851					0	0	0	3	2	0	0	$65	$15,290	$45	$10,585
285	SP-285	MH-773	MH-774	1996		0	69.04	8	PVC	911.851	912.011					0	0	0	3	2	0	0	$65	$4,488	$45	$3,107
286	SP-286	MH-774	MH-775	1996		0	100.52	8	PVC	912.011	910.548					0	0	0	3	2	0	0	$65	$6,534	$45	$4,523
287	SP-287	MH-775	MH-776	1996		0	112.68	8	PVC	910.548	909.064					0	0	0	3	2	0	0	$65	$7,324	$45	$5,071
288	SP-288	MH-776	MH-024	1996		0	148.26	8	PVC	909.064	907.613					0	0	0	3	2	1	2	$65	$9,637	$45	$6,672
289	SP-289	MH-024	MH-025	1996		0	139.23	8	PVC	907.613	908.480					0	0	0	3	2	1	2	$65	$9,050	$45	$6,265
290	SP-290	MH-025	MH-026	1996		0	152.97	8	PVC	908.480	908.560					0	0	0	3	2	1	2	$65	$9,943	$45	$6,884
291	SP-291	MH-006	MH-024	1996		0	255.62	8	PVC	908.179	907.613					0	0	0	3	2	1	2	$65	$16,615	$45	$11,503
292	SP-292	MH-005	MH-019	1996		0	183.25	8	PVC	914.492	915.763					0	0	0	3	2	1	2	$65	$11,911	$45	$8,246
293	SP-293	MH-019	MH-018	1996		0	137.98	8	PVC	915.763	914.753					0	0	0	3	2	1	2	$65	$8,969	$45	$6,209
294	SP-294	MH-018	MH-017	1996		0	85.12	8	PVC	914.753	913.056					0	0	0	3	2	1	2	$65	$5,533	$45	$3,830
295	SP-295	MH-017	MH-020	1996		0	97.09	8	PVC	913.056	913.543					0	0	0	3	2	1	2	$65	$6,311	$45	$4,369
296	SP-296	MH-020	MH-021	1996		0	367.42	8	PVC	913.543	913.070					0	0	0	3	2	1	2	$65	$23,882	$45	$16,534
297	SP-297	MH-021	MH-022	1996		0	157.46	8	PVC	913.070	911.820					0	0	0	3	2	0	0	$65	$10,235	$45	$7,086
298	SP-298	MH-022	MH-023	1996		0	226.46	8	PVC	911.820	911.035					0	0	0	3	2	0	0	$65	$14,720	$45	$10,191
299	SP-299	MH-023	MH-024	1996		0	333.97	8	PVC	911.035	907.613					0	0	0	3	2	1	2	$65	$21,708	$45	$15,029
300	SP-300	MH-016	MH-019	1996		0	296.46	8	PVC	913.904	915.763					0	0	0	3	2	1	2	$65	$19,270	$45	$13,341
301	SP-301	MH-385	MH-384	1965	Jennings	313	314.21	8	VCP	908.538	908.111	9.14	11.03	899.40	897.08	0	3100	0	2	4	1	4	$65	$20,424	$45	$14,140
302	SP-302	MH-384	MH-380	1965	Jennings	319	319.00	8	VCP	908.111	908.507	11.03	12.71	897.08	895.80	0	0	0	2	4	1	4	$65	$20,735	$45	$14,355
303	SP-303	MH-380	MH-374	1965	Jennings	323	327.03	8	VCP	908.507	903.552	12.71	12.13	895.80	891.42	0	3100	3100	2	4	1	4	$65	$21,257	$45	$14,716
304	SP-304	MH-381	MH-376	1965	Longfellow	228	235.48	8	VCP	909.973	907.580	8.92	9.24	901.05	898.34	0	3223	3223	3	5	1	5	$65	$15,306	$45	$10,597
305	SP-305	MH-376	MH-375	1965	Longfellow	102	110.00	8	VCP	907.580	902.640	9.24	11.78	898.34	890.86	0	0	0	3	5	2	10	$65	$7,150	$45	$4,950
306	SP-306	MH-383	MH-382	1965	Hillcrest	158	158.00	8	VCP	908.088	909.350	6.76	8.80	901.33	900.55	0	0	0	2	4	1	4	$65	$10,270	$45	$7,110
307	SP-307	MH-382	MH-368	1965	Hillcrest	298	298.93	8	VCP	909.350	909.132	8.80	9.82	900.55	899.31	0	4132	4132	4	6	1	6	$65	$19,431	$45	$13,452
308	SP-308	MH-368	MH-367	1965	Hillcrest	267	300.53	8	VCP	909.132	907.733	9.82	9.50	899.31	898.23	0	4632	4632	4	6	1	6	$65	$19,534	$45	$13,524
309	SP-309	MH-367	MH-362	1965	Hillcrest	272	274.72	8	VCP	907.733	906.396	9.50	9.79	898.23	896.61	4100	0	4100	3	5	1	5	$65	$17,857	$45	$12,362
310	SP-310	MH-362	MH-360	1965	Hillcrest	242	242.00	8	VCP	906.396	902.161	9.79	13.15	896.61	889.01	3100	5146	5146	4	7	1	7	$65	$15,730	$45	$10,890
311	SP-311	MH-365	MH-358	1965	Whittier	125	145.06	8	VCP	906.333	900.606	9.53	10.29	896.80	890.32	0	0	0	2	4	1	4	$65	$9,429	$45	$6,528
312	SP-312	MH-322	MH-332	1965	Phlox	243	252.10	8	VCP	911.394	909.499	7.28	9.56	904.11	899.94	0	4135	4135	4	6	2	12	$65	$16,387	$45	$11,345
313	SP-313	MH-332	MH-331	1965	Garfield	298	322.72	8	VCP	909.499	905.420	9.56	6.68	899.94	898.74	0	3123	3123	3	5	1	5	$65	$20,977	$45	$14,522
314	SP-314	MH-331	MH-343	1965	Garfield	68	301.60	8	VCP	905.420	904.856	6.68	7.32	898.74	897.54	0	4131	4131	4	6	1	6	$65	$19,604	$45	$13,572
315	SP-315	MH-343	MH-342	1965	Garfield	309	316.45	8	VCP	904.856	904.982	7.32	8.82	897.54	896.16	0	4139	4139	4	6	1	6	$65	$20,570	$45	$14,240
316	SP-316	MH-323	MH-324	1965	Forest	253	252.87	8	VCP	911.653	909.650	8.05	8.25	903.60	901.40	0	0	0	2	4	1	4	$65	$16,436	$45	$11,379
317	SP-317	MH-324	MH-340	1965	Forest	307	329.06	8	VCP	909.650	905.702	8.25	7.03	901.40	898.67	0	3522	3522	3	5	1	5	$65	$21,389	$45	$14,808
318	SP-318	MH-340	MH-339	1965	Forest	305	313.70	8	VCP	905.702	902.975	7.03	5.70	898.67	897.27	0	0	0	2	4	1	4	$65	$20,390	$45	$14,116
319	SP-319	MH-315	MH-316	1965	Grove	125	128.40	8	VCP	910.600	911.469	7.40	8.98	903.20	902.49	0	0	0	2	4	1	4	$65	$8,346	$45	$5,778
320	SP-320	MH-316	MH-317	1965	Grove	66	73.36	8	VCP	911.469	911.426	8.98	9.28	902.49	902.15	0	5122	5122	4	6	1	6	$65	$4,768	$45	$3,301
321	SP-321	MH-317	MH-318	1965	Grove	282	294.03	8	VCP	911.426	909.060	9.28	8.09	902.15	900.97	0	3527	3527	3	5	1	5	$65	$19,112	$45	$13,231

Northfield Township Asset Management Plan
Gravity Main Asset Inventory

Asset ID Information				Asset Inventory Information												Inspection Data				Criticality			Asset Renewal Cost			
OBJECT ID	Facility ID	US MH	DS MH	Install Date	Street	CCTV Length	Length	Diameter	Material	US RIM	DS RIM	US Depth	DS Depth	US I.E.	DS I.E.	PACP QStr	PAPC QOM	PACP QOverall	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost	Rehab $/Ft	Rehabilitation Cost
322	SP-322	MH-318	MH-319	1965	Ridge	53	61.70	8	VCP	909.060	909.339	8.09	9.02	900.97	900.32	0	0	0	2	4	1	4	$65	$4,011	$45	$2,777
323	SP-323	MH-314	MH-321	1965	Jay R	205	211.76	8	VCP	911.173	911.490	8.61	9.73	902.56	901.76	0	3222	3222	3	5	2	10	$65	$13,764	$45	$9,529
324	SP-324	MH-321	MH-320	1965	Jay R	204	215.02	8	VCP	911.490	910.825	9.73	9.95	901.76	900.87	0	0	0	3	5	1	5	$65	$13,976	$45	$9,676
325	SP-325	MH-320	MH-319	1965	Ridge	125	127.61	8	VCP	910.825	909.339	9.95	9.02	900.87	900.32	0	0	0	2	4	1	4	$65	$8,294	$45	$5,742
326	SP-326	MH-319	MH-338	1965	Grove	328	345.64	8	VCP	909.339	905.243	9.02	6.24	900.32	899.00	0	3200	3200	3	5	1	5	$65	$22,467	$45	$15,554
327	SP-327	MH-338	MH-337	1965	Grove	289	291.11	8	VCP	905.243	903.602	6.24	5.84	899.00	897.76	0	3100	3100	3	5	1	5	$65	$18,922	$45	$13,100
328	SP-328	MH-279	MH-278	1965	Front	109	111.70	8	VCP	911.502	911.591	7.68	8.25	903.82	903.34	0	0	0	2	4	2	8	$65	$7,260	$45	$5,026
329	SP-329	MH-278	MH-280	1965	Butternut	184	198.66	8	VCP	911.591	911.779	8.25	9.19	903.34	902.59	0	3323	3323	3	5	1	5	$65	$12,913	$45	$8,940
330	SP-330	MH-280	MH-276	1965	Butternut	231	234.86	8	VCP	911.779	911.919	9.19	10.29	902.59	901.63	0	4434	4434	4	6	1	6	$65	$15,266	$45	$10,569
331	SP-331	MH-276	MH-277	1965	Ridge	56	62.89	8	VCP	911.919	911.737	10.29	10.40	901.63	901.34	0	3100	3100	3	5	1	5	$65	$4,088	$45	$2,830
332	SP-332	MH-277	MH-285	1965	Butternut	308	308.00	8	VCP	911.737	909.829	10.40	9.73	901.34	900.10	0	3429	3429	3	5	1	5	$65	$20,020	$45	$13,860
333	SP-333	MH-285	MH-283	1965	Butternut	310	373.90	8	VCP	909.829	905.631	9.73	6.81	900.10	898.82	0	3200	0	3	5	1	5	$65	$24,303	$45	$16,825
334	SP-334	MH-273	MH-282	1965	Walnut	288	290.76	8	VCP	910.825	912.268	6.23	8.83	904.60	903.44	0	2100	2100	2	4	1	4	$65	$18,899	$45	$13,084
335	SP-335	MH-282	MH-281	1965	Walnut	285	293.01	8	VCP	912.268	912.432	8.83	10.15	903.44	902.28	0	0	0	2	4	1	4	$65	$19,046	$45	$13,185
336	SP-336	MH-281	MH-286	1965	Walnut	311	313.83	8	VCP	912.432	911.454	10.15	10.42	902.28	901.03	0	4936	4936	4	6	1	6	$65	$20,399	$45	$14,122
337	SP-337	MH-286	MH-284	1965	Walnut	303	309.18	8	VCP	911.454	910.143	10.42	10.38	901.03	899.76	0	2100	2100	2	4	1	4	$65	$20,097	$45	$13,913
338	SP-338	MH-284	MH-283	1965	Ash	224	240.83	8	VCP	910.143	905.631	10.38	6.81	899.76	898.82	0	0	0	2	4	1	4	$65	$15,654	$45	$10,838
339	SP-339	MH-283	MH-337	1965	Ash	246	246.00	8	VCP	905.631	903.602	6.81	5.84	898.82	897.76	0	0	0	2	4	1	4	$65	$15,990	$45	$11,070
340	SP-340	MH-337	MH-339	1965	Ash	237	244.48	8	VCP	903.602	902.975	5.84	5.70	897.76	897.27	0	4200	4200	4	6	1	6	$65	$15,891	$45	$11,002
341	SP-341	MH-339	MH-342	1965	Ash	244	250.17	10	VCP	902.975	904.982	5.70	8.82	897.27	896.16	0	3500	3500	3	5	1	5	$75	$18,763	$50	$12,508
342	SP-342	MH-491	MH-349	1965	Garfield	365	371.00	8	VCP	908.739	906.782	7.18	7.44	901.56	899.34	0	3521	3521	3	5	1	5	$65	$24,115	$45	$16,695
343	SP-343	MH-349	MH-348	1965	Garfield	377	381.02	8	VCP	906.782	903.603	7.44	5.78	899.34	897.82	0	0	0	4	6	1	6	$65	$24,767	$45	$17,146
344	SP-344	MH-348	MH-342	1965	Garfield	383	388.69	8	VCP	903.603	904.982	5.78	8.82	897.82	896.16	0	3423	3423	3	5	1	5	$65	$25,265	$45	$17,491
345	SP-345	MH-490	MH-347	1965	Lincoln	366	371.00	8	VCP	909.202	908.439	9.08	9.80	900.12	898.64	0	2100	0	2	4	1	4	$65	$24,115	$45	$16,695
346	SP-346	MH-081	MH-080	1969	Mart	249	252.64	8	VCP	899.504	898.858	4.49	4.87	895.01	893.99	0	0	0	2	4	1	4	$65	$16,422	$45	$11,369
347	SP-347	MH-347	MH-346	1965	Lincoln	368	371.00	8	VCP	908.439	902.242	9.80	5.08	898.64	897.16	0	4134	4134	3	5	1	5	$65	$24,115	$45	$16,695
348	SP-348	MH-366	MH-365	1965	Whittier	79	76.49	8	VCP	909.663	906.333	10.14	9.53	899.52	896.80	0	0	0	2	4	2	8	$65	$4,972	$45	$3,442
349	SP-349	MH-373	MH-634	1965		0	113.46	8	VCP	903.667	904.151		4.95		899.20	0	0	0	3	4	1	4	$65	$7,375	$45	$5,106
350	SP-350	MH-634	MH-372	1965		0	131.19	8	VCP	904.151	906.868	4.95	8.67	899.20	898.20	0	0	0	3	4	1	4	$65	$8,527	$45	$5,904
351	SP-351	MH-372	MH-357	1965		0	274.73	8	VCP	906.868	907.455	8.67	10.37	898.20	897.09	0	0	0	3	4	1	4	$65	$17,857	$45	$12,363
352	SP-352	MH-357	MH-356	1965		0	352.93	8	VCP	907.455	908.271	10.37	12.66	897.09	895.61	0	0	0	3	4	1	4	$65	$22,941	$45	$15,882
353	SP-353	MH-356	MH-351	1965		0	318.84	8	VCP	908.271	907.462	12.66	16.83	895.61	890.63	0	0	0	3	5	1	5	$65	$20,724	$45	$14,348
354	SP-354	MH-635	MH-634	1965		0	315.99	8	VCP	906.721	904.151		4.95		899.20	0	0	0	3	4	1	4	$65	$20,539	$45	$14,220
355	SP-355	MH-334	MH-333	1965		0	61.39	8	VCP	907.020	906.345	8.43	7.99	898.59	898.35	0	0	0	3	4	1	4	$65	$3,990	$45	$2,762
356	SP-356	MH-335	MH-336	1965		0	304.40	8	VCP	906.988	906.751	6.15	7.13	900.84	899.62	0	0	0	3	4	1	4	$65	$19,786	$45	$13,698
357	SP-357	MH-336	MH-333	1965		0	307.69	8	VCP	906.751	906.345	7.13	7.99	899.62	898.35	0	0	0	3	4	1	4	$65	$20,000	$45	$13,846
358	SP-358	MH-333	MH-327	1965	Pine	194	209.74	8	VCP	906.345	904.665	7.99	7.20	898.35	897.47	0	3300	3300	3	5	1	5	$65	$13,633	$45	$9,438
359	SP-359	MH-330	MH-329	1965	Lincoln	123	134.90	8	VCP	906.507	905.193	7.00	6.24	899.51	898.95	0	3623	3623	3	5	1	5	$65	$8,769	$45	$6,071
360	SP-360	MH-329	MH-328	1965	Lincoln	55	54.93	8	VCP	905.193	905.337	6.24	6.72	898.95	898.62	0	0	0	2	4	1	4	$65	$3,570	$45	$2,472
361	SP-361	MH-328	MH-327	1965	Lincoln	281	304.86	8	PVC	905.337	904.665	6.72	7.20	898.62	897.47	0	2500	2500	2	3	1	3	$65	$19,816	$45	$13,719
362	SP-362	MH-531	MH-525	1978	Greenland	405	405.00	8	VCP	910.756	903.212	9.00	13.76	901.76	889.45	3100	0	0	3	5	2	10	$65	$26,325	$45	$18,225
363	SP-363	MH-522	MH-523	1978	Schrum	190	196.27	8	VCP	911.256	910.210	6.62	6.04	904.64	904.17	0	3100	3100	2	3	1	3	$65	$12,758	$45	$8,832
364	SP-364	MH-523	MH-521	1978	Schrum	290	296.93	8	VCP	910.210	902.635	6.04	5.89	904.17	896.75	0	0	0	2	3	2	6	$65	$19,300	$45	$13,362
365	SP-365	MH-521	MH-520	1978	Lakeview	69	93.66	8	VCP	902.635	901.628	5.89	10.35	896.75	891.28	0	0	0	2	3	2	6	$65	$6,088	$45	$4,215
366	SP-366	MH-512	MH-507	1978	Lakeview	138	142.47	8	VCP	900.619	903.412	3.21	6.57	897.41	896.84	0	0	0	2	3	2	6	$65	$9,260	$45	$6,411
367	SP-367	MH-507	MH-506	1978	Lakeview	285	285.00	8	VCP	903.412	901.997	6.57	6.38	896.84	895.62	0	0	0	2	3	2	6	$65	$18,525	$45	$12,825
368	SP-368	MH-506	MH-508	1978	Lakeview	413	423.67	8	VCP	901.997	901.710	6.38	8.85	895.62	892.86	0	0	0	2	3	2	6	$65	$27,539	$45	$19,065
369	SP-369	MH-508	MH-520	1978	Lakeview	158	163.02	8	VCP	901.710	901.628	8.85	10.35	892.86	891.28	4100	0	4100	4	5	3	15	$65	$10,596	$45	$7,336
370	SP-370	MH-520	MH-519	1978	Lakeview	69	69.00	8	VCP	901.628	902.414	10.35	11.48	891.28	890.93	0	0	0	2	3	2	6	$65	$4,485	$45	$3,105
371	SP-371	MH-519	MH-525	1978	Lakeview	349	349.00	8	VCP	902.414	903.212	11.48	13.76	890.93	889.45	0	0	0	2	4	2	8	$65	$22,685	$45	$15,705
372	SP-372	MH-525	MH-524	1978	Lakeview	292	292.00	8	VCP	903.212	901.898	13.76	13.17	889.45	888.73	3100	0	3100	3	5	2	10	$65	$18,980	$45	$13,140
373	SP-373	MH-524	MH-530	1978	Lakeview	224	232.06	8	VCP	901.898	900.828	13.17	12.75	888.73	888.08	0	2200	2200	2	4	2	8	$65	$15,084	$45	$10,443
374	SP-374	MH-530	MH-726	1978		0	94.01	10	VCP	900.828		12.75		888.08		0	0	0	3	4	1	4	$75	$7,051	$50	$4,700

Northfield Township Asset Management Plan
Gravity Main Asset Inventory

Asset ID Information				Asset Inventory Information												Inspection Data				Criticality			Asset Renewal Cost			
OBJECT ID	Facility ID	US MH	DS MH	Install Date	Street	CCTV Length	Length	Diameter	Material	US RIM	DS RIM	US Depth	DS Depth	US I.E.	DS I.E.	PACP QStr	PAPC QOM	PACP QOverall	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost	Rehab $/Ft	Rehabilitation Cost
375	SP-375	MH-510	MH-509	1978	Schrum	219	224.46	8	VCP	903.618	910.073	3.88	11.54	899.74	898.53	0	0	0	2	3	1	3	$65	$14,590	$45	$10,101
376	SP-376	MH-509	MH-507	1978	Schrum	295	299.95	8	VCP	910.073	903.412	11.54	6.57	898.53	896.84	0	0	0	2	3	2	6	$65	$19,496	$45	$13,498
377	SP-377	MH-298	MH-297	1965		0	248.50	8	VCP	907.794	906.862	9.87	9.92	897.92	896.94	0	0	0	3	4	1	4	$65	$16,153	$45	$11,183
378	SP-378	MH-297	MH-296	1965		0	183.67	8	VCP	906.862	906.621	9.92	10.39	896.94	896.23	0	0	0	3	4	1	4	$65	$11,939	$45	$8,265
379	SP-379	MH-296	MH-302	1965		0	176.66	8	VCP	906.621	906.727	10.39	11.07	896.23	895.66	0	0	0	3	4	1	4	$65	$11,483	$45	$7,950
380	SP-380	MH-311	MH-310	1965	West	291	317.93	8	VCP	908.231	907.636	7.38	8.36	900.85	899.28	0	4234	4234	4	6	1	6	$65	$20,666	$45	$14,307
381	SP-381	MH-310	MH-309	1965	Margaret	275	288.97	8	VCP	907.636	908.672	8.36	10.84	899.28	897.83	0	0	0	2	4	1	4	$65	$18,783	$45	$13,004
382	SP-382	MH-309	MH-304	1965	Margaret	154	154.00	8	VCP	908.672	908.054	10.84	11.02	897.83	897.03	0	0	0	2	4	1	4	$65	$10,010	$45	$6,930
383	SP-383	MH-304	MH-303	1965	Margaret	69	72.83	8	VCP	908.054	908.119	11.02	11.46	897.03	896.66	0	4133	4133	4	6	1	6	$65	$4,734	$45	$3,277
384	SP-384	MH-303	MH-302	1965	Margaret	279	293.62	8	VCP	908.119	906.727	11.46	11.07	896.66	895.66	0	0	0	4	6	1	6	$65	$19,085	$45	$13,213
385	SP-385	MH-305	MH-308	1965	Barker	255	261.16	8	VCP	908.414	908.406	8.36	9.71	900.05	898.70	0	0	0	2	4	1	4	$65	$16,975	$45	$11,752
386	SP-386	MH-308	MH-307	1965	Barker	255	257.92	8	VCP	908.406	908.164	9.71	10.82	898.70	897.34	0	3327	3327	3	6	1	6	$65	$16,765	$45	$11,606
387	SP-387	MH-307	MH-399	1965	Barker	131	246.00	8	PVC	908.164	903.900	10.82	7.92	897.34	895.98	3100	3100	3200	3	4	1	4	$65	$15,990	$45	$11,070
388	SP-388	MH-399	MH-400	1965		0	40.63	8	VCP	903.900	903.940	7.92	8.86	895.98	895.08	0	0	0	3	4	1	4	$65	$2,641	$45	$1,828
389	SP-389	MH-400	MH-401	1965	Barker	224	239.56	8	VCP	903.940	898.241	8.86	11.91	895.08	886.33	4100	0	4100	5	8	2	16	$65	$15,571	$45	$10,780
390	SP-390	MH-007	MH-034	1996		0	183.06	8	PVC	910.460	909.426					0	0	0	3	3	1	3	$65	$11,899	$45	$8,238
391	SP-391	MH-027	MH-028	1996		0	169.75	8	PVC	908.530	907.875					0	0	0	3	3	1	3	$65	$11,033	$45	$7,639
392	SP-392	MH-028	MH-029	1996		0	104.97	8	PVC	907.875	908.640					0	0	0	3	3	1	3	$65	$6,823	$45	$4,724
393	SP-393	MH-029	MH-034	1996		0	174.00	8	PVC	908.640	909.426					0	0	0	3	3	1	3	$65	$11,310	$45	$7,830
394	SP-394	MH-034	MH-033	1996		0	191.23	8	PVC	909.426	908.884					0	0	0	3	3	1	3	$65	$12,430	$45	$8,605
395	SP-395	MH-033	MH-032	1996		0	88.19	8	PVC	908.884	908.958					0	0	0	3	3	1	3	$65	$5,733	$45	$3,969
396	SP-396	MH-032	MH-031	1996		0	35.09	8	PVC	908.958	909.261					0	0	0	3	3	1	3	$65	$2,281	$45	$1,579
397	SP-397	MH-031	MH-030	1996		0	186.20	8	PVC	909.261	908.858					0	0	0	3	3	1	3	$65	$12,103	$45	$8,379
398	SP-398	MH-030	MH-266	1996	Posey	161	335.94	8	PVC	908.858	907.452		13.65		893.80	0	0	0	2	2	1	2	$65	$21,836	$45	$15,117
399	SP-399	MH-266	MH-264	1969	Posey	331	331.00	8	PVC	907.452	909.741	13.65	17.22	893.80	892.52	0	5100	5100	5	6	1	6	$65	$21,515	$45	$14,895
400	SP-400	MH-260	MH-264	1969		0	318.69	8	VCP	905.030	909.741	11.35	17.22	893.68	892.52	0	0	0	3	4	1	4	$65	$20,715	$45	$14,341
401	SP-401	MH-264	MH-263	1969		0	216.32	8	VCP	909.741	906.673	17.22	14.98	892.52	891.69	0	0	0	3	4	1	4	$65	$14,061	$45	$9,734
402	SP-402	MH-258	MH-259	1969		0	201.09	12	VCP	904.771	899.435	15.38	10.48	889.39	888.95	0	0	0	3	4	2	8	$85	$17,093	$50	$10,055
403	SP-403	MH-259	MH-261	1969		0	201.24	12	VCP	899.435	899.610	10.48	11.10	888.95	888.51	0	0	0	3	4	2	8	$85	$17,105	$50	$10,062
404	SP-404	MH-261	MH-262	1969		0	176.10	12	VCP	899.610	900.017	11.10	11.93	888.51	888.09	0	0	0	3	4	2	8	$85	$14,968	$50	$8,805
405	SP-405	MH-262	MH-265	1969		0	356.22	12	VCP	900.017	904.424	11.93	17.10	888.09	887.32	0	0	0	3	4	2	8	$85	$30,279	$50	$17,811
406	SP-406	MH-265	MH-267	1969		0	98.69	12	VCP	904.424	905.438	17.10	18.35	887.32	887.09	0	0	0	3	4	3	12	$85	$8,389	$50	$4,934
407	SP-407	MH-267	MH-268	1969		0	95.40	12	VCP	905.438	905.345	18.35	18.47	887.09	886.88	0	0	0	3	4	2	8	$85	$8,109	$50	$4,770
408	SP-408	MH-268	MH-269	1969		0	290.93	12	VCP	905.345	898.358	18.47	12.26	886.88	886.10	0	0	0	3	4	2	8	$85	$24,729	$50	$14,546
409	SP-409	MH-263	MH-262	1969		0	207.38	8	VCP	906.673	900.017	14.98	11.93	891.69	888.09	0	0	0	3	4	1	4	$65	$13,480	$45	$9,332
410	SP-410	MH-269	MH-270	1969		0	31.92	12	VCP	898.358	900.218	12.26	17.07	886.10	883.15	0	0	0	3	3	2	6	$85	$2,713	$50	$1,596
411	SP-411	MH-271	MH-272	1969		0	277.18	8	VCP	904.922	898.950	8.92	4.95	896.00	894.00	0	0	0	3	4	1	4	$65	$18,017	$45	$12,473
412	SP-412	MH-272	MH-269	1969		0	238.67	8	VCP	898.950	898.358	4.95	12.26	894.00	886.10	0	0	0	3	4	1	4	$65	$15,514	$45	$10,740
413	SP-413	MH-723	MH-270	1996		0	89.45	10	PVC	902.286	900.218	8.94	17.07	893.35	883.15	0	0	0	3	2	3	6	$75	$6,709	$50	$4,472
414	SP-414	MH-270	MH-630	1969		0	13.25	12	VCP	900.218		17.07		883.15		0	0	0	3	3	2	6	$85	$1,126	$50	$663
415	SP-415	MH-080	MH-079	1969	Mart	224	227.97	8	VCP	898.858	905.000	4.87	11.93	893.99	893.07	0	0	0	2	4	1	4	$65	$14,818	$45	$10,259
416	SP-416	MH-079	MH-099	1969	Mart	197	200.51	8	VCP	905.000	906.282	11.93	14.10	893.07	892.18	0	0	0	2	4	1	4	$65	$13,033	$45	$9,023
417	SP-417	MH-099	MH-098	1969	Heenan	248	249.86	8	VCP	906.282	898.308	14.10	7.65	892.18	890.66	0	0	0	2	4	1	4	$65	$16,241	$45	$11,244
418	SP-418	MH-098	MH-100	1969	Heenan	250	250.49	8	VCP	898.308	897.775	7.65	8.54	890.66	889.24	0	0	0	2	4	1	4	$65	$16,282	$45	$11,272
419	SP-419	MH-083	MH-100	1969		0	263.18	10	VCP	898.418	897.775	8.39	8.54	890.03	889.24	0	0	0	3	4	1	4	$75	$19,738	$50	$13,159
420	SP-420	MH-082	MH-083	1969		0	237.90	10	VCP	901.061	898.418	10.36	8.39	890.70	890.03	0	0	0	3	4	1	4	$75	$17,842	$50	$11,895
421	SP-421	MH-092	MH-082	1969		0	171.63	10	VCP	903.955	901.061	12.65	10.36	891.30	890.70	0	0	0	3	4	1	4	$75	$12,872	$50	$8,581
422	SP-422	MH-100	MH-103	1969		0	277.54	10	VCP	897.775	899.643	8.54	11.46	889.24	888.18	0	0	0	3	4	1	4	$75	$20,816	$50	$13,877
423	SP-423	MH-103	MH-102	1969		0	122.70	10	VCP	899.643	900.246	11.46	12.34	888.18	887.91	0	0	0	3	4	1	4	$75	$9,202	$50	$6,135
424	SP-424	MH-102	MH-101	1969		0	336.00	10	VCP	900.246	904.497	12.34	17.59	887.91	886.91	0	0	0	3	4	1	4	$75	$25,200	$50	$16,800
425	SP-425	MH-101	MH-106	1969		0	225.32	10	VCP	904.497	905.237	17.59	19.60	886.91	885.64	0	0	0	3	4	1	4	$75	$16,899	$50	$11,266
426	SP-426	MH-085	MH-086	1969		0	95.01	10	VCP	909.342	909.825	17.05	17.78	892.29	892.04	0	0	0	3	4	2	8	$75	$7,126	$50	$4,751
427	SP-427	MH-086	MH-092	1969		0	237.96	10	VCP	909.825	903.955	17.78	12.65	892.04	891.30	0	0	0	3	4	2	8	$75	$17,847	$50	$11,898

Northfield Township Asset Management Plan
Gravity Main Asset Inventory

Asset ID Information				Asset Inventory Information												Inspection Data				Criticality			Asset Renewal Cost			
OBJECT ID	Facility ID	US MH	DS MH	Install Date	Street	CCTV Length	Length	Diameter	Material	US RIM	DS RIM	US Depth	DS Depth	US I.E.	DS I.E.	PACP QStr	PAPC QOM	PACP QOverall	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost	Rehab $/Ft	Rehabilitation Cost
428	SP-428	MH-070	MH-073	1969	Grange	236	242.44	8	VCP	915.606	915.283	11.15	12.28	904.46	903.00	0	0	0	2	4	2	8	$65	$15,758	$45	$10,910
429	SP-429	MH-075	MH-073	1969	Grange	125	131.78	8	VCP	911.383	915.283	7.86	12.28	903.52	903.00	0	0	0	2	4	2	8	$65	$8,566	$45	$5,930
430	SP-430	MH-073	MH-074	1969	Pacific Pl	140	160.16	8	VCP	915.283	908.222	12.28	14.98	903.00	893.24	0	0	0	2	4	2	8	$65	$10,410	$45	$7,207
431	SP-431	MH-069	MH-074	1969	Groomes	241	247.47	8	VCP	912.299	908.222	12.24	14.98	900.06	893.24	0	0	0	2	4	1	4	$65	$16,085	$45	$11,136
432	SP-432	MH-087	MH-074	1969	Groomes	251	252.50	8	VCP	906.025	908.222	11.57	14.98	894.45	893.24	0	0	0	2	4	1	4	$65	$16,413	$45	$11,363
433	SP-433	MH-074	MH-092	1969	Groomes	291	291.00	8	VCP	908.222	903.955	14.98	12.65	893.24	891.30	0	0	0	2	4	1	4	$65	$18,915	$45	$13,095
434	SP-434	MH-105	MH-106	1969		0	305.74	8	VCP	903.150	905.237	16.25	19.60	886.90	885.64	0	0	0	3	4	1	4	$65	$19,873	$45	$13,758
435	SP-435	MH-106	MH-718	1969		0	45.87	10	VCP	905.237		19.60		885.64		0	0	0	3	4	1	4	$75	$3,441	$50	$2,294
436	SP-436	MH-109	MH-105	1969		0	307.66	8	VCP	903.079	903.150	15.12	16.25	887.96	886.90	0	0	0	3	4	1	4	$65	$19,998	$45	$13,845
437	SP-437	MH-104	MH-108	1974		0	176.50	8	VCP	901.880	903.097		13.73		889.37	0	0	0	3	3	1	3	$65	$11,473	$45	$7,943
438	SP-438	MH-107	MH-108	1969	Lesia	345	381.76	8	VCP	906.907	903.097	12.88	13.73	894.03	889.37	0	0	0	2	4	1	4	$65	$24,814	$45	$17,179
439	SP-439	MH-096	MH-108	1969	McNally	337	338.54	8	VCP	901.720	903.097	10.99	13.73	890.73	889.37	0	0	0	2	4	1	4	$65	$22,005	$45	$15,234
440	SP-440	MH-095	MH-096	1969	McNally	169	219.44	8	VCP	899.621	901.720	8.21	10.99	891.41	890.73	0	0	0	2	4	1	4	$65	$14,263	$45	$9,875
441	SP-441	MH-097	MH-096	1969	Julia	336	381.43	8	VCP	906.837	901.720	12.92	10.99	893.92	890.73	0	0	0	2	4	1	4	$65	$24,793	$45	$17,164
442	SP-442	MH-108	MH-109	1969	McNally	174	338.83	8	VCP	903.097	903.079	13.73	15.12	889.37	887.96	0	4100	4100	3	5	1	5	$65	$22,024	$45	$15,247
443	SP-443	MH-110	MH-109	1969		0	355.69	8	VCP	905.797	903.079	14.58	15.12	891.22	887.96	0	0	0	3	4	1	4	$65	$23,120	$45	$16,006
444	SP-444		MH-754	1974		0	72.55	8	VCP		906.718					0	0	0	3	3	2	6	$65	$4,716	$45	$3,265
445	SP-445	MH-754	MH-753	1974		0	180.99	8	VCP	906.718	907.877					0	0	0	3	3	2	6	$65	$11,764	$45	$8,145
446	SP-446	MH-753	MH-755	1974		0	225.26	8	VCP	907.877	906.700					0	0	0	3	3	1	3	$65	$14,642	$45	$10,137
447	SP-447	MH-755	MH-113	1974		0	81.22	8	VCP	906.700	906.301		12.22		894.08	0	0	0	3	3	1	3	$65	$5,280	$45	$3,655
448	SP-448		MH-753	1974		0	46.07	8	VCP		907.877					0	0	0	3	3	2	6	$65	$2,995	$45	$2,073
449	SP-449	MH-114	MH-113	1974		0	290.61	8	VCP	907.092	906.301	11.80	12.22	895.29	894.08	0	0	0	3	3	1	3	$65	$18,890	$45	$13,077
450	SP-450	MH-113	MH-112	1974		0	216.40	8	VCP	906.301	907.756	12.22	14.50	894.08	893.26	0	0	0	3	3	1	3	$65	$14,066	$45	$9,738
451	SP-451	MH-112	MH-111	1969		0	159.39	8	VCP	907.756	908.806	14.50	16.17	893.26	892.64	0	0	0	3	4	1	4	$65	$10,360	$45	$7,173
452	SP-452	MH-115	MH-114	1969		0	162.64	8	VCP	908.433	907.092	12.67	11.80	895.76	895.29	0	0	0	3	4	1	4	$65	$10,572	$45	$7,319
453	SP-453	MH-116	MH-117	1969		0	54.95	12	VCP	908.755	909.376	12.71	13.51	896.05	895.87	0	0	0	3	4	2	8	$85	$4,671	$50	$2,748
454	SP-454	MH-117	MH-118	1969		0	151.05	12	VCP	909.376	910.371	13.51	14.85	895.87	895.52	0	0	0	3	4	2	8	$85	$12,839	$50	$7,552
455	SP-455	MH-111	MH-110	1969		0	341.71	8	VCP	908.806	905.797	16.17	14.58	892.64	891.22	0	0	0	3	4	1	4	$65	$22,211	$45	$15,377
458	SP-458	MH-118	MH-119	1969		0	267.17	12	VCP	910.371	910.579	14.85	15.63	895.52	894.95	0	0	0	3	4	2	8	$85	$22,710	$50	$13,359
459	SP-459	MH-122	MH-123	1969			70.31	8	VCP	909.522	910.622	10.52	11.86	899.00	898.76	0	0	0	3	4	1	4	$65	$4,570	$45	$3,164
460	SP-460	MH-123	MH-124	1969		0	80.23	8	VCP	910.622	910.643	11.86	12.26	898.76	898.38	0	0	0	3	4	2	8	$65	$5,215	$45	$3,611
461	SP-461	MH-120	MH-121	1969		0	85.99	8	VCP	911.312	912.348	13.25	14.54	898.06	897.81	0	0	0	3	4	1	4	$65	$5,589	$45	$3,869
462	SP-462	MH-121	MH-119	1969		0	183.70	8	VCP	912.348	910.579	14.54	15.63	897.81	894.95	0	0	0	3	4	1	4	$65	$11,940	$45	$8,266
463	SP-463	MH-119	MH-125	1969		0	354.15	12	VCP	910.579	903.278	15.63	9.10	894.95	894.18	0	0	0	3	4	2	8	$85	$30,102	$50	$17,707
464	SP-464	MH-125	MH-126	1969		0	317.78	12	VCP	903.278	902.158	9.10	8.75	894.18	893.41	0	0	0	3	4	2	8	$85	$27,011	$50	$15,889
465	SP-465	MH-126	MH-127	1969		0	358.33	12	VCP	902.158	903.633	8.75	10.97	893.41	892.66	0	0	0	3	4	2	8	$85	$30,458	$50	$17,916
466	SP-466	MH-127	MH-128	1969		0	350.95	12	VCP	903.633	902.682	10.97	10.81	892.66	891.87	0	0	0	3	4	2	8	$85	$29,831	$50	$17,548
468	SP-468	MH-205	MH-206	1969	Northshore	174	174.00	8	VCP	913.124	899.379	17.20	9.38	895.92	890.00	0	0	0	2	4	1	4	$65	$11,310	$45	$7,830
469	SP-469	MH-206	MH-714	1969		0	26.74	10	VCP	899.379		9.38		890.00		0	0	0	3	4	1	4	$75	$2,006	$50	$1,337
470	SP-470	MH-192	MH-191	1969	Northshore	204	224.99	8	VCP	897.895	898.901	4.81	6.46	893.08	892.44	0	0	0	2	4	1	4	$65	$14,625	$45	$10,125
471	SP-471	MH-191	MH-207	1969	Northshore	203	203.86	8	VCP	898.901	893.756	6.46	1.93	892.44	891.83	0	0	0	2	4	1	4	$65	$13,251	$45	$9,174
472	SP-472	MH-207	MH-206	1969	Northshore		273.18	8	VCP	893.756	899.379	1.93	9.38	891.83	890.00	0	0	0	3	4	3	12	$65	$17,757	$45	$12,293
473	SP-473	MH-212	MH-211	1969		0	55.63	8	VCP	898.560	901.518					0	0	0	3	4	1	4	$65	$3,616	$45	$2,503
474	SP-474	MH-215	MH-214	1969	Northshore	160	165.52	8	VCP	901.017	898.057	7.02	4.76	894.00	893.30	0	0	0	2	4	2	8	$65	$10,759	$45	$7,448
475	SP-475	MH-214	MH-724	1969	Northshore	155	156.20	8	VCP	898.057	901.677	4.76	9.00	893.30	892.68	0	0	0	2	4	1	4	$65	$10,153	$45	$7,029
476	SP-476	MH-724	MH-218	1969	Northshore	94	94.00	8	VCP	901.677	909.698	9.00	19.20	892.68	890.50	4100	0	4100	4	6	1	6	$65	$6,110	$45	$4,230
479	SP-479	MH-256	MH-289	1965	N Main	379	379.00	10	VCP	908.421	907.238	11.54	11.50	896.88	895.74	0	2100	2100	2	5	1	5	$75	$28,425	$50	$18,950
480	SP-480	MH-289	MH-288	1965	N Main	410	410.00	10	VCP	907.238	906.364	11.50	11.65	895.74	894.71	0	0	0	2	5	1	5	$75	$30,750	$50	$20,500
481	SP-481	MH-288	MH-287	1965	Main	312	312.00	12	VCP	906.364	902.450	11.65	8.73	894.71	893.72	5100	0	5100	5	8	2	16	$85	$26,520	$50	$15,600
482	SP-482	MH-287	MH-390	1965	Main	208	213.31	12	VCP	902.450	904.701	8.73	11.61	893.72	893.09	0	0	0	2	5	2	10	$85	$18,131	$50	$10,665
483	SP-483	MH-390	MH-391	1965	Main	253	252.55	12	VCP	904.701	907.016	11.61	14.86	893.09	892.16	0	0	0	2	5	1	5	$85	$21,467	$50	$12,627
484	SP-484	MH-391	MH-393	1965	Main	152	172.92	12	VCP	907.016	901.174	14.86	9.55	892.16	891.62	0	0	0	2	5	2	10	$85	$14,699	$50	$8,646
485	SP-485	MH-393	MH-396	1965	Main	312	373.54	12	VCP	901.174	910.197	9.55	19.64	891.62	890.56	0	3100	3100	4	7	1	7	$85	$31,751	$50	$18,677

Northfield Township Asset Management Plan
Gravity Main Asset Inventory

Asset ID Information				Asset Inventory Information												Inspection Data				Criticality			Asset Renewal Cost			
OBJECT ID	Facility ID	US MH	DS MH	Install Date	Street	CCTV Length	Length	Diameter	Material	US RIM	DS RIM	US Depth	DS Depth	US I.E.	DS I.E.	PACP QStr	PAPC QOM	PACP QOverall	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost	Rehab $/Ft	Rehabilitation Cost
486	SP-486	MH-392	MH-393	1965	Main	250	250.00	8	VCP	900.690	901.174	7.82	9.55	892.87	891.62	0	0	0	2	5	0	0	$65	$16,250	$45	$11,250
487	SP-487	MH-291	MH-392	1965	Main	233	233.00	8	VCP	901.831	900.690	8.05	7.82	893.78	892.87	0	0	0	2	5	2	10	$65	$15,145	$45	$10,485
488	SP-488	MH-292	MH-291	1965	Main	170	170.00	8	VCP	901.462	901.831	6.94	8.05	894.52	893.78	0	0	0	2	5	2	10	$65	$11,050	$45	$7,650
489	SP-489	MH-294	MH-292	1965	Main	156	157.12	8	VCP	904.182	901.462	9.03	6.94	895.15	894.52	0	0	0	2	5	1	5	$65	$10,213	$45	$7,071
490	SP-490	MH-293	MH-294	1965	Main	152	152.00	8	VCP	905.300	904.182	9.53	9.03	895.77	895.15	0	0	0	2	4	1	4	$65	$9,880	$45	$6,840
491	SP-491	MH-295	MH-293	1965	Main	120	121.53	8	VCP	908.366	905.300	12.12	9.53	896.25	895.77	0	0	0	2	4	1	4	$65	$7,899	$45	$5,469
492	SP-492	MH-290	MH-295	1965		0	30.07	8	VCP	905.788	908.366	9.23	12.12	896.56	896.25	0	0	0	3	4	1	4	$65	$1,954	$45	$1,353
493	SP-493	MH-306	MH-290	1965	Main	271	409.25	8	VCP	907.348	905.788	9.15	9.23	898.20	896.56	4133	3622	4139	4	6	1	6	$65	$26,601	$45	$18,416
494	SP-494	MH-302	MH-301	1965		0	122.71	8	VCP	906.727	907.747	11.07	12.56	895.66	895.19	0	0	0	3	4	1	4	$65	$7,976	$45	$5,522
495	SP-495	MH-301	MH-300	1965		0	187.72	8	VCP	907.747	907.898	12.56	13.47	895.19	894.43	0	0	0	3	5	1	5	$65	$12,202	$45	$8,447
496	SP-496	MH-300	MH-299	1965		0	174.18	8	VCP	907.898	905.285	13.47	11.50	894.43	893.79	0	0	0	3	5	1	5	$65	$11,322	$45	$7,838
497	SP-497	MH-299	MH-354	1965		0	309.94	8	VCP	905.285	899.840	11.50	7.33	893.79	892.51	0	0	0	3	5	2	10	$65	$20,146	$45	$13,947
498	SP-498	MH-143	MH-144	2000	Turnberry	168	172.68	8	PVC	911.565	912.187					0	0	0	2	2	0	0	$65	$11,224	$45	$7,771
499	SP-499	MH-208	MH-691	1979	Elmcrest	57	57.00	8	VCP	900.558	901.707					0	0	0	2	3	1	3	$65	$3,705	$45	$2,565
500	SP-500	MH-693	MH-624	1978	Coyle	205	202.26	8	VCP	908.672	907.109	8.28	7.54	900.39	899.57	0	0	0	2	3	1	3	$65	$13,147	$45	$9,102
501	SP-501	MH-354	MH-353	1965		0	22.06	8	VCP	899.840	899.840	7.33	7.41	892.51	892.43	0	0	0	3	5	2	10	$65	$1,434	$45	$993
502	SP-502	MH-352	MH-350	1965		0	212.55	12	VCP	902.469	907.530	10.30	15.79	892.17	891.74	0	0	0	3	5	2	10	$85	$18,067	$50	$10,628
503	SP-503	MH-353	MH-352	1965		0	145.38	12	VCP	899.840	902.469	7.41	10.30	892.43	892.17	0	0	0	3	5	3	15	$85	$12,358	$50	$7,269
504	SP-504	MH-274	MH-275	1965	East Shore	190	191.14	12	VCP	907.691	908.421	5.51	6.71	902.18	901.71	0	0	0	2	4	2	8	$85	$16,247	$50	$9,557
505	SP-505	MH-275	MH-312	1965	East Shore	203	207.28	10	VCP	908.421	908.210	6.71	6.99	901.71	901.22	0	4132	4132	4	6	1	6	$75	$15,546	$50	$10,364
506	SP-506	MH-312	MH-313	1965	East Shore	341	349.17	12	VCP	908.210	908.405	6.99	8.03	901.22	900.38	0	3728	3728	4	6	2	12	$85	$29,680	$50	$17,459
507	SP-507	MH-313	MH-325	1965	East Shore	327	327.05	12	VCP	908.405	908.028	8.03	8.45	900.38	899.58	0	0	0	2	4	2	8	$85	$27,799	$50	$16,352
508	SP-508	MH-325	MH-326	1965	East Shore	382	404.14	16	VCP	908.028	907.330	8.45	8.91	899.58	898.42	0	3100	3100	3	5	3	15	$105	$42,434	$75	$30,310
509	SP-509	MH-326	MH-350	1965	East Shore	301	312.11	12	VCP	907.330	907.530	8.91	15.79	898.42	891.74	0	0	0	2	5	2	10	$85	$26,529	$50	$15,605
510	SP-510	MH-725	MH-586	1976		0	222.31	10	VCP		905.569		9.24		896.33	0	0	0	3	4	1	4	$75	$16,673	$50	$11,115
511	SP-511	MH-581	MH-591	1978		0	35.33	10	VCP	901.385	901.959	10.38	11.19	891.00	890.77	0	0	0	3	2	2	4	$75	$2,650	$50	$1,766
512	SP-512	MH-591	MH-725	1978		0	16.75	10	VCP	901.959		11.19		890.77		0	0	0	3	2	1	2	$75	$1,256	$50	$838
513	SP-513	MH-576	MH-581	1976	Lakeshore	265	276.40	10	DI	898.505	901.385	6.46	10.38	892.04	891.00	0	2100	2100	2	2	3	6	$75	$20,730	$50	$13,820
514	SP-514	MH-622	MH-619	1978	Coyle	325	325.00	8	VCP	908.588	912.017	7.89	12.63	900.70	899.39	3100	3100	3200	3	4	1	4	$65	$21,125	$45	$14,625
515	SP-515	MH-619	MH-616	1978	Coyle	285	293.77	8	VCP	912.017	912.678	12.63	14.68	899.39	898.00	0	0	0	2	3	1	3	$65	$19,095	$45	$13,220
516	SP-516	MH-609	MH-610	1978	Coyle	274	274.00	8	VCP	912.132	911.300	9.68	11.09	902.45	900.21	0	0	0	2	3	1	3	$65	$17,810	$45	$12,330
517	SP-517	MH-610	MH-616	1978	Coyle	227	236.71	8	VCP	911.300	912.678	11.09	14.68	900.21	898.00	0	0	0	2	3	1	3	$65	$15,386	$45	$10,652
518	SP-518	MH-616	MH-611	1978	Coyle	59	75.19	8	DI	912.678	912.013	14.68	16.05	898.00	895.96	0	0	0	2	3	1	3	$65	$4,887	$45	$3,384
519	SP-519	MH-747	MH-748	1965		0	174.03	8	VCP	910.479	911.735					0	0	0	3	3	0	0	$65	$11,312	$45	$7,831
520	SP-520	MH-748	MH-749	1965		0	200.45	8	VCP	911.735	912.327					0	0	0	3	3	0	0	$65	$13,029	$45	$9,020
521	SP-521	MH-749	MH-750	1965		0	180.37	8	VCP	912.327	911.172					0	0	0	3	3	0	0	$65	$11,724	$45	$8,117
522	SP-522	MH-750	MH-751	1965		0	33.86	8	VCP	911.172	910.238					0	0	0	3	3	0	0	$65	$2,201	$45	$1,524
523	SP-523	MH-751	MH-752	1965		0	207.04	8	VCP	910.238	907.160					0	0	0	3	3	0	0	$65	$13,458	$45	$9,317
524	SP-524	MH-752	MH-413	1965		0	273.58	8	VCP	907.160	892.363		9.43		882.93	0	0	0	3	3	1	3	$65	$17,783	$45	$12,311
525	SP-525	MH-413	MH-414	1965		0	367.72	18	VCP	892.363	890.377	9.43	8.04	882.93	882.34	0	0	0	3	4	4	16	$135	$49,642	$85	$31,256
526	SP-526	MH-414	MH-417	1965		0	366.25	18	VCP	890.377	892.168	8.04	10.42	882.34	881.75	0	0	0	3	4	3	12	$135	$49,444	$85	$31,131
527	SP-527	MH-417	MH-416	1965		0	344.50	18	VCP	892.168	891.161	10.42	9.97	881.75	881.19	0	0	0	3	4	3	12	$135	$46,508	$85	$29,283
528	SP-528	MH-416	MH-415	1965		0	221.16	18	VCP	891.161	890.227	9.97	9.39	881.19	880.84	0	0	0	3	4	4	16	$135	$29,856	$85	$18,798
529	SP-529	MH-415	MH-449	1965		0	308.38	18	VCP	890.227	890.367	9.39	10.03	880.84	880.34	0	0	0	3	4	3	12	$135	$41,631	$85	$26,212
530	SP-530	MH-449	MH-450	1965		0	376.68	18	VCP	890.367	889.890	10.03	10.15	880.34	879.74	0	0	0	3	4	2	8	$135	$50,852	$85	$32,018
531	SP-531	MH-450	MH-386	1965		0	139.97	18	VCP	889.890	889.760	10.15	10.24	879.74	879.52	0	0	0	3	5	2	10	$135	$18,896	$85	$11,897
532	SP-532	MH-386	MH-677	1965		0	259.73	18	VCP	889.760	889.473	10.24	10.37	879.52	879.10	0	0	0	3	4	3	12	$135	$35,064	$85	$22,077
533	SP-533	MH-396	MH-395	1965	Main	235	238.98	12	VCP	910.197	918.755	19.64	28.95	890.56	889.80	0	2100	0	2	5	3	15	$85	$20,314	$50	$11,949
534	SP-534	MH-395	MH-394	1965	Main	237	238.61	12	VCP	918.755	902.653	28.95	13.87	889.80	888.78	0	0	0	2	5	3	15	$85	$20,282	$50	$11,930
535	SP-535	MH-394	MH-407	1965	Main	256	399.01	12	VCP	902.653	900.148	13.87	12.65	888.78	887.50	3200	3100	3300	3	6	3	18	$85	$33,916	$50	$19,950
536	SP-536	MH-407	MH-406	1965	Barker	354	375.85	12	VCP	900.148	898.860	12.65	12.96	887.50	885.90	3100	0	3100	3	6	2	12	$85	$31,947	$50	$18,793
537	SP-537	MH-401	MH-406	1965		0	327.86	18	VCP	898.241	898.860	11.91	12.96	886.33	885.90	0	0	0	3	5	6	30	$135	$44,261	$85	$27,868
538	SP-538	MH-370	MH-374	1965		0	142.20	15	VCP	897.857	903.552	6.06	12.13	891.80	891.42	0	0	0	3	5	4	20	$105	$14,931	$75	$10,665

Northfield Township Asset Management Plan
Gravity Main Asset Inventory

Asset ID Information				Asset Inventory Information												Inspection Data				Criticality			Asset Renewal Cost			
OBJECT ID	Facility ID	US MH	DS MH	Install Date	Street	CCTV Length	Length	Diameter	Material	US RIM	DS RIM	US Depth	DS Depth	US I.E.	DS I.E.	PACP QStr	PAPC QOM	PACP QOverall	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost	Rehab $/Ft	Rehabilitation Cost
539	SP-539	MH-374	MH-375	1965		0	365.20	15	VCP	903.552	902.640	12.13	11.78	891.42	890.86	0	0	0	3	5	3	15	$105	$38,346	$75	$27,390
540	SP-540	MH-375	MH-358	1965		0	314.99	15	VCP	902.640	900.606	11.78	10.29	890.86	890.32	0	0	0	3	5	3	15	$105	$33,073	$75	$23,624
541	SP-541	MH-358	MH-369	1965		0	270.79	15	VCP	900.606	900.025	10.29	10.13	890.32	889.90	0	0	0	3	5	3	15	$105	$28,433	$75	$20,309
542	SP-542	MH-369	MH-359	1965		0	268.12	15	VCP	900.025	897.632	10.13	8.15	889.90	889.48	0	0	0	3	5	4	20	$105	$28,152	$75	$20,109
543	SP-543	MH-359	MH-361	1965		0	157.06	15	VCP	897.632	899.373	8.15	10.12	889.48	889.25	0	0	0	3	5	4	20	$105	$16,492	$75	$11,780
544	SP-544	MH-361	MH-360	1965		0	162.65	15	VCP	899.373	902.161	10.12	13.15	889.25	889.01	0	0	0	3	5	4	20	$105	$17,079	$75	$12,199
545	SP-545	MH-351	MH-355	1965		0	367.96	12	VCP	907.462	901.535	16.83	11.75	890.63	889.79	0	0	0	3	5	2	10	$85	$31,277	$50	$18,398
546	SP-546	MH-355	MH-361	1965		0	232.78	12	VCP	901.535	899.373	11.75	10.12	889.79	889.25	0	0	0	3	5	4	20	$85	$19,787	$50	$11,639
547	SP-547	MH-493	MH-492	1965	Main	192	242.19	12	VCP	908.668	908.458	10.74	10.94	897.93	897.52	0	0	0	2	4	2	8	$85	$20,586	$50	$12,109
548	SP-548	MH-492	MH-628	1965	Main	166	378.03	12	VCP	908.458	906.776	10.94	9.90	897.52	896.88	0	0	0	2	4	2	8	$85	$32,132	$50	$18,901
549	SP-549	MH-628	MH-692	1965		0	194.63	12	VCP	906.776	907.686	9.90	11.71	896.88	895.98	0	0	0	3	4	2	8	$85	$16,544	$50	$9,732
550	SP-550	MH-378	MH-379	1965		0	240.30	12	VCP	906.858	906.687	11.78	12.51	895.08	894.18	0	0	0	3	5	2	10	$85	$20,425	$50	$12,015
551	SP-551	MH-379	MH-377	1965		0	134.57	12	VCP	906.687	906.178	12.51	12.55	894.18	893.63	0	0	0	3	5	2	10	$85	$11,438	$50	$6,728
552	SP-552	MH-377	MH-370	1965		0	138.47	12	VCP	906.178	897.857	12.55	6.06	893.63	891.80	0	0	0	3	5	3	15	$85	$11,770	$50	$6,923
553	SP-553	MH-578	MH-577	1976	Shady Beach	189	189.00	12	RCP	901.578	899.307	6.07	4.41	895.51	894.90	0	0	0	2	3	3	9	$85	$16,065	$50	$9,450
554	SP-554	MH-577	MH-517	1976	Shady Beach	324	326.57	12	DI	899.307	899.051	4.41	4.93	894.90	894.12	0	0	0	2	3	3	9	$85	$27,759	$50	$16,329
555	SP-555	MH-517	MH-516	1976	Shady Beach	176	197.49	12	DI	899.051	899.792	4.93	6.04	894.12	893.75	0	0	0	2	3	3	9	$85	$16,787	$50	$9,875
556	SP-556	MH-516	MH-536	1976	Shady Beach	297	297.00	12	DI	899.792	900.504	6.04	7.57	893.75	892.93	0	0	0	2	3	3	9	$85	$25,245	$50	$14,850
557	SP-557	MH-536	MH-533	1976	Shady Beach	343	344.26	12	DI	900.504	901.046	7.57	9.37	892.93	891.68	0	3100	3100	3	4	3	12	$85	$29,262	$50	$17,213
558	SP-558	MH-533	MH-535	1976	Shady Beach	227	226.15	12	DI	901.046	899.374	9.37	8.78	891.68	890.59	0	0	0	2	3	3	9	$85	$19,223	$50	$11,308
559	SP-559	MH-535	MH-534	1976	Shady Beach	212	216.38	12	RCP	899.374	897.964	8.78	7.60	890.59	890.36	0	0	0	2	3	3	9	$85	$18,393	$50	$10,819
560	SP-560	MH-534	MH-543	1976	Shady Beach	325	327.14	12	RCP	897.964	905.276	7.60	15.57	890.36	889.71	0	3100	3100	3	4	3	12	$85	$27,807	$50	$16,357
561	SP-561	MH-586	MH-580	1976	Shady Beach	74	76.23	12	DI	905.569	904.538	9.24	8.31	896.33	896.23	0	0	0	2	3	3	9	$85	$6,479	$50	$3,811
562	SP-562	MH-580	MH-579	1976	Shady Beach	236	236.32	12	DI	904.538	902.471	8.31	6.64	896.23	895.83	0	0	0	2	3	3	9	$85	$20,088	$50	$11,816
563	SP-563	MH-579	MH-578	1976	Shady Beach	211	232.20	12	DI	902.471	901.578	6.64	6.07	895.83	895.51	0	0	0	2	3	3	9	$85	$19,737	$50	$11,610
565	SP-565	MH-543	MH-528	1978	Whitemore Lake rd	311	311.00	12	RCP	905.276	903.851	15.57	14.75	889.71	889.10	0	0	0	2	3	3	9	$85	$26,435	$50	$15,550
566	SP-566	MH-528	MH-529	1978	Whitemore Lake rd	267	267.00	12	DI	903.851	899.285	14.75	10.76	889.10	888.53	0	0	0	2	3	2	6	$85	$22,695	$50	$13,350
567	SP-567	MH-529	MH-726	1978		0	46.71	12	VCP	899.285		10.76		888.53		0	0	0	3	3	2	6	$85	$3,971	$50	$2,336
568	SP-568	MH-526	MH-527	1978		0	240.67	12	VCP	909.323	911.702	5.29	8.20	904.03	903.50	0	0	0	3	3	2	6	$85	$20,457	$50	$12,033
569	SP-569	MH-527	MH-532	1978		0	338.41	12	VCP	911.702	911.132	8.20	8.37	903.50	902.76	0	0	0	3	3	2	6	$85	$28,765	$50	$16,920
570	SP-570	MH-532	MH-500	1978		0	244.69	12	VCP	911.132	909.159	8.37	6.94	902.76	902.22	0	0	0	3	3	2	6	$85	$20,799	$50	$12,235
571	SP-571	MH-500	MH-501	1978		0	361.02	12	VCP	909.159	907.903	6.94	6.48	902.22	901.42	0	0	0	3	3	2	6	$85	$30,687	$50	$18,051
572	SP-572	MH-501	MH-497	1978		0	414.16	12	VCP	907.903	908.017	6.48	7.51	901.42	900.51	0	0	0	3	3	2	6	$85	$35,204	$50	$20,708
573	SP-573	MH-497	MH-498	1978		0	343.96	12	VCP	908.017	908.324	7.51	8.56	900.51	899.76	0	0	0	3	3	2	6	$85	$29,236	$50	$17,198
574	SP-574	MH-498	MH-499	1978		0	90.38	12	VCP	908.324	908.537	8.56	8.98	899.76	899.56	0	0	0	3	3	2	6	$85	$7,682	$50	$4,519
575	SP-575	MH-499	MH-494	1978		0	325.90	12	VCP	908.537	908.466	8.98	9.63	899.56	898.84	0	0	0	3	3	2	6	$85	$27,702	$50	$16,295
576	SP-576	MH-494	MH-495	1965		0	132.36	12	VCP	908.466	908.533	9.63	9.98	898.84	898.55	0	0	0	3	4	2	8	$85	$11,251	$50	$6,618
577	SP-577	MH-495	MH-496	1965	Main	253	253.00	12	VCP	908.533	908.061	9.98	9.69	898.55	898.37	0	0	0	3	5	2	10	$85	$21,505	$50	$12,650
578	SP-578	MH-496	MH-493	1965	Main	376	376.00	12	VCP	908.061	908.668	9.69	10.74	898.37	897.93	0	0	0	2	4	2	8	$85	$31,960	$50	$18,800
579	SP-579	MH-135	MH-134	2000	Turnberry	194	215.54	8	PVC	912.742	915.534					0	0	0	2	2	1	2	$65	$14,010	$45	$9,699
581	SP-581	MH-141	MH-139	2000		0	41.73	8	PVC	913.853						0	0	0	3	2	2	4	$65	$2,712	$45	$1,878
582	SP-582	MH-548	MH-550	2000		0	372.45	8	PVC	909.487	912.009	9.20	13.19	900.29	898.82	0	0	0	3	3	2	6	$65	$24,209	$45	$16,760
583	SP-583	MH-550	MH-551	2000		0	382.52	8	PVC	912.009	915.882	13.19	18.58	898.82	897.30	0	0	0	3	3	2	6	$65	$24,864	$45	$17,213
584	SP-584	MH-551	MH-553	2000		0	481.28	8	PVC	915.882	902.311	18.58	6.91	897.30	895.40	0	0	0	3	3	3	9	$65	$31,283	$45	$21,658
585	SP-585	MH-554	MH-555	1976		0	45.16	10	VCP	900.580	899.390	5.18	4.09	895.40	895.30	0	0	0	3	3	3	9	$75	$3,387	$50	$2,258
586	SP-586	MH-555	MH-567	1976	Lakeshore	208	308.13	10	VCP	899.390	898.427	4.09	3.85	895.30	894.58	0	3100	3100	3	4	2	8	$75	$23,110	$50	$15,406
587	SP-587	MH-567	MH-568	1976	Lakeshore	196	196.09	10	VCP	898.427	899.252	3.85	5.46	894.58	893.79	0	0	0	2	3	1	3	$75	$14,707	$50	$9,804
588	SP-588	MH-556	MH-554	1976	6mile	57	61.13	8	VCP	903.404	900.580	5.34	5.18	898.06	895.40	0	0	0	2	3	3	9	$65	$3,974	$45	$2,751
589	SP-589	MH-568	MH-570	1976	Lakeshore	121	137.50	10	VCP	899.252	898.611	5.46	5.21	893.79	893.40	0	0	0	2	3	2	6	$75	$10,313	$50	$6,875
590	SP-590	MH-570	MH-569	1976	Lakeshore	265	281.83	10	VCP	898.611	898.360	5.21	5.76	893.40	892.60	3100	3100	3200	3	4	2	8	$75	$21,137	$50	$14,092
591	SP-591	MH-569	MH-576	1976	Lakeshore	220	220.00	10	VCP	898.360	898.505	5.76	6.46	892.60	892.04	0	3100	3100	3	4	2	8	$75	$16,500	$50	$11,000
593	SP-593	MH-728	MH-482	1978		0	39.97	8	VCP		899.985		10.76		889.23	0	0	0	3	2	2	4	$65	$2,598	$45	$1,799
595	SP-595	MH-144	MH-130	2000	Turnberry	286	293.83	8	PVC	912.187	914.142					3100	0	3100	3	3	1	3	$65	$19,099	$45	$13,222

Northfield Township Asset Management Plan
Gravity Main Asset Inventory

Asset ID Information				Asset Inventory Information												Inspection Data				Criticality			Asset Renewal Cost			
OBJECT ID	Facility ID	US MH	DS MH	Install Date	Street	CCTV Length	Length	Diameter	Material	US RIM	DS RIM	US Depth	DS Depth	US I.E.	DS I.E.	PACP QStr	PAPC QOM	PACP QOverall	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost	Rehab $/Ft	Rehabilitation Cost
596	SP-596	MH-130	MH-136	2000	Turnberry	259	264.62	8	PVC	914.142	915.090					0	0	0	2	2	1	2	$65	$17,201	$45	$11,908
597	SP-597	MH-136	MH-142	2000	Turnberry	144	144.00	8	PVC	915.090	916.262					0	0	0	2	2	1	2	$65	$9,360	$45	$6,480
598	SP-598	MH-142	MH-140	2000	Turnberry	142	142.00	8	PVC	916.262	915.163					0	0	0	2	2	1	2	$65	$9,230	$45	$6,390
599	SP-599	MH-132	MH-131	2000	Turnberry	175	174.00	8	PVC	911.894	912.420					0	0	0	2	2	1	2	$65	$11,310	$45	$7,830
600	SP-600	MH-131	MH-137	2000	Turnberry	160	165.39	8	PVC	912.420	912.924					0	0	0	2	2	1	2	$65	$10,750	$45	$7,442
601	SP-601	MH-137	MH-138	2000	Turnberry	206	206.00	8	PVC	912.924	914.083					0	0	0	2	2	1	2	$65	$13,390	$45	$9,270
602	SP-602	MH-140	MH-138	2000	Turnberry	165	183.24	8	PVC	915.163	914.083					0	0	0	2	2	1	2	$65	$11,911	$45	$8,246
603	SP-603	MH-138	MH-141	2000	Turnberry	75	75.00	8	PVC	914.083	913.853					0	0	0	2	2	1	2	$65	$4,875	$45	$3,375
604	SP-604	MH-133	MH-141	2000	Turnberry	209	217.56	8	PVC	914.775	913.853					0	0	0	2	2	1	2	$65	$14,141	$45	$9,790
605	SP-605	MH-134	MH-133	2000	Turnberry	89	93.96	8	PVC	915.534	914.775					0	0	0	2	2	1	2	$65	$6,108	$45	$4,228
606	SP-606	MH-360	MH-363	1965		0	315.12	15	VCP	902.161	896.921	13.15	8.35	889.01	888.57	0	0	0	3	5	3	15	$105	$33,087	$75	$23,634
607	SP-607	MH-363	MH-364	1965		0	148.57	15	VCP	896.921	895.407	8.35	7.10	888.57	888.31	0	0	0	3	5	4	20	$105	$15,599	$75	$11,142
608	SP-608	MH-364	MH-405	1965		0	298.60	15	VCP	895.407	899.892	7.10	12.09	888.31	887.80	0	0	0	3	5	4	20	$105	$31,353	$75	$22,395
609	SP-609	MH-405	MH-404	1965		0	160.42	15	VCP	899.892	896.682	12.09	9.14	887.80	887.54	0	0	0	3	5	3	15	$105	$16,844	$75	$12,031
610	SP-610	MH-404	MH-403	1965		0	92.27	15	VCP	896.682	893.226	9.14	5.86	887.54	887.37	0	0	0	3	5	4	20	$105	$9,689	$75	$6,921
613	SP-613	MH-403	MH-402	1965		0	302.24	15	VCP	893.226	899.551	5.86	12.66	887.37	886.89	0	0	0	3	5	4	20	$105	$31,735	$75	$22,668
614	SP-614	MH-402	MH-401	1965		0	219.60	15	VCP	899.551	898.241	12.66	11.91	886.89	886.33	0	0	0	3	5	5	25	$105	$23,058	$75	$16,470
615	SP-615	MH-410	MH-411	1965		0	426.47	18	VCP	906.616	904.116	21.47	19.65	885.15	884.47	0	0	0	3	4	5	20	$135	$57,574	$85	$36,250
616	SP-616	MH-411	MH-397	1965		0	268.53	18	VCP	904.116	902.617	19.65	18.58	884.47	884.04	0	0	0	3	4	5	20	$135	$36,252	$85	$22,825
617	SP-617	MH-397	MH-398	1965		0	345.88	18	VCP	902.617	892.669	18.58	9.18	884.04	883.49	0	0	0	3	4	6	24	$135	$46,693	$85	$29,399
618	SP-618	MH-398	MH-413	1965		0	290.32	18	VCP	892.669	892.363	9.18	9.43	883.49	882.93	0	0	0	3	4	4	16	$135	$39,193	$85	$24,677
619	SP-619		MH-411	1965		0	154.17	8	VCP		904.116		19.65		884.47	0	0	0	3	3	3	9	$65	$10,021	$45	$6,938
620	SP-620	MH-667	MH-734	2000		0	416.97	12	PVC	919.746	918.320	12.81	14.45	906.94	903.87	0	0	0	3	2	1	2	$85	$35,443	$50	$20,849
621	SP-621	MH-668	MH-735	2000		0	792.69	12	PVC	917.786	916.656	11.79	12.57	906.00	904.09	0	0	0	3	2	1	2	$85	$67,379	$50	$39,635
622	SP-622	MH-735	MH-734	2000		0	20.45	12	PVC	916.656	918.320	12.57	14.45	904.09	903.87	0	0	0	3	2	1	2	$85	$1,738	$50	$1,022
623	SP-623	MH-734	MH-733	2001		0	141.25	12	PVC	918.320	916.805	14.45	13.46	903.87	903.35	0	0	0	3	2	2	4	$85	$12,006	$50	$7,063
624	SP-624	MH-733	MH-732	2001		0	308.87	12	PVC	916.805	910.753	13.46	7.92	903.35	902.83	0	0	0	3	2	1	2	$85	$26,254	$50	$15,444
625	SP-625	MH-732	MH-731	2001		0	271.31	12	PVC	910.753	913.036	7.92	11.07	902.83	901.97	0	0	0	3	2	1	2	$85	$23,061	$50	$13,565
626	SP-626	MH-731	MH-736	2001		0	405.99	15	PVC	913.036	913.700	11.07	13.18	901.97	900.52	0	0	0	3	2	4	8	$105	$42,629	$75	$30,450
627	SP-627	MH-736	MH-644	2001		0	193.56	21	PVC	913.700	912.725	13.18	12.43	900.52	900.29	0	0	0	3	2	3	6	$145	$28,067	$100	$19,356
628	SP-628	MH-640	MH-639	2001		0	352.52	21	PVC	920.905	917.841	19.55	16.96	901.35	900.88	0	0	0	3	2	2	4	$145	$51,115	$100	$35,252
629	SP-629	MH-639	MH-742	2001		0	175.95	21	PVC	917.841	916.926	16.96	16.58	900.88	900.35	0	0	0	3	2	2	4	$145	$25,513	$100	$17,595
630	SP-630	MH-175	MH-742	2000		0	82.61	8	PVC	918.085	916.926	16.01	16.58	902.07	900.35	0	0	0	3	2	1	2	$65	$5,370	$45	$3,717
631	SP-631	MH-742	MH-741	2001		0	375.26	21	PVC	916.926	917.728	16.58	17.77	900.35	899.96	0	0	0	3	2	2	4	$145	$54,413	$100	$37,526
632	SP-632	MH-741	MH-739	2001		0	402.61	21	PVC	917.728	917.624	17.77	18.13	899.96	899.49	0	0	0	3	2	2	4	$145	$58,379	$100	$40,261
633	SP-633	MH-739	MH-740	2001		0	101.76	21	PVC	917.624	917.561	18.13	18.43	899.49	899.13	0	0	0	3	2	3	6	$145	$14,755	$100	$10,176
634	SP-634	MH-740	MH-641	2001		0	317.54	21	PVC	917.561	919.195	18.43	20.55	899.13	898.64	0	0	0	3	2	3	6	$145	$46,044	$100	$31,754
635	SP-635	MH-646	MH-739	2001		0	220.56	8	PVC	917.527	917.624	13.07	18.13	904.46	899.49	0	0	0	3	2	0	0	$65	$14,336	$45	$9,925
636	SP-636	MH-644	MH-643	2001		0	202.54	21	PVC	912.725	913.776	12.43	13.83	900.29	899.95	0	0	0	3	2	4	8	$145	$29,368	$100	$20,254
637	SP-637	MH-643	MH-738	2001		0	359.09	21	PVC	913.776	917.626	13.83	18.14	899.95	899.49	0	0	0	3	2	3	6	$145	$52,068	$100	$35,909
638	SP-638	MH-738	MH-641	2001		0	309.51	21	PVC	917.626	919.195	18.14	20.55	899.49	898.64	0	0	0	3	2	3	6	$145	$44,879	$100	$30,951
639	SP-639	MH-641	MH-642	2000		0	21.15	30	PVC	919.195	919.183	20.55	20.83	898.64	898.35	0	0	0	3	2	3	6	$200	$4,231	$150	$3,173
640	SP-640	MH-642	MH-645	2000		0	42.35	30	PVC	919.183		20.83		898.35		0	0	0	3	2	3	6	$200	$8,469	$150	$6,352
641	SP-641		MH-646	2001		0	44.48	8	PVC		917.527		13.07		904.46	0	0	0	3	2	0	0	$65	$2,891	$45	$2,002
642	SP-642	MH-649	MH-640	2001		0	349.79	21	PVC	921.301	920.905	19.66	19.55	901.64	901.35	0	0	0	3	2	2	4	$145	$50,720	$100	$34,979
645	SP-645	MH-652	MH-650	2001		0	399.81	21	PVC	922.135	922.893	18.68	19.95	903.45	902.94	0	0	0	3	2	2	4	$145	$57,972	$100	$39,981
646	SP-646	MH-650	MH-647	2001		0	226.83	21	PVC	922.893	922.035	19.95	19.35	902.94	902.68	0	0	0	3	2	2	4	$145	$32,890	$100	$22,683
647	SP-647	MH-692	MH-378	1965		0	183.39	12	VCP	907.686	906.858	11.71	11.78	895.98	895.08	0	0	0	3	5	2	10	$85	$15,588	$50	$9,169
648	SP-648	MH-647	MH-648	2001		0	401.02	21	PVC	922.035	921.670	19.35	19.35	902.68	902.32	0	0	0	3	2	3	6	$145	$58,147	$100	$40,102
649	SP-649	MH-648	MH-649	2001		0	351.95	21	PVC	921.670	921.301	19.35	19.66	902.32	901.64	0	0	0	3	2	2	4	$145	$51,033	$100	$35,195
650	SP-650		MH-640	2001		0	84.80	8	PVC		920.905		19.55		901.35	0	0	0	3	2	1	2	$65	$5,512	$45	$3,816
651	SP-651		MH-649	2001		0	80.47	8	PVC		921.301		19.66		901.64	0	0	0	3	2	1	2	$65	$5,231	$45	$3,621
652	SP-652	MH-651	MH-650	2000		0	91.48	8	PVC	921.945	922.893	18.21	19.95	903.73	902.94	0	0	0	3	2	1	2	$65	$5,946	$45	$4,116

Northfield Township Asset Management Plan
Gravity Main Asset Inventory

Asset ID Information				Asset Inventory Information												Inspection Data				Criticality			Asset Renewal Cost			
OBJECT ID	Facility ID	US MH	DS MH	Install Date	Street	CCTV Length	Length	Diameter	Material	US RIM	DS RIM	US Depth	DS Depth	US I.E.	DS I.E.	PACP QStr	PAPC QOM	PACP QOverall	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost	Rehab $/Ft	Rehabilitation Cost
653	SP-653	MH-659	MH-653	2001		0	408.90	21	PVC	923.825	924.009	19.17	19.76	904.65	904.25	0	0	0	3	2	2	4	$145	$59,290	$100	$40,890
654	SP-654	MH-653	MH-652	2001		0	399.77	21	PVC	924.009	922.135	19.76	18.68	904.25	903.45	0	0	0	3	2	2	4	$145	$57,967	$100	$39,977
656	SP-656	MH-660	MH-659	2000		0	161.25	8	PVC	927.257	923.825	19.70	19.17	907.56	904.65	0	0	0	3	2	1	2	$65	$10,481	$45	$7,256
657	SP-657	MH-664	MH-659	2001		0	339.66	21	PVC	924.284	923.825	15.01	19.17	909.27	904.65	0	0	0	3	2	2	4	$145	$49,251	$100	$33,966
658	SP-658	MH-661	MH-662	2000		0	51.05	8	PVC	920.919	920.616	9.91	10.05	911.01	910.57	0	0	0	3	2	0	0	$65	$3,318	$45	$2,297
659	SP-659	MH-662	MH-663	2000		0	297.52	8	PVC	920.616	922.113	10.05	13.00	910.57	909.11	0	0	0	3	2	0	0	$65	$19,339	$45	$13,388
660	SP-660	MH-663	MH-660	2000		0	454.92	8	PVC	922.113	927.257	13.00	19.70	909.11	907.56	0	0	0	3	2	0	0	$65	$29,570	$45	$20,471
662	SP-662	MH-665	MH-664	2001		0	289.10	21	PVC	923.359	924.284	13.29	15.01	910.07	909.27	0	0	0	3	2	2	4	$145	$41,920	$100	$28,910
663	SP-663	MH-666	MH-667	2000		0	398.00	12	PVC	934.594	919.746	19.35	12.81	915.24	906.94	0	0	0	3	2	2	4	$85	$33,830	$50	$19,900
664	SP-664	MH-670	MH-669	2000		0	60.60	12	PVC	917.725	917.272	10.74	10.86	906.99	906.41	0	0	0	3	2	1	2	$85	$5,151	$50	$3,030
665	SP-665	MH-669	MH-668	2000		0	133.14	12	PVC	917.272	917.786	10.86	11.79	906.41	906.00	0	0	0	3	2	1	2	$85	$11,317	$50	$6,657
666	SP-666	MH-673	MH-670	2000		0	329.46	8	PVC	928.785	917.725	12.73	10.74	916.06	906.99	0	0	0	3	2	0	0	$65	$21,415	$45	$14,826
667	SP-667	MH-795	MH-672	2016		0	252.89	12	PVC	918.720	919.070	10.55	11.58	908.17	907.49	0	0	0	3	2	1	2	$85	$21,496	$50	$12,645
668	SP-668	MH-672	MH-670	2016		0	218.36	12	PVC	919.070	917.725	11.58	10.74	907.49	906.99	0	0	0	3	2	1	2	$85	$18,560	$50	$10,918
670	SP-670	MH-674	MH-673	2000		0	198.39	8	PVC	931.017	928.785	8.88	12.73	922.14	916.06	0	0	0	3	2	0	0	$65	$12,895	$45	$8,928
671	SP-671	MH-675	MH-737	2000		0	403.49	12	PVC	910.070	910.774	6.66	8.39	903.41	902.38	0	0	0	3	2	2	4	$85	$34,297	$50	$20,175
672	SP-672	MH-737	MH-736	2000		0	404.13	12	PVC	910.774	913.700	8.39	13.18	902.38	900.52	0	0	0	3	2	3	6	$85	$34,351	$50	$20,207
686	SP-686	MH-677	MH-730	1965		0	26.77	18	VCP	889.473		10.37		879.10		0	0	0	3	4	3	12	$135	$3,614	$85	$2,275
687	SP-687	MH-743	MH-744	2003		0	142.77	8	PVC	909.960	907.796	12.51	11.07	897.45	896.73	0	0	0	3	2	1	2	$65	$9,280	$45	$6,424
688	SP-688	MH-744	MH-745	2003		0	294.47	8	PVC	907.796	907.393	11.07	12.44	896.73	894.95	0	0	0	3	2	1	2	$65	$19,141	$45	$13,251
689	SP-689	MH-745	MH-746	2003		0	295.31	8	PVC	907.393	907.377	12.44	13.36	894.95	894.02	0	0	0	3	2	1	2	$65	$19,195	$45	$13,289
690	SP-690	MH-746	MH-636	2003		0	172.58	8	PVC	907.377	905.282	13.36	11.97	894.02	893.31	0	0	0	3	2	0	0	$65	$11,218	$45	$7,766
691	SP-691	MH-636	MH-637	2003		0	88.06	8	PVC	905.282	901.704	11.97	8.87	893.31	892.83	0	0	0	3	2	1	2	$65	$5,724	$45	$3,963
692	SP-692	MH-637	MH-638	2003		0	75.68	8	PVC	901.704	902.393	8.87	9.95	892.83	892.44	0	0	0	3	2	1	2	$65	$4,919	$45	$3,405
693	SP-693	MH-638	MH-101	2003		0	134.84	8	PVC	902.393	904.497	9.95	17.59	892.44	886.91	0	0	0	3	2	1	2	$65	$8,764	$45	$6,068
694	SP-694	MH-689	MH-569	1976	S Horseshoe Blvd	204	249.19	8	PVC	904.172	898.360		5.76		892.60	0	0	0	2	2	2	4	$65	$16,197	$45	$11,214
695	SP-695	MH-690	MH-689	1976	S Horseshoe Blvd	369	402.17	8	PVC	914.939	904.172					0	0	0	2	2	1	2	$65	$26,141	$45	$18,098
697	SP-697	MH-694	MH-013	1996		0	44.55	12	PVC	910.006	910.131					0	0	0	3	2	2	4	$85	$3,787	$50	$2,227
698	SP-698	MH-695	MH-341	1965	Lincoln	262	262.00	8	VCP	905.458	904.408	8.85	8.77	896.61	895.64	0	3500	3500	3	5	1	5	$65	$17,030	$45	$11,790
699	SP-699	MH-658	MH-431	1993		0	95.05	8	PVC	907.590	907.983					0	0	0	3	2	1	2	$65	$6,178	$45	$4,277
700	SP-700	MH-657	MH-658	1993		0	214.73	8	PVC	907.669	907.590					0	0	0	3	2	1	2	$65	$13,958	$45	$9,663
701	SP-701	MH-656	MH-657	1993		0	260.00	8	PVC	908.089	907.669					0	0	0	3	2	1	2	$65	$16,900	$45	$11,700
702	SP-702	MH-655	MH-656	1993		0	120.00	8	PVC	909.058	908.089					0	0	0	3	2	1	2	$65	$7,800	$45	$5,400
703	SP-703	MH-654	MH-655	1993		0	400.03	8	PVC	908.228	909.058					0	0	0	3	2	0	0	$65	$26,002	$45	$18,001
704	SP-704	MH-696	MH-697	2006		0	196.44	8	PVC	906.259	906.904	9.96	11.49	896.30	895.41	0	0	0	3	2	1	2	$65	$12,769	$45	$8,840
705	SP-705	MH-697	MH-345	2006		0	202.90	8	PVC	906.904	905.943	11.49	11.32	895.41	894.62	0	0	0	3	3	1	3	$65	$13,189	$45	$9,131
706	SP-706	MH-344	MH-345	1965	Ash	204	212.30	10	VCP	905.298	905.943	10.01	11.32	895.29	894.62	0	3521	3521	3	6	1	6	$75	$15,922	$50	$10,615
707	SP-707	MH-341	MH-344	1965	Ash	101	108.75	10	VCP	904.408	905.298	8.77	10.01	895.64	895.29	0	3222	3222	3	5	1	5	$75	$8,157	$50	$5,438
708	SP-708	MH-342	MH-341	1965	Ash	240	240.00	10	VCP	904.982	904.408	8.82	8.77	896.16	895.64	0	0	0	2	4	1	4	$75	$18,000	$50	$12,000
709	SP-709	MH-327	MH-695	1965	Ash	236	270.71	8	VCP	904.665	905.458	7.20	8.85	897.47	896.61	0	3123	3123	3	5	1	5	$65	$17,596	$45	$12,182
710	SP-710	MH-346	MH-341	1965	Lincoln	358	390.18	8	VCP	902.242	904.408	5.08	8.77	897.16	895.64	4100	3300	4133	4	6	1	6	$65	$25,362	$45	$17,558
711	SP-711	MH-345	MH-371	1965	Ash	270	275.80	10	VCP	905.943	899.859	11.32	6.12	894.62	893.74	3200	2100	3221	3	6	1	6	$75	$20,685	$50	$13,790
712	SP-712	MH-371	MH-370	1965	Ash	119	119.00	10	VCP	899.859	897.857	6.12	6.06	893.74	891.80	0	0	0	2	5	3	15	$75	$8,925	$50	$5,950
713	SP-713	MH-150	MH-170	1986	Charring Cross	342	347.83	8	PVC	926.108	919.238	16.92	12.49	909.19	906.75	0	0	0	2	2	1	2	$65	$22,609	$45	$15,652
714	SP-714	MH-170	MH-159	1986		0	294.41	8	PVC	919.238	930.957	12.49	13.38	906.75	917.58	0	0	0	3	3	1	3	$65	$19,137	$45	$13,248
715	SP-715	MH-048	MH-147	1986		0	306.33	8	PVC	984.249	977.196	14.75	11.67	969.50	965.53	0	0	0	3	3	1	3	$65	$19,911	$45	$13,785
716	SP-716	MH-147	MH-146	1986		0	172.08	8	PVC	977.196	970.805	11.67	14.12	965.53	956.69	0	0	0	3	3	1	3	$65	$11,185	$45	$7,743
717	SP-717	MH-146	MH-149	1986		0	193.60	8	PVC	970.805	960.660	14.12	16.22	956.69	944.44	0	0	0	3	3	1	3	$65	$12,584	$45	$8,712
718	SP-718	MH-149	MH-153	1986	Charring Cross	153	156.49	8	PVC	960.660	949.905	16.22	15.90	944.44	934.00	0	0	0	2	2	1	2	$65	$10,172	$45	$7,042
719	SP-719	MH-153	MH-151	1986	Charring Cross	146	152.71	8	PVC	949.905	935.019	15.90	11.30	934.00	923.72	0	0	0	2	2	1	2	$65	$9,926	$45	$6,872
720	SP-720	MH-151	MH-150	1986	Charring Cross	172	171.56	8	PVC	935.019	926.108	11.30	16.92	923.72	909.19	0	0	0	2	2	1	2	$65	$11,151	$45	$7,720
721	SP-721	MH-050	MH-049	1986		0	143.66	8	PVC	984.189	983.527	9.94	11.03	974.25	972.50	0	0	0	3	3	1	3	$65	$9,338	$45	$6,465
722	SP-722	MH-049	MH-065	1986		0	202.58	8	PVC	983.527	978.204	11.03	11.94	972.50	966.26	0	0	0	3	3	1	3	$65	$13,167	$45	$9,116

Northfield Township Asset Management Plan
Gravity Main Asset Inventory

Asset ID Information				Asset Inventory Information												Inspection Data				Criticality			Asset Renewal Cost			
OBJECT ID	Facility ID	US MH	DS MH	Install Date	Street	CCTV Length	Length	Diameter	Material	US RIM	DS RIM	US Depth	DS Depth	US I.E.	DS I.E.	PACP QStr	PAPC QOM	PACP QOverall	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost	Rehab $/Ft	Rehabilitation Cost
723	SP-723	MH-065	MH-064	1986		0	168.95	8	PVC	978.204	970.979	11.94	15.36	966.26	955.62	0	0	0	3	3	1	3	$65	$10,982	$45	$7,603
724	SP-724	MH-064	MH-157	1986		0	251.03	8	PVC	970.979	950.435	15.36	11.98	955.62	938.45	0	0	0	3	3	1	3	$65	$16,317	$45	$11,296
725	SP-725	MH-157	MH-159	1986		0	251.74	8	PVC	950.435	930.957	11.98	13.38	938.45	917.58	0	0	0	3	3	1	3	$65	$16,363	$45	$11,328
726	SP-726	MH-170	MH-171	1986		0	356.85	8	PVC	919.238	913.625	12.49		906.75		0	0	0	3	3	1	3	$65	$23,195	$45	$16,058
727	SP-727	MH-152	MH-153	1986	Glengary	195	195.00	8	PVC	955.720	949.905	12.80	15.90	942.92	934.00	0	0	0	2	2	1	2	$65	$12,675	$45	$8,775
728	SP-728	MH-145	MH-148	1986		0	337.05	8	PVC	964.804	940.092	7.07	14.05	957.73	926.04	0	0	0	3	3	1	3	$65	$21,908	$45	$15,167
729	SP-729	MH-148	MH-150	1986	Harpers Ferry	225	228.38	8	PVC	940.092	926.108	14.05	16.92	926.04	909.19	0	0	0	2	2	1	2	$65	$14,845	$45	$10,277
730	SP-730	MH-039	MH-038	1996		0	164.86	8	PVC	911.135	909.993	11.29	10.89	899.85	899.10	0	0	0	3	2	2	4	$65	$10,716	$45	$7,419
731	SP-731	MH-038	MH-037	1996		0	97.18	8	PVC	909.993	911.445	10.89	13.13	899.10	898.31	0	0	0	3	2	1	2	$65	$6,317	$45	$4,373
732	SP-732	MH-037	MH-036	1996		0	30.18	8	PVC	911.445	910.425	13.13	12.03	898.31	898.39	0	0	0	3	2	1	2	$65	$1,962	$45	$1,358
733	SP-733	MH-036	MH-035	1996	Lake Pine	190	190.40	8	PVC	910.425	909.408	12.03		898.39		0	0	0	2	2	2	4	$65	$12,376	$45	$8,568
734	SP-734	MH-043	MH-044	1996		0	200.86	8	PVC	910.850	911.450	12.41	13.82	898.44	897.63	0	0	0	3	2	1	2	$65	$13,056	$45	$9,039
735	SP-735	MH-044	MH-045	1996		0	108.50	8	PVC	911.450	912.100	13.82	14.97	897.63	897.13	0	0	0	3	2	1	2	$65	$7,053	$45	$4,883
736	SP-736	MH-045	MH-047	1996		0	173.64	8	PVC	912.100	911.550	14.97	14.96	897.13	896.59	0	0	0	3	2	2	4	$65	$11,287	$45	$7,814
737	SP-737	MH-047	MH-046	1996		0	47.40	8	PVC	911.550	911.550	14.96	15.62	896.59	895.93	0	0	0	3	2	2	4	$65	$3,081	$45	$2,133
738	SP-738	MH-046	MH-633	1996		0	327.98	10	PVC	911.550	910.421	15.62	15.47	895.93	894.95	0	0	0	3	2	1	2	$75	$24,599	$50	$16,399
739	SP-739	MH-041	MH-042	1996		0	121.71	8	PVC	910.600	911.250	10.94	12.16	899.66	899.09	0	0	0	3	2	1	2	$65	$7,911	$45	$5,477
740	SP-740	MH-042	MH-043	1996		0	131.51	8	PVC	911.250	910.850	12.16	12.41	899.09	898.44	0	0	0	3	2	1	2	$65	$8,548	$45	$5,918
741	SP-741	MH-633	MH-632	1996		0	118.14	10	PVC	910.421	909.207	15.47	14.61	894.95	894.60	0	0	0	3	2	1	2	$75	$8,861	$50	$5,907
742	SP-742	MH-632	MH-631	1996		0	162.35	10	PVC	909.207	906.662	14.61	12.55	894.60	894.11	0	0	0	3	2	1	2	$75	$12,177	$50	$8,118
743	SP-743	MH-631	MH-723	1996		0	252.98	10	PVC	906.662	902.286	12.55	8.94	894.11	893.35	0	0	0	3	2	3	6	$75	$18,973	$50	$12,649
744	SP-744	MH-004	MH-040	1996		0	387.86	10	PVC	911.864	910.487					0	0	0	3	2	1	2	$75	$29,089	$50	$19,393
745	SP-745	MH-040	MH-046	1996		0	131.70	10	PVC	910.487	911.550		15.62		895.93	0	0	0	3	2	1	2	$75	$9,878	$50	$6,585
746	SP-746	MH-003	MH-035	1996		0	132.17	12	PVC	907.394	909.408					0	0	0	3	2	2	4	$85	$11,235	$50	$6,609
747	SP-747	MH-002	MH-003	1996		0	204.49	12	PVC	907.201	907.394					0	0	0	3	2	2	4	$85	$17,381	$50	$10,224
748	SP-748	MH-035	MH-729	1996	Lake Pine	128	128.00	12	PVC	909.408						0	0	0	2	2	2	4	$85	$10,880	$50	$6,400
749	SP-749	MH-629	MH-257	1969		0	85.60	12	VCP	906.177	906.700	15.85	16.48	890.33	890.22	0	0	0	3	4	2	8	$85	$7,276	$50	$4,280
750	SP-750	MH-129	MH-629	1969		0	315.52	12	VCP	903.152	906.177	12.07	15.85	891.08	890.33	0	0	0	3	4	2	8	$85	$26,820	$50	$15,776
751	SP-751	MH-128	MH-129	1969		0	357.51	12	VCP	902.682	903.152	10.81	12.07	891.87	891.08	0	0	0	3	4	2	8	$85	$30,388	$50	$17,875
752	SP-752	MH-699	MH-700	2003		0	198.24	8	PVC	924.000	926.530	5.58	9.37	918.42	917.16	0	0	0	3	2	1	2	$65	$12,885	$45	$8,921
753	SP-753	MH-701	MH-702	2003		0	342.95	8	PVC	924.900	918.512	9.94	9.46	914.96	909.05	0	0	0	3	2	1	2	$65	$22,292	$45	$15,433
754	SP-754	MH-702	MH-703	2003		0	243.40	8	PVC	918.512	916.400	9.46	11.45	909.05	904.95	0	0	0	3	2	1	2	$65	$15,821	$45	$10,953
755	SP-755	MH-700	MH-701	2003		0	345.77	8	PVC	926.530	924.900	9.37	9.94	917.16	914.96	0	0	0	3	2	1	2	$65	$22,475	$45	$15,560
756	SP-756	MH-703	MH-704	2003		0	191.32	8	PVC	916.400	913.350	11.45	10.19	904.95	903.16	0	0	0	3	2	1	2	$65	$12,436	$45	$8,609
757	SP-757	MH-089	MH-088	1974		0	235.24	8	VCP	925.644	923.688					0	0	0	3	3	1	3	$65	$15,290	$45	$10,586
758	SP-758	MH-088	MH-084	1974		0	138.83	8	VCP	923.688	909.541		16.81		892.73	0	0	0	3	2	1	2	$65	$9,024	$45	$6,247
759	SP-759	MH-091	MH-084	1974		0	245.23	8	VCP	902.064	909.541		16.81		892.73	0	0	0	3	3	1	3	$65	$15,940	$45	$11,036
760	SP-760	MH-084	MH-085	1969		0	151.44	10	VCP	909.541	909.342	16.81	17.05	892.73	892.29	0	0	0	3	4	1	4	$75	$11,358	$50	$7,572
761	SP-761	MH-057	MH-712	1974	9 Mile	54	54.00	8	VCP	900.809	898.383					0	0	0	2	3	1	3	$65	$3,510	$45	$2,430
762	SP-762	MH-056	MH-713	1974	Nine Mile	146	149.63	8	VCP	895.131						0	0	0	2	3	1	3	$65	$9,726	$45	$6,733
763	SP-763	MH-052	MH-051	1974	9 Mile	260	269.74	8	VCP	896.879	901.597					0	0	0	2	3	3	9	$65	$17,533	$45	$12,138
764	SP-764	MH-055	MH-051	1974		0	191.93	8	VCP	904.395	901.597					0	0	0	3	3	1	3	$65	$12,475	$45	$8,637
765	SP-765	MH-051	MH-056	1974	9 Mile	394	399.13	8	VCP	901.597	895.131					0	0	0	2	3	1	3	$65	$25,944	$45	$17,961
766	SP-766	MH-712	MH-713	1974		0	8.20	8	VCP	898.383						0	0	0	3	3	1	3	$65	$533	$45	$369
767	SP-767	MH-068	MH-067	1974	Lakeview	234	242.10	8	VCP	978.371	962.590					0	0	0	2	3	1	3	$65	$15,736	$45	$10,894
768	SP-768	MH-067	MH-062	1974	Lakeview	158	166.70	8	VCP	962.590	956.987					0	0	0	2	3	1	3	$65	$10,836	$45	$7,502
769	SP-769	MH-062	MH-061	1974	Lakeview	161	172.77	8	VCP	956.987	945.240					0	0	0	2	3	1	3	$65	$11,230	$45	$7,774
770	SP-770	MH-061	MH-078	1974	Nine Mile	157	163.16	8	VCP	945.240	936.312					0	0	0	2	3	1	3	$65	$10,605	$45	$7,342
771	SP-771	MH-063	MH-067	1974	Lakeview	223	227.14	8	VCP	954.528	962.590					0	0	0	2	3	1	3	$65	$14,764	$45	$10,221
772	SP-772	MH-060	MH-059	1974	Lakeview	210	218.52	8	VCP	940.998	927.187					0	0	0	2	3	1	3	$65	$14,204	$45	$9,834
773	SP-773	MH-059	MH-053	1974	Lakeview	208	216.36	8	VCP	927.187	918.939					0	0	0	2	3	1	3	$65	$14,064	$45	$9,736
774	SP-774	MH-053	MH-054	1974	Lakeview	124	254.84	8	VCP	918.939	913.251					0	0	0	2	3	1	3	$65	$16,564	$45	$11,468
775	SP-775	MH-054	MH-055	1974		0	53.09	8	VCP	913.251	904.395					0	0	0	3	3	0	0	$65	$3,451	$45	$2,389

Northfield Township Asset Management Plan
Gravity Main Asset Inventory

Asset ID Information				Asset Inventory Information												Inspection Data				Criticality			Asset Renewal Cost			
OBJECT ID	Facility ID	US MH	DS MH	Install Date	Street	CCTV Length	Length	Diameter	Material	US RIM	DS RIM	US Depth	DS Depth	US I.E.	DS I.E.	PACP QStr	PAPC QOM	PACP QOverall	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost	Rehab $/Ft	Rehabilitation Cost
776	SP-776	MH-183	MH-091	1974		0	236.32	8	VCP	903.999	902.064					0	0	0	3	3	1	3	$65	$15,361	$45	$10,634
777	SP-777	MH-704	MH-705	2003		0	180.02	8	PVC	913.350	911.900	10.19	9.94	903.16	901.96	0	0	0	3	2	1	2	$65	$11,701	$45	$8,101
778	SP-778	MH-705	MH-706	2003		0	404.22	8	PVC	911.900	908.470	9.94	9.53	901.96	898.94	0	0	0	3	2	1	2	$65	$26,274	$45	$18,190
779	SP-779	MH-706	MH-707	2003		0	368.48	8	PVC	908.470	907.950	9.53	10.58	898.94	897.37	0	0	0	3	2	1	2	$65	$23,951	$45	$16,581
780	SP-780	MH-707	MH-708	2003		0	427.39	8	PVC	907.950	906.000	10.58	10.03	897.37	895.97	0	0	0	3	2	1	2	$65	$27,780	$45	$19,233
781	SP-781	MH-708	MH-709	2003		0	339.44	8	PVC	906.000	911.350	10.03	16.78	895.97	894.57	0	0	0	3	2	1	2	$65	$22,064	$45	$15,275
782	SP-782	MH-709	MH-710	2003		0	278.72	8	PVC	911.350	907.100	16.78	13.93	894.57	893.17	0	0	0	3	2	1	2	$65	$18,117	$45	$12,542
783	SP-783	MH-710	MH-711	2003		0	277.85	8	PVC	907.100	910.650	13.93	19.21	893.17	891.44	0	0	0	3	2	1	2	$65	$18,060	$45	$12,503
784	SP-784	MH-711	MH-257	2003		0	252.05	12	PVC	910.650	906.700	19.21	16.48	891.44	890.22	0	0	0	3	2	2	4	$85	$21,424	$50	$12,602
785	SP-785	MH-257	MH-258	1969		0	347.81	12	VCP	906.700	904.771	16.48	15.38	890.22	889.39	0	0	0	3	4	2	8	$85	$29,564	$50	$17,390
786	SP-786	MH-196	MH-188	1979	Jay R	229	238.69	8	VCP	896.568	899.440	4.07	8.84	892.50	890.60	0	0	0	2	3	1	3	$65	$15,515	$45	$10,741
787	SP-787	MH-188	MH-187	1979	Elmcrest	369	393.26	8	VCP	899.440	901.376	8.84	13.92	890.60	887.46	0	0	0	2	3	1	3	$65	$25,562	$45	$17,697
788	SP-788	MH-200	MH-199	1979		0	78.18	8	VCP	902.380	905.820	6.45	10.55	895.93	895.27	0	0	0	3	3	1	3	$65	$5,082	$45	$3,518
789	SP-789	MH-199	MH-195	1979	Northshore	95	98.50	8	VCP	905.820	902.336	10.55	7.50	895.27	894.84	0	0	0	2	3	1	3	$65	$6,403	$45	$4,433
790	SP-790	MH-195	MH-197	1979	Northshore	12	29.59	8	VCP	902.336	897.942	7.50	3.24	894.84	894.70	0	0	0	2	3	1	3	$65	$1,924	$45	$1,332
791	SP-791	MH-197	MH-198	1969	Northshore	257	257.00	8	VCP	897.942	898.097	3.24	4.48	894.70	893.62	0	0	0	2	4	1	4	$65	$16,705	$45	$11,565
792	SP-792	MH-192	MH-198	1969	Northshore	165	165.00	8	VCP	897.895	898.097	4.81	4.48	893.08	893.62	0	0	0	2	4	1	4	$65	$10,725	$45	$7,425
793	SP-793	MH-189	MH-188	1979	Elmcrest	214	213.40	8	VCP	901.362	899.440	9.76	8.84	891.60	890.60	0	0	0	2	3	1	3	$65	$13,871	$45	$9,603
794	SP-794	MH-194	MH-193	1979	Canal	122	122.00	8	VCP	897.034	897.357	4.82	5.64	892.21	891.72	0	0	0	2	3	2	6	$65	$7,930	$45	$5,490
795	SP-795	MH-193	MH-187	1979	Canal	307	318.76	8	VCP	897.357	901.376	5.64	13.92	891.72	887.46	0	0	0	2	3	2	6	$65	$20,719	$45	$14,344
797	SP-797	MH-792	MH-794	2016			312.92	8	PVC	938.332	927.681					0	0	0	3	2	2	4	$65	$20,340	$45	$14,082
798	SP-798	MH-794	MH-795	2016			346.88	8	PVC	927.681	918.720		10.55		908.17	0	0	0	3	2	1	2	$65	$22,547	$45	$15,609
799	SP-799	MH-796	MH-797	2016			72.42	12	PVC	921.862	921.786		13.09		908.70	0	0	0	3	2	1	2	$85	$6,156	$50	$3,621
800	SP-800	MH-797	MH-671	2016			94.16	12	PVC	921.786	919.743	13.09	11.57	908.70	908.17	0	0	0	3	2	1	2	$85	$8,003	$50	$4,708
801	SP-801		MH-568	1976			575.97	8	VCP		899.252		5.46		893.79	0	0	0	3	3	2	6	$65	$37,438	$45	$25,919
802	SP-460A	MH-124	MH-120	1969		0	69.02	8	VCP	910.643	911.312	12.26	13.25	898.38	898.06	0	0	0	3	4	1	4	$65	$4,486	$45	$3,106
803	SP-802	MH-671	MH-795	2016			135.30	12	PVC	919.743	918.720	11.57	10.55	908.17	908.17	0	0	0	3	2	1	2	$85	$11,500	$50	$6,765
804	SP-803	MH-801	MH-491	1965	Garfield	122	134.97	8	PVC		908.739		7.18		901.56	0	0	0	3	3	1	3	$65	$8,773	$45	$6,073
805	SP-804		MH-490	1965			156.99	8	VCP		909.202		9.08		900.12	0	0	0	2	4	1	4	$65	$10,205	$45	$7,065
																							Total	**$13,036,046**	--	**$8,740,247**

Northfield Township Asset Management Plan
Manhole Asset Inventory

Asset ID Information			Asset Inventory Information												Inspection Data								Asset Criticality			Asset Renewal
OBJECT ID	Facility ID	Legacy ID	Install Date	Rim Elevation	Chimney Depth	Invert Elev	Manhole Type	Cover Type	Cover Size (in.)	Chimney Material	Manhole Diameter (ft)	Wall Material	Steps Material	Potential Runoff	Inspection Status	Cover IQ	Frame IQ	Chimney IQ	Wall IQ	Surface Condition	Overall Interior Condition	Manhole Condition	POF	COF	BRE	Replacement Cost
1	MH-001	252		908.16	0				0		0	1											3	5	15	$ 10,000.00
2	MH-002	253		907.20	21		Junction	Solid	26	Block	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
3	MH-003	254		907.39	0				0		0	1											3	5	15	$ 10,000.00
4	MH-004	256		911.86	0				0		0	1											3	4	12	$ 10,000.00
5	MH-005	213		914.49	2		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
6	MH-006	204		908.18	0				0		0	1											3	5	15	$ 10,000.00
7	MH-007	197		910.46	0				0		0	1											3	5	15	$ 10,000.00
8	MH-008	222		907.98	0		Junction	Solid	26		4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
9	MH-009	221		909.65	0		Junction	Solid	26		4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
10	MH-010	218		911.87	6		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
11	MH-011	217		912.92	6		Junction	Solid	26	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	Evidence	None				2	5	10	$ 10,000.00
12	MH-012	219		911.57	0		Junction	Solid	26		4	Concrete	Plastic	Sheeting	Surface Inspection	None	None		None				2	5	10	$ 10,000.00
13	MH-013	220		910.13	0				0		0	1											3	5	15	$ 10,000.00
14	MH-014	216		913.51	0				0		0	1											3	5	15	$ 10,000.00
15	MH-015	215		913.75	11		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
16	MH-016	214		913.90	7		Junction	Solid	26	Block	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
17	MH-017	210		913.06	6		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
18	MH-018	211		914.75	0				0		0	1											3	5	15	$ 10,000.00
19	MH-019	212		915.76	0				0		0	1											3	5	15	$ 10,000.00
20	MH-020	209		913.54	0				0		0	1											3	5	15	$ 10,000.00
21	MH-021	208		913.07	0				0		0	1											3	4	12	$ 10,000.00
22	MH-022	207		911.82	5		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
23	MH-023	206		911.03	0				0		0	1											3	4	12	$ 10,000.00
24	MH-024	205		907.61	9		Junction	Solid	26	Brick	4	Concrete		Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
25	MH-025	203		908.48	0				0		0	1											3	4	12	$ 10,000.00
26	MH-026	202		908.56	0				0		0	1											3	5	15	$ 10,000.00
27	MH-027	200		908.53	8		Junction	Solid	26	Concrete	4	1	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
28	MH-028	199		907.88	9		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
29	MH-029	198		908.64	13		Junction		26	Concrete	4	Concrete	Plastic		Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
30	MH-030	192		908.86	0				0		0	1											3	5	15	$ 10,000.00
31	MH-031	193		909.26	5		Junction	Solid	26	Concrete	4	Concrete		Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
32	MH-032	194		908.96	0				0		0	1											3	5	15	$ 10,000.00
33	MH-033	195		908.88	0				0		0	1											3	5	15	$ 10,000.00
34	MH-034	196		909.43	9		Junction	Solid	26	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
35	MH-035	255		909.41	23		Junction	Solid	26	Block	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
36	MH-036	269		910.42	0	898.31			0		0	1											3	5	15	$ 10,000.00
37	MH-037	268		911.44	0	898.61			0		0	1											3	5	15	$ 10,000.00
38	MH-038	267		909.99	0	899.1			0		0	1											3	6	18	$ 10,000.00
39	MH-039	266		911.14	0	899.85			0		0	1											3	5	15	$ 10,000.00
40	MH-040			910.49	7		Junction	Solid	26	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
41	MH-041	265		910.60	0	899.66			0		0	1											3	5	15	$ 10,000.00
42	MH-042	264		911.25	0	899.07			0		0	1											3	5	15	$ 10,000.00
43	MH-043	263		910.85	0	898.43			0		0	1											3	5	15	$ 10,000.00
44	MH-044	262		911.45	0	897.53			0		0	1											3	5	15	$ 10,000.00
45	MH-045	261		912.10	0	896.99			0		0	1											3	5	15	$ 10,000.00
46	MH-046	259		911.55	0	895.93			0		0	1											3	6	18	$ 10,000.00
47	MH-047	260		911.55	0	896.23			0		0	1											3	6	18	$ 10,000.00
48	MH-048	G174		984.25	8	969.5	Junction	Solid	22	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
49	MH-049	G172		983.53	9	972.5	Junction	Solid	22	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00

Northfield Township Asset Management Plan
Manhole Asset Inventory

Asset ID Information			Asset Inventory Information												Inspection Data								Asset Criticality			Asset Renewal
OBJECT ID	Facility ID	Legacy ID	Install Date	Rim Elevation	Chimney Depth	Invert Elev	Manhole Type	Cover Type	Cover Size (in.)	Chimney Material	Manhole Diameter (ft)	Wall Material	Steps Material	Potential Runoff	Inspection Status	Cover IQ	Frame IQ	Chimney IQ	Wall IQ	Surface Condition	Overall Interior Condition	Manhole Condition	POF	COF	BRE	Replacement Cost
50	MH-050	G173		984.19	7	974.25	Junction	Solid	22	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
51	MH-051	G113		901.60	0	884.62			0		0												3	5	15	$ 10,000.00
52	MH-052	G114		896.88	0	886.6			0		0												3	6	18	$ 10,000.00
53	MH-053	G123		918.94	0	911.95			0		0												3	5	15	$ 10,000.00
54	MH-054	G124		913.25	0	906.03			0		0												3	4	12	$ 10,000.00
55	MH-055	G125		904.39	0	905.66			0		0												3	4	12	$ 10,000.00
56	MH-056	G112		895.13	0	884.04			0		0												3	5	15	$ 10,000.00
57	MH-057	G110		900.81	0	912			0		0												3	5	15	$ 10,000.00
58	MH-058	G158		910.29	0	899.96	Junction	Solid	22		4	Concrete	Cast Iron	None	Surface Inspection	None	None		None				3	5	15	$ 10,000.00
59	MH-059	G122		927.19	0	919.92			0		0												3	5	15	$ 10,000.00
60	MH-060	G121		941.00	0	932			0		0												3	5	15	$ 10,000.00
61	MH-061	G119		945.24	0	935.94			0		0												3	5	15	$ 10,000.00
62	MH-062	G118		956.99	0	941			0		0												3	5	15	$ 10,000.00
63	MH-063	G117		954.53	0	947			0		0												3	5	15	$ 10,000.00
64	MH-064	G170		970.98	13	955.62	Junction	Solid	22	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	6	12	$ 10,000.00
65	MH-065	G171		978.20	16	966.26	Junction	Solid	22	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
66	MH-066	G103		941.72	0	930.98			0		0												3	4	12	$ 10,000.00
67	MH-067	G116		962.59	0	945.96			0		0												3	5	15	$ 10,000.00
68	MH-068	G115		978.37	0	966.24			0		0												3	5	15	$ 10,000.00
69	MH-069	G151		912.30	14	900.06	Junction		22	Concrete	4	Concrete	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				3	5	15	$ 10,000.00
70	MH-070	G153		915.61	0	904.46			0		0												4	6	24	$ 10,000.00
71	MH-071	G108		921.91	0	913.55			0		0												3	5	15	$ 10,000.00
72	MH-072	G109		920.12	0	913.9			0		0												3	5	15	$ 10,000.00
73	MH-073	G150		915.28	0	903			0		0												4	6	24	$ 10,000.00
74	MH-074	G149		908.22	0	893.45			0		0												4	5	20	$ 10,000.00
75	MH-075	G154		911.38	0	903.52			0		0												4	4	16	$ 10,000.00
76	MH-076	G107		923.67	0	912.3			0		0												3	5	15	$ 10,000.00
77	MH-077	G106		925.58	0	911.88			0		0												3	5	15	$ 10,000.00
78	MH-078	G120		936.31	0	926.55			0		0												3	5	15	$ 10,000.00
79	MH-079	G159		905.00	0	892.18			0		0												4	5	20	$ 10,000.00
80	MH-080	G160		898.86	0	893.03	Junction	Solid	22		4	Concrete	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				3	4	12	$ 10,000.00
81	MH-081	G161		899.50	0	895.01			0		0												4	3	12	$ 10,000.00
82	MH-082	G132		901.06	0	890.07			0		0												4	5	20	$ 10,000.00
83	MH-083	G133		898.42	0	890.03			0		0												4	4	16	$ 10,000.00
84	MH-084	G128		909.54	0	892.68			0		0												4	6	24	$ 10,000.00
85	MH-085	G129		909.34	0	892.29			0		0												4	6	24	$ 10,000.00
86	MH-086	G130		909.82	0	892.04			0		0												4	7	28	$ 10,000.00
87	MH-087	G152		906.02	0	894.45			0		0												4	4	16	$ 10,000.00
88	MH-088	G127		923.69	0	906			0		0												3	5	15	$ 10,000.00
89	MH-089	G126		925.64	0	911			0		0												3	4	12	$ 10,000.00
90	MH-090	G104		929.82	0	918.74			0		0												3	5	15	$ 10,000.00
91	MH-091	G147		902.06	0				0		0												3	5	15	$ 10,000.00
92	MH-092	G131		903.95	0	891.03			0		0												4	5	20	$ 10,000.00
93	MH-093	G105		928.06	0	911.1			0		0												3	5	15	$ 10,000.00
94	MH-094	G157		910.99	0	898.96	Junction	Solid	22		4	Concrete	Cast Iron	None	Surface Inspection	None	None		None				3	5	15	$ 10,000.00
95	MH-095	G164		899.62	6	891.41	Junction	Solid	22	Concrete	4	Concrete	Cast Iron	Sheeting	Surface Inspection			None	None				3	4	12	$ 10,000.00
96	MH-096	G163		901.72	3	890.73	Junction	Solid	22	Brick	4	Concrete	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				3	5	15	$ 10,000.00
97	MH-097	G166		906.84	14	893.92	Junction	Solid	22	Brick	4	Concrete	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				3	5	15	$ 10,000.00
98	MH-098	G155		898.31	0	890.66	Junction	Solid	22		4	Concrete	Cast Iron	None	Surface Inspection	None	None		None				3	4	12	$ 10,000.00

Northfield Township Asset Management Plan
Manhole Asset Inventory

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OBJECT ID	Facility ID	Legacy ID	Install Date	Rim Elevation	Chimney Depth	Invert Elev	Manhole Type	Cover Type	Cover Size (in.)	Chimney Material	Manhole Diameter (ft)	Wall Material	Steps Material	Potential Runoff	Inspection Status	Cover IQ	Frame IQ	Chimney IQ	Wall IQ	Surface Condition	Overall Interior Condition	Manhole Condition	POF	COF	BRE	Replacement Cost
99	MH-099	G156		906.28	0	892.18	Junction	Solid	22		4	Concrete	Cast Iron	None	Surface Inspection	None	None		None				3	5	15	$ 10,000.00
100	MH-100	G134		897.78	0	889.24			0		0												4	4	16	$ 10,000.00
101	MH-101	G137		904.50	0	886.91			0		0												4	6	24	$ 10,000.00
102	MH-102	G136		900.25	0	887.91			0		0												4	5	20	$ 10,000.00
103	MH-103	G135		899.64	0	888.18			0		0												4	5	20	$ 10,000.00
104	MH-104	XX1		901.88	0	889.45	Junction	Solid	24		4	Concrete	Cast Iron	Sheeting	Surface Inspection	None	None		None				2	4	8	$ 10,000.00
105	MH-105	G139		903.15	0	886.9			0		0												4	6	24	$ 10,000.00
106	MH-106	G138		905.24	0	885.64			0		0												4	6	24	$ 10,000.00
107	MH-107	G165		906.91	5	894.03	Junction	Solid	22	Brick	4	Concrete	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				3	5	15	$ 10,000.00
108	MH-108	G162		903.10	5	889.37	Junction	Solid	22	Brick	4	Concrete	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				3	5	15	$ 10,000.00
109	MH-109	G140		903.08	0	889.83			0		0												4	6	24	$ 10,000.00
110	MH-110	G141		905.80	0	891.22			0		0												4	5	20	$ 10,000.00
111	MH-111	G142		908.81	0	892.64			0		0												4	6	24	$ 10,000.00
112	MH-112	G143		907.76	0	893.26			0		0												4	5	20	$ 10,000.00
113	MH-113	G144		906.30	0	894.08			0		0												3	5	15	$ 10,000.00
114	MH-114	G145		907.09	0	895.29			0		0												3	5	15	$ 10,000.00
115	MH-115	G146		908.43	0	895.76			0		0												4	5	20	$ 10,000.00
116	MH-116	N-182		908.76	0	906.05			0		0												4	5	20	$ 10,000.00
117	MH-117	N-181		909.38	0	895.87			0		0												4	5	20	$ 10,000.00
118	MH-118	N-180		910.37	0	895.52			0		0												4	5	20	$ 10,000.00
119	MH-119	N-179		910.58	0	894.95			0		0												4	6	24	$ 10,000.00
120	MH-120	N-184		911.31	0	898.06			0		0												4	5	20	$ 10,000.00
121	MH-121	N-183		912.35	0	898.81			0		0												4	5	20	$ 10,000.00
122	MH-122	N-187		909.52	0	899			0		0												4	4	16	$ 10,000.00
123	MH-123	N-186		910.62	0	898.76			0		0												4	5	20	$ 10,000.00
124	MH-124	N-185		910.64	0	898.38			0		0												4	5	20	$ 10,000.00
125	MH-125	N-178		903.28	0	894.18			0		0												4	4	16	$ 10,000.00
126	MH-126	N-177		902.16	0	893.41			0		0												4	4	16	$ 10,000.00
127	MH-127	N-176		903.63	0	892.66			0		0												4	5	20	$ 10,000.00
128	MH-128	N-175		902.68	0	891.87			0		0												4	5	20	$ 10,000.00
129	MH-129	N-174		903.15	0	891.08			0		0												4	5	20	$ 10,000.00
130	MH-130	SW9		914.14	9		Junction	Solid	26	Block	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
131	MH-131	SW13		912.42	0		Junction	Solid	26		4	Concrete	Plastic	Sheeting	Surface Inspection	None	None		None				2	5	10	$ 10,000.00
132	MH-132	SW12		911.89	0		Junction	Solid	26		4	Concrete	Plastic	Sheeting	Surface Inspection	None	None		None				2	5	10	$ 10,000.00
133	MH-133	SW3		914.78	0				0		0	Concrete											3	5	15	$ 10,000.00
134	MH-134	SW2		915.53	6		Junction		26	Concrete	4	Concrete	Plastic		Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
135	MH-135	SW1		912.74	19		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
136	MH-136	SW8		915.09	5		Junction		26	Concrete	4	Concrete	Plastic		Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
137	MH-137	SW14		912.92	0		Junction	Solid	26		4	Concrete	Plastic	Sheeting	Surface Inspection	None	None		None				2	5	10	$ 10,000.00
138	MH-138	SW5		914.08	5		Junction		26	Concrete	4	Concrete	Plastic		Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
140	MH-140	SW6		915.16	0				0		0	Concrete											3	5	15	$ 10,000.00
141	MH-141	SW4		913.85	5		Other	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
142	MH-142	SW7		916.26	5		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
143	MH-143	SW11		911.57	0				0		0	Concrete											3	4	12	$ 10,000.00
144	MH-144	SW10		912.19	4		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
145	MH-145	G183		964.80	0	957.73	Junction		26		4	Concrete	Plastic		Surface Inspection	None	None		None				2	3	6	$ 10,000.00
146	MH-146	G176		970.81	16	956.69	Junction	Solid	22	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
147	MH-147	G175		977.20	10	965.53	Junction	Solid	22	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
148	MH-148	G182		940.09	7	926.04	Junction	Solid	22	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00

Northfield Township Asset Management Plan
Manhole Asset Inventory

Asset ID Information			Asset Inventory Information												Inspection Data								Asset Criticality			Asset Renewal
OBJECT ID	Facility ID	Legacy ID	Install Date	Rim Elevation	Chimney Depth	Invert Elev	Manhole Type	Cover Type	Cover Size (in.)	Chimney Material	Manhole Diameter (ft)	Wall Material	Steps Material	Potential Runoff	Inspection Status	Cover IQ	Frame IQ	Chimney IQ	Wall IQ	Surface Condition	Overall Interior Condition	Manhole Condition	POF	COF	BRE	Replacement Cost
149	MH-149	G177		960.66	8	944.44	Junction	Solid	22	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	6	12	$ 10,000.00
150	MH-150	G181		926.11	7	909.19	Junction	Solid	22	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	6	12	$ 10,000.00
151	MH-151	G180		935.02	14	923.72	Junction	Solid	22	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
152	MH-152	G179		955.72	5	942.92	Junction		26	Brick	4	Concrete	Plastic		Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
153	MH-153	G178		949.90	15	934	Junction	Solid	22	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	6	12	$ 10,000.00
154	MH-154	G93		926.30	0	914.66			0		0												3	5	15	$ 10,000.00
155	MH-155	G95		917.35	24	902.79	Junction	Solid	23	Block	4	Concrete	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
156	MH-156	G94		923.71	0	913.07			0		0												3	5	15	$ 10,000.00
157	MH-157	G169		950.43	5	938.45	Junction	Solid	22	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
158	MH-158	G100		935.08	0	919.9			0		0												3	5	15	$ 10,000.00
159	MH-159	G168		930.96	10	917.58	Junction	Solid	22	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
160	MH-160	G92		935.93	0	924.93	Junction	Solid	23	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
161	MH-161	G79		931.86	0	916.62			0		0												3	6	18	$ 10,000.00
162	MH-162	G87		959.90	18	941.44	Junction	Solid	22	Block	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
163	MH-163	G101		957.48	0	944.24			0		0												3	5	15	$ 10,000.00
164	MH-164	G102		963.57	0	957.99			0		0												3	5	15	$ 10,000.00
165	MH-165	G77		904.36	0	894.31			0		0												3	5	15	$ 10,000.00
166	MH-166	G78		913.55	0	903.04			0		0												3	5	15	$ 10,000.00
167	MH-167	G86		947.22	0	934.21			0		0												3	5	15	$ 10,000.00
168	MH-168	G88		939.71	0	909.4			0		0												3	4	12	$ 10,000.00
169	MH-169	G99		927.22	0	914.98			0		0												3	5	15	$ 10,000.00
170	MH-170	G167		919.24	10	906.85	Junction	Solid	22	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
171	MH-171	G84		913.63	0	899.37			0		0												3	5	15	$ 10,000.00
172	MH-172	G97		911.09	0	900.4			0		0												3	5	15	$ 10,000.00
173	MH-173	G96		910.32	0	901.43			0		0												3	4	12	$ 10,000.00
174	MH-174	G75		900.27	0	891.4			0		0												3	5	15	$ 10,000.00
175	MH-175	TER-15A		918.08	0				0		0												3	6	18	$ 10,000.00
176	MH-176	G80		905.58	0	895.17			0		0												3	5	15	$ 10,000.00
177	MH-177	G81		899.96	0	896.27			0		0												3	5	15	$ 10,000.00
178	MH-178	G85		939.68	0	927.3			0		0												3	5	15	$ 10,000.00
179	MH-179	G74		901.06	0	890.1			0		0												3	4	12	$ 10,000.00
180	MH-180	G82		905.42	0	896.91			0		0												3	5	15	$ 10,000.00
181	MH-181	G83		907.98	0	897.9			0		0												3	5	15	$ 10,000.00
182	MH-182	G91		911.08	0	903.57			0		0												3	5	15	$ 10,000.00
183	MH-183	G148		904.00	0				0		0												3	6	18	$ 10,000.00
184	MH-184	G89		902.02	0	894.6			0		0												3	5	15	$ 10,000.00
185	MH-185	G90		904.03	0	898.1			0		0												3	5	15	$ 10,000.00
186	MH-186	G76		902.07	0	893			0		0												3	5	15	$ 10,000.00
187	MH-187	G67		901.38	0	889.91			0		0												3	5	15	$ 10,000.00
188	MH-188	G66		899.44	10	891.55	Junction	Solid	23	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
189	MH-189	G72		901.36	13	891.6	Junction	Solid	22	Block	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
190	MH-190	G73		918.51	0	911.1	Junction	Solid	23		4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
191	MH-191	G59		898.90	0	892.44			0		0												4	4	16	$ 10,000.00
192	MH-192	G58		897.89	0	893.08			0		0												4	4	16	$ 10,000.00
193	MH-193	G68		897.36	0	891.72			0		0												3	4	12	$ 10,000.00
194	MH-194	G69		897.03	12	892.21	Junction	Solid	23	Block	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	6	12	$ 10,000.00
195	MH-195	G56A		902.34	0	895.27			0		0												3	4	12	$ 10,000.00
196	MH-196	G65		896.57	0	892.5			0		0												3	5	15	$ 10,000.00
197	MH-197	G56		897.94	0	894.88			0		0												4	4	16	$ 10,000.00

Northfield Township Asset Management Plan
Manhole Asset Inventory

Asset ID Information			Asset Inventory Information												Inspection Data								Asset Criticality			Asset Renewal
OBJECT ID	Facility ID	Legacy ID	Install Date	Rim Elevation	Chimney Depth	Invert Elev	Manhole Type	Cover Type	Cover Size (in.)	Chimney Material	Manhole Diameter (ft)	Wall Material	Steps Material	Potential Runoff	Inspection Status	Cover IQ	Frame IQ	Chimney IQ	Wall IQ	Surface Condition	Overall Interior Condition	Manhole Condition	POF	COF	BRE	Replacement Cost
198	MH-198	G57		898.10	0	893.62			0		0												4	4	16	$ 10,000.00
199	MH-199	G56B		905.82	0	895.32			0		0												3	6	18	$ 10,000.00
200	MH-200	G56C		902.38	0	895.93			0		0												3	4	12	$ 10,000.00
201	MH-201	G51		908.06	0	895.1			0		0												4	6	24	$ 10,000.00
202	MH-202	G52		909.37	0	896.84			0		0												4	5	20	$ 10,000.00
203	MH-203	G30		913.87	4	905.65		Solid	2275	Brick	4		Cast Iron	None	Complete								4	4	16	$ 10,000.00
204	MH-204	G53		911.24	0	893.36			0		0												4	5	20	$ 10,000.00
205	MH-205	G54		913.12	0	895.92			0		0												4	6	24	$ 10,000.00
206	MH-206	G61		899.38	0	890			0		0												4	4	16	$ 10,000.00
207	MH-207	G60		893.76	0	891.83			0		0												4	4	16	$ 10,000.00
208	MH-208	G71		900.56	0	889			0		0												3	4	12	$ 10,000.00
209	MH-209	G46		905.27	0	893.98			0		0												4	5	20	$ 10,000.00
210	MH-210	G47		900.91	0	893.22			0		0												4	4	16	$ 10,000.00
211	MH-211	G46A		901.52	0	894.49			0		0												4	4	16	$ 10,000.00
212	MH-212	G46B		898.56	0	894.69			0		0												4	5	20	$ 10,000.00
213	MH-213	G48		905.89	0	896.84			0		0												4	5	20	$ 10,000.00
214	MH-214	G43		898.06	0				0		0												4	4	16	$ 10,000.00
215	MH-215	G42		901.02	0	894			0		0												4	4	16	$ 10,000.00
216	MH-216	G19		910.73	0	900.51			0		0												4	6	24	$ 10,000.00
217	MH-217	G20		910.53	0	902.15			0		0												4	3	12	$ 10,000.00
218	MH-218	G50		909.70	0	893.98			0		0												4	6	24	$ 10,000.00
219	MH-219	SS-0308		916.91	0	905.38			0		0												4	5	20	$ 10,000.00
220	MH-220	G49		908.77	0	895.1			0		0												4	6	24	$ 10,000.00
221	MH-221	G31		914.31	0	904.67	junction	Solid	2275		4		Cast Iron	None	Complete								4	4	16	$ 10,000.00
222	MH-222	G29		917.60	0	907.24			0		0												4	5	20	$ 10,000.00
223	MH-223	G28		916.86	8	903.42	junction	Solid	2275	Brick	4		Cast Iron	None	Complete								4	5	20	$ 10,000.00
224	MH-224	G32		912.00	12	902.1	deadend	Solid	22	Brick	4		Cast Iron	Ponding	Surface Inspection								3	4	12	$ 10,000.00
225	MH-225	G35		912.03	0	901.07			0		0												4	5	20	$ 10,000.00
226	MH-226	G34		912.40	0	902.43			0		0												4	4	16	$ 10,000.00
227	MH-227	G33		911.76	0	900.9	junction	Solid	22		4		Cast Iron	None	Surface Inspection								3	5	15	$ 10,000.00
228	MH-228	G13		915.42	0	906.14	junction	Solid	23		4		Cast Iron	Ponding	Surface Inspection								3	3	9	$ 10,000.00
229	MH-229	G26		914.84	0	901.42	junction	Solid	22		4		Cast Iron	None	Surface Inspection								3	5	15	$ 10,000.00
230	MH-230	G27		915.54	4	902.44	junction		23	Brick	4		Cast Iron	None	Surface Inspection								3	5	15	$ 10,000.00
231	MH-231	G17		899.49	0	895.13	junction	Solid	22		4		Cast Iron	None	Surface Inspection								3	4	12	$ 10,000.00
232	MH-232	G18		908.00	0	896.01			0		0												4	6	24	$ 10,000.00
233	MH-233	G39		911.35	8	899.63	Junction	Solid	22		4		Cast Iron	Sheeting	Surface Inspection								3	5	15	$ 10,000.00
234	MH-234	G38		910.40	0	901.5			0		0												4	4	16	$ 10,000.00
235	MH-235	G16		898.84	0	893.04	junction	Solid	22		4		Cast Iron	None	Surface Inspection								3	4	12	$ 10,000.00
236	MH-236	G24		912.54	0	899.64			0		0												4	5	20	$ 10,000.00
237	MH-237	G23		911.03	0	899.05	Junction	Solid	22		4		Cast Iron	Sheeting	Surface Inspection								3	5	15	$ 10,000.00
238	MH-238	G11		915.59	0	905.23	junction	Solid	22		4		Cast Iron	None	Surface Inspection								3	5	15	$ 10,000.00
239	MH-239	G12		914.27	0	904.94	junction	Solid	2134		4		Cast Iron	None	Surface Inspection								3	3	9	$ 10,000.00
240	MH-240	G10		913.41	6	903.74	junction	Solid	22	Block	4		Cast Iron	None	Surface Inspection								3	4	12	$ 10,000.00
241	MH-241	G9		910.45	10	900	junction	Solid	22	cast Concr	4		Cast Iron	Ponding	Surface Inspection								3	5	15	$ 10,000.00
242	MH-242	G9A		905.91	0	895.77	junction	Solid	22		4		Cast Iron	Ponding	Surface Inspection								3	5	15	$ 10,000.00
243	MH-243	G21		903.58	0	889.8	junction	Solid	22		4		Cast Iron	Ponding	Surface Inspection								3	5	15	$ 10,000.00
244	MH-244	G22		906.63	0	896.8	junction	Solid	22		4		Cast Iron	None	Surface Inspection								3	4	12	$ 10,000.00
245	MH-245	G25		912.87	0	900.34			0		0												4	5	20	$ 10,000.00
246	MH-246	G15		898.17	0	891.03	junction		22		4		Cast Iron	None	Surface Inspection								3	4	12	$ 10,000.00

Northfield Township Asset Management Plan
Manhole Asset Inventory

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OBJECT ID	Facility ID	Legacy ID	Install Date	Rim Elevation	Chimney Depth	Invert Elev	Manhole Type	Cover Type	Cover Size (in.)	Chimney Material	Manhole Diameter (ft)	Wall Material	Steps Material	Potential Runoff	Inspection Status	Cover IQ	Frame IQ	Chimney IQ	Wall IQ	Surface Condition	Overall Interior Condition	Manhole Condition	POF	COF	BRE	Replacement Cost
247	MH-247	G2		909.65	0	900	Junction	Solid	22		4		Cast Iron	None	Surface Inspection								3	4	12	$ 10,000.00
248	MH-248	G4		910.54	0	900.7	Junction	Solid	22		4		Cast Iron	None	Surface Inspection								3	4	12	$ 10,000.00
249	MH-249	G8		898.60	6	895.18	junction	Solid	22	Concrete	4		Cast Iron	Ponding	Surface Inspection								3	4	12	$ 10,000.00
250	MH-250	G7		909.87	0	896.02			0		0												4	5	20	$ 10,000.00
251	MH-251	G8A		906.25	30	894.16	junction	Solid	22	Block	4		Cast Iron	Ponding	Surface Inspection								3	5	15	$ 10,000.00
252	MH-252	G5		913.61	0	902.06	Junction		22		4		Cast Iron		Surface Inspection								3	5	15	$ 10,000.00
253	MH-253	G1		909.72	0	897.78			0		0												4	5	20	$ 10,000.00
254	MH-254	N-153		908.19	0	898.95	Junction	Solid	22		4		Cast Iron	Sheeting	Surface Inspection								3	5	15	$ 10,000.00
255	MH-255	G6		915.26	2	904.46	Junction	Solid	22		4			Sheeting	Surface Inspection								3	4	12	$ 10,000.00
256	MH-256	N-152		908.42	0	897.9			0		0												4	5	20	$ 10,000.00
257	MH-257	N-172		906.70	0	890.22			0		0												4	6	24	$ 10,000.00
258	MH-258	N-171		904.77	0	888.39			0		0												4	6	24	$ 10,000.00
259	MH-259	N-170		899.43	0	888.95			0		0												4	5	20	$ 10,000.00
260	MH-260	191		905.03	0	893.68	Junction	Solid	22		4	Concrete	Cast Iron	Sheeting	Surface Inspection	None	None		None				3	5	15	$ 10,000.00
261	MH-261	N-169		899.61	0	888.51			0		0												4	5	20	$ 10,000.00
262	MH-262	N-168		900.02	0	888.09			0		0												4	5	20	$ 10,000.00
263	MH-263	190		906.67	9	891.69	Junction	Solid	22	Concrete	4	Concrete	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				3	5	15	$ 10,000.00
264	MH-264	189		909.74	0	892.52	Junction	Solid	22		4	Concrete	Cast Iron	Sheeting	Surface Inspection	None	None		None				3	6	18	$ 10,000.00
265	MH-265	N-167		904.42	0	887.32			0		0												4	6	24	$ 10,000.00
266	MH-266	188		907.45	0	893.8			0		0	1											4	5	20	$ 10,000.00
267	MH-267	N-166		905.44	0	887.09			0		0												4	6	24	$ 10,000.00
268	MH-268	N-165		905.35	0	886.88			0		0												4	6	24	$ 10,000.00
269	MH-269	N-164		898.36	0	893			0		0												4	5	20	$ 10,000.00
270	MH-270	LP0		900.22	0	886.1			0		0												4	6	24	$ 10,000.00
271	MH-271	N-162		904.92	0	896			0		0												6	5	30	$ 10,000.00
272	MH-272	N-163		898.95	0	894			0		0												6	4	24	$ 10,000.00
273	MH-273	N-105		910.83	0	904.6			0		0												6	4	24	$ 10,000.00
274	MH-274	N-109		907.69	0	902.67			0		0												6	4	24	$ 10,000.00
275	MH-275	N-110		908.42	0	901.71			0		0												6	4	24	$ 10,000.00
276	MH-276	N-102		911.92	0	901.67			0		0												6	5	30	$ 10,000.00
277	MH-277	N-103		911.74	8	901.34	Junction	Solid	22	Brick	4	Block	Cast Iron	None	Surface Inspection	None	None	None	None				5	5	25	$ 10,000.00
278	MH-278	N-100		911.59	0	903.38			0		0												6	4	24	$ 10,000.00
279	MH-279	N-99		911.50	0	903.82			0		0												6	4	24	$ 10,000.00
280	MH-280	N-101		911.78	0	902.59			0		0												6	4	24	$ 10,000.00
281	MH-281	N-107		912.43	0	902.28			0		0												6	5	30	$ 10,000.00
282	MH-282	N-106		912.27	0	903.44			0		0												6	4	24	$ 10,000.00
283	MH-283	N-65		905.63	12	898.82	Junction	Solid	21	Block	4	Block	Steel	None	Surface Inspection				None				5	4	20	$ 10,000.00
284	MH-284	N-66		910.14	6	899.76	Junction	Solid	22	Brick	4	Block	Cast Iron	None	Surface Inspection	None	None	None	None				5	5	25	$ 10,000.00
285	MH-285	N-104		909.83	10	900.1	Junction	Solid	22	Brick	4	Block	Cast Iron	None	Surface Inspection	None		None	None				5	4	20	$ 10,000.00
286	MH-286	N-108		911.45	0	901.03			0		0												6	5	30	$ 10,000.00
287	MH-287	N-149		902.45	18	893.78	Junction	Solid	22	Brick	4	Block	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
288	MH-288	N-150		906.36	10	894.71	Junction	Solid	22		4		Cast Iron	Sheeting	Surface Inspection								3	5	15	$ 10,000.00
289	MH-289	N-151		907.24	0	895.74			0		0												4	5	20	$ 10,000.00
290	MH-290	N-160		905.79	0	896.56			0		0												6	4	24	$ 10,000.00
291	MH-291	N-155		901.83	12	893.78	Junction	Solid	22		4		Cast Iron	Ponding	Surface Inspection								5	4	20	$ 10,000.00
292	MH-292	N-156		901.46	22		Junction	Solid	22	Brick	4	Block	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
293	MH-293	N-158		905.30	0	895.77			0		0												6	4	24	$ 10,000.00
294	MH-294	N-157		904.18	0	895.15			0		0												6	4	24	$ 10,000.00
295	MH-295	N-159		908.37	0	896.45			0		0												6	5	30	$ 10,000.00

Northfield Township Asset Management Plan
Manhole Asset Inventory

Asset ID Information			Asset Inventory Information												Inspection Data								Asset Criticality			Asset Renewal
OBJECT ID	Facility ID	Legacy ID	Install Date	Rim Elevation	Chimney Depth	Invert Elev	Manhole Type	Cover Type	Cover Size (in.)	Chimney Material	Manhole Diameter (ft)	Wall Material	Steps Material	Potential Runoff	Inspection Status	Cover IQ	Frame IQ	Chimney IQ	Wall IQ	Surface Condition	Overall Interior Condition	Manhole Condition	POF	COF	BRE	Replacement Cost
296	MH-296	N-129		906.62	0	896.23			0		0												6	5	30	$ 10,000.00
297	MH-297	N-130		906.86	0	896.94			0		0												6	4	24	$ 10,000.00
298	MH-298	N-131		907.79	0	897.92			0		0												6	4	24	$ 10,000.00
299	MH-299	N-125		905.29	0	893.79			0		0												6	5	30	$ 10,000.00
300	MH-300	N-126		907.90	0	894.43			0		0												6	5	30	$ 10,000.00
301	MH-301	N-127		907.75	0	895.15			0		0												6	5	30	$ 10,000.00
302	MH-302	128		906.73	0	895.56			0		0												6	6	36	$ 10,000.00
303	MH-303	N-136		908.12	0	896.66			0		0												6	5	30	$ 10,000.00
304	MH-304	N-135		908.05	21	897.03	Junction	Solid	22		4		Cast Iron	Sheeting	Surface Inspection								5	6	30	$ 10,000.00
305	MH-305	N-137		908.41	0	900.05			0		0												6	4	24	$ 10,000.00
306	MH-306	N-161		907.35	0	898.2			0		0												6	4	24	$ 10,000.00
307	MH-307	N-139		908.16	0	897.34			0		0												6	5	30	$ 10,000.00
308	MH-308	N-138		908.41	0	898.7			0		0												6	4	24	$ 10,000.00
309	MH-309	N-134		908.67	16	897.83	Junction	Solid	22		4		Cast Iron	Sheeting	Surface Inspection								5	5	25	$ 10,000.00
310	MH-310	N-133		907.64	22	899.28	Junction		22		4		Cast Iron		Surface Inspection								5	4	20	$ 10,000.00
311	MH-311	N-132		908.23	0	900.85			0		0												6	3	18	$ 10,000.00
312	MH-312	N-111		908.21	15	901.22	Junction	Solid	22		4		Cast Iron	Sheeting	Surface Inspection								5	4	20	$ 10,000.00
313	MH-313	N-112		908.41	12	900.38	Junction	Solid	22		4		Cast Iron	Sheeting	Surface Inspection								5	4	20	$ 10,000.00
314	MH-314	N-94		911.17	12	901.76	Junction	Solid	22	Brick	4	Block	Cast Iron	None	Surface Inspection	None	None	None	None				5	5	25	$ 10,000.00
315	MH-315	N-90		910.60	6	903.2	Junction	Solid	22	Brick	4	Block	Cast Iron	None	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
316	MH-316	N-91		911.47	6	902.49	Junction	Solid	22	Brick	4	Block	Cast Iron	None	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
317	MH-317	N-92		911.43	8	902.15	Junction		22	Brick	4	Block	Cast Iron		Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
318	MH-318	N-93		909.06	8	901.01	Junction		22	Brick	4	Block	Cast Iron		Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
319	MH-319	N-97		909.34	8	900.97	Junction	Solid	22	Brick	4	Block	Cast Iron	Ponding	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
320	MH-320	N-96		910.82	4	900.32	Junction	Solid	22	Brick	4	Block	Cast Iron	None	Surface Inspection	None	None						5	4	20	$ 10,000.00
321	MH-321	N-95		911.49	2	900.87	Junction	Solid	22	Concrete	4	Block	Cast Iron	None	Surface Inspection			None	None				5	4	20	$ 10,000.00
322	MH-322	N-83		911.39	4	904.11	Junction	Solid	22	Brick	4	Block	Cast Iron	None	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
323	MH-323	N-87		911.65	4	903.6	Junction	Solid	22	Brick	4	Block	Cast Iron	None	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
324	MH-324	N-88		909.65	0	901.4			0		0												6	4	24	$ 10,000.00
325	MH-325	N-113		908.03	0	899.58			0		0												6	4	24	$ 10,000.00
326	MH-326	N-114		907.33	0	898.42			0		0												6	4	24	$ 10,000.00
327	MH-327	N-75		904.67	0	897.42			0		0												6	4	24	$ 10,000.00
328	MH-328	N-76		905.34	0	898.62			0		0												6	4	24	$ 10,000.00
329	MH-329	N-77		905.19	0	898.95			0		0												6	4	24	$ 10,000.00
330	MH-330	N-78		906.51	0	899.51			0		0												6	3	18	$ 10,000.00
331	MH-331	N-85		905.42	0	898.74	Junction		22		4	Block	Steel		Surface Inspection	None	None		Runner				5	4	20	$ 10,000.00
332	MH-332	N-84		909.50	8	899.98	Junction	Solid	22	Brick	4	Block	Steel		Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
333	MH-333	N-80		906.34	20	898.35	Junction	Solid	22	Brick	4	Block	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
334	MH-334	N-79		907.02	20	898.59	Junction	Solid	22	Brick	4	Block	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
335	MH-335	N-81		906.99	0	900.84			0		0												6	4	24	$ 10,000.00
336	MH-336	N-82		906.75	0	899.62			0		0												6	4	24	$ 10,000.00
337	MH-337	N-64		903.60	0	897.76	Junction	Solid	22		4	Block	Cast Iron	None	Surface Inspection	None	None		None				5	4	20	$ 10,000.00
338	MH-338	N-98		905.24	0	899.8			0		0												6	5	30	$ 10,000.00
339	MH-339	N-63		902.97	8	897.31	Junction	Solid	22	Brick	4	Block	Cast Iron	None	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
340	MH-340	N-89		905.70	0	898.67			0		0												6	4	24	$ 10,000.00
341	MH-341	N-61		904.41	0	895.64			0		0												6	4	24	$ 10,000.00
342	MH-342	N-62		904.98	6	896.16	Junction	Solid	22	Brick	4	Block	Steel	Inundated	Surface Inspection	None	None	None					5	4	20	$ 10,000.00
343	MH-343	N-86		904.86	10	897.54	Junction	Solid	22	Brick	4	Block	Steel	Inundated	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
344	MH-344	N-60		905.30	4	895.29	Junction	Solid	22	Concrete	4	Concrete	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				3	5	15	$ 10,000.00

Northfield Township Asset Management Plan
Manhole Asset Inventory

Asset ID Information			Asset Inventory Information												Inspection Data								Asset Criticality			Asset Renewal
OBJECT ID	Facility ID	Legacy ID	Install Date	Rim Elevation	Chimney Depth	Invert Elev	Manhole Type	Cover Type	Cover Size (in.)	Chimney Material	Manhole Diameter (ft)	Wall Material	Steps Material	Potential Runoff	Inspection Status	Cover IQ	Frame IQ	Chimney IQ	Wall IQ	Surface Condition	Overall Interior Condition	Manhole Condition	POF	COF	BRE	Replacement Cost
345	MH-345	N-59		905.94	6	894.62	Junction		22	Brick	4	Concrete	Cast Iron		Surface Inspection	None	None	None	None				3	5	15	$ 10,000.00
346	MH-346	N-69		902.24	0	897.16			0		0												6	4	24	$ 10,000.00
347	MH-347	N-68		908.44	0	898.64			0		0												6	4	24	$ 10,000.00
348	MH-348	N-73		903.60	6	897.82	Junction	Solid	22	Brick	4	Block	Cast Iron	None	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
349	MH-349	N-72		906.78	6	899.34	Junction		22	Brick	4	Block	Steel	Inundated	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
350	MH-350	N-115		907.53	0	891.72			0		0												6	6	36	$ 10,000.00
351	MH-351	N-116		907.46	0	891.62			0		0												6	6	36	$ 10,000.00
352	MH-352	N-122		902.47	0	892.14			0		0												6	5	30	$ 10,000.00
353	MH-353	N-123		899.84	0	892.43			0		0												6	5	30	$ 10,000.00
354	MH-354	N-124		899.84	0	892.51			0		0												6	5	30	$ 10,000.00
355	MH-355	N-117		901.54	0	889.79			0		0												4	4	16	$ 10,000.00
356	MH-356	N-118		908.27	0	895.61			0		0												6	5	30	$ 10,000.00
357	MH-357	N-119		907.46	0	897.09			0		0												6	5	30	$ 10,000.00
358	MH-358	N-31		900.61	0	890.32			0		0												4	5	20	$ 10,000.00
359	MH-359	N-29		897.63	0	889.48			0		0												4	4	16	$ 10,000.00
360	MH-360	N-27		902.16	7	889.01	Junction	Solid	22	Brick	4	Concrete	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				3	4	12	$ 10,000.00
361	MH-361	N-28		899.37	0	889.25			0		0												4	6	24	$ 10,000.00
362	MH-362	N-54		906.40	10	896.61	Junction	Solid	22	Brick	4	Concrete	Cast Iron	None	Surface Inspection	None	None	None	None				3	4	12	$ 10,000.00
363	MH-363	N-26		896.92	7	888.57	Junction	Solid	22	Brick	4	Concrete	Cast Iron	None	Surface Inspection	None	None	None	None				3	4	12	$ 10,000.00
364	MH-364	N-25		895.41	0	888.31	Junction		22		4	Concrete	Cast Iron		Surface Inspection	None	None	None	None				3	4	12	$ 10,000.00
365	MH-365	N-31A		906.33	14	896.8	Junction	Solid	22	Brick	4	Concrete	Cast Iron	Sheeting	Surface Inspection			None	None				3	5	15	$ 10,000.00
366	MH-366	N-31B		909.66	12	899.52	Junction		22	Brick	4	Concrete	Cast Iron	None	Surface Inspection	None	None	None	None				3	6	18	$ 10,000.00
367	MH-367	N-53		907.73	11	898.23	Junction	Solid	22	Brick	4	Concrete	Cast Iron	None	Surface Inspection	None	None	None	None				3	4	12	$ 10,000.00
368	MH-368	N-52		909.13	12	899.31	Junction	Solid	22	Brick	4	Concrete	Cast Iron	None	Surface Inspection	None	None	None	None				3	4	12	$ 10,000.00
369	MH-369	N-30		900.03	0	890.9			0		0												4	5	20	$ 10,000.00
370	MH-370	N-34		897.86	0	891.8			0		0												4	5	20	$ 10,000.00
371	MH-371	N-58		899.86	0	893.74			0		0												4	3	12	$ 10,000.00
372	MH-372	N-120		906.87	0	898.2			0		0												6	4	24	$ 10,000.00
373	MH-373	N-121		903.67	0	899.2			0		0												6	3	18	$ 10,000.00
374	MH-374	N-33		903.55	0				0		0												4	5	20	$ 10,000.00
375	MH-375	N-32		902.64	9	890.86	Junction	Solid	22	Brick	4	Concrete	Cast Iron	None	Surface Inspection	None	None	None	None				3	5	15	$ 10,000.00
376	MH-376	N-32A		907.58	20	892.2	Junction	Solid	22	Brick	4	Concrete	Cast Iron	Sheeting	Surface Inspection								3	5	15	$ 10,000.00
377	MH-377	N-35		906.18	0	893.6			0		0												4	5	20	$ 10,000.00
378	MH-378	N-37		906.86	0	895.08			0		0												4	5	20	$ 10,000.00
379	MH-379	N-36		906.69	0	894.18			0		0												4	5	20	$ 10,000.00
380	MH-380	N-57		908.51	18	895.8	Junction	Solid	22	Brick	4	Concrete	Cast Iron	Sheeting	Surface Inspection	None	None		None				3	5	15	$ 10,000.00
381	MH-381	N-32B		909.97	0	891.05			0		0												4	4	16	$ 10,000.00
382	MH-382	N-51		909.35	13	900.55	Junction	Solid	22	Brick	4	Concrete	Cast Iron	None	Surface Inspection	None	None	None	None				3	4	12	$ 10,000.00
383	MH-383	N-50		908.09	0	901.33			0		0												4	4	16	$ 10,000.00
384	MH-384	N-56		908.11	22	897.08	Junction	Solid	22	Brick	4	Concrete		Sheeting	Surface Inspection	None	None	None	None				3	5	15	$ 10,000.00
385	MH-385	55		908.54	0				0		0												4	4	16	$ 10,000.00
386	MH-386	N-1		889.76	0	879.54			0		0												4	4	16	$ 10,000.00
387	MH-387	SS-0476		886.17	0	879.15	Blow Off		0		0												4	4	16	$ 10,000.00
388	MH-388	SS-0477		913.44	0	904.05			0		0												4	4	16	$ 10,000.00
389	MH-389	SS-0478		887.40	0	879.15	Blow Off		0		0												4	4	16	$ 10,000.00
390	MH-390	N-148		904.70	0	892.87			0		0												6	4	24	$ 10,000.00
391	MH-391	N-147		907.02	0	891.66			0		0												6	4	24	$ 10,000.00
392	MH-392	N-154		900.69	9	892.87	Junction	Solid	22	Brick	4	Block	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				5	3	15	$ 10,000.00
393	MH-393	N-146		901.17	8	891.62	Junction	Solid	22	Brick	4	Block	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00

Northfield Township Asset Management Plan
Manhole Asset Inventory

Asset ID Information			Asset Inventory Information												Inspection Data								Asset Criticality			Asset Renewal
OBJECT ID	Facility ID	Legacy ID	Install Date	Rim Elevation	Chimney Depth	Invert Elev	Manhole Type	Cover Type	Cover Size (in.)	Chimney Material	Manhole Diameter (ft)	Wall Material	Steps Material	Potential Runoff	Inspection Status	Cover IQ	Frame IQ	Chimney IQ	Wall IQ	Surface Condition	Overall Interior Condition	Manhole Condition	POF	COF	BRE	Replacement Cost
394	MH-394	N-143		902.65	9	888.78	Junction	Solid	22	Brick	4	Block	Cast Iron	Sheeting	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
395	MH-395	N-144		918.75	9	889.8	Junction	Solid	22	Brick	4	Block	Cast Iron	Ponding	Surface Inspection	None	None	None	None				5	5	25	$ 10,000.00
396	MH-396	N-145		910.20	9	890.56	Junction	Solid	22	Brick	4	Block	Cast Iron	Ponding	Surface Inspection	None	None	None	None				5	5	25	$ 10,000.00
397	MH-397	N-10		902.62	0	884.03			0		0												4	7	28	$ 10,000.00
398	MH-398	N-9		892.67	0	883.49			0		0												4	4	16	$ 10,000.00
399	MH-399	N-140		903.90	0	895.98	Junction	Solid	22		4	Block	Cast Iron	None	Surface Inspection	None	None	None	None				5	4	20	$ 10,000.00
400	MH-400	N-141		903.94	0	895.08	Junction	Solid	0		4		Cast Iron	None									6	4	24	$ 10,000.00
401	MH-401	N-20		898.24	0	886.3	Junction	Solid	22		4	cast Concr	Cast Iron	Sheeting	Surface Inspection	None	None	None	Runner				3	6	18	$ 10,000.00
402	MH-402	N-21		899.55	0	886.41			0		0												4	5	20	$ 10,000.00
403	MH-403	N-22		893.23	0	886.89			0		0												4	4	16	$ 10,000.00
404	MH-404	N-23		896.68	0	887.37			0		0												4	4	16	$ 10,000.00
405	MH-405	N-24		899.89	0	887.54			0		0												4	4	16	$ 10,000.00
406	MH-406	N-19		898.86	0	885.46			0		0												4	4	16	$ 10,000.00
407	MH-407	N-142		900.15	0	887.5			0		0												6	5	30	$ 10,000.00
408	MH-408	N-18		897.84	0	885.67			0		0												4	5	20	$ 10,000.00
409	MH-409	N-17		899.82	0	885.42			0		0												4	5	20	$ 10,000.00
410	MH-410	N-12		906.62	0	887.2			0		0												4	5	20	$ 10,000.00
411	MH-411	N-11		904.12	0	884.52			0		0												4	6	24	$ 10,000.00
412	MH-412	292		909.37	11		Junction	Solid	24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
413	MH-413	N-8		892.36	0	883			0		0												4	4	16	$ 10,000.00
414	MH-414	N-7		890.38	0	882.42			0		0												4	4	16	$ 10,000.00
415	MH-415	N-4		890.23	0	880.83			0		0												4	4	16	$ 10,000.00
416	MH-416	N-5		891.16	0	881.19			0		0												4	4	16	$ 10,000.00
417	MH-417	N-6		892.17	0	881.84			0		0												4	5	20	$ 10,000.00
418	MH-418	N-13		906.77	0	888.33			0		0												4	5	20	$ 10,000.00
419	MH-419	N-14		907.09	0	885.5			0		0												4	6	24	$ 10,000.00
420	MH-420	294		906.21	0				0		0												3	4	12	$ 10,000.00
421	MH-421	N-15		905.47	0	889.91			0		0												3	6	18	$ 10,000.00
422	MH-422	283		908.74	16		Junction	Solid	24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
423	MH-423	287		909.33	11		Junction	Solid	24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
424	MH-424	284		906.90	2		Junction		24	Concrete	4	Concrete	Plastic		Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
425	MH-425	N-16		905.14	0	894.36			0		0												3	5	15	$ 10,000.00
426	MH-426	295A		904.15	0				0		0												3	5	15	$ 10,000.00
427	MH-427	295		904.81	0				0		0												3	5	15	$ 10,000.00
428	MH-428	271		906.96	3		Junction	Solid	24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None		None	None				2	5	10	$ 10,000.00
429	MH-429	270		904.70	1		Junction	Solid	24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
430	MH-430	293		907.77	0		Junction		24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
431	MH-431	290		907.98	9		Junction		24	Concrete	4	Concrete	Plastic		Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
432	MH-432	288		907.95	9		Junction		24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
433	MH-433	279		907.45	12		Junction	Solid	24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
434	MH-434	291		908.88	0		Junction	Solid	24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
435	MH-435	289		908.53	8		Junction	Solid	24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
436	MH-436	277		907.79	4		Junction	Solid	24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
437	MH-437	278		907.93	9		Junction	Solid	24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
438	MH-438	280		907.00	6		Junction	Solid	24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
439	MH-439	281		908.91	12		Junction	Solid	24	Block	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
440	MH-440	282		908.62	17		Junction	Solid	24	Block	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
441	MH-441	276		907.08	10		Junction		24	Concrete	4	Concrete	Plastic		Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
442	MH-442	.		908.04	11		Junction	Solid	24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00

Northfield Township Asset Management Plan
Manhole Asset Inventory

Asset ID Information			Asset Inventory Information												Inspection Data								Asset Criticality			Asset Renewal
OBJECT ID	Facility ID	Legacy ID	Install Date	Rim Elevation	Chimney Depth	Invert Elev	Manhole Type	Cover Type	Cover Size (in.)	Chimney Material	Manhole Diameter (ft)	Wall Material	Steps Material	Potential Runoff	Inspection Status	Cover IQ	Frame IQ	Chimney IQ	Wall IQ	Surface Condition	Overall Interior Condition	Manhole Condition	POF	COF	BRE	Replacement Cost
443	MH-443	285		908.25	10		Junction	Solid	24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
444	MH-444	272		908.93	5		Junction		0	Concrete	4	Concrete	Plastic		Surface Inspection	None	None		None				2	5	10	$ 10,000.00
445	MH-445	273		910.22	8		Junction	Solid	24	Concrete	4	Concrete	Plastic	None	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
446	MH-446	274		908.83	5		Junction	Solid	0	Concrete	4	Concrete	Plastic	None	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
447	MH-447	318		908.06	0				0		0												3	5	15	$ 10,000.00
448	MH-448	275		907.71	6		Junction	Solid	24	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
449	MH-449	N-3		890.37	0	880.34			0		0												4	4	16	$ 10,000.00
450	MH-450	N-2		889.89	0	879.75			0		0												4	4	16	$ 10,000.00
451	MH-451	297		907.21	0				0		0												3	5	15	$ 10,000.00
452	MH-452	322		907.36	8		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	Gusher				2	5	10	$ 10,000.00
453	MH-453	315		907.97	8		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
454	MH-454	314		906.23	6		Junction	Solid	26	Block	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
455	MH-455	298		903.12	0				0		0												3	4	12	$ 10,000.00
456	MH-456	299		905.16	16		Junction	Solid	24		4		Plastic	Ponding	Surface Inspection								2	5	10	$ 10,000.00
457	MH-457	310		908.91	18		Junction	Solid	26	Block	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
458	MH-458	309		908.18	0				0		0												3	5	15	$ 10,000.00
459	MH-459	312		906.74	18		Junction	Solid	26	Block	4		Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
460	MH-460	308		910.79	8		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
461	MH-461	311		908.45	23		Junction	Solid	26	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	Dripper	None				2	5	10	$ 10,000.00
462	MH-462	313		906.42	4		Junction	Solid	26	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
463	MH-463	300		906.13	10		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
464	MH-464	301		906.76	0				0		0												3	5	15	$ 10,000.00
465	MH-465	303		907.97	0				0		0												3	5	15	$ 10,000.00
466	MH-466	302		907.10	0				0		0												3	5	15	$ 10,000.00
467	MH-467	305		907.72	12		Junction	Solid	26	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
468	MH-468	306		911.90	10		Junction	Solid	26	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	Dripper	None				2	5	10	$ 10,000.00
469	MH-469	304		906.01	0				0		0												3	4	12	$ 10,000.00
470	MH-470	307		909.26	12		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
471	MH-471	317		908.51	16		Junction	Solid	26	Concrete	4	Concrete	PVC	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
472	MH-472	316		908.58	14		Junction	Solid	26	Concrete	4	Concrete	PVC	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
473	MH-473	320		907.93	12		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
474	MH-474	296		905.61	0		Junction	Solid	26		4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	Weeper				2	5	10	$ 10,000.00
475	MH-475	321		906.32	16		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	Weeper				2	5	10	$ 10,000.00
476	MH-476	319		909.23	10		Junction	Solid	26	Concrete	4	Concrete	PVC	Sheeting	Surface Inspection	None	None	None	Weeper				2	5	10	$ 10,000.00
477	MH-477	HL1-225		916.00	0	908.6			0		0												3	4	12	$ 10,000.00
478	MH-478	HL1-226		914.78	0	909.08			0		0												3	4	12	$ 10,000.00
479	MH-479	HL1-224		915.80	0	907.77			0		0												3	4	12	$ 10,000.00
480	MH-480	HL1-305A		901.92	0	897.86			0		0												3	5	15	$ 10,000.00
481	MH-481	HL1-301		899.99	0	890.65			0		0												3	5	15	$ 10,000.00
482	MH-482	HL1-300		899.99	0	889.28			0		0												3	6	18	$ 10,000.00
483	MH-483	HL1-306		901.30	0				0		0												3	6	18	$ 10,000.00
484	MH-484	HL1-315		898.82	0	890.28			0		0												3	4	12	$ 10,000.00
485	MH-485	HL1-223		901.67	0	897.39			0		0												3	5	15	$ 10,000.00
486	MH-486	HL1-304		902.22	0	896.78			0		0												3	5	15	$ 10,000.00
487	MH-487	HL1-303		900.45	0	896			0		0												3	5	15	$ 10,000.00
488	MH-488	HL1-302		899.25	0	893.72	Junction		23		4	Concrete	Plastic		Surface Inspection	None	None		None				2	5	10	$ 10,000.00
489	MH-489	HL1-305		902.04	0	896.66			0		0												3	5	15	$ 10,000.00
490	MH-490	N-67		909.20	0	900.12			0		0												6	4	24	$ 10,000.00
491	MH-491	N-71		908.74	0	901.56			0		0												6	4	24	$ 10,000.00

Northfield Township Asset Management Plan
Manhole Asset Inventory

Asset ID Information			Asset Inventory Information												Inspection Data								Asset Criticality			Asset Renewal
OBJECT ID	Facility ID	Legacy ID	Install Date	Rim Elevation	Chimney Depth	Invert Elev	Manhole Type	Cover Type	Cover Size (in.)	Chimney Material	Manhole Diameter (ft)	Wall Material	Steps Material	Potential Runoff	Inspection Status	Cover IQ	Frame IQ	Chimney IQ	Wall IQ	Surface Condition	Overall Interior Condition	Manhole Condition	POF	COF	BRE	Replacement Cost
492	MH-492	N-40		908.46	0	896.88			0		0												4	5	20	$ 10,000.00
493	MH-493	N-41		908.67	0				0		0												4	5	20	$ 10,000.00
494	MH-494	HL1-1A		908.47	0	898.94			0		0												4	4	16	$ 10,000.00
495	MH-495	N-43		908.53	0	898.65			0		0												4	4	16	$ 10,000.00
496	MH-496	N-42		908.06	0				0		0												4	4	16	$ 10,000.00
497	MH-497	HL1-3		908.02	0	900.66			0		0												3	4	12	$ 10,000.00
498	MH-498	HL1-2		908.32	0	899.86			0		0												3	4	12	$ 10,000.00
499	MH-499	HL1-1		908.54	0	899.66			0		0												3	4	12	$ 10,000.00
500	MH-500	HL1-5		909.16	0	902.31			0		0												3	4	12	$ 10,000.00
501	MH-501	HL1-4		907.90	0	901.43			0		0												3	3	9	$ 10,000.00
502	MH-502	HL1-308		903.63	0				0		0												3	6	18	$ 10,000.00
503	MH-503	HL1-310		900.06	0				0		0												3	5	15	$ 10,000.00
504	MH-504	HL1-311		902.10	0				0		0												3	5	15	$ 10,000.00
505	MH-505	HL1-312		899.91	0				0		0												3	4	12	$ 10,000.00
506	MH-506	HL1-107		902.00	0	895.28			0		0												3	5	15	$ 10,000.00
507	MH-507	HL1-108		903.41	0	896.52			0		0												3	5	15	$ 10,000.00
508	MH-508	HL1-106		901.71	0	892.73			0		0												3	5	15	$ 10,000.00
509	MH-509	HL1-115A		910.07	6	896.75	Junction		23		4			Sheeting	Surface Inspection								2	5	10	$ 10,000.00
510	MH-510	HL1-114		903.62	0	897.85			0		0												3	4	12	$ 10,000.00
511	MH-511	HL1-309		900.66	0				0		0												3	6	18	$ 10,000.00
512	MH-512	HL1-109		900.62	0	896.93			0		0												3	5	15	$ 10,000.00
513	MH-513	HL1-313		901.81	0				0		0												3	5	15	$ 10,000.00
514	MH-514	HL1-314		898.38	0				0		0												3	4	12	$ 10,000.00
515	MH-515	HL1-307		900.67	0				0		0												3	5	15	$ 10,000.00
516	MH-516	HL1-144		899.79	0	893.75			0		0												3	5	15	$ 10,000.00
517	MH-517	HL1-145		899.05	0	894.12			0		0												3	5	15	$ 10,000.00
518	MH-518	HL1-159		903.49	0	894.93			0		0												3	5	15	$ 10,000.00
519	MH-519	104		902.41	0	892.37			0		0												3	6	18	$ 10,000.00
520	MH-520	HL1-105		901.63	0	890.92			0		0												3	6	18	$ 10,000.00
521	MH-521	HL1-113		902.64	0	895.43			0		0												3	5	15	$ 10,000.00
522	MH-522	HL1-111		911.26	0	903.42			0		0												3	4	12	$ 10,000.00
523	MH-523	HL1-112		910.21	0	902.7			0		0												3	4	12	$ 10,000.00
524	MH-524	102		901.90	9	888.72	Junction	Solid	23		4			Sheeting	Surface Inspection								2	6	12	$ 10,000.00
525	MH-525	103		903.21	0	896.47			0		0												3	6	18	$ 10,000.00
526	MH-526	HL1-8		909.32	0	904			0		0												3	4	12	$ 10,000.00
527	MH-527	HL1-7		911.70	0	903.61			0		0												3	4	12	$ 10,000.00
528	MH-528	HL1-116		903.85	0	889.03			0		0												3	5	15	$ 10,000.00
529	MH-529	HL1-115		899.29	0	888.51			0		0												3	5	15	$ 10,000.00
530	MH-530	101		900.83	0	888.08	Junction	Solid	22		4		Plastic	Ponding	Surface Inspection								2	5	10	$ 10,000.00
531	MH-531	HL1-110		910.76	0	902.14			0		0												3	4	12	$ 10,000.00
532	MH-532	HL1-6		911.13	0	902.84			0		0												3	4	12	$ 10,000.00
533	MH-533	HL1-142		901.05	0	891.63			0		0												3	5	15	$ 10,000.00
534	MH-534	HL1-140		897.96	0	890.36	Junction	Solid	23	Concrete	4	Concrete	Plastic	Ponding	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
535	MH-535	HL1-141		899.37	0	890.59	Junction	Solid	23		4	Concrete	Plastic	Ponding	Surface Inspection	None	None		Gusher				2	5	10	$ 10,000.00
536	MH-536	HL1-143		900.50	0	892.95			0		0												3	5	15	$ 10,000.00
537	MH-537	HL1-158		907.91	0	894.93			0		0												3	4	12	$ 10,000.00
538	MH-538	HL1-160		907.27	0	894.4			0		0												3	5	15	$ 10,000.00
539	MH-539	HL1-161		905.41	0	899.81			0		0												3	4	12	$ 10,000.00
540	MH-540	HL1-161B		907.62	0	896.16			0		0												3	5	15	$ 10,000.00

Northfield Township Asset Management Plan
Manhole Asset Inventory

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OBJECT ID	Facility ID	Legacy ID	Install Date	Rim Elevation	Chimney Depth	Invert Elev	Manhole Type	Cover Type	Cover Size (in.)	Chimney Material	Manhole Diameter (ft)	Wall Material	Steps Material	Potential Runoff	Inspection Status	Cover IQ	Frame IQ	Chimney IQ	Wall IQ	Surface Condition	Overall Interior Condition	Manhole Condition	POF	COF	BRE	Replacement Cost
541	MH-541	HL1-162		911.43	0	901.49			0		0												3	5	15	$ 10,000.00
542	MH-542	HL1-157		903.87	0	895.12			0		0												3	6	18	$ 10,000.00
543	MH-543	HL1-117		905.28	0	893			0		0												3	6	18	$ 10,000.00
544	MH-544	HL1-118		912.06	0				0		0												3	5	15	$ 10,000.00
545	MH-545	HL1-162A		904.81	0	897.72			0		0												3	5	15	$ 10,000.00
546	MH-546	HL1-161A		906.08	0	897.02			0		0												3	4	12	$ 10,000.00
547	MH-547	HL1-163		909.33	0	902.8			0		0												3	4	12	$ 10,000.00
548	MH-548	HL1-219		909.49	0	900.29			0		0												3	4	12	$ 10,000.00
549	MH-549	MC2		910.59	0		Junction	Solid	23		4	Concrete	Plastic	Sheeting	Surface Inspection	None	None		None				2	4	8	$ 10,000.00
550	MH-550	HL1-218		912.01	0	898.82			0		0												3	6	18	$ 10,000.00
551	MH-551	HL1-217		915.88	0	897.3			0		0												3	6	18	$ 10,000.00
552	MH-552	MC1		913.55	0		junction	Solid	23		4		Plastic	Ponding	Surface Inspection								2	4	8	$ 10,000.00
553	MH-553	HL1-216		902.31	0	895.62			0		0												3	5	15	$ 10,000.00
554	MH-554	HL1-215		900.58	0	895.4			0		0												3	6	18	$ 10,000.00
555	MH-555	HL1-214		899.39	0	895.3			0		0												3	5	15	$ 10,000.00
556	MH-556	HL1-216A		903.40	0	898.06			0		0												3	5	15	$ 10,000.00
557	MH-557	HL1-220		915.75	0	901.41			0		0												3	5	15	$ 10,000.00
558	MH-558	HL1-221		914.77	0	902.6			0		0												3	6	18	$ 10,000.00
559	MH-559	HL1-221A		913.89	0				0		0												3	5	15	$ 10,000.00
560	MH-560	HL1-221B		911.62	0				0		0												3	4	12	$ 10,000.00
561	MH-561	HL1-223		913.98	0	903.92	Junction		23		4	Concrete	Plastic		Surface Inspection	None	None		None				2	5	10	$ 10,000.00
562	MH-562	HL1-222A		914.05	0		Junction		23		4	Concrete	Plastic		Surface Inspection	None	None		None				2	5	10	$ 10,000.00
563	MH-563	HL1-222B		913.86	0				0		0												3	4	12	$ 10,000.00
564	MH-564	HL1-206		908.85	0	902.06			0		0												3	4	12	$ 10,000.00
565	MH-565	HL1-222		913.89	0				0		0												3	5	15	$ 10,000.00
566	MH-566	HL1-222C		912.24	0				0		0												3	3	9	$ 10,000.00
567	MH-567	HL1-213		898.43	0	894.38			0		0												3	4	12	$ 10,000.00
568	MH-568	HL1-212		899.25	0	893.79			0		0												3	4	12	$ 10,000.00
569	MH-569	HL1-210		898.36	8	892.6	Junction	Solid	22	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
570	MH-570	HL1-211		898.61	0	893.4			0		0												3	5	15	$ 10,000.00
571	MH-571	HL1-204		918.39	0	900.18			0		0												3	6	18	$ 10,000.00
572	MH-572	HL1-205		912.40	4	900.94	Junction	Solid	22	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
573	MH-573	HL1-222D		913.69	0				0		0												3	4	12	$ 10,000.00
574	MH-574	HL1-202		901.80	0	893.67			0		0												3	5	15	$ 10,000.00
575	MH-575	HL1-203		911.76	0	897.59			0		0												3	5	15	$ 10,000.00
576	MH-576	HL1-201		898.50	0	892.04			0		0												3	5	15	$ 10,000.00
577	MH-577	HL1-146		899.31	0	894.9			0		0												3	5	15	$ 10,000.00
578	MH-578	HL1-147		901.58	0	895.51			0		0												3	5	15	$ 10,000.00
579	MH-579	HL1-148		902.47	0	895.83			0		0												3	5	15	$ 10,000.00
580	MH-580	HL1-149		904.54	0	896.23			0		0												3	5	15	$ 10,000.00
581	MH-581	HL1-200A		901.38	0	891			0		0												3	6	18	$ 10,000.00
582	MH-582	HL1-176		903.03	0	899.24			0		0												3	4	12	$ 10,000.00
583	MH-583	HL1-177		909.00	0	899.69			0		0												3	4	12	$ 10,000.00
584	MH-584	HL1-178		911.87	3	901.4	Junction	Solid	22	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
585	MH-585	HL1-200B		905.92	0	891			0		0												3	4	12	$ 10,000.00
586	MH-586	HL1-150		905.57	0	896.33			0		0												3	4	12	$ 10,000.00
587	MH-587	HL1-151		910.24	0	896.85	Junction	Solid	23		4		Plastic	Sheeting	Surface Inspection								2	5	10	$ 10,000.00
588	MH-588	HL1-152		911.90	0	897.62			0		0												3	5	15	$ 10,000.00
589	MH-589	HL1-153		910.29	0	898.3			0		0												3	5	15	$ 10,000.00

Northfield Township Asset Management Plan
Manhole Asset Inventory

Asset ID Information			Asset Inventory Information												Inspection Data								Asset Criticality			Asset Renewal
OBJECT ID	Facility ID	Legacy ID	Install Date	Rim Elevation	Chimney Depth	Invert Elev	Manhole Type	Cover Type	Cover Size (in.)	Chimney Material	Manhole Diameter (ft)	Wall Material	Steps Material	Potential Runoff	Inspection Status	Cover IQ	Frame IQ	Chimney IQ	Wall IQ	Surface Condition	Overall Interior Condition	Manhole Condition	POF	COF	BRE	Replacement Cost
590	MH-590	HL1-175		912.32	0	898.74	Junction	Solid	22		4	Concrete	Plastic	Sheeting	Surface Inspection	None	None		None				2	4	8	$ 10,000.00
591	MH-591	HL1-200		901.96	0	890.77			0		0												3	5	15	$ 10,000.00
592	MH-592	HL1-164		913.74	0	900.55			0		0												3	5	15	$ 10,000.00
593	MH-593	HL1-166		908.93	0	896.2			0		0												3	4	12	$ 10,000.00
594	MH-594	HL1-169		910.70	0	901.88			0		0												3	4	12	$ 10,000.00
595	MH-595	HL1-168		909.11	0	899.13			0		0												3	4	12	$ 10,000.00
596	MH-596	HL1-154		908.12	0				0		0												3	4	12	$ 10,000.00
597	MH-597	HL1-154A		908.32	0	900.63			0		0												3	4	12	$ 10,000.00
598	MH-598	HL1-155		910.44	0	901.09			0		0												3	4	12	$ 10,000.00
599	MH-599	HL1-156		911.10	0	901.6			0		0												3	3	9	$ 10,000.00
600	MH-600	HL1-171		913.41	8	902.31	Junction	Solid	22		4		Plastic	Sheeting	Surface Inspection								2	5	10	$ 10,000.00
601	MH-601	HL1-165		909.59	0	902			0		0												3	4	12	$ 10,000.00
602	MH-602	HL1-167		910.79	0	899.6			0		0												3	4	12	$ 10,000.00
603	MH-603	HL1-170		909.05	0	903.5	Junction	Solid	23		4		Plastic	Sheeting	Surface Inspection								2	4	8	$ 10,000.00
604	MH-604	HL1-168A		907.09	0	902.2			0		0												3	4	12	$ 10,000.00
605	MH-605	HL1-173		911.71	0	904.5			0		0												3	4	12	$ 10,000.00
606	MH-606	HL1-172		915.59	0	903.91			0		0												3	5	15	$ 10,000.00
607	MH-607	HL1-139		905.29	0	896.66			0		0												3	5	15	$ 10,000.00
608	MH-608	HL1-119		912.11	0	894.04			0		0												3	6	18	$ 10,000.00
609	MH-609	HL1-129		912.13	0	902.42			0		0												3	4	12	$ 10,000.00
610	MH-610	HL1-128		911.30	0	900.21			0		0												3	5	15	$ 10,000.00
611	MH-611	HL1-120		912.01	0	895.86			0		0												3	6	18	$ 10,000.00
612	MH-612	HL1-132		909.51	0	898.64			0		0												3	5	15	$ 10,000.00
613	MH-613	HL1-133		907.71	0	900.87			0		0												3	3	9	$ 10,000.00
614	MH-614	HL1-135		907.10	6	899.11	Junction	Solid	23		4		Plastic	Sheeting	Surface Inspection								2	4	8	$ 10,000.00
615	MH-615	HL1-138		905.07	0	900.55			0		0												3	4	12	$ 10,000.00
616	MH-616	HL1-127		912.68	0	895.96			0		0												3	5	15	$ 10,000.00
617	MH-617	HL1-121		910.47	0	896.92			0		0												3	5	15	$ 10,000.00
618	MH-618	HL1-134		908.01	4	897.78	Junction	Solid	23		4		Plastic	Sheeting	Surface Inspection								2	5	10	$ 10,000.00
619	MH-619	HL1-130		912.02	0	899.39			0		0												3	4	12	$ 10,000.00
620	MH-620	HL1-136		909.58	0	898.92			0		0												3	5	15	$ 10,000.00
621	MH-621	HL1-137		910.20	0	899.9			0		0												3	5	15	$ 10,000.00
622	MH-622	HL1-131		908.59	0	900.7			0		0												3	4	12	$ 10,000.00
623	MH-623	HL1-122		908.91	0	897.76			0		0												3	5	15	$ 10,000.00
624	MH-624	HL1-123		907.11	0	899.57			0		0												3	4	12	$ 10,000.00
625	MH-625	HL1-126		906.59	0	902.22			0		0												3	4	12	$ 10,000.00
626	MH-626	HL1-125		908.41	0	901.18			0		0												3	4	12	$ 10,000.00
627	MH-627	HL1-151A		909.53	0	905.06			0		0												3	4	12	$ 10,000.00
629	MH-629	173		906.18	0	890.33			0		0												4	6	24	$ 10,000.00
631	MH-631	LP2		906.66	16		Junction	Solid	26	Block	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
632	MH-632	LP3		909.21	16		Junction	Solid	26	Block	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
633	MH-633	LP4		910.42	0		Junction	Solid	26		4	Concrete	Plastic	Sheeting	Surface Inspection	None	None		None				2	6	12	$ 10,000.00
634	MH-634	N-120A		904.15	0				0		0												6	4	24	$ 10,000.00
635	MH-635	N-120B		906.72	0				0		0												6	3	18	$ 10,000.00
636	MH-636	WB3		905.28	0	593.31			0		0												3	4	12	$ 10,000.00
637	MH-637	WB2		901.70	0	892.83			0		0												3	4	12	$ 10,000.00
638	MH-638	WB1		902.39	0	892.44			0		0												3	4	12	$ 10,000.00
639	MH-639	TER-16		917.84	0				0		0												3	5	15	$ 10,000.00
640	MH-640	TER-17		920.90	0				0		0												3	5	15	$ 10,000.00

Northfield Township Asset Management Plan
Manhole Asset Inventory

Asset ID Information			Asset Inventory Information												Inspection Data								Asset Criticality			Asset Renewal
OBJECT ID	Facility ID	Legacy ID	Install Date	Rim Elevation	Chimney Depth	Invert Elev	Manhole Type	Cover Type	Cover Size (in.)	Chimney Material	Manhole Diameter (ft)	Wall Material	Steps Material	Potential Runoff	Inspection Status	Cover IQ	Frame IQ	Chimney IQ	Wall IQ	Surface Condition	Overall Interior Condition	Manhole Condition	POF	COF	BRE	Replacement Cost
641	MH-641	TER-9		919.19	0				0		0												3	5	15	$ 10,000.00
642	MH-642	TER-10		919.18	0				0		0												3	5	15	$ 10,000.00
643	MH-643	TER-7		913.78	0				0		0												3	5	15	$ 10,000.00
644	MH-644	TER-6		912.72	0				0		0												3	5	15	$ 10,000.00
646	MH-646	TER-12		917.53	0				0		0												3	4	12	$ 10,000.00
647	MH-647	TER-20		922.03	0				0		0												3	5	15	$ 10,000.00
648	MH-648	TER-19		921.67	0				0		0												3	5	15	$ 10,000.00
649	MH-649	TER-18		921.30	0				0		0												3	5	15	$ 10,000.00
650	MH-650	TER-21		922.89	0				0		0												3	5	15	$ 10,000.00
651	MH-651	TER-21A		921.94	0				0		0												3	6	18	$ 10,000.00
652	MH-652	TER-22		922.13	0				0		0												3	5	15	$ 10,000.00
653	MH-653	TER-23		924.01	0				0		0												3	5	15	$ 10,000.00
654	MH-654	GVH-1		908.23	0	907.83			0		0												3	4	12	$ 10,000.00
655	MH-655	GVH-2		909.06	0	908.6			0		0												3	4	12	$ 10,000.00
656	MH-656	GVH-3		908.09	0	906.07			0		0												3	5	15	$ 10,000.00
657	MH-657	GVH-4		907.67	0				0		0												3	4	12	$ 10,000.00
658	MH-658	GVH-5		907.59	0	906.25			0		0												3	5	15	$ 10,000.00
659	MH-659	TER-24		923.82	0				0		0												3	5	15	$ 10,000.00
660	MH-660	TER-24A		927.26	0				0		0												3	5	15	$ 10,000.00
661	MH-661	TER-24D		920.92	0				0		0												3	3	9	$ 10,000.00
662	MH-662	TER-24C		920.62	0				0		0												3	4	12	$ 10,000.00
663	MH-663	TER-24B		922.11	0				0		0												3	4	12	$ 10,000.00
664	MH-664	TER-25		924.28	0				0		0												3	5	15	$ 10,000.00
665	MH-665	TER-26		923.36	0				0		0												3	4	12	$ 10,000.00
666	MH-666	TER-1B		934.59	0				0		0												3	6	18	$ 10,000.00
667	MH-667	TER-1A		919.75	0				0		0												3	4	12	$ 10,000.00
668	MH-668	TER-104		917.79	0				0		0												3	4	12	$ 10,000.00
669	MH-669	TER-105		917.27	0				0		0												3	4	12	$ 10,000.00
670	MH-670	TER-106		917.73	0				0		0												3	4	12	$ 10,000.00
671	MH-671	TER-108		919.74	0				0		0												3	4	12	$ 10,000.00
672	MH-672	TER-107		919.07	0				0		0												3	4	12	$ 10,000.00
673	MH-673	TER-106A		928.79	0				0		0												3	4	12	$ 10,000.00
674	MH-674	TER-106B		931.02	0				0		0												3	3	9	$ 10,000.00
675	MH-675	TER-5B		910.07	0				0		0												3	3	9	$ 10,000.00
676	MH-676	SS-0761		908.80	0				0		0												3	3	9	$ 10,000.00
677	MH-677	SS-0762		889.47	0				0		0												4	5	20	$ 10,000.00
679	MH-679	SS-0764		945.56	0				0		0												3	5	15	$ 10,000.00
680	MH-680	SS-0765		943.40	0				0		0												3	4	12	$ 10,000.00
681	MH-681	SS-0766		938.28	0				0		0												3	4	12	$ 10,000.00
682	MH-682	SS-0767		935.46	0				0		0												3	4	12	$ 10,000.00
683	MH-683	SS-0768		937.17	0				0		0												3	4	12	$ 10,000.00
684	MH-684	SS-0769		938.68	0				0		0												3	5	15	$ 10,000.00
685	MH-685	SS-0770		934.07	0				0		0												3	5	15	$ 10,000.00
686	MH-686	SS-0771		938.95	0				0		0												3	4	12	$ 10,000.00
687	MH-687	SS-0772		934.36	0				0		0												3	4	12	$ 10,000.00
689	MH-689	HL1-210A		904.17	5		Junction	Solid	26	Concrete	4	Concrete	Plastic	Ponding	Surface Inspection			None	None				2	4	8	$ 10,000.00
690	MH-690	HL1-210B		914.94	0		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
691	MH-691	G70		901.71	0	888.56			0		0												3	5	15	$ 10,000.00
692	MH-692	N-38		907.69	0		Junction		0		4												4	5	20	$ 10,000.00

Northfield Township Asset Management Plan
Manhole Asset Inventory

Asset ID Information			Asset Inventory Information												Inspection Data								Asset Criticality			Asset Renewal
OBJECT ID	Facility ID	Legacy ID	Install Date	Rim Elevation	Chimney Depth	Invert Elev	Manhole Type	Cover Type	Cover Size (in.)	Chimney Material	Manhole Diameter (ft)	Wall Material	Steps Material	Potential Runoff	Inspection Status	Cover IQ	Frame IQ	Chimney IQ	Wall IQ	Surface Condition	Overall Interior Condition	Manhole Condition	POF	COF	BRE	Replacement Cost
693	MH-693	HL1-124		908.67	0				0		0												3	4	12	$ 10,000.00
694	MH-694	223		910.01	0		Junction	Solid	26		4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
695	MH-695	N-74		905.46	0				0		0												6	4	24	$ 10,000.00
696	MH-696	N-59B		906.26	4		Junction		26	Concrete	4	Concrete	Plastic		Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
697	MH-697	N-59A		906.90	0				0		0												3	5	15	$ 10,000.00
698	MH-698	G98		922.78	0	910.79			0		0												3	5	15	$ 10,000.00
699	MH-699	7-13		924.00	0	918.42			0		0												3	3	9	$ 10,000.00
700	MH-700	7-12		926.53	15	917.16	Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
701	MH-701	7-11		924.90	5	914.96	Junction		26	Concrete	4	Concrete	Plastic		Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
702	MH-702	7-10		918.51	11	909.05	Junction		26	Concrete	4	Concrete	Plastic		Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
703	MH-703	7-9		916.40	7	904.95	Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
704	MH-704	7-8		913.35	14	903.16	Junction	Solid	26	Cast Iron	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
705	MH-705	7-7		911.90	0	901.96	Junction	Solid	26	None	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
706	MH-706	26		908.47	19	898.94	Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
707	MH-707	7-5		907.95	7	897.37	Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
708	MH-708	7-4		906.00	14	895.97	Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
709	MH-709	7-3		911.35	0	894.57	Junction	Solid	26	Concrete	4	Concrete	Plastic	None	Surface Inspection	None	None	None	None				2	6	12	$ 10,000.00
710	MH-710	7-2		907.10	12	893.17	Junction	Solid	26		4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
711	MH-711	7-1		910.65	18	891.44	Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	6	12	$ 10,000.00
712	MH-712	G111		898.38	0	887			0		0												3	5	15	$ 10,000.00
719	MH-719	G3		908.83	0	900.27			0		0												4	4	16	$ 10,000.00
720	MH-720	G7A		909.77	0	896.48			0		0												4	5	20	$ 10,000.00
721	MH-721	G14		901.37	0	890.08	junction	Solid	22		4		Cast Iron	Ponding	Surface Inspection								3	5	15	$ 10,000.00
722	MH-722	G37		913.18	0	903.46			0		0												4	5	20	$ 10,000.00
723	MH-723	LP1		902.29	0				0		0	1											3	4	12	$ 10,000.00
724	MH-724	G44		901.68	0	892.68			0		0												4	3	12	$ 10,000.00
727	MH-727	SS-0032			0		WWTP		0		0												4	4	16	$ 10,000.00
731	MH-731	TER-4		913.04	0				0		0												3	4	12	$ 10,000.00
732	MH-732	TER-3		910.75	0				0		0												3	3	9	$ 10,000.00
733	MH-733	TER-2		916.81	0				0		0												3	4	12	$ 10,000.00
734	MH-734	TER-1		918.32	0				0		0												3	4	12	$ 10,000.00
735	MH-735	TER-101		916.66	0				0		0												3	4	12	$ 10,000.00
736	MH-736	TER-5		913.70	0				0		0												3	4	12	$ 10,000.00
737	MH-737	TER-5A		910.77	0				0		0												3	4	12	$ 10,000.00
738	MH-738	TER-8		917.63	0				0		0												3	5	15	$ 10,000.00
739	MH-739	TER-13		917.62	0				0		0												3	5	15	$ 10,000.00
740	MH-740	TER-11		917.56	0				0		0												3	5	15	$ 10,000.00
741	MH-741	TER-14		917.73	0				0		0												3	5	15	$ 10,000.00
742	MH-742	TER-15		916.93	0				0		0												3	5	15	$ 10,000.00
743	MH-743	WB7		909.96	0	897.45			0		0												3	4	12	$ 10,000.00
744	MH-744	WB6		907.80	0	596.73			0		0												3	4	12	$ 10,000.00
745	MH-745	WB5		907.39	0	594.95			0		0												3	5	15	$ 10,000.00
746	MH-746	WB4		907.38	0	894.02			0		0												3	4	12	$ 10,000.00
747	MH-747	XX2		910.48	0				0		0												4	3	12	$ 10,000.00
748	MH-748	XX3		911.73	0				0		0												4	3	12	$ 10,000.00
749	MH-749	XX4		912.33	0				0		0												4	3	12	$ 10,000.00
750	MH-750	XX5		911.17	0				0		0												4	3	12	$ 10,000.00
751	MH-751	XX6		910.24	0				0		0												4	3	12	$ 10,000.00
752	MH-752	XX7		907.16	0				0		0												4	3	12	$ 10,000.00

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Manhole Asset Inventory

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753	MH-753	SS-0058		907.88	0				0		0												3	5	15	$ 10,000.00
754	MH-754	SS-0059		906.72	0				0		0												3	6	18	$ 10,000.00
755	MH-755	SS-0060		906.70	0				0		0												3	5	15	$ 10,000.00
756	MH-756	236		911.69	4		Junction	Solid	26	Brick	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
757	MH-757	235		909.89	4		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
758	MH-758	231		909.96	0		Junction	Solid	26		4	Concrete	Plastic	Sheeting	Surface Inspection	None	None		None				2	4	8	$ 10,000.00
759	MH-759	230		912.31	0				0		0	1											3	4	12	$ 10,000.00
760	MH-760	226		910.28	0		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None		None				2	5	10	$ 10,000.00
761	MH-761	225		910.85	5		Junction	Solid	26	Concrete	4	1	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
762	MH-762	224		910.07	0		Junction	Solid	26		4	Concrete	Plastic	Sheeting	Surface Inspection	None	None		None				2	5	10	$ 10,000.00
763	MH-763	227		911.42	0		Junction		26		4	1	Plastic		Surface Inspection	None	None		None				2	4	8	$ 10,000.00
764	MH-764	229		911.60	0				0		0	1											3	4	12	$ 10,000.00
765	MH-765	228		911.90	0				0		0	1											3	4	12	$ 10,000.00
766	MH-766	234		909.11	5		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
767	MH-767	232		912.09	11		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting		None	None	None	None				3	4	12	$ 10,000.00
768	MH-768	233		909.99	12		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
769	MH-769	237		911.80	16		Junction	Solid	26	Block	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
770	MH-770	238		912.30	0				0		0	1											3	4	12	$ 10,000.00
771	MH-771	245		913.22	0				0		0	1											3	4	12	$ 10,000.00
772	MH-772	246		912.86	0				0		0	1											3	4	12	$ 10,000.00
773	MH-773	247		911.85	0				0		0	1											3	4	12	$ 10,000.00
774	MH-774	248		912.01	0				0		0	1											3	4	12	$ 10,000.00
775	MH-775	249		910.55	0				0		0	1											3	4	12	$ 10,000.00
776	MH-776	250		909.06	0				0		0	1											3	4	12	$ 10,000.00
777	MH-777	241		910.03	18		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
778	MH-778	240		911.32	12		Junction	Solid	26	Block	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
779	MH-779	239		911.93	9		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
780	MH-780	242		911.55	16		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	5	10	$ 10,000.00
781	MH-781	243		910.79	8		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	Runner				2	4	8	$ 10,000.00
782	MH-782	244		910.10	5		Junction	Solid	26	Concrete	4	Concrete	Plastic	Sheeting	Surface Inspection	None	None	None	None				2	4	8	$ 10,000.00
783	MH-783	201		908.82	0				0		0	1											3	5	15	$ 10,000.00
784	MH-784	251		909.38	0				0		0	1											3	5	15	$ 10,000.00
787	MH-787			903.60	0		Junction		0		4												6	4	24	$ 10,000.00
788	MH-788			905.87	0		Junction		0		4												6	4	24	$ 10,000.00
789	MH-789			928.83	0				0		0												3	5	15	$ 10,000.00
790	MH-790			933.46	0		Air Relief		0		0												3	4	12	$ 10,000.00
791	MH-791			937.66	0		Air Relief		0		0												3	4	12	$ 10,000.00
792	MH-792			938.33	0				0		0												3	4	12	$ 10,000.00
793	MH-793			940.01	0		Air Relief		0		0												3	4	12	$ 10,000.00
794	MH-794			927.68	0				0		0												3	5	15	$ 10,000.00
795	MH-795			918.72	0				0		0												3	4	12	$ 10,000.00
796	MH-796			921.86	0		Cleanout		0		0												3	4	12	$ 10,000.00
797	MH-797			921.79	0		Cleanout		0		0												3	4	12	$ 10,000.00
1198	MH-628	N-39		906.78	0	895.98			0		0											Excellent	4	4	16	$ 10,000.00
2000	MH-800			910.85			Junction				4	1											3	5	15	$ 10,000.00
2001	MH_801	N-70									4												6	4	24	$ 10,000.00
																									Total	$ 7,810,000.00

Northfield Township Asset Management Plan
Force Main Inventory

Asset ID Information				Asset Inventory Information							Criticality			Asset Renewal Cost	
OBJECT ID	Facility ID	Pump Station Name	Pump Station Number	Install Date	EEL	Est. Replacement Year	Length	Diameter	Material	ECR	POF	COF	BRE	Replacement $/Ft	Replacement Cost
		Eagle Gardens		1995	75	2070	10	10		3	2	2	4	$100	$ 1,000.00
30	FM-30	East Shore 1	PS-12	2007	75	2082	561	6	DI	3	4	4	16	$55	$ 30,900.00
4	FM-04	East Shore 2	PS-5	1969	75	2044	2,207	6		3	6	4	24	$55	$ 121,400.00
10	FM-10	8 Mile Rd.	PS-10	2001	75	2076	2,951	12		3	6	10	60	$125	$ 368,900.00
8	FM-08	Horseshoe Lake 1	PS-7	1978	75	2053	460	6		3	6	6	36	$55	$ 25,300.00
		Horseshoe Lake 2		1978	75	2053	900	6		3	6	4	24	$55	$ 49,500.00
11	FM-11	Horseshoe Lake 3	PS-8	1978	75	2053	827	4		3	6	4	24	$45	$ 37,200.00
13	FM-13	Lake Point Dr.	PS-15	2004	75	2079	1,265	2		3	4	2	8	$30	$ 38,000.00
7	FM-07	Main St.	G-8	1969	75	2044	787	6		3	6	4	24	$55	$ 43,300.00
14	FM-14	North Territorial Rd.	PS-13	2002	75	2077	13,200	12		3	4	8	32	$125	$ 1,650,000.00
2	FM-02	Nine Mile Rd.	PS-1	1978	75	2053	512	4		3	6	2	12	$45	$ 23,000.00
		North Shore 1		1969	75	2044	67	4		3	6	2	12	$45	$ 3,000.00
6	FM-06	North Shore 2	PS-2	1969	75	2044	777	4		3	6	2	12	$45	$ 35,000.00
9	FM-09	Shadowoods	PS-11	1996	75	2071	2,840	3		3	4	4	16	$35	$ 99,400.00
1	FM-01	Canal (Elmcrest)	PS-3	1978	75	2053	583	4		3	6	6	36	$45	$ 26,200.00
		WL GS-1		2016	75	2091	120	1.5		2	1	1	1	$25	$ 3,000.00
		WL GS-2		2016	75	2091	104	1.5		2	1	1	1	$25	$ 2,600.00
		WL GS-3		2016	75	2091	210	1.5		2	1	1	1	$25	$ 5,300.00
		WL GS-4		2016	75	2091	83	1.5		2	1	1	1	$25	$ 2,100.00
		WL GS-5		2016	75	2091	174	1.5		2	1	1	1	$25	$ 4,400.00
		WL GS-6		2016	75	2091	250	1.5		2	1	1	1	$25	$ 6,300.00
		WL GS-7		2016	75	2091	104	1.5		2	1	1	1	$25	$ 2,600.00
		WL GS-8		2016	75	2091	221	1.5		2	1	1	1	$25	$ 5,500.00
		WL GS-9		2016	75	2091	109	1.5		2	1	1	1	$25	$ 2,700.00
		WL GS-10		2016	75	2091	104	1.5		2	1	1	1	$25	$ 2,600.00
														Total	**$ 2,589,200.00**

APPENDIX D: PUMP STATION INVENTORY TABLES

Northfield Township Asset Management Plan
Pump Station Inventory

Asset ID Information		Asset Inventory Information	Inspection Data	Criticality			Asset Renewal
OBJECT ID	Facility ID	Install Date	ECR	POF	COF	BRE	Replacement Cost
PS-15	Canal (Elmcrest)	1978	4	4	2	8	$ 491,000.00
PS-1	Eagle Gardens	1995	3	4	2	8	$ 549,000.00
PS-2	East Shore 1	2007	3	4	2	8	$ 714,000.00
PS-3	East Shore 2	1969	4	6	2	12	$ 635,000.00
PS-4	Eight Mile Rd.	2001	3	4	10	40	$ 1,500,000.00
PS-5	Horseshoe Lake 1	1978	4	6	4	24	$ 650,000.00
PS-6	Horseshoe Lake 2	1978	3	4	4	16	$ 545,000.00
PS-7	Horseshoe Lake 3	1978	3	4	2	8	$ 519,000.00
PS-8	Lake Point Dr.	2004	3	2	2	4	$ 176,000.00
PS-9	Main St.	1969	4	4	4	16	$ 441,000.00
PS-11	Nine Mile Rd.	1978	3	4	2	8	$ 474,000.00
PS-12	North Shore 1	1969	3	4	4	16	$ 509,000.00
PS-13	North Shore 2	1969	4	6	2	12	$ 629,000.00
PS-10	North Territorial Rd.	2002	3	4	2	8	$ 987,000.00
PS-14	Shadowoods	1996	3	2	2	4	$ 470,000.00
						Total	**$ 9,289,000.00**

PS-1 Eagle Gardens


Location: Lake Pine Dr-Eagle Gardens Subdivision

Description: Pump Station PS-1 is a duplex submersible pump station with a 10-foot round precast concrete wet well which houses pumps and discharge piping. The station also incorporates a precast concrete valve vault which houses discharge piping and valves. The station is designed to service homes in the Eagle Gardens development on the south side of Whitmore Lake. The station was originally constructed in 1995 and currently discharges to an existing 10-inch sewer via a 10 inch force main. The pumps and valves are in fair condition. The controls and control cabinet are also in fair to good condition.

Deficiencies: Surface Corrosion-Discharge piping and valves; Infiltration (stains) at wet well joints
Current Service Area: 200 Connections
Avg Daily Flow gpd(assumed): 52,000 gal
Configuration: Duplex Submersible
Wet Well Diameter: 10 feet
Force Main Length: 10 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
PS-1-RSP1	Hydromatic	200 gpm, 34.5 TDH	
PS-1-RSP2	ABS Piranha S10/4 Grinder	200 gpm, 34.5 TDH	

Standby Power: None – Has receptacle

Remote Monitoring: Tied into Northfield Township wastewater SCADA

PS-2 East Shore 1

Location: Lake Pine Dr.

Description: Pump Station PS-2 is a duplex submersible pump station with a 10-foot round precast concrete wet well (buried under a wooden gazebo) which houses pumps and discharge piping. The station services flows from the Eagle Gardens subdivision that aren't picked up by the Eagle Gardens station (approximately 70 homes) in addition to flows discharged from the Lake Point Dr., Eagle Gardens, and East Shore 2 pump stations. The station was originally constructed in 1960 and replaced in 2007. The station currently discharges through an existing 6-inch force main to an existing 12-inch sewer. The pumps and valves are in good working condition. The controls and control cabinet are also in fair condition. The station's odor control canister unit is in fair condition.

Deficiencies: Corrosion on control panel enclosure
Current Service Area: Eagle Gardens, Lake Point Dr. PS, East Shore 2 PS
Avg Daily Flow gpd(assumed): 1 MGD
Configuration: Duplex
Wet Well Diameter: 10 feet
Force Main Length: 560 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
PS-2-RSP1	ABS Piranha S10/4 Grinder	760 gpm, 46 TDH	14/460/3
PS-2-RSP2	ABS Piranha S10/4 Grinder	760 gpm, 46 TDH	14/460/3
PS-2-MBP	Main Breaker Panel		
PS-2-MSCP	Station Control Panel		
PS-2-OCU			

Standby Power: Cummins 85 kW Generator

Remote Monitoring: Tied into Northfield Township SCADA

PS-3 East Shore 2

Location: End of Preservation Drive

Description: Pump Station PS-3 is a duplex submersible pump station with an 8-foot round precast concrete wet well which houses the pump suction bells. The station also includes a 4-foot x approximately 8-foot steel can dry pit valve vault that houses the pumps, discharge piping and valves. The station services the developments around the northeast side of Whitmore Lake in addition to the flows discharged from the 9 Mile Rd. pump station. The station was originally constructed in 1969 and currently discharges through an existing 6-inch ductile iron force main to an existing 12-inch VCP sewer. The pumps and valves are in poor to fair condition condition. The controls and control cabinet are also in poor to fair condition. The wet well and valve vault are in fair condition.

Deficiencies: Corrosion on exterior of valve vault; corrosion on pumps, valves and discharge piping.
Current Service Area: Developments around NE side of Whitmore Lake and flows from 9 Mile Rd. pump station
Avg Daily Flow gpd (assumed): 100,000 gal
Configuration: Duplex
Wet Well Diameter: 8 feet
Force Main Length: 630 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
PS-3-RSP1	Allis Chalmers Model 300	300 gpm, 25 TDH	10/240/3
PS-3-RSP2	Allis Chalmers Model 300	300 gpm, 25 TDH	10/240/3
PS-3-MSCP	Station Control Panel		

Standby Power: Cummins 35 kW Generator

Remote Monitoring: Tied into Northfield Township SCADA

PS-4 Eight Mile Rd.


Location: Eight Mile Road between Emerald Cir. And Lemen Rd.

Description: Pump Station PS-4 is a quadplex submersible pump station with a 14-foot by 16-foot rectangular concrete wet well which houses pumps, inlet gates and discharge piping. The station receives flow from the entire Township before pumping it directly to the wastewater treatment plant headworks. The station was originally constructed in 2001 and currently discharges through an existing 12-inch force main to the wastewater treatment plant. The pumps and valves are in good working condition. The controls and control cabinet are also in good condition. The inlet gates are in fair condition. The crane is in good condition. The site fence and drive are in good condition. Pumps 2 and 3 were replaced in 2012 and 2014, respectively. VFD 4 was replaced in 2019.

Deficiencies: Moderate corrosion on discharge piping; minor corrosion on wet well hatches and inlet gate stems
Current Service Area: Entire Township
Avg Daily Flow gpd(assumed): Inflow to Plant
Configuration: Quadplex
Wet Well Diameter: 14 x 16 feet rectangular
Force Main Length: 2950 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
PS-4-RSP1	C-3300	1100 gpm, 125 TDH	60/460/3
PS-4-RSP2	C-3300	1100 gpm, 125 TDH	60/460/3
PS-4-RSP3	C-3300	1100 gpm, 125 TDH	60/460/3
PS-4-RSP4	C-3300	1100 gpm, 125 TDH	60/460/3
PS-4-MSCP	Main Station Control Panel		
PS-4-MCC	Motor Control Center		
PS-4-ATS	Automatic Transfer Switch		
PS-4-VFD1	VFD 1		
PS-4-VFD2	VFD 2		
PS-4-VFD3	VFD 3		
PS-4-VFD4	VFD 4		

Standby Power: Cummins 200 kW Diesel Generator

Remote Monitoring: Tied into Northfield Township SCADA

PS-5 Horseshoe Lake 1

Location: 8082 Main St.

Description: Pump Station PS-5 is a duplex submersible pump station with an 8-foot round precast concrete wet well which houses pumps and discharge piping. The station also includes a precast concrete valve vault that houses discharge piping and valves. The station services developments on the west side of US 23, developments around the west half of Horseshoe Lake in addition to receiving flow from the Horseshoe Lake 2, Horseshoe Lake 3 and Shadowoods pump stations. The station was originally constructed in 1978 and currently discharges through an existing 6-inch force main to an existing 12-inch concrete sewer. The pumps are in fair working condition. The controls and control cabinet are also in fair condition. The discharge piping and valves appear to be corroded and in poor condition. The generator and generator controls appear to be in poor to fair condition. The pumps were replaced in 2010.

Deficiencies: Infiltration; corrosion
Current Service Area: South half of Horseshoe Lake and some development west of US 23
Avg Daily Flow gpd(assumed): 2,600 gallons
Configuration: Duplex
Wet Well Diameter: 8 feet
Force Main Length: 460 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
PS-5-RSP1	Flygt NP 3102 MT 3~ 462	400 gpm, 32 TDH	5/460/3
PS-5-RSP2	Flygt NP 3102 MT 3~ 462	400 gpm, 32 TDH	5/460/3
PS-5-MSCP	Station Control Panel		

Standby Power: Cummins 20 kW Generator

Remote Monitoring: Tied into Northfield Township SCADA

PS-6 Horseshoe Lake 2

Location: Edmund St.

Description: Pump Station PS-6 is a duplex submersible pump station with an 8-foot round precast concrete wet well that houses pumps and discharge piping. The station also incorporates a precast concrete valve vault, which houses discharge piping and valves. The station services homes along the south side of Horseshoe Lake in addition to receiving discharge flows from both the Horseshoe Lake 3 and Shadowoods pump stations. The station was originally constructed in 1978 and currently discharges to an existing 10-inch sewer via a force main. The pumps and valves are in fair working condition. The controls and control cabinet are also in fair condition.

Deficiencies: Infiltration in wet well and valve vault; corrosion on exterior of generator, interior of control panel enclosure and on discharge piping and valves

Current Service Area: South side of Horseshoe Lake, Horseshoe Lake 3 pump station and Shadowoods pump station

Avg Daily Flow gpd(assumed): 2,600 gallons

Configuration: Duplex

Wet Well Diameter: 8 feet

Force Main Length: 900 feet

Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
PS-6-RSP1	Flygt N 3085	150 gpm, 13 TDH	3/460/3
PS-6-RSP2	Flygt N 3085	150 gpm, 13 TDH	3/460/3
PS-6-MSCP	Station Control Panel		

Standby Power: Cummins 20 kW Generator

Remote Monitoring: Tied into Northfield Township SCADA

PS-7 Horseshoe Lake 3

Location: Lakeshore Rd.

Description: Pump Station PS-7 is a duplex submersible pump station with an 8-foot round precast concrete wet well which houses pumps and discharge piping. The station also incorporates a precast concrete valve vault, which houses discharge piping and valves. The station services homes on Lakeshore Rd. north of Highland Rd. The station was originally constructed in 1978 and currently discharges through a 4-inch force main to an existing 8-inch sewer. The pumps and valves are in fair working condition. The controls and control cabinet are also in fair condition. The pumps were replaced in 2010.

Deficiencies: Infiltration at wet well joints; infiltration in valve vault; corrosion on interior of control panel enclosure; corrosion on discharge piping and valves
Current Service Area: Lakeshore Rd. north of Highland Rd
Avg Daily Flow gpd(assumed): 12,000 gal
Configuration: Duplex
Wet Well Diameter: 8 feet
Force Main Length: 827 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
PS-7-RSP1	Flygt N 3085	100 gpm, 24 TDH	3/460/3
PS-7-RSP2	ABS Piranha S10/4 Grinder	100 gpm, 24 TDH	3/460/3
PS-7-ATS	Automatic Transfer Switch		
PS-7-MSCP	Station Control Panel		

Standby Power: Cummins 20 kW Generator

Remote Monitoring: Tied into Northfield Township SCADA

PS-8 Lake Point Dr.

Location: End of Lake Point Dr.

Description: Pump Station PS-8 is a duplex grinder pump station. The station services 4 homes on the Lake Point Dr. peninsula on the south side of Whitmore Lake. The station was originally constructed in 2004 and currently discharges through a 2-inch force main to an existing 12-inch sewer. The pumps and valves are in good working condition. The controls and control cabinet are also in good condition.

Deficiencies: None
Current Service Area: 4 homes on Lake Point Dr. peninsula
Avg Daily Flow gpd(assumed): 1,000 gal
Configuration: Duplex
Wet Well Diameter:
Force Main Length: 1265 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
PS-8-GP1	E-One 2000	12 gpm, 24 TDH	1/240/1
PS-8-GP2	E-One 2000	12 gpm, 24 TDH	1/240/1
PS-8-MBP	Main Breaker Panel		
PS-8-MSCP	Station Control Panel		

Standby Power: None – Has receptacle

Remote Monitoring: Tied into Northfield Township SCADA

PS-9 Main St.

Location: North Main St. (in front of 11773 N. Main St.)

Description: Pump Station PS-9 is a duplex dry pit pump station with an 8-foot round precast concrete wet well which houses the pump suction bells. The station also incorporates an approximate 4-foot by 8-foot steel can valve vault, which houses pumps, discharge piping, valves and controls. The station services the northwest side of Whitmore Lake (area between Kenton Dr. and the DNR boat launch) in addition to receiving discharge flows from the North Shore 1, North Shore 2 and Canal (Elmcrest) pump stations. The station was originally constructed in 1969 and currently discharges through a 6-inch force main to an existing 10-inch sewer. The pumps and valves are in fair to good working condition. The controls and control cabinet are also in fair condition. The pump pots were replaced in 2009. The existing discharge force main is set to be replaced in Spring 2019.

Deficiencies: Existing discharge force main has leaked on multiple occasions; Infiltration
Current Service Area: NW side of Whitmore Lake, North Shore 1 PS, North Shore 2 PS, Canal (Elmcrest) PS
Avg Daily Flow gpd(assumed):
Configuration: Duplex
Wet Well Diameter: 8 feet
Force Main Length: 788 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
PS-9-RSP1	Deming 7181	100 gpm, 15 TDH	5/460/3
PS-9-RSP2	ABS Piranha S10/4 Grinder	100 gpm, 15 TDH	5/460/3
PS-9-MBP	Main Breaker Panel		
PS-9-MSCP	Station Control Panel		

Standby Power: None – Has receptacle

Remote Monitoring: Tied into Northfield Township SCADA

PS-10 N. Territorial Rd


Location: End of Preservation Drive

Description: Pump Station PS-10 is a triplex submersible pump station with a 10-foot by 12-foot rectangular precast concrete wet well which houses pumps and discharge piping. The station also incorporates a rectangular precast concrete valve vault. The station services flows from the MDOT Rest Area pump station on US 23 in addition to flows from developments along US 23 at the North Territorial Rd. exit and along North Territorial Rd. east of US 23. The station was originally constructed in 2002 and currently discharges through a 12-inch force main to the Eight Mile Rd. pump station. The pumps and valves are in fair condition. The discharge piping appears corroded and in poor condition. The controls and control cabinet are in good condition. The site fence is in good condition.

Deficiencies: Corrosion on discharge piping and valves; Infiltration in valve vault (valves submerged)
Current Service Area: MDOT Rest Area, developments along US 23 at North Territorial, North Territorial east of US 23
Avg Daily Flow gpd(assumed): 0.3 MG
Configuration: Triplex (only two pumps currently installed)
Wet Well Diameter: 10 feet by 12 feet
Force Main Length: 2.5 miles
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
PS-10-RSP1	Flygt N 3153.181	760 gpm, 46 TDH	15/460/3
PS-10-RSP2	Flygt N 3153.181	760 gpm, 46 TDH	15/460/3
PS-10-MBP	Main Breaker Panel		
PS-10-MSCP	Station Control Panel		
PS10-ATS	Automatic Transfer Switch		

Standby Power: Cummins 85 kW Generator

Remote Monitoring: Tied into Northfield Township SCADA

PS-11 Nine Mile Rd.

Location: 9 Mile Rd.

Description: Pump Station PS-11 is a duplex submersible pump station with an 8-foot round precast concrete wet well which houses pumps and discharge piping. The station also incorporates a precast concrete valve vault, which houses discharge piping and valves. The station services approximately 23 homes along Nine Mile Rd. and Lakeview Dr. on the northeast side of Whitmore Lake. The station was originally constructed in 1978 and currently discharges through a 4-inch force main to an existing 8-inch sewer. The pumps and valves are in fair condition. The controls and control cabinet are in fair to good condition. Pump 1 was rebuilt in 2009.

Deficiencies: Infiltration in valve vault; corrosion on discharge piping and valves; minor corrosion on interior of control panel enclosure
Current Service Area: 23 homes
Avg Daily Flow gpd(assumed): 6,000 gallons
Configuration: Duplex
Wet Well Diameter: 8 feet
Force Main Length: 512 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
PS-11-RSP1	Flygt N 3085	100 gpm, 42 TDH	2.2/460/3
PS-11-RSP2	Flygt N 3085	100 gpm/42 TDH	2.2/460/3
PS-11-MBP	Main Breaker Panel		
PS-11-MSCP	Station Control Panel		

Standby Power: None – Has receptacle

Remote Monitoring: Tied into Northfield Township SCADA

PS-12 North Shore 1

Location: North Shore Dr. (corner of Shore Dr. and North Shore Dr.)

Description: Pump Station PS-12 is a duplex ejector pump station with an approximate 4-foot by 8-foot steel can dry pit which houses pumps, valves, discharge piping and controls. The station services homes along North Shore Dr. in addition to receiving flows from North Shore 2 and Canal (Elmcrest) pump stations. The station was originally constructed in 1969 and currently discharges through a four-inch force main to an 8-inch sewer. The pumps and valves are in fair to good condition. The controls and control cabinet are also in fair to good condition. New air/water tanks were installed in 2009.

Deficiencies: Minor corrosion on discharge piping and control panel enclosure
Current Service Area: North Shore Dr., North Shore 2 and Canal (Elmcrest) pump stations
Avg Daily Flow gpd(assumed): 2,600 gallons
Configuration: Duplex
Wet Well Diameter: 8 feet
Force Main Length: 67 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
PS-12-EP1	Quincy 210 QRB	100 Gallons	
PS-12-EP2	Quincy 210 QRB	100 Gallons	
PS-12-MBP	Main Breaker Panel		
PS-12-MSCP	Station Control Panel		

Standby Power: None – Has receptacle

Remote Monitoring: Tied into Northfield Township SCADA

PS-13 North Shore 2

Location: Corner of North Shore Dr. and DNR Park Rd.

Description: Pump Station PS-1 is a duplex submersible pump station with a 8-foot round precast concrete wet well which houses pumps and discharge piping. The station also incorporates a precast concrete valve vault. The station services approximately 15 homes on North Shore Dr. and Elmcrest Rd. along the northwest corner of Whitmore Lake in addition to receiving flows from the Canal (Elmcrest) pump station. The station was originally constructed in 1969, but was replaced in 1985. The station currently discharges through a 4-inch force main to an existing existing 10-inch sewer. The pumps are in fair condition. The discharge piping appears to be in poor to fair condition. The wet well appears to be in poor to fair condition with some infiltration and corrosion present on the walls of the lower half of the well. The controls and control cabinet are in fair condition. The valve vault was submerged in stormwater drainage due to the recent construction on the boat launch parking area.

Deficiencies: Infiltration through and corrosion on wet well walls; corrosion on discharge piping; minor corrosion on interior of control panel enclosure; valve vault susceptible to submergence by stormwater drainage.

Current Service Area: 15 homes on North Shore Dr. and Elmcrest Rd. along NW corner of Whitmore Lake in addition to flows from Canal (Elmcrest) station

Avg Daily Flow gpd(assumed): 105,000 gal

Configuration: Duplex

Wet Well Diameter: 8 feet

Force Main Length: 777 feet

Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
PS-13-RSP1	Flygt NP 3102.090	455 gpm, 32 TDH	5/230/3
PS-13-RSP2	Flygt NP 3102.090	455 gpm, 32 TDH	5/230/3
PS-13-MBP	Main Breaker Panel		
PS-13-MSCP	Station Control Panel		

Standby Power: None – Has receptacle

Remote Monitoring: Tied into Northfield Township SCADA

PS-14 Shadowoods

Location: Northwest side of intersection of Turnberry Dr. and St. Andrews Ct.

Description: Pump Station PS-14 is a duplex grinder pump station with an 8-foot round precast concrete wet well which houses pumps and discharge piping. The station also incorporates a precast concrete valve vault, which houses discharge piping and valves. The station services 44 homes in the Shadowoods development on Six Mile Rd. east of Horseshoe Lake. The station was originally constructed in 1996 and currently discharges through a 3-inch force main to an existing 8-inch sewer. The pumps and valves were replaced in 2018 and are in good working condition. The controls and control cabinet are also in good condition. The discharge piping and valves are in fair condition.

Deficiencies: Corrosion on discharge piping
Current Service Area: Shadowoods development (44 homes)
Avg Daily Flow gpd(assumed): 11,400 gal
Configuration: Duplex
Wet Well Diameter: 8 feet
Force Main Length: 2840 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
PS-14-RSP1	Flygt 3068	50 gpm, 42 TDH	3/460/3
PS-14-RSP2	Flygt 3068	50 gpm, 42 TDH	3/460/3
PS-14-MBP	Main Breaker Panel		
PS-14-MSCP	Station Control Panel		

Standby Power: None – Has receptacle

Remote Monitoring: Tied into Northfield Township SCADA

PS-15 Canal (Elmcrest)

Location: Northeast side of intersection of Canal St. and Elmcrest Rd.

Description: Pump Station PS-15 is a duplex submersible pump station with an 8-foot round precast concrete wet well which houses pumps and discharge piping. The station also incorporates a precast concrete valve vault, which houses discharge piping and valves. The station services homes on the north side of Whitmore Lake (south of Nine Mile Rd.) in addition to the Stilsonburg Station development and some homes along Fieldcrest Dr. The station was originally constructed in 1978 and currently discharges through a 4-inch force main to an existing 10-inch sewer. The pumps are in fair condition. The impellers and wear rings were replaced in 2018. The discharge piping and valves are in poor to fair condition. The controls and control cabinet are in fair condition.

Deficiencies: Infiltration in wet well and valve vault; corrosion on discharge piping and valves; corrosion on interior of control panel enclosure; minor cracking in top slab of wet well
Current Service Area: North side of Whitmore Lake (south of Nine Mile Rd.), Stilsonburg Station, homes along Fieldcrest Dr.
Avg Daily Flow gpd(assumed): 41,000 gal
Configuration: Duplex
Wet Well Diameter: 8 feet
Force Main Length: 583 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
PS-15-RSP1	Flygt CP-3085	100 gpm, 17 TDH	3/230/3
PS-15-RSP2	Flygt CP-3085	100 gpm, 17 TDH	3/230/3
PS-15-MBP	Main Breaker Panel		
PS-15-MSCP	Station Control Panel		

Standby Power: None – Has receptacle

Remote Monitoring: Tied into Northfield Township SCADA

Grinder Station GS-1

Location: Alexander Farm Market & Greenhouses-6925 Whitmore Lake Rd.

Description: Pump Station GS-1 is a simplex submersible grinder pump station with a round plastic wet well which houses one pump and discharge piping. The station is designed to service the sanitary sewer discharge from Alexander Farm Market & Greenhouses (6925 Whitmore Lake Rd.). The station was originally constructed in 2016 and currently discharges to an existing 3-inch force main from a 1.5-inch service lead. The station is in good condition.

Deficiencies: None
Current Service Area: 6925 Whitmore Lake Rd.
Avg Daily Flow gpd(assumed): Unknown
Configuration: Simplex Submersible
Wet Well Diameter: 2 feet
Service Lead Length: 120 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
GS1-P1	E-One	9 gpm @ 138’ TDH	1/240/1

Standby Power: None

Remote Monitoring: None – Local alarm light

Grinder Station GS-2

Location: Hamlin Trucking-6542 Whitmore Lake Rd.

Description: Pump Station GS-2 is a simplex submersible grinder pump station with a round plastic wet well which houses one pump and discharge piping. The station is designed to service the sanitary sewer discharge from Hamlin Trucking (6542 Whitmore Lake Rd). The station was originally constructed in 2016 and currently discharges to an existing 3-inch force main from a 1.5-inch service lead. The station is in good condition.

Deficiencies: None
Current Service Area: 6542 Whitmore Lake Rd.
Avg Daily Flow gpd(assumed): Unknown
Configuration: Simplex Submersible
Wet Well Diameter: 2 feet
Service Lead Length: 104 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
GS2-P1	E-One	9 gpm @ 138' TDH	1/240/1

Standby Power: None

Remote Monitoring: None – Local alarm light

Grinder Station GS-3

Location: SLM Trailers-6480 Whitmore Lake Rd.

Description: Pump Station GS-3 is a simplex submersible grinder pump station with a round plastic wet well which houses one pump and discharge piping. The station is designed to service the sanitary sewer discharge from SLM Trailers (6480 Whitmore Lake Rd). The station was originally constructed in 2016 and currently discharges to an existing 3-inch force main from a 1.5-inch service lead. The station is in good condition.

Deficiencies: None
Current Service Area: 6480 Whitmore Lake Rd.
Avg Daily Flow gpd(assumed): Unknown
Configuration: Simplex Submersible
Wet Well Diameter: 2 feet
Service Lead Length: 210 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
GS3-P1	E-One	9 gpm @ 138' TDH	1/240/1

Standby Power: None

Remote Monitoring: None – Local alarm light

Grinder Station GS-4

Location: 6431 Whitmore Lake Rd.

Description: Pump Station GS-4 is a simplex submersible grinder pump station with a round plastic wet well which houses one pump and discharge piping. The station is designed to service the sanitary sewer discharge from 6431 Whitmore Lake Rd, a private residence. The station was originally constructed in 2016 and currently discharges to an existing 3-inch force main from a 1.5-inch service lead. The station is in good condition.

Deficiencies: None
Current Service Area: 6431 Whitmore Lake Rd.
Avg Daily Flow gpd(assumed): Unknown
Configuration: Simplex Submersible
Wet Well Diameter: 2 feet
Service Lead Length: 83 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
GS3-P1	E-One	9 gpm @ 138’ TDH	1/240/1

Standby Power: None

Remote Monitoring: None – Local alarm light

Grinder Station GS-5

Location: 6410 Whitmore Lake Rd.

Description: Pump Station GS-5 is a simplex submersible grinder pump station with a round plastic wet well which houses one pump and discharge piping. The station is designed to service the sanitary sewer discharge from 6410 Whitmore Lake Rd, a private residence. The station was originally constructed in 2016 and currently discharges to an existing 3-inch force main from a 1.5-inch service lead. The station is in good condition.

Deficiencies: None
Current Service Area: 6410 Whitmore Lake Rd.
Avg Daily Flow gpd(assumed): Unknown
Configuration: Simplex Submersible
Wet Well Diameter: 2 feet
Service Lead Length: 174 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
GS3-P1	E-One	9 gpm @ 138' TDH	1/240/1

Standby Power: None

Remote Monitoring: None – Local alarm light

Grinder Station GS-6

Location: 6400 Whitmore Lake Rd.

Description: Pump Station GS-6 is a simplex submersible grinder pump station with a round plastic wet well which houses one pump and discharge piping. The station is designed to service the sanitary sewer discharge from 6400 Whitmore Lake Rd, a private residence. The station was originally constructed in 2016 and currently discharges to an existing 3-inch force main from a 1.5-inch service lead. The station is in good condition.

Deficiencies: None
Current Service Area: 6400 Whitmore Lake Rd.
Avg Daily Flow gpd(assumed): Unknown
Configuration: Simplex Submersible
Wet Well Diameter: 2 feet
Service Lead Length: 250 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
GS3-P1	E-One	9 gpm @ 138' TDH	1/240/1

Standby Power: None

Remote Monitoring: None – Local alarm light

Grinder Station GS-7

Location: 6371 Whitmore Lake Rd.

Description: Pump Station GS-7 is a simplex submersible grinder pump station with a round plastic wet well which houses one pump and discharge piping. The station is designed to service the sanitary sewer discharge from 6371 Whitmore Lake Rd, a private residence. The station was originally constructed in 2016 and currently discharges to an existing 3-inch force main from a 1.5-inch service lead. The station is in good condition.

Deficiencies: None
Current Service Area: 6371 Whitmore Lake Rd.
Avg Daily Flow gpd(assumed): Unknown
Configuration: Simplex Submersible
Wet Well Diameter: 2 feet
Service Lead Length: 104 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
GS7-P1	E-One	9 gpm @ 138’ TDH	1/240/1

Standby Power: None

Remote Monitoring: None – Local alarm light

Grinder Station GS-8

Location: Broadscape Landscaping-6350 Whitmore Lake Rd.

Description: Pump Station GS-8 is a simplex submersible grinder pump station with a round plastic wet well which houses one pump and discharge piping. The station is designed to service the sanitary sewer discharge from Broadscape Landscaping-6350 Whitmore Lake Rd. The station was originally constructed in 2016 and currently discharges to an existing 3-inch force main from a 1.5-inch service lead. The station is in good condition.

Deficiencies: None
Current Service Area: 6350 Whitmore Lake Rd.
Avg Daily Flow gpd(assumed): Unknown
Configuration: Simplex Submersible
Wet Well Diameter: 2 feet
Service Lead Length: 221 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
GS8-P1	E-One	9 gpm @ 138’ TDH	1/240/1

Standby Power: None

Remote Monitoring: None – Local alarm light

Grinder Station GS-9

Location: 6289 Whitmore Lake Rd.

Description: Pump Station GS-9 is a simplex submersible grinder pump station with a round plastic wet well which houses one pump and discharge piping. The station is designed to service the sanitary sewer discharge from 6289 Whitmore Lake Rd, a private residence. The station was originally constructed in 2016 and currently discharges to an existing 3-inch force main from a 1.5-inch service lead. The station is in good condition.

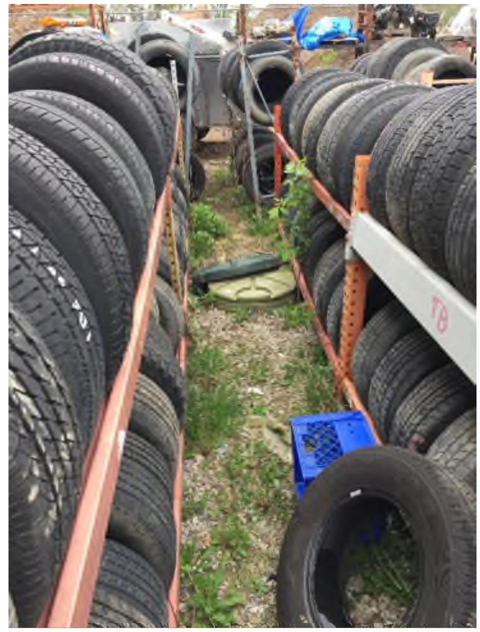
Deficiencies: None
Current Service Area: 6289 Whitmore Lake Rd.
Avg Daily Flow gpd(assumed): Unknown
Configuration: Simplex Submersible
Wet Well Diameter: 2 feet
Service Lead Length: 109 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
GS9-P1	E-One	9 gpm @ 138' TDH	1/240/1

Standby Power: None

Remote Monitoring: None – Local alarm light

Grinder Station GS-10

Location: Regal Recycling-6270 Whitmore Lake Rd.

Description: Pump Station GS-10 is a simplex submersible grinder pump station with a round plastic wet well which houses one pump and discharge piping. The station is designed to service the sanitary sewer discharge from Regal Recycling (6270 Whitmore Lake Rd). The station was originally constructed in 2016 and currently discharges to an existing 3-inch force main from a 1.5-inch service lead. The station is in good condition.

Deficiencies: None
Current Service Area: 6270 Whitmore Lake Rd.
Avg Daily Flow gpd(assumed): Unknown
Configuration: Simplex Submersible
Wet Well Diameter: 2 feet
Service Lead Length: 104 feet
Equipment:

Equipment	Manufacturer/Description	Rated Capacity	HP/Volts/Phase
GS10-P1	E-One	9 gpm @ 138' TDH	1/240/1

Standby Power: None

Remote Monitoring: None – Local alarm light

APPENDIX E: WWTP INVENTORY TABLES

Northfield Township Asset Management Plan
Wastewater Treatment Plant Asset Inventory
Preliminary Treatment

Current Year 2019

FACILITIES

Asset ID	Building/Process	Location	Equipment Description	Asset Size	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Grit/Screen Building Walls - External	Grit/Screen Building			38 ft x 27 ft x 12 ft H		1998	60	39	3	40	3	0%	3	9	2059	$ 343,200	$ 5,720	$ 8,580
Grit/Screen Building Roof	Grit/Screen Building					1998	20	-1	3	5	3	0%	4	12	2024	$ 26,500	$ 1,325	$ 5,300
Grit Screen Guard Rail	Grit/Screen Building		33 ft			1998	40	19	3	20	4	0%	3	12	2039	$ 3,300	$ 83	$ 165
Grit and Screen Building Garage Door	Grit/Screen Building			10' x 10'	Need to replace;	1998	20	-1	4	5	3	0%	5	15	2024	$ 10,000	$ 500	$ 2,000
Grit and Screen Building Doors (3)	Grit/Screen Building					1998	30	9	3	10	3	0%	3	9	2029	$ 3,000	$ 100	$ 300

Total Asset Cost	$ 386,000		
Total Annual Asset Cost		$ 7,728	$ 16,345

EQUIPMENT

Asset ID	Type	Quantity	Equipment Description	Asset Size	Manufacturer	Series	Model	Equip Param 1	Equip Param 2	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition of Equipment (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Process																							
Hycor Solids Separator	Process	1	Fine Screens				HLS500	H-0012362Z	Motor: 0.5 hp, 3-phase, 1725 rpm, 460 V	2008 New Screw Shaft Installed 2016 New Stainless Steel Basket	1998	30	9	3	15	3	0%	3	9	2034	$ 75,000	$ 2,500	$ 5,000
Manual Bar Screen	Process	1								Back-up to Hycor	1998	45	24	3	30	2	0%	3	6	2049	$ 12,000	$ 267	$ 400
Screenings Hopper	Process	1									2015	15	11	2	15	3	0%	2	6	2034	$ 5,000	$ 333	$ 333
Grit Tank	Process	1		10 ft diameter	Pista Grit		Trap Model 7.0	Steel Tank		Paint not bad	1998	30	9	4	10	3	0%	4	12	2029	$ 100,000	$ 3,333	$ 10,000
Grit Mechanism	Process	1			Smith and Loveless		7.0	Paddle Drive			1998	30	9	3	15	3	0%	3	9	2034	$ 55,500	$ 1,850	$ 3,700
Grit Pump	Pump	1			Smith and Loveless			250 gpm, @ 16 ft TDH		Rusty, but works, replace as needed	1998	20	-1	3	5	3	0%	3	9	2024	$ 65,000	$ 3,250	$ 13,000
Cyclone Grit Separator	Process	1			Smith and Loveless		SN-3R-01834-V				1998	30	9	3	15	3	0%	3	9	2034	$ 55,000	$ 1,833	$ 3,667
Grit Conveyor	Process	1			Pista Grit		Screw Conveyor	Motor: 1 hp, 1200 rpm, 3-phase, 460 V			2018	20	19	2	25	3	0%	2	6	2044	$ 137,000	$ 6,850	$ 5,480
Grit Hopper	Process	1									2007	15	3	3	5	3	0%	3	9	2024	$ 5,000	$ 333	$ 1,000
Parshall Flume	Process	1									1998	60	39	3	40	4	0%	3	12	2059	$ 5,000	$ 83	$ 125
Weirs (2)	Process	2									1998	30	9	3	10	3	0%	3	9	2029	$ 3,000	$ 100	$ 300
SP-3-1 to SP-3-4	Process	1	Stop Plate	24 in. x 30 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 27,000	$ 900	$ 2,700
SP-4-1	Process	1	Stop Plate	42 in. x 30 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 7,000	$ 233	$ 700
SP-4-2	Process	1	Stop Plate	37 in. x 30 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 7,000	$ 233	$ 700
SP-5-1	Process	1	Stop Plate	48 in. x 30 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 7,000	$ 233	$ 700
P-11-1	Valve	1	Plug Valve	6 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 9,800	$ 327	$ 980
Piping																							
Grit Bldg Piping	Pipework	1	8" DIP	50							1998	30	9	3	15	3	0%	3	9	2034	$ 50,000	$ 1,667	$ 3,333
Electrical																							
FIT-1	Electrical and Instrumentation	1	Grit and Screen Building		Total Plant Flow						1998	15	-6	3	5	5	0%	3	15	2024	$ 2,000	$ 133	$ 400
FE/FY-1	Electrical and Instrumentation	1	Preliminary Treatment - Service Building	Parshall Flume	Influent Flow Meter	9 in				0 to 1200 gpm	1998	15	-6	3	5	5	0%	3	15	2024	$ 3,000	$ 200	$ 600
AIT-1	Electrical and Instrumentation	1	Preliminary Treatment - Grit and Screen Building		Gas Monitor						1998	15	-6	3	5	5	0%	3	15	2024	$ 2,000	$ 133	$ 400
AS-1A	Electrical and Instrumentation	1	Preliminary Treatment - Grit and Screen Building	on AIT-1	Oxygen Sensor						1998	15	-6	3	5	5	0%	3	15	2024	$ 1,000	$ 67	$ 200
AS-1B	Electrical and Instrumentation	1	Preliminary Treatment - Grit and Screen Building	on AIT-1	Combustible Sensor						1998	15	-6	3	5	5	0%	3	15	2024	$ 1,000	$ 67	$ 200
AS-1C	Electrical and Instrumentation	1	Preliminary Treatment - Grit and Screen Building	on AIT-1	Toxics Sensor						1998	15	-6	3	5	5	0%	3	15	2024	$ 1,000	$ 67	$ 200
AA-1	Electrical and Instrumentation	1	Preliminary Treatment - Grit and Screen Building	Tied to AIT-1	Alarm					*Part of PLC software	1998	15	-6	3	5	5	0%	3	15	2024	$ -	$ -	$ -
Flow Meter (2)	Electrical and Instrumentation	2	Preliminary Treatment - Grit and Screen Building	In Parshall Flume			Hycor				1998	15	-6	3	5	3	0%	3	9	2024	$ 10,000	$ 667	$ 2,000
Sonic Meters	Electrical and Instrumentation	1	Preliminary Treatment - Grit and Screen Building								1998	15	-6	3	5	3	0%	3	9	2024	$ 2,000	$ 133	$ 400
Panel-G	Electrical and Instrumentation	1	Preliminary Treatment - Grit and Screen Building								1976	20	-23	4	5	5	0%	4	20	2024	$ 10,000	$ 500	$ 2,000
Panel-G Transformer	Electrical and Instrumentation	1	Preliminary Treatment - Grit and Screen Building								1976	20	-23	4	5	5	0%	4	20	2024	$ 5,800	$ 290	$ 1,160
MCC-G	Electrical and Instrumentation	1	Preliminary Treatment - Grit and Screen Building		Motor Control Center		Cutler Hammer		Freedom 2100 Contro	400 Amp, 480 V	1998	40	19	3	20	5	0%	3	15	2039	$ 72,000	$ 1,800	$ 3,600
Mechanical																							
Forced Air Furnace	Mechanical Equipment	1	Hot Water Unit Heater	4099 cfm	Trane		260S			Corrosion Resistant; Explosion Proof; Works, but not well	1998	15	-6	3	2	2	0%	3	6	2021	$ 2,300	$ 153	$ 1,150
P-4	Mechanical Equipment	1	Submersible Grinder Sample Pump	10 gpm @ 24 ft TDH				2 hp		Sampler Pump	1998	20	-1	3	5	3	0%	3	9	2024	$ 2,100	$ 105	$ 420
RF-2	Mechanical Equipment	1	Exhaust Fan	4825 cfm	Loren-Cook					Corrosion Resistant; Explosion Proof	1998	25	4	3	10	4	0%	3	12	2029	$ 1,300	$ 52	$ 130
RF-3	Mechanical Equipment	1	Exhaust Fan	235 cfm	Loren-Cook						1998	25	4	3	10	4	0%	3	12	2029	$ 1,300	$ 52	$ 130
AD-1	Mechanical Equipment	1	Automatic Damper	2412 cfm				40" x 48"		Corrosion Resistant; Explosion Proof	1998	30	9	3	10	4	0%	3	12	2029	$ 1,600	$ 53	$ 160
AD-2	Mechanical Equipment	1	Automatic Damper	2412 cfm				40" x 48"		Corrosion Resistant; Explosion Proof	1998	30	9	3	10	4	0%	3	12	2029	$ 1,600	$ 53	$ 160
AD-3	Mechanical Equipment	1	Automatic Damper	236 cfm				16" x 16"			1998	30	9	3	10	4	0%	3	12	2029	$ 1,600	$ 53	$ 160
Heating Unit/Furnace	Mechanical Equipment	1			Reznor						2015	15	11	3	10	2	0%	3	6	2029	$ 3,500	$ 233	$ 350

Total Asset Cost	$ 750,400		
Total Annual Asset Cost		$ 29,139	$ 65,938

Total Number of Assets	44
Total Replacement Cost	$ 1,136,400.00

Northfield Township Asset Management Plan
Wastewater Treatment Plant Asset Inventory
Primary Treatment

Current Year 2019

FACILITIES

Asset ID	Building/Process	Location	Equipment Description	Asset Size	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Influent Flow Split Structure Concrete	Primary Clarifier					1998	60	39	3	45	4	0%	3	12	2064	$ 30,000	$ 500	$ 667
Primary Clarifier Tanks 1 & 2	Primary Clarifier			42 ft x 23 ft x 12 ft		1965	60	6	3	10	4	25%	3	9	2029	$ 232,000	$ 3,867	$ 23,200
Scum Well Concrete 1 & 2	Primary Clarifier			6 ft x 4 ft x 10 ft		1965	60	6	3	10	4	0%	3	12	2029	$ 23,000	$ 383	$ 2,300
Primary Clarifier Tank 3 & 4	Primary Clarifier			42 ft x 23 ft x 12 ft		1998	60	39	3	40	4	25%	3	9	2059	$ 232,000	$ 3,867	$ 5,800
Scum Well Concrete 3 & 4	Primary Clarifier			6 ft x 4 ft x 10 ft		1998	60	39	3	40	4	0%	3	12	2059	$ 23,000	$ 383	$ 575
Primary Effluent Pump Station with Wet Well	Primary Clarifier					1998	60	39	3	40	4	0%	3	12	2059	$ 32,000	$ 533	$ 800

Total Asset Cost	$ 572,000.00		
Total Annual Asset Cost		$ 9,533.33	$ 33,341.67

EQUIPMENT

Asset ID	Type	Quantity	Building/Process	Location	Equipment Description	Asset Size	Manufacturer	Series	Model	Equip Param 1	Equip Param 2	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition of Equipment (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Process																									
Stop Plates (2)	Process	2	Influent Flow Split Structure	Yard	Stop Plate	30" x 24"	Waterman					Good working order	1998	30	9	3	10	3	0%	3	9	2029	$ 14,000	$ 467	$ 1,400
P-12-1 to P-12-2	Valve	2	Primary Clarifier 3 & 4	Yard	Plug Valve	8 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 12,000	$ 400	$ 1,200
Plug Valves (2)	Valve	2	Primary Clarifier 1 & 2	Service Building Basement	Plug Valve	8 in.							1976	30	-13	3	5	3	0%	3	9	2024	$ 12,000	$ 400	$ 2,400
Primary Clarifier Mechanism 1	Process	1	Primary Clarifier	Primary Clarifier 1	Clarifier Mechanism		SEW Euro-drive					Al new collector components	2007	30	18	2	20	4	25%	2	6	2039	$ 60,000	$ 2,000	$ 3,000
Primary Clarifier Mechanism 2	Process	1	Primary Clarifier	Primary Clarifier 2	Clarifier Mechanism		SEW Euro-drive						2007	30	18	2	20	4	25%	2	6	2039	$ 60,000	$ 2,000	$ 3,000
P-5-1	Valve	1	Primary Clarifier 1 & 2	Yard	Plug Valve	12 in.							1992	30	3	3	10	4	25%	3	9	2029	$ 13,400	$ 447	$ 1,340
Primary Clarifier Mechanism 3	Process	1	Primary Clarifier	Primary Clarifier 3	Clarifier Mechanism								1998	30	9	3	10	4	25%	3	9	2029	$ 60,000	$ 2,000	$ 6,000
Primary Clarifier Mechanism 4	Process	1	Primary Clarifier	Primary Clarifier 4	Clarifier Mechanism								1998	30	9	3	10	4	25%	3	9	2029	$ 60,000	$ 2,000	$ 6,000
RA-1-1	Valve	1	Primary Clarifier 3 & 4		Gate Valve	12 in.						Bypass	1998	30	9	3	10	3	0%	3	9	2029	$ 13,400	$ 447	$ 1,340
P-2-1 to P-2-3	Valve	1	Primary Effluent PS	Service Building Basement	Plug Valves	10 in.	Clow						1976	30	-13	3	10	3	0%	3	9	2029	$ 19,700	$ 657	$ 1,970
Primary Effluent Pumps (3)	Pump	3	Primary Effluent PS	Service Building Basement	Pumps	25 hp @ 58 TDH	Worthington Dresser		6MFC14 Fr-5A	Centrifugal	1190 rpm	All 3 replaced in 1991; Rebuild as needed	1991	30	2	3	5	4	33%	3	8.04	2024	$ 125,000	$ 4,167	$ 25,000
Check Valve (1)	Valve	1	Primary Effluent PS	Service Building Basement	Valves	8 in.							2017	30	28	1	30	3	0%	1	3	2049	$ 3,700	$ 123	$ 123
Check Valves (2)	Valve	2	Primary Effluent PS	Service Building Basement	Valves	8 in.	Clow						1976	30	-13	3	5	3	0%	3	9	2024	$ 7,300	$ 243	$ 1,460
P-6-1 to P-6-3	Valve	3	Primary Effluent PS	Service Building Basement	Valves	8 in.	Clow						1976	30	-13	3	5	3	0%	3	9	2024	$ 14,000	$ 467	$ 2,800
BCV-1-1 (Ball Control Valve)	Valve	1	Primary Effluent PS	Service Building Basement	Valves	4 in.							1976	30	-13	3	5	3	0%	3	9	2024	$ 15,000	$ 500	$ 3,000
A-2-1	Valve	1	Primary Effluent Yard Piping	Yard	Gate Valve								1976	30	-13	3	5	3	0%	3	9	2024	$ 4,700	$ 157	$ 940
A-2-2	Valve	1	Primary Effluent Yard Piping	Yard	Gate Valve								1976	30	-13	3	5	3	0%	3	9	2024	$ 4,700	$ 157	$ 940
A-4-1	Valve	1	Primary Effluent Yard Piping	Yard	Gate Valve	10 in.							1976	30	-13	3	5	3	0%	3	9	2024	$ 6,600	$ 220	$ 1,320
A-4-2	Valve	1	Primary Effluent Yard Piping	Yard	Gate Valve	10 in.							1976	30	-13	3	5	3	0%	3	9	2024	$ 6,600	$ 220	$ 1,320
Piping																									
Electrical																									
LIC-2	Electrical and Instrumentation	1	Primary Settling Tanks - Service Building	Primary Effluent Wet Well	Level Controller on BCV 1-1 with output meter							*Part of PLC software	1976	15	-28	4	5	3	0%	4	12	1991	$ -	$ -	$ -
LS-2	Electrical and Instrumentation	1	Primary Settling Tanks - Service Building	Primary Effluent Wet Well	Current Switch								1976	15	-28	4	5	4	0%	4	16	1991	$ 500	$ 33	$ 100
LAL-2/LAH-2	Electrical and Instrumentation	1	Primary Settling Tanks - Service Building	Primary Effluent Wet Well	Low and High Level Alarm							*Part of PLC software	1976	15	-28	4	5	4	0%	4	16	1991	$ -	$ -	$ -
CR-14	Electrical and Instrumentation	1	Primary Settling Tanks - Service Building	Primary Effluent Wet Well	Interlock Relay							*Part of CP	1976	15	-28	4	5	3	0%	4	12	1991	$ -	$ -	$ -
LI-2	Electrical and Instrumentation	1	Primary Settling Tanks - Service Building	Primary Effluent Wet Well	Light Indicator for LIT-2							*Part of PLC software	1976	15	-28	4	5	3	0%	4	12	1991	$ -	$ -	$ -
LE-2	Electrical and Instrumentation	1	Primary Settling Tanks - Service Building	Primary Effluent Wet Well	Bubbler Wet Well Level					MCP		*decommissioned	1976	15	-28	5	5	0	0%	5	0	1991	$ -	$ -	$ -
LIT-2	Electrical and Instrumentation	1	Primary Settling Tanks - Service Building	Primary Effluent Wet Well	Level Transmitter							*decommissioned	1976	15	-28	5	5	0	0%	5	0	1991	$ 2,000	$ 133	$ 400
LSL-2/LSH-2	Electrical and Instrumentation	1	Primary Settling Tanks - Service Building	Primary Effluent Wet Well	Pressure Switches Pump Control and Alarm Circuits								1976	15	-28	4	5	3	0%	4	12	1991	$ 2,000	$ 133	$ 400
Primary VFDs (3)	Electrical and Instrumentation	3	Primary Settling Tanks - Service Building	Basement	VFD		Allen Bradley		Power Flex 400				2009	15	5	2	10	3	0%	2	6	2024	$ 135,000	$ 9,000	$ -
Mechanical																									

Total Asset Cost	$ 651,600		
Total Annual Asset Cost		$ 26,370	$ 65,453

Total Number of Assets	$ 44
Total Replacement Cost	$ 1,223,600

Northfield Township Asset Management Plan
Wastewater Treatment Plant Asset Inventory
Intermediate Treatment

Current Year 2019

FACILITIES

Asset ID	Building/Process	Location	Equipment Description	Asset Size	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Trickling Filter Tank	Trickling Filter			104 ft diameter	Upgrades 1991 and 2008;	1962	60	3	3	5	4	0%	3	12	2024	$ 956,000	$ 15,933	$ 191,200
Intermediate Tank	Intermediate Tank			30 ft diam.	Piers for support are cracked	1962	60	3	3	5	4	0%	3	12	2024	$ 157,000	$ 2,617	$ 31,400
Intermediate Tank Bridge	Intermediate Tank					1962	40	-17	4	2	4	0%	5	20	2021	$ 37,000	$ 925	$ 18,500
Intermediate Tank Handrail	Intermediate Tank					1962	40	-17	4	2	4	0%	5	20	2021	$ 12,000	$ 300	$ 6,000

Total Asset Cost	$ 1,162,000		
Total Annual Asset Cost		$ 19,775	$ 247,100

EQUIPMENT

Asset ID	Type	Quantity	Building/Process	Location	Equipment Description	Asset Size	Manufacturer	Series	Model	Equip Param 1	Equip Param 2	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition of Equipment (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Process																									
Trickling Filter Mechanism	Process	1	Trickling Filter			104 ft diam							1998	30	9	3	15	3	0%	3	9	2034	$ 150,000	$ 5,000	$ 10,000
Trickling Filter Media	Process	1	Trickling Filter			1,940 cyd Tank Volume				Plastic Media			1998	50	29	3	35	2	0%	3	6	2054	$ 350,000	$ 7,000	$ 10,000
Intermediate Settling Tank Mechanism	Process	1	Trickling Filter	Between Trickling Filter and	Clarifier Mechanism	30 ft diam.							1998	30	9	3	15	4	0%	3	12	2034	$ 214,000	$ 7,133	$ 14,267
Piping																									
Electrical																									
FE-5/FQ-5	Electrical and Instrumentation	1	Intermediate Settling Tank Sludge Pumps	on CP-1	Flow Meter/Signal					0 to 120 gpm			1976	15	-28	4	5	3	0%	5	15	2024	$ 5,000	$ 333	$ 1,000
FIQ-5	Electrical and Instrumentation	1	Intermediate Settling Tank Sludge Pumps	on CP-1	Totalizer of Sludge Pump Flow							*Part of PLC software	1976	15	-28	4	5	3	0%	5	15	2024	$ -	$ -	$ -
KK-5	Electrical and Instrumentation	1	Intermediate Settling Tank Sludge Pumps	Behind CP-1	Timer							*Part of PLC software	1976	15	-28	4	5	3	0%	5	15	2024	$ -	$ -	$ -
Mechanical																									

Total Asset Cost	$ 719,000		
Total Annual Asset Cost		$ 19,467	$ 35,267

Total Number of Assets	$ 10
Total Replacement Cost	$ 1,881,000

Northfield Township Asset Management Plan
Wastewater Treatment Plant Asset Inventory
Aeration System Treatment

Current Year 2019

FACILITIES

415000

Asset ID	Building/Process	Location	Equipment Description	Asset Size	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Aeration Tank 1	Aeration Tank			35 ft x 15 ft x 23 ft (H)	Need work on top	1976	60	17	3	20	4	33%	4	10.72	2039	$ 415,000	$ 6,917	$ 20,750
Aeration Tank 2	Aeration Tank			35 ft x 15 ft x 23 ft (H)	Need work on top	1976	60	17	3	20	4	33%	4	10.72	2039	$ 415,000	$ 6,917	$ 20,750
Aeration Tank 3	Aeration Tank			26 ft x 42 ft x 18 ft (H)	Need work on top	1991	60	32	3	35	4	33%	4	10.72	2054	$ 530,000	$ 8,833	$ 15,143

Total Asset Cost	$ 1,360,000		
Total Annual Asset Cost		$ 22,667	$ 56,643

EQUIPMENT

Asset ID	Type	Quantity	Building/Process	Location	Equipment Description	Asset Size	Manufacturer	Series	Model	Equip Param 1	Equip Param 2	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition of Equipment (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Process																									
Parshall Flume	Process	1	Grit and Screen										1998	60	39	3	15	4	0%	3	12	2034	$ 5,000	$ 83	$ 333
Parshall Flume (2)	Process	2	Aeration Tank 2										1976	60	17	3	15	4	0%	3	12	2034	$ 10,000	$ 167	$ 667
SH-1-1	Gate	1	Parshall Flume	Flume 3 to A. Tank 2	Shear Gate	6 in. diameter							1998	30	9	3	10	3	0%	3	9	2029	$ 11,000	$ 367	$ 1,100
S-6-1	Gate	1	Parshall Flume	Flume 3 to A. Tank 3	Sluice Gate	12 in. x 12 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 1,500	$ 50	$ 150
S-7-1	Gate	1	Aeration Tank No. 3	Mixed Liquor	Sluice Gate	12 in. x 12 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 1,500	$ 50	$ 150
Diffusers	Process	1	Aerations Tanks 1-3							#1 & 2 1978; #3 1998		New drop pipes in Tanks 1 & 2 in 2018	2018	30	29	2	30	5	0%	2	10	2049	$ 75,000	$ 2,500	$ 2,500
Sluice Gates (8)	Gate	8	Aerations Tanks 1-2		Sluice Gate	12 in. x 12 in.						Don't close well; to be addressed with blower project	1976	30	-13	4	5	3	0%	4	12	2024	$ 12,000	$ 400	$ 2,400
IB-1-1	Valve	1	Aeration Tank No. 3		Industrial Butterfly Valve	10 in.						Air	1998	30	9	3	10	3	0%	3	9	2029	$ 3,400	$ 113	$ 340
IB-11-1 & IB-11-2	Valve	2	Aeration Tanks 1-2		Industrial Butterfly Valve	10 in.						Air	1976	30	-13	4	5	3	0%	4	12	2024	$ 6,800	$ 227	$ 1,360
IB-2-1 to IB-2-4	Valve	4	Aeration Tank No. 3		Industrial Butterfly Valve	6 in.						Air	1998	30	9	3	10	3	0%	3	9	2029	$ 12,100	$ 403	$ 1,210
IB 3-1	Valve	1	Aeration Tank No. 3		Industrial Butterfly Valve	3 in.						Air	1998	30	9	3	10	3	0%	3	9	2029	$ 2,100	$ 70	$ 210
IB-12-1 to IB-12-4 and IB-12-11 to IB-12-14	Valve	6	Aerations Tanks 1-2		Industrial Butterfly Valve	6 in.						Don't close well; to be addressed with blower project	1998	30	9	3	5	3	0%	3	9	2024	$ 24,100	$ 803	$ 4,820
Aeration Tank Blower No. 1	Process	1	Filter Building No. 1	Aeration Tank No. 1	Blowers		Hoffman			1060 cfm; 75 hp		Oversized, but work well	1976	30	-13	4	2	5	33%	4	13.4	2020	$ 216,900	$ 7,230	$ 108,450
Aeration Tank Blower No. 2	Process	1	Filter Building No. 1	Aeration Tank No. 2	Blowers		Hoffman			1060 cfm; 75 hp		Oversized, but work well	1976	30	-13	4	2	5	33%	4	13.4	2021	$ 216,900	$ 7,230	$ 108,450
Aeration Tank Blower No. 3	Process	1	Filter Building No. 1	Aeration Tank No. 3	Blowers		Hoffman			1410 cfm, 100 hp		Oversized, but work well; Replacing one blower others will be back-up	1976	30	-13	4	2	5	33%	4	13.4	2021	$ 289,200	$ 9,640	$ 144,600
Plug Valves	Valve		Aerations Tanks 1-3		Valve	6 in.						Don't close well; to be addressed with blower project	1998	30	9	3	5	3	0%	3	9	2024	$ 3,960	$ 132	$ 792
Return Sludge Pump No. 1	Pumps	1	Filter Building No. 1		Pumps		Flygt		3102				2015	30	26	1	30	5	20%	1	4	2049	$ 26,900	$ 897	$ 897
Return Sludge Pump No. 2	Pumps	1	Filter Building No. 1		Pumps		Flygt		3102				2018	30	29	1	30	5	20%	1	4	2049	$ 26,900	$ 897	$ 897
Return Sludge Pump No. 3	Pumps	1	Filter Building No. 1		Pumps		Flygt		3102				2018	30	29	1	30	5	20%	1	4	2049	$ 26,900	$ 897	$ 897
Return Sludge Pump No. 4	Pumps	1	Filter Building No. 1	Final Clarifier No. 3	Pumps	5 hp	Chicago Pumps		T751A, Type 44	450 gpm			1998	30	9	3	10	5	20%	3	12	2029	$ 25,000	$ 833	$ 2,500
Return Sludge Pump No. 5	Pumps	1	Filter Building No. 1	Final Clarifier No. 3	Pumps	5 hp	Chicago Pumps		T751A, Type 44	450 gpm			1998	30	9	3	10	5	20%	3	12	2029	$ 25,000	$ 833	$ 2,500
RAS Plug Valves (3)	Valve	3	Filter Building No. 1	RAS Pumps 1, 2, & 3	Valves	6 in.							2019	30	30	1	30	3	0%	1	3	2049	$ 18,000	$ 600	$ 600
RAS Check Valves (3)	Valve	3	Filter Building No. 1	RAS Pumps 1, 2, & 3	Valves	6 in.							2019	30	30	1	30	3	0%	1	3	2049	$ 12,000	$ 400	$ 400
RAS Ball Control Valves (8)	Valve	8	Filter Building No. 1	RAS Pumps 1, 2, & 3	Valves	6 in.	Dezurick					Electric Actuator	2019	30	30	1	30	3	0%	1	3	2049	$ 72,300	$ 2,410	$ 2,410
RAS Wasting Valve	Valve	1	Filter Building No. 1	RAS Pumps 1, 2, & 3	Valves	6 in.							2019	30	30	1	30	3	0%	1	3	2049	$ 3,800	$ 127	$ 127
RAS Inlet Valves - P-15-1 to P-15-2	Valve	2	Filter Building No. 1	RAS Pumps 4 & 5	Valves	8 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 9,300	$ 310	$ 930
RAS Check Valves - RAS 4 & 5 (2)	Valve	2	Filter Building No. 1	RAS Pumps 4 & 5	Valves	6 in.	Dezurick						1998	30	9	3	10	3	0%	3	9	2029	$ 5,500	$ 183	$ 550
RAS Plug Valves - RAS 4 & 5 (8)	Valve	8	Filter Building No. 1	RAS Pumps 4 & 5	Valves	6 in.	Kennedy						1998	30	9	3	10	3	0%	3	9	2029	$ 32,000	$ 1,067	$ 3,200
RAS Ball Control Valves (2)	Valve	2	Filter Building No. 1	RAS Pumps 4 & 5	Valves	3 in. and 4 in.							1976	30	-13	3	5	3	0%	3	9	2024	$ 18,100	$ 603	$ 3,620
Piping																									
RAS - Filter Bldg 1 to Aerators	Pipework	1	Yard		6" DIP	350 ft							1998	30	9	3	10	3	0%	3	9	2029	$ 210,000	$ 7,000	$ 21,000
RAS Filter Bldg 1 to Aerators	Pipework	1	Yard		6" DIP	200 ft							1978	30	-11	4	5	3	0%	4	12	2024	$ 120,000	$ 4,000	$ 24,000
Electrical																									
FE-2/FT 3-2	Electrical and Instrumentation	1	Aeration Tank 1		Influent Flow Meter and Sonic Flow Sensor								1998	15	-6	3	5	5	0%	3	15	2024	$ 3,000	$ 200	$ 600
FE-4/FT 4-2	Electrical and Instrumentation	1	Aeration Tank 2		Influent Flow Meter and Sonic Flow Sensor								1998	15	-6	3	5	5	0%	3	15	2024	$ 3,000	$ 200	$ 600
FE-31/FY 31-2	Electrical and Instrumentation	1	Aeration Tank 3		Influent Flow Meter and Sonic Flow Sensor								1998	15	-6	3	5	5	0%	3	15	2024	$ 3,000	$ 200	$ 600
FE-11	Electrical and Instrumentation	1	Aeration Tank 1							0 to 1200 cfm			1998	15	-6	3	5	3	0%	3	9	2024	$ 1,000	$ 67	$ 200
FE-12	Electrical and Instrumentation	1	Aeration Tank 2							0 to 1200 cfm			1998	15	-6	3	5	3	0%	3	9	2024	$ 1,000	$ 67	$ 200
FIO-11	Electrical and Instrumentation	1	Aeration Tank 1										1998	15	-6	3	5	3	0%	3	9	2024	$ -	$ -	$ -
FI-12	Electrical and Instrumentation	1	Aeration Tank 2										1998	15	-6	3	5	3	0%	3	9	2024	$ 2,000	$ 133	$ 400
FT 3-1	Electrical and Instrumentation	1	Aeration Tanks - Filter Building No. 1 - Return Activated Sludge	to Aeration Tank No. 1	Flow Meter					0 to 300 gpm			1998	15	-6	3	5	4	0%	3	12	2024	$ 8,000	$ 533	$ 1,600
FFK-31	Electrical and Instrumentation	1	Aeration Tanks - Filter Building No. 1 - Return Activated Sludge	in FK 31-1	Ratio Station							*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
FIC 31-1	Electrical and Instrumentation	1	Aeration Tanks - Filter Building No. 1 - Return Activated Sludge	Operates BCV 2-1	Return Sludge Controller							*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
FY-3	Electrical and Instrumentation	1	Aeration Tanks - Filter Building No. 1 - Return Activated Sludge		Signal Converter							*Part of PLC software	1998	15	-6	3	5	3	0%	3	9	2024	$ -	$ -	$ -
FT 4-1	Electrical and Instrumentation	1	Aeration Tanks - Filter Building No. 1 - Return Activated Sludge	to Aeration Tank No. 2	Flow Meter								1998	15	-6	3	5	4	0%	3	12	2024	$ 8,000	$ 533	$ 1,600
FIC 31-2	Electrical and Instrumentation	1	Aeration Tanks - Filter Building No. 1 - Return Activated Sludge	Operates BCV 2-2	Return Sludge Controller							*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
FY-4	Electrical and Instrumentation	1	Aeration Tanks - Filter Building No. 1 - Return Activated Sludge		Signal Converter							*Part of PLC software	1998	15	-6	3	5	3	0%	3	9	2024	$ -	$ -	$ -
FIC 31-3	Electrical and Instrumentation	1	Aeration Tanks - Filter Building No. 1 - Return Activated Sludge	Operates BCV 2-1	Return Sludge Controller							*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
FY 31-1	Electrical and Instrumentation	1	Aeration Tanks - Filter Building No. 1 - Return Activated Sludge		Signal Converter							*Part of PLC software	1998	15	-6	3	5	3	0%	3	9	2024	$ -	$ -	$ -
FQ-3	Electrical and Instrumentation	1	Aeration Tank No. 1 - Return Activated Sludge									*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
FIQ-3	Electrical and Instrumentation	1	Aeration Tanks - Filter Building No. 1 - Return Activated Sludge	on CP-1	Totalizer							*Part of PLC software	1998	15	-6	3	5	3	0%	3	9	2024	$ -	$ -	$ -
FQ-4	Electrical and Instrumentation	1	Aeration Tank No. 2 - Return Activated Sludge									*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
FIQ-4	Electrical and Instrumentation	1	Aeration Tanks - Filter Building No. 1 - Return Activated Sludge	on CP-1	Totalizer							*Part of PLC software	1998	15	-6	3	5	3	0%	3	9	2024	$ -	$ -	$ -
FE-6	Electrical and Instrumentation	1	Aeration Tanks - Waste Activated	from Aeration Tanks Nos. 1	Flow Meter					0 to 200 gpm			1998	15	-6	3	5	4	0%	3	12	2024	$ 8,000	$ 533	$ 1,600
FT 3-1	Electrical and Instrumentation	1	Return Activated Sludge	to Aeration Tank No. 1	Flow Meter					0 to 300 gpm			1998	15	-6	3	5	4	0%	3	12	2024	$ 8,000	$ 533	$ 1,600
FFK-31	Electrical and Instrumentation	1	Return Activated Sludge	in FK 31-1	Ratio Station							*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
FIC 31-1	Electrical and Instrumentation	1	Return Activated Sludge	Operates BCV 2-1	Return Sludge Controller							*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
FY-3	Electrical and Instrumentation	1	Return Activated Sludge		Signal Converter							*Part of PLC software	1998	15	-6	3	5	3	0%	3	9	2024	$ -	$ -	$ -
FT 4-1	Electrical and Instrumentation	1	Return Activated Sludge	to Aeration Tank No. 2	Flow Meter								1998	15	-6	3	5	4	0%	3	12	2024	$ 8,000	$ 533	$ 1,600
FIC 31-2	Electrical and Instrumentation	1	Return Activated Sludge	Operates BCV 2-2	Return Sludge Controller							*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
FY-4	Electrical and Instrumentation	1	Return Activated Sludge		Signal Converter							*Part of PLC software	1998	15	-6	3	5	3	0%	3	9	2024	$ -	$ -	$ -
FIC 31-3	Electrical and Instrumentation	1	Return Activated Sludge	Operates BCV 2-1	Return Sludge Controller							*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
FY 31-1	Electrical and Instrumentation	1	Return Activated Sludge		Signal Converter							*Part of PLC software	1998	15	-6	3	5	3	0%	3	9	2024	$ -	$ -	$ -
FQ-3	Electrical and Instrumentation	1	Return Activated Sludge Aeration Tank No. 1									*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
FIQ-3	Electrical and Instrumentation	1	Return Activated Sludge Aeration Tank No. 1	on CP-1	Totalizer							*Part of PLC software	1998	15	-6	3	5	3	0%	3	9	2024	$ -	$ -	$ -
FQ-4	Electrical and Instrumentation	1	Return Activated Sludge Aeration Tank No. 2									*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
FIQ-4	Electrical and Instrumentation	1	Return Activated Sludge Aeration Tank No. 2	on CP-1	Totalizer							*Part of PLC software	1998	15	-6	3	5	3	0%	3	9	2024	$ -	$ -	$ -
Mechanical																									

Total Asset Cost	$ 1,576,160		
Total Annual Asset Cost		$ 54,055	$ 452,659

Total Number of Assets	105
Total Replacement Cost	$ 2,936,160.00

Northfield Township Asset Management Plan
Wastewater Treatment Plant Asset Inventory
Final Settling Tanks

Current Year 2019

FACILITIES

Asset ID	Building/Process	Location	Equipment Description	Asset Size	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Final Clarifier Flow Split Structure	Final Clarifier					1998	60	39	3	40	4	0%	3	12	2059	$ 57,000	$ 950	$ 1,425
Final Clarifier 1	Final Clarifier			30 ft diam.	Piers for support are cracked	1976	60	17	3	20	4	33%	3	8.04	2039	$ 157,000	$ 2,617	$ 7,850
Final Clarifier 1 Bridge	Final Clarifier				Painting Required	1976	40	-3	4	2	4	0%	5	20	2021	$ 37,000	$ 925	$ 18,500
Final Clarifier 1 Handrail	Final Clarifier				Painting Required	1976	40	-3	4	2	4	0%	5	20	2021	$ 12,000	$ 300	$ 6,000
Final Clarifier 1 Weirs	Final Clarifier		Fiberglass		Good Maintenance	1976	30	-13	4	5	3	0%	5	15	2024	$ 22,000	$ 733	$ 4,400
Final Clarifier 2	Final Clarifier			30 ft diam.	Piers for support are cracked	1976	60	17	3	20	4	33%	3	8.04	2039	$ 157,000	$ 2,617	$ 7,850
Final Clarifier 2 Bridge	Final Clarifier				Painting Required	1976	40	-3	3	2	4	0%	4	16	2021	$ 37,000	$ 925	$ 18,500
Final Clarifier 2 Handrail	Final Clarifier				Painting Required	1976	40	-3	3	2	4	0%	4	16	2021	$ 12,000	$ 300	$ 6,000
Final Clarifier 2 Weirs	Final Clarifier		Fiberglass		Good Maintenance	1976	30	-13	4	2	3	0%	5	15	2021	$ 22,000	$ 733	$ 11,000
Final Clarifier 3	Final Clarifier		15 ft deep	40 ft diam.		1991	60	32	3	35	4	33%	3	8.04	2054	$ 235,000	$ 3,917	$ 6,714
Final Clarifier 3 Bridge	Final Clarifier				Good shape	1991	40	12	3	15	4	0%	3	12	2034	$ 47,000	$ 1,175	$ 3,133
Final Clarifier 3 Handrail	Final Clarifier				Good shape	1991	40	12	3	15	4	0%	3	12	2034	$ 15,000	$ 375	$ 1,000
Final Clarifier 3 Weirs	Final Clarifier		Fiberglass		Good Maintenance	1991	30	2	3	7	3	0%	3	9	2026	$ 28,000	$ 933	$ 4,000

Total Asset Cost	$ 838,000		
Total Annual Asset Cost		$ 16,500	$ 96,373

EQUIPMENT

Asset ID	Type	Quantity	Building/Process	Location	Equipment Description	Asset Size	Manufacturer	Series	Model	Equip Param 1	Equip Param 2	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition of Equipment (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Process																									
SP-1-1 to SP-1-2	Process	2	Final Tank Flow Split Structure	A. Tank to split structure	Stop Plate	24 in. x 84 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 14,000	$ 467	$ 1,400
SP-2-1	Process	1	Final Tank Flow Split Structure	split structure FC 1 & 2	Stop Plate	30 in. x 78 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 7,000	$ 233	$ 700
S-2-1 to S-2-2	Gate	2	Final Tank Flow Split Structure	split structure FC 1 & 2	Sluice Gate	10 in. x 10 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 2,000	$ 67	$ 200
S-1-1	Gate	1	Final Tank Flow Split Structure	split structure FC 3	Sluice Gate	14 in. x 14 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 2,000	$ 67	$ 200
Final Clarifier Mechanism 1	Process	1	Final Clarifier 1			30 ft diam.						Arm replaced	1976	30	-13	4	2	5	33%	4	13.4	2021	$ 214,000	$ 7,133	$ 107,000
Final Clarifier Mechanism 2	Process	1	Final Clarifier 2			30 ft diam.						Arm to be replaced	1976	30	-13	4	2	5	33%	4	13.4	2021	$ 214,000	$ 7,133	$ 107,000
Final Clarifier Mechanism 3	Process	1	Final Clarifier 3			40 ft diam.							1998	30	9	3	10	5	33%	3	10.05	2029	$ 244,000	$ 8,133	$ 24,400
Scum Troughs	Process	1	Final Clarifiers									Scum system not used	1978	30	-11	4	2	0	0%	4	0	2021	$ 25,000	$ 833	$ 12,500
S-3-1	Gate	1	Final Tank No. 3	Effluent	Sluice Gate	12 in. x 12 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 1,500	$ 50	$ 150
S-3-2	Gate	1	Final Tank No. 3	Effluent	Sluice Gate	12 in. x 12 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 1,500	$ 50	$ 150
A-6-1	Valve	1	Final Clarifier 1 & 2	Effluent	Plug Valve	12 in.							1976	30	-13	3	2	3	0%	3	9	2021	$ 13,400	$ 447	$ 6,700
Piping																									
Electrical																									
LE-9	Electrical and Instrumentation	1	Final Tank Effluent Wet Well		Bubbler Wet Well Level							*decommissioned	1976	15	-28	5		0	0%	5	0		$ -	$ -	$ -
LIT-9	Electrical and Instrumentation	1	Final Tank Effluent Wet Well		Level Transmitter (LE-9)							*decommissioned	1976	15	-28	5		0	0%	5	0	2019	$ 2,000	$ 133	$ -
LI-9	Electrical and Instrumentation	1	Final Tank Effluent Wet Well		Level Indicator							*decommissioned	1976	15	-28	5		0	0%	5	0		$ -	$ -	$ -
Filter Building No. 1 Control Panel CP-1	Electrical and Instrumentation	1	Final Tank Effluent Wet Well	Filter Building No. 1	Control Panel							*already accounted above	1976	20	-23	4	2	5	0%	4	20	2021	$ -	$ -	$ -
LSH-9A/LAH-9	Electrical and Instrumentation	1	Final Tank Effluent Wet Well		Pressure Switch and Alarm							*Part of PLC software	1976	15	-28	4	2	3	0%	4	12	2021	$ -		
LSL-9	Electrical and Instrumentation	1	Final Tank Effluent Wet Well		Low Level Switch								1976	15	-28	4	2	4	0%	4	16	2021	$ 500	$ 33	$ 250
LAL-9	Electrical and Instrumentation	1	Final Tank Effluent Wet Well		Low Level Alarm							*Part of PLC software	1976	15	-28	4	2	4	0%	4	16	2021	$ -	$ -	$ -
Filter Influent Pump No. 1 VFD	Electrical and Instrumentation	1	Final Tank Effluent Wet Well										1998	15	-6	3	5	3	0%	3	9	2024	$ 6,000	$ 400	$ 1,200
Filter Influent Pump No. 2 VFD	Electrical and Instrumentation	1	Final Tank Effluent Wet Well										1998	15	-6	3	5	3	0%	3	9	2024	$ 6,000	$ 400	$ 1,200
Mechanical																									

Total Asset Cost	$ 752,900		
Total Annual Asset Cost		$ 25,580	$ 263,050

Total Number of Assets	$ 35
Total Replacement Cost	$ 1,590,900

Northfield Township Asset Management Plan
Wastewater Treatment Plant Asset Inventory
Tertiary Filtration and Disinfection

Current Year 2019

FACILITIES

Asset ID	Building/Process	Location	Equipment Description	Asset Size	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Filter Building No. 1 Walls	Filter Building No. 1			66 ft x 38 ft x10.67 ft	1998 Update	1976	60	17	3	20	3	0%	3	9	2039	$ 740,000	$ 12,333	$ 37,000
Filter Building No. 1 Doors (1 double door, 1 single door)	Filter Building No. 1					1976	30	-13	4	2	3	0%	5	15	2021	$ 3,000	$ 100	$ 1,500
Filter Building No. 1 Handrail	Filter Building No. 1					1976	30	-13	4	2	4	0%	5	20	2021	$ 15,500	$ 517	$ 7,750
Filter Building No. 1 Roof	Filter Building No. 1				Ponds water	1976	30	-13	4	2	3	0%	5	15	2021	$ 59,750	$ 1,992	$ 29,875
Waste Backwash Water Wet Well and Tertiary Effluent Wet Well	Filter Building No. 1					1998	60	39	3	45	4	0%	3	12	2064	$ 165,000	$ 2,750	$ 3,667
Chlorine Contact Tank (Original) and SE WW	Filter Building No. 1					1976	60	17	3	20	4	0%	3	12	2039	$ 172,000	$ 2,867	$ 8,600
Filter Building No. 2	Filter Building No. 2		66 ft x 38 ft			1998	60	39	3	40	4	0%	3	12	2059	$ 489,000	$ 8,150	$ 12,225
Filter Building No. 2 Doors (1 double door, 1 single door)	Filter Building No. 2					1998	30	9	3	10	3	0%	3	9	2029	$ 3,000	$ 100	$ 300
Filter Building No. 2 Handrail	Filter Building No. 2					1998	30	9	3	10	4	0%	3	12	2029	$ 16,000	$ 533	$ 1,600
Concrete Channels	Filter Building No. 2			3.5 ft x 4 ft x 4 ft		1998	60	39	3	40	4	0%	3	12	2059	$ 126,000	$ 2,100	$ 3,150

Total Asset Cost	$ 1,789,250		
Total Annual Asset Cost		$ 31,442	$ 105,667

EQUIPMENT

Asset ID	Type	Quantity	Building/Process	Location	Equipment Description	Asset Size	Manufacturer	Series	Model	Equip Param 1	Equip Param 2	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition of Equipment (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Process																									
Filter Influent Pump No. 1	Pump	1	Filter Building No. 1		Pumps	1050 gpm @ 75 ft TDH	Fairbanks Morse		G56884 - V06V0356435 R-2	U.S. Electrical Motors 460 V, 61/31 Amps		Rebuilt by Hydrodynamics	1998	30	9	3	10	4	25%	3	9	2029	$ 40,500	$ 1,350	$ 4,050
Filter Influent Pump No. 2	Pump	1	Filter Building No. 1		Pumps	1050 gpm @ 75 ft TDH	Fairbanks Morse		G56884 - V06V0356435 R-2	U.S. Electrical Motors 460 V, 61/31 Amps		Rebuilt by Hydrodynamics	1998	30	9	3	10	4	25%	3	9	2029	$ 40,500	$ 1,350	$ 4,050
Filter Weirs	Process	1	Filter Building No. 1										1998	30	9	3	10	3	0%	3	9	2029	$ 5,000	$ 167	$ 500
Composite Sampler No. 1	Process	1	Filter Building No. 1		Sampler		American Sigma		1600	Pipper Arm			1998	30	9	3	10	5	0%	3	15	2029	$ 13,000	$ 433	$ 1,300
Composite Sampler No. 2	Process	1	Filter Building No. 1		Sampler		American Sigma		1600	Pipper Arm			1998	30	9	3	10	5	0%	3	15	2029	$ 13,000	$ 433	$ 1,300
Composite Sampler No. 3	Process	1	Filter Building No. 1		Sampler		Hach		Sigma 900	Positive Displacement			1998	30	9	3	10	5	0%	3	15	2029	$ 13,000	$ 433	$ 1,300
Filter Influent Check Valve No. 1	Valve	1	Filter Building No. 1	Filter Influent Pump Discharge	Valves	16 in.				Air cushioned		Does not work well	1976	30	-13	4	2	3	0%	4	12	2021	$ 23,900	$ 797	$ 11,950
Filter Influent Check Valve No. 2	Valve	1	Filter Building No. 1	Filter Influent Pump Discharge	Valves	16 in.				Air cushioned		Does not work well	1976	30	-13	4	2	3	0%	4	12	2021	$ 23,900	$ 797	$ 11,950
Filter Influent Intake Gate Valves (2)	Valve	2	Filter Building No. 1	Filter Influent Pumps	Valves	12 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 14,300	$ 477	$ 1,430
Filter Influent Discharge Gate Valves (2)	Valve	2	Filter Building No. 1	Filter Influent Pumps	Valves	10 in.				Air cushioned			1998	30	9	3	10	3	0%	3	9	2029	$ 13,100	$ 437	$ 1,310
Dilution Water Check Valve	Valve	1	Secondary Effluent Wet Well		Valves	6 in.				Air cushioned			1998	30	9	3	10	3	0%	3	9	2029	$ 2,750	$ 92	$ 275
Chlorine Distribution System	Process	1	Final Effluent										1997	30	8	3	10	5	0%	3	15	2029	$ 55,000	$ 1,833	$ 5,500
Traveling Bridge Filter No. 1	Process	1	Filter Building No. 2		Filter	1.3 MGD	Aqua-Aerobic Systems	105111-2	ABF-940			2015 Rebuilt, new sand, porous plates, wear strips; Operate 3 hr/day	1998	30	9	3	10	5	50%	3	7.5	2029	$ 250,000	$ 8,333	$ 25,000
Traveling Bridge Filter No. 2	Process	1	Filter Building No. 2		Filter	1.3 MGD	Aqua-Aerobic Systems	105111-2	ABF-940			2015 Rebuilt, new sand, porous plates, wear strips; Operate 3 hr/day	1998	30	9	3	10	5	50%	3	7.5	2029	$ 250,000	$ 8,333	$ 25,000
Filter Weirs (4)	Process	4	Filter Building No. 2										1998	30	9	3	10	3	0%	3	9	2029	$ 5,000	$ 167	$ 500
Backwash Water Pump North	Pump	1	Filter Building No. 2	Filter No. 1	Pumps		Flygt		3085	3 hp		Rebuilt in 2015	1998	30	9	3	10	4	0%	3	12	2029	$ 25,000	$ 833	$ 2,500
Backwash Water Pump South	Pump	1	Filter Building No. 2	Filter No. 2	Pumps		Flygt		3085	3 hp			1998	30	9	3	10	4	0%	3	12	2029	$ 25,000	$ 833	$ 2,500
Stop Plates (2)	Process	2	Filter Building No. 2										1998	20	-1	4	5	3	0%	4	12	2024	$ 14,000	$ 700	$ 2,800
Traveling Bridge Plug Valves (2)	Valve	2	Filter Building No. 2			3 in.		97D000058		EPDM Seals	150 psi @ 70 degrees		1998	30	9	3	10	3	0%	3	9	2029	$ 2,640	$ 88	$ 264
Traveling Bridge Ball Valves (2)	Valve	2	Filter Building No. 2			3 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 1,750	$ 58	$ 175
Piping																									
Electrical																									
MCC-B	Electrical and Instrumentation	1	Filter Building No. 1	Alternator for Air Compressor	Motor Control Center								1976	40	-3	3	10	4	0%	3	12	2029	$ 72,000	$ 1,800	$ 7,200
Automatic Transfer Switch	Electrical and Instrumentation	1	Filter Building No. 1	Main Floor									1976	30	-13	3	5	5	0%	3	15	2024	$ 12,000	$ 400	$ 2,400
MCC-A	Electrical and Instrumentation	1	Filter Building No. 1		Motor Control Center								1976	40	-3	3	10	5	0%	3	15	2029	$ 72,000	$ 1,800	$ 7,200
MCC-F	Electrical and Instrumentation	1	Filter Building No. 2		Motor Control Center								1998	40	19	2	20	5	0%	2	10	2039	$ 36,000	$ 900	$ 1,800
CP-1	Electrical and Instrumentation	1	Filter Building No. 1	Main Floor									1976	20	-23	4	5	5	0%	4	20	2024	$ 65,000	$ 3,250	$ 13,000
Control Panel	Electrical and Instrumentation	1	Filter Building No. 2				Cutler Hammer			Section #1 - 600 Amp; Section #2 - 300 Amp; Section #3 - None		Needs to be cleaned	1998	20	-1	3	15	5	0%	3	15	2034	$ 3,000	$ 150	$ 200
Filter Influent Pump No. 1 VFD	Electrical and Instrumentation	1	Filter Building No. 1		VFD		Allen Bradley		Powerflex-40				1998	15	-6	2	15	3	0%	2	6	2034	$ 6,000	$ 400	$ 400
Filter Influent Pump No. 2 VFD	Electrical and Instrumentation	1	Filter Building No. 1		VFD		Allen Bradley		Powerflex-40				1998	15	-6	2	15	3	0%	2	6	2034	$ 6,000	$ 400	$ 400
Ventilation Contactors	Electrical and Instrumentation	1	Filter Building No. 2	Walls									1998	20	-1	3	10	5	0%	3	15	2029	$ 2,000	$ 100	$ 200
FK 31-1	Electrical and Instrumentation	1	Tertiary Filtration - Filter Building No. 1	Filter Building No. 1	Flow Controller							*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
FK 31-2	Electrical and Instrumentation	1	Tertiary Filtration - Filter Building No. 1	Filter Building No. 1	Flow Controller							*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
LC 9-1	Electrical and Instrumentation	1	Filter Influent Pump No. 1 VFD		Level Controller							*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
LC 9-2	Electrical and Instrumentation	1	Filter Influent Pump No. 2 VFD		Level Controller							*Part of PLC software	1998	15	-6	3	5	4	0%	3	12	2024	$ -	$ -	$ -
HS-1A/HS-1B	Electrical and Instrumentation	1	Filter Influent PumpVFD		Lead Lag Pump Selector							*Part of PLC software	1998	15	-6	3	5	3	0%	3	9	2024	$ -	$ -	$ -
LIT 2A	Electrical and Instrumentation	1	Filter Influent Pump No. 2 VFD										1998	15	-6	3	5	3	0%	3	9	2024	$ 2,000	$ 133	$ 400
Sand Filter Control Panel No. 1	Electrical and Instrumentation	1	Tertiary Filtration - Filter Building No. 2	Sand Filter			Aqua-Aerobics					*decommissioned	1998	20	-1	5		0	0%	5	0		x0	$ -	$ -
Sand Filter Control Panel No. 2	Electrical and Instrumentation	1	Tertiary Filtration - Filter Building No. 2	Sand Filter			Aqua-Aerobics					*decommissioned	1998	20	-1	5		0	0%	5	0		x0	$ -	$ -
LE-10	Electrical and Instrumentation	1	Tertiary Filtration - Filter Building No. 2	Sand Filter Effluent Wet Well	Bubbler							*decommissioned	1976	15	-28	5		0	0%	5	0	2019	$ 2,000	$ 133	$ -
LI-10	Electrical and Instrumentation	1	Tertiary Filtration - Filter Building No. 2		Level Indicator on CP-1							*decommissioned	1976	15	-28	5		0	0%	5	0		x0	$ -	$ -
LSL-10	Electrical and Instrumentation	1	Tertiary Filtration - Filter Building No. 2		Pressure Switch with Low Level Alarm								1976	15	-28	4	5	3	0%	4	12	2024	$ 2,500	$ 167	$ 500
LE-8	Electrical and Instrumentation	1	Tertiary Filtration - Filter Building No. 2	Waste Backwash Water Wet Well	Bubbler							*decommissioned	1998	15	-6	5		0	0%	5	0	2019	$ -	$ -	$ -
LI-8	Electrical and Instrumentation	1	Tertiary Filtration - Filter Building No. 2	Waste Backwash Water Wet Well	Level Indicator on CP-1							*decommissioned	1998	15	-6	5		0	0%	5	0		x0	$ -	$ -
KK-8	Electrical and Instrumentation	1	Tertiary Filtration - Filter Building No. 2	Waste Backwash Water Wet Well	Low Level Timer							*Part of PLC software	1998	15	-6	3	5	2	0%	3	6	2024	$ -	$ -	$ -
LS 8-2	Electrical and Instrumentation	1	Tertiary Filtration - Filter Building No. 2	Waste Backwash Water Wet Well	Level Switch								1998	15	-6	3	5	3	0%	3	9	2024	$ 400	$ 27	$ 80
LS 8-1	Electrical and Instrumentation	1	Tertiary Filtration - Filter Building No. 2		Level Switch								1998	15	-6	3	5	3	0%	3	9	2024	$ 400	$ 27	$ 80
FFK-11	Electrical and Instrumentation	1	Disinfection Filter Building No. 1 - Chlorine Feed Control	on CP-1	Ratio Station							*Part of PLC software	1976	15	-28	4	5	5	0%	4	20	2024	$ -	$ -	$ -
HS 1-9	Electrical and Instrumentation	1	Disinfection Filter Building No. 1 - Chlorine Feed Control	on CP-1	Controls whether pacing off influent or sand filter flow							*Part of PLC software	1976	15	-28	4	5	3	0%	4	12	2024	$ -	$ -	$ -
FIC-11	Electrical and Instrumentation	1	Disinfection Filter Building No. 1 - Chlorine Feed Control		Controller							*Part of PLC software	1976	15	-28	4	5	5	0%	4	20	2024	$ -	$ -	$ -
AIT-11	Electrical and Instrumentation	1	Disinfection Filter Building No. 1 - Plant Effluent		Ammonia Nitrogen Analyzer								1976	15	-28	4	5	3	0%	4	12	2024	$ 5,000	$ 333	$ 1,000
HK-11	Electrical and Instrumentation	1	Disinfection Filter Building No. 1 - Chlorine Feed Control	on Cp-1	Manual set Chlorine Feed Rate							*Part of PLC software	1976	15	-28	4	5	4	0%	4	16	2024	$ -	$ -	$ -

Northfield Township Asset Management Plan
Wastewater Treatment Plant Asset Inventory
Tertiary Filtration and Disinfection

Asset ID	Type	Quantity	Building/Process	Location	Equipment Description	Asset Size	Manufacturer	Series	Model	Equip Param 1	Equip Param 2	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition of Equipment (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Chlorine Gas Pressure	Electrical and Instrumentation	1	Disinfection Filter Building No. 1 - Chlorine Feed Control	Chlorinators on MCP	Low Pressure Level Alarm							*Part of PLC software	1976	15	-28	4	5	5	0%	4	20	2024	$ -	$ -	$ -
AIT-12	Electrical and Instrumentation	1	Disinfection Filter Building No. 1 - Chlorine Feed Control	Plant Outfall	Residual Chlorine Analyzer								1976	15	-28	4	5	5	0%	4	20	2024	$ 5,000	$ 333	$ 1,000
AR-12	Electrical and Instrumentation	1	Disinfection Service Building	on MCP	Recorder of Residual Chlorine							*Part of PLC software	1976	15	-28	4	5	5	0%	4	20	2024	$ -	$ -	$ -
Residual Chlorine Alarm	Electrical and Instrumentation	1	Disinfection Service Building	on MCP								*Part of PLC software	1976	15	-28	4	5	5	0%	4	20	2024	$ -	$ -	$ -
pH Analyzer with Local Indicator	Electrical and Instrumentation	1	Disinfection Filter Building No. 1 - Final Effluent	on CP-1								*Part of PLC software	1976	15	-28	4	5	5	0%	4	20	2024	$ -	$ -	$ -
High pH Alarm	Electrical and Instrumentation	1	Disinfection Filter Building No. 1 - Final Effluent	on CP-1								*Part of PLC software	1976	15	-28	4	5	5	0%	4	20	2024	$ -	$ -	$ -
Low pH Alarm	Electrical and Instrumentation	1	Disinfection Filter Building No. 1 - Final Effluent	on CP-1								*Part of PLC software	1976	15	-28	4	5	5	0%	4	20	2024	$ -	$ -	$ -
FQ/FIQ-9	Electrical and Instrumentation	1	Tertiary Filter - Sand Filter		Filter Backwash?							*decommissioned	1998	20	-1	5		0	0%	5	0		x0	$ -	$ -
Disinfection Carry Water VFDs (2)	Electrical and Instrumentation	2	Disinfection - Final Effluent				Allen Bradley						2016	15	12	1	15	3	0%	1	3	2034	$ 12,000	$ 800	$ 800
Control Panel	Electrical and Instrumentation	1	Tertiary Filter - Filter Building No. 2				Cutler Hammer			Section #1 - 600 Amp; Section #2 - 300 Amp; Section #3 - None		Needs to be cleaned	1998	20	-1	3	15	5	0%	3	15	2034	$ 3,000	$ 150	$ 200
MCC-F	Electrical and Instrumentation	1	Tertiary Filters - Filter Building No. 2		Motor Control Center								1998	40	19	2	20	5	0%	2	10	2039	$ 36,000	$ 900	$ 1,800
CP-2	Electrical and Instrumentation	1	Misc. Filter Building No. 1	Main Floor									1976	20	-23	4	5	5	0%	4	20	2024	$ 65,000	$ 3,250	$ 13,000
Panel-A	Electrical and Instrumentation	1	Misc. - Filter Building No. 1										1976	20	-23	4	5	5	0%	4	20	2024	$ 5,000	$ 250	$ 1,000
Ventilation Contactors	Electrical and Instrumentation	1	Disinfection - Filter Building No. 2	Walls									1998	20	-1	3	10	5	0%	3	15	2029	$ 2,000	$ 100	$ 200
Mechanical																									
RF-4	Mechanical Equipment	1	Filter Building		Exhaust Fan	1677 cfm	Loren-Cook					Corrosion Resistant	1998	25	4	2	10	2	0%	2	4	2029	$ 1,300	$ 52	$ 130
RF-5	Mechanical Equipment	1	Filter Building		Exhaust Fan	1677 cfm	Loren-Cook					Corrosion Resistant	1998	25	4	2	10	2	0%	2	4	2029	$ 1,300	$ 52	$ 130
AD-4	Mechanical Equipment	1	Filter Building		Automatic Damper	1677 cfm				40" x 40"		Corrosion Resistant	1998	30	9	2	15	3	0%	2	6	2034	$ 1,600	$ 53	$ 107
AD-5	Mechanical Equipment	1	Filter Building		Automatic Damper	1677 cfm				40" x 40"		Corrosion Resistant	1998	30	9	2	15	3	0%	2	6	2034	$ 1,600	$ 53	$ 107
Boiler	Mechanical Equipment	1	Filter Building No. 1	Basement	Boiler	196,000 BTU	Lochinvar		KBN-211				2016	30	27	1	30	2	0%	1	2	2049	$ 36,000	$ 1,200	$ 1,200
Air Compressors (2)	Mechanical Equipment	2	Filter Building No. 1				Gardner Denver		AEE1014	Lincoln Motor, 5 hp, 460 V, S-F184T		Abandon in place	1978	25	-16	3	2	0	0%	4	0	2021	$ 4,100	$ 164	$ 2,050
Air Tank	Mechanical Equipment	1	Filter Building No. 1				Niles	S0840				Abandon in place	1978	30	-11	2	2	0	0%	3	0	2021	$ 1,100	$ 37	$ 550
GUH-1	Mechanical Equipment	1	Filter Building No. 1		Gas Fired Unit Heater	1480 cfm	Trane		GHND-010	1/20 hp, 1050 rpm		Corrosion Resistant	1998	20	-1	2	10	3	0%	3	9	2029	$ 2,300	$ 115	$ 230
GUH-2	Mechanical Equipment	1	Filter Building No. 1		Gas Fired Unit Heater	1480 cfm	Trane		GHND-010	1/20 hp, 1050 rpm		Corrosion Resistant	1998	20	-1	2	10	3	0%	3	9	2029	$ 2,300	$ 115	$ 230
GUH-3	Mechanical Equipment	1	Filter Building No. 1		Gas Fired Unit Heater	1480 cfm	Trane		GHND-010	1/20 hp, 1050 rpm		Corrosion Resistant	1998	20	-1	2	10	3	0%	3	9	2029	$ 2,300	$ 115	$ 230
GUH-4	Mechanical Equipment	1	Filter Building No. 1		Gas Fired Unit Heater	1480 cfm	Trane		GHND-010	1/20 hp, 1050 rpm		Corrosion Resistant	1998	20	-1	2	10	3	0%	3	9	2029	$ 2,300	$ 115	$ 230
Filter Building No. 2 Heaters (4)	Mechanical Equipment	4	Filter Building No. 2				Trane	A97K4328	GHND010ADE 2000ADEJ			Only 1 works, but only 1 needed	1998	15	-6	3	5	2	0%	4	8	2024	$ 9,200	$ 613	$ 1,840

Total Asset Cost	$ 1,311,040		
Total Annual Asset Cost		$ 46,433	$ 163,547

Total Number of Assets	$ 99
Total Replacement Cost	$ 3,100,290

Northfield Township Asset Management Plan
Wastewater Treatment Plant Asset Inventory
Solids Handling

Current Year 2019

369600
1367555.556

FACILITIES

Asset ID	Building/Process	Location	Equipment Description	Asset Size	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Thickener Tank	Thickener Tank			20 ft diameter	20 ft diameter	1976	60	17	3	20	4	0%	3	12	2039	$ 198,000	$ 3,300	$ 9,900
Digester Building	Digester Building				1991 Update; No problems	1962	60	3	4	5	3	0%	4	12	2024	$ 286,000	$ 4,767	$ 57,200
Digester Building Roof	Digester Building					1991	20	-8	4	5	3	0%	5	15	2024	$ 23,650	$ 1,183	$ 4,730
Digester No. 1	Digester No. 1			89,000 gal	25 ft diameter	1962	60	3	4	5	4	33%	4	10.72	2024	$ 154,000	$ 2,567	$ 30,800
Digester No. 1 Cover	Digester No. 1		Fixed Cover		Good shape	1962	60	3	4	5	3	0%	4	12	2024	$ 49,100	$ 818	$ 9,820
Digester No. 2	Digester No. 2			89,000 gal	25 ft diameter	1962	60	3	4	5	4	33%	4	10.72	2024	$ 154,000	$ 2,567	$ 30,800
Digester No. 2 Cover	Digester No. 2		Floating Cover, Steel Coating			1978	30	-11	3	10	3	0%	4	12	2029	$ 49,100	$ 1,637	$ 4,910
Digester No. 3	Digester No. 3			89,000 gal	40 ft diameter	1978	60	19	3	20	4	33%	3	8.04	2039	$ 295,400	$ 4,923	$ 14,770
Digester No. 3 Cover	Digester No. 3		Floating Cover, Steel Coating			2008	30	19	2	25	3	0%	2	6	2044	$ 125,700	$ 4,190	$ 5,028
Digester Windows	Digester Building				4 of 8 Windows do not operate	1962	30	-27	4	5	1	0%	5	5	2024	$ 10,000	$ 333	$ 2,000
Digester Doors	Digester Building				4 doors	1962	30	-27	4	5	3	0%	5	15	2024	$ 5,000	$ 167	$ 1,000
Sludge Storage Tank No. 1	Sludge Storage Tank No. 1		0.37 MG	85 ft x 55 ft x 12 ft (each)	Precast, Shelby Corp	1991	60	32	3	35	4	0%	3	12	2054	$ 1,368,000	$ 22,800	$ 39,086
Sludge Storage Tank No. 2	Sludge Storage Tank No. 2		0.37 MG	85 ft x 55 ft x 12 ft (each)	Precast, Shelby Corp; Caulk	1991	60	32	3	35	4	0%	3	12	2054	$ 1,368,000	$ 22,800	$ 39,086
															Total Asset Cost	$ 4,085,950		
															Total Annual Asset Cost		$ 72,051	$ 249,129

EQUIPMENT

Asset ID	Type	Quantity	Building/Process	Location	Equipment Description	Asset Size	Manufacturer	Series	Model	Equip Param 1	Equip Param 2	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition of Equipment (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Process																									
P-13-1 to P-13-8	Valve	8	Yard	Primary and Return Sludge	Plug Valve	6 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 29,700	$ 990	$ 2,970
Sludge Pump 1	Pumps	1	Service Building	Basement	Pumps	70 gpm @ 30 TDH	Carter		800	Piston Pump		Not in use	1976	30	-13	4	5	3	0%	4	12	2024	$ 97,000	$ 3,233	$ 19,400
Sludge Pump 2	Pumps	1	Service Building	Basement	Pumps	100 gpm @ 120 ft TDH	Carter		801HS	Piston Pump			1998	30	9	3	10	3	0%	3	9	2029	$ 97,000	$ 3,233	$ 9,700
P-14-1 to P-14-2	Valve	2	Service Building	Primary Sludge	Plug Valve	6 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 7,500	$ 250	$ 750
Plug Valves (8)	Valve	8	Service Building		Valves	6 in.						Varies - Good to Not good	1976	30	-13	4	5	3	0%	4	12	2024	$ 29,700	$ 990	$ 5,940
Scum Pumps (3)	Pumps	3	Final Clarifiers	Outside								Scum system not used	1978	30	-11	4	2	0	33%	4	0	2021	$ 45,000	$ 1,500	$ 22,500
C-3-1	Valve	1	Final Clarifier 3	Valve Manhole	Check Valve	4 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 1,900	$ 63	$ 190
P-18-1	Valve	1	Final Clarifier 3	Valve Manhole	Plug Valve	4 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 1,320	$ 44	$ 132
Thickener Dilution Water Pump (2)	Pumps	2	Secondary Effluent Wet Well		Pumps	22 hp	Flygt		3085	Submersible			1976	30	-13	4	5	3	0%	4	12	2024	$ 30,000	$ 1,000	$ 6,000
Sludge Thickener	Process	1	Sludge Thickener			20 ft diameter by 10 ft SWD	Envirex						1976	30	-13	4	5	4	0%	4	16	2024	$ 79,600	$ 2,653	$ 15,920
Thickened Sludge Pump	Pumps	1	Service Building	Basement									1976	30	-13	4	5	4	0%	4	16	2024	$ 35,000	$ 1,167	$ 7,000
C-1-1 to C-1-2	Valve	2	Filter Building No. 1		Check Valve	6 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 5,000	$ 167	$ 500
Intermediate Settled Sludge Pump	Pumps	1	Filter Building No. 1		Pumps		Carter		simplex			Operated 3 hours per week; Old needs work	1976	30	-13	4	5	3	0%	4	12	2024	$ 15,000	$ 500	$ 3,000
Digester Sludge Pump - Triplex Piston Pump	Pumps	1	Digester Building									1 piston does not work	1978	30	-11	4	2	4	0%	4	16	2021	$ 85,000	$ 2,833	$ 42,500
Carter Simplex Pump (transfer pump)	Pumps	1	Digester Building			5 hp	Carter		800 Simplex	U.S. Electric Motor - Frame 215 T	2nd at 70 gpm @ 30 ft TDH		1963	30	-26	4	2	3	0%	5	15	2021	$ 15,000	$ 500	$ 7,500
P-17-1	Valve	1	Digester Building	Primary Sludge	Plug Valve	6 in.							1998	30	9	3	10	3	0%	3	9	2029	$ 3,800	$ 127	$ 380
Plug Valves (4)	Valve	4	Digester Building			6 in.							1976	30	-13	4	5	3	0%	4	12	2024	$ 14,900	$ 497	$ 2,980
Check Valves (2)	Valve	2	Digester Building			6 in.							1976	30	-13	4	5	3	0%	4	12	2024	$ 5,000	$ 167	$ 1,000
Ball Control Valves (2)	Valve	2	Digester Building			6 in.							1976	30	-13	4	5	3	0%	4	12	2024	$ 18,100	$ 603	$ 3,620
Digester 6 in. Plug Valves (21)	Valve	21	Digester Building			6 in.							1976	30	-13	4	5	3	0%	4	12	2024	$ 78,000	$ 2,600	$ 15,600
Digester 4 in. Plug Valves (4)	Valve	4	Digester Building			4 in.							1976	30	-13	4	5	3	0%	4	12	2024	$ 9,900	$ 330	$ 1,980
Digester Hot Water Valves (13)	Valve	13	Digester Building			2.5 in.	Nibco						1976	30	-13	4	5	3	0%	4	12	2024	$ 20,800	$ 693	$ 4,160
Pressure Relief Valves (3)	Valve	3	Digester Building				Varec		5800			Vacuum Breaker with Flame Arrester	1976	30	-13	4	5	3	0%	4	12	2024	$ 15,300	$ 510	$ 3,060
Digester Circulating Pump No. 1	Pumps	1	Digester Building				Taco		VI2007				1997	30	8	3	10	4	20%	3	9.6	2029	$ 10,000	$ 333	$ 1,000
Digester Circulating Pump No. 2	Pumps	1	Digester Building				Taco		VI2007				1997	30	8	3	10	4	20%	3	9.6	2029	$ 10,000	$ 333	$ 1,000
Digester Circulating Pump No. 3	Pumps	1	Digester Building				Taco		VI2507				1997	30	8	3	10	4	20%	3	9.6	2029	$ 10,000	$ 333	$ 1,000
Digester Circulating Pump No. 4	Pumps	1	Digester Building				Taco		133-147RP				1997	30	8	3	10	4	20%	3	9.6	2029	$ 10,000	$ 333	$ 1,000
Digester Circulating Pump No. 5	Pumps	1	Digester Building				Taco		133-147RP				1997	30	8	3	10	4	20%	3	9.6	2029	$ 10,000	$ 333	$ 1,000
Digester No. 1 Components	Process	1	Digester No. 1									OK	1995	30	6	3	10	5	33%	3	10.05	2029	$ 254,000	$ 8,467	$ 25,400
Digester No. 2 Components	Process	1	Digester No. 2										1998	30	9	3	10	5	33%	3	10.05	2029	$ 254,000	$ 8,467	$ 25,400
Digester No. 3 Components	Process	1	Digester No. 3										2008	30	19	2	25	5	33%	2	6.7	2044	$ 254,000	$ 8,467	$ 10,160
Water Jacket Inside Digester No. 1	Process	1	Digester No. 1										1962	30	-27	4	2	3	33%	4	8.04	2021	$ 45,000	$ 1,500	$ 22,500
Water Jacket Inside Digester No. 2	Process	1	Digester No. 2										1998	30	9	3	10	3	33%	3	6.03	2029	$ 45,000	$ 1,500	$ 4,500
Water Jacket Inside Digester No. 3	Process	1	Digester No. 3										2008	30	19	2	15	3	33%	2	4.02	2034	$ 45,000	$ 1,500	$ 3,000
Piping																									
PS - 1 & 2 to Digester	Pipework	1	Yard		6" DIP	35							1978	30	-11	4	5	3	0%	4	12	2024	$ 21,000	$ 700	$ 4,200
PS - 3 & 4 to Service Bldg	Pipework	1	Yard		6" DIP	125							1998	30	9	3	10	3	0%	3	9	2029	$ 75,000	$ 2,500	$ 7,500
Digester Bldg Piping	Pipework	1	Digester Building		6" DIP	175							1978	30	-11	4	5	3	0%	4	12	2024	$ 105,000	$ 3,500	$ 21,000
TFS - Intermediate to Filter Bldg 1	Pipework	1	Yard		8" DIP	175							1978	30	-11	4	5	3	0%	4	12	2024	$ 140,000	$ 4,667	$ 28,000
WAS - Filter Bldg 1 to PE Pumps	Pipework	1	Yard		6" DIP	275							1978	30	-11	4	5	3	0%	4	12	2024	$ 165,000	$ 5,500	$ 33,000
WAS to Digester Bldg	Pipework	1	Yard		6" DIP	50							1978	30	-11	4	5	3	0%	4	12	2024	$ 30,000	$ 1,000	$ 6,000
WWD to Filter Bldg 1	Pipework	1	Yard		12" DIP	100							1998	30	9	3	10	3	0%	3	9	2029	$ 160,000	$ 5,333	$ 16,000
FT 3 to Filter Bldg 1	Pipework	1	Yard		8" DIP	115							1998	30	9	3	10	3	0%	3	9	2029	$ 92,000	$ 3,067	$ 9,200
Filter Bldg 1 to Digester Bldg	Pipework	1	Yard		4" DIP	200							1978	30	-11	4	5	3	0%	4	12	2024	$ 80,000	$ 2,667	$ 16,000
FS - FS 1 to Filter Bldg 1	Pipework	1	Yard		6" DIP	50							1978	30	-11	4	5	3	0%	4	12	2024	$ 30,000	$ 1,000	$ 6,000
FS - FS 2 to Filter Bldg 1	Pipework	1	Yard		6" DIP	50							1978	30	-11	4	5	3	0%	4	12	2024	$ 30,000	$ 1,000	$ 6,000
WWD Piping	Pipework	1	Yard		6" DIP	200							1978	30	-11	4	5	3	0%	4	12	2024	$ 120,000	$ 4,000	$ 24,000
Thickener to WWD	Pipework	1	Yard		6" DIP	50							1978	30	-11	4	5	3	0%	4	12	2024	$ 30,000	$ 1,000	$ 6,000
TDW to Digester Bldg	Pipework	1	Yard		6" DIP	225							1978	30	-11	4	5	3	0%	4	12	2024	$ 135,000	$ 4,500	$ 27,000
WWD to Aerators	Pipework	1	Yard		6" DIP	50							1978	30	-11	4	5	3	0%	4	12	2024	$ 30,000	$ 1,000	$ 6,000
Primary to Digester	Pipework	1	Yard		6" DIP	225							1998	30	9	3	10	3	0%	3	9	2029	$ 135,000	$ 4,500	$ 13,500
FT 3 Piping	Pipework	1	Yard		4" DIP	100							1998	30	9	3	10	3	0%	3	9	2029	$ 40,000	$ 1,333	$ 4,000
Electrical																									
FE-6	Electrical and Instrumentation	1	Waste Activated Sludge	from Aeration Tanks Nos. 1 and 2	Flow Meter					0 to 200 gpm			1998	15	-6	4	5	4	0%	4	16	2024	$ 8,000	$ 533	$ 1,600
FQ-6	Electrical and Instrumentation	1	Sludge - Filter Building No. 1 - Waste Activated Sludge	on CP-1	Flow Count					1200 counts/hour		*Part of PLC software	1998	15	-6	4	5	3	0%	4	12	2024	$ -	$ -	$ -
FIQ-6	Electrical and Instrumentation	1	Sludge - Waste Activated Sludge	on CP-1	Flow Display (FQ-6)					Count = 10 gal		*Part of PLC software	1998	15	-6	4	5	3	0%	4	12	2024	$ -	$ -	$ -
FBQ-6	Electrical and Instrumentation	1	Sludge - Waste Activated Sludge	on CP-1	Batch Counter					3 inch		*Part of PLC software	1998	15	-6	4	5	3	0%	4	12	2024	$ -	$ -	$ -
FE-32	Electrical and Instrumentation	1	Sludge - Waste Activated Sludge	from Aeration Tanks No. 3	Flow Meter								1998	15	-6	4	5	4	0%	4	16	2024	$ 8,000	$ 533	$ 1,600
FQ-32	Electrical and Instrumentation	1	Sludge - Waste Activated Sludge	on CP-1	Flow Count							*Part of PLC software	1998	15	-6	4	5	3	0%	4	12	2024	$ -	$ -	$ -
FK-32	Electrical and Instrumentation	1	Sludge - Waste Activated Sludge	on CP-1	Flow Controller							*Part of PLC software	1998	15	-6	4	5	4	0%	4	16	2024	$ -	$ -	$ -
FIC-6	Electrical and Instrumentation	1	Sludge - Waste Activated Sludge	on CP-1	Flow Controller							*Part of PLC software	1998	15	-6	4	5	4	0%	4	16	2024	$ -	$ -	$ -
FY-6	Electrical and Instrumentation	1	Sludge - Waste Activated Sludge	opens BCV-3	Converter							*Part of PLC software	1998	15	-6	4	5	3	0%	4	12	2024	$ -	$ -	$ -

Northfield Township Asset Management Plan
Wastewater Treatment Plant Asset Inventory
Solids Handling

Asset ID	Type	Quantity	Building/Process	Location	Equipment Description	Asset Size	Manufacturer	Series	Model	Equip Param 1	Equip Param 2	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition of Equipment (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
FY-32	Electrical and Instrumentation	1	Sludge - Waste Activated Sludge	opens BCV-1-1	Converter							*Part of PLC software	1998	15	-6	4	5	3	0%	4	12	2024	$ -	$ -	$ -
FE-17	Electrical and Instrumentation	1	Sludge - Dilution Water for Thickener	Indicator in Basement of Filter Bldg No. 1	Flow Meter								1965	15	-39	4	5	3	0%	4	12	2024	$ 8,000	$ 533	$ 1,600
Panel-C	Electrical and Instrumentation	1	Digester Building	Digester Building									1976	20	-23	4	5	5	0%	4	20	2024	$ 5,000	$ 250	$ 1,000
Panel-C Lighting Contactor	Electrical and Instrumentation	1	Digester Building	Digester Building									1976	20	-23	4	5	5	0%	4	20	2024	$ 1,500	$ 75	$ 300
Panel-C Transformer	Electrical and Instrumentation	1	Digester Building	Digester Building									1976	20	-23	4	5	5	0%	4	20	2024	$ 2,900	$ 145	$ 580
Flow Meters	Electrical and Instrumentation	1	Sludge Storage										1976	15	-28	4	2	4	0%	4	16	2021	$ 4,000	$ 267	$ 2,000
MCC-D	Electrical and Instrumentation	1	Sludge - Digester Building	Digester Building	Motor Control Center								1965	40	-14	4	5	5	0%	4	20	2024	$ 48,000	$ 1,200	$ 9,600
Boiler Control Panel	Electrical and Instrumentation	1	Digester Building									Included in Boiler	1998	20	-1	4	5	5	0%	4	20	2024	$ 30,000	$ 1,500	$ 6,000
Mechanical																									
P-1	Mechanical Equipment	1	Digester Building	Boiler Room - Hot Water Heating Circulation	In-line Centrifugal Pump	52 gpm at 40 ft TDH				1.5 hp		Replace as needed	1998	20	-1	4	5	4	0%	3	12	2024	$ 12,700	$ 635	$ 2,540
P-2	Mechanical Equipment	1	Digester Building	Boiler Room - Hot Water Heating Circulation	In-line Centrifugal Pump	52 gpm at 40 ft TDH				1.5 hp		Replace as needed	1998	20	-1	4	5	4	0%	3	12	2024	$ 12,700	$ 635	$ 2,540
P-3	Mechanical Equipment	1	Digester Building	Basement - Digester #3 Sludge Heating	In-line Centrifugal Pump	100 gpm @ 35 ft TDH				2 hp		Replace as needed	1998	20	-1	4	5	4	0%	3	12	2024	$ 12,700	$ 635	$ 2,540
Digester Boiler No. 1	Mechanical Equipment	1			Natural Gas Boiler	550 MBH	Kewanee		M-55 KG			Boiler	1998	30	9	3	10	3	0%	3	9	2029	$ 18,000	$ 600	$ 1,800
Digester Boiler No. 2	Mechanical Equipment	1	Digester Building			550 MBH	Kewanee		M-55 KX			Good Shape	1990	30	1	4	5	4	0%	4	16	2024	$ 18,000	$ 600	$ 3,600
Digester Gas Compressor Housing No. 1	Mechanical Equipment	1	Digester Building									Good Shape	1978	30	-11	4	5	4	0%	5	20	2024	$ 3,000	$ 100	$ 600
Digester Gas Compressor Housing No. 2	Mechanical Equipment	1	Digester Building									Good Shape	1978	30	-11	4	5	4	0%	5	20	2024	$ 3,000	$ 100	$ 600
Digester Gas Compressor Housing No. 3	Mechanical Equipment	1	Digester Building										1998	30	9	3	10	4	0%	3	12	2029	$ 3,000	$ 100	$ 300
Sump Pumps	Mechanical Equipment	1	Digester Building									Replace as needed	1991	20	-8	4	2	2	0%	5	10	2021	$ 4,100	$ 205	$ 2,050
Heaters (3)	Mechanical Equipment	3	Digester Building		Heater		Chromalox			Explosion Proof		Not needed	1991	15	-13	4	2	1	0%	5	5	2021	$ 6,900	$ 460	$ 3,450
Backflow Preventer Valves	Mechanical Equipment	1	Digester Building			2 in.	Watts		909			Replace as needed	1991	30	2	4	5	3	0%	4	12	2024	$ 2,000	$ 67	$ 400

Total Asset Cost	$ 3,316,020		
Total Annual Asset Cost		$ 112,657	$ 483,260

Total Number of Assets	$ 155
Total Replacement Cost	$ 7,401,970

Northfield Township Asset Management Plan
Wastewater Treatment Plant Asset Inventory
Chemical Feed System

Current Year 2019

FACILITIES

Asset ID	Building/Process	Location	Equipment Description	Asset Size	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Service Building Walls	Service Building				1978, 1991 updates	1962	60	3	3	10	3	0%	3	9	2029	$ 892,000	$ 14,867	$ 89,200
Service Building Roof	Service Building				Need to replace	1991	30	2	4	2	3	0%	4	12	2021	$ 40,000	$ 1,333	$ 20,000
Service Building Doors	Service Building				Good shape	1978	30	-11	3	5	3	0%	4	12	2024	$ 6,000	$ 200	$ 1,200
Garage Roof	Service Bldg Garage			31'-4" x 32'		1998	30	9	3	10	3	0%	3	9	2029	$ 25,064	$ 835	$ 2,506
Garage Walls	Service Bldg Garage					1998	60	39	2	40	2	0%	2	4	2059	$ 246,500	$ 4,108	$ 6,163

Total Asset Cost	$ 1,209,564		
Total Annual Asset Cost		$ 21,344	$ 119,069

EQUIPMENT

Asset ID	Type	Quantity	Building/Process	Location	Equipment Description	Asset Size	Manufacturer	Series	Model	Equip Param 1	Equip Param 2	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition of Equipment (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Process																									
Ferric Chloride Feed Pump	Pump	1	Service Building	Basement	Chemical Feed Pump	26 gph @ 150 psi	Milton Roy Company	02815958-1	651P8PML/nin			Replace as needed	2005	10	-4	4	5	3	0%	4	12	2024	$ 4,000	$ 400	$ 800
Polymer Feed Pump	Pump	1	Service Building	Basement	Chemical Feed Pump	16.76 gph @600 psi	Pulsa Series 7120	E360926-1	7170H-S-AE			Replace as needed	2010	10	1	4	5	3	0%	4	12	2024	$ 4,000	$ 400	$ 800
Polymer Storage Tanks (2)	Process	2	Service Building		Chemical Storage Tank	500 gal				Fiberglass		Size is each; replace as needed	1997	20	-2	4	5	3	0%	4	12	2024	$ 20,000	$ 1,000	$ 4,000
Ferric Chloride Storage Tank	Process	1	Service Building	Outside	Chemical Storage Tank	6000 gal.				Fiberglass		Replace as needed	1998	15	-6	4	5	4	0%	4	16	2024	$ 30,000	$ 2,000	$ 6,000
Raw Influent Sampler	Process	1	Service Building				Sigma		1600 Hach				1998	20	-1	4	5	4	0%	4	16	2024	$ 14,000	$ 700	$ 2,800
Primary Sampler	Process	1	Service Building				Sigma		900 Hach			Replace as needed	1998	20	-1	4	5	3	0%	4	12	2024	$ 14,000	$ 700	$ 2,800
Piping																									
Electrical																									
FE/FY-1	Electrical and Instrumentation	1	Service Building	Parshall Flume	Influent Flow Meter	9 in				0 to 1200 gpm			1998	15	-6	4	5	5	0%	4	20	2024	$ 3,000	$ 200	$ 600
LE-2	Electrical and Instrumentation	1		Primary Effluent Wet Well	Bubbler Wet Well Level					MCP		*decommissioned	1976	15	-28	5	0	0	0%	5	0	2019	$ -	$ -	$ -
LIT-2	Electrical and Instrumentation	1		Primary Effluent Wet Well	Level Transmitter							*decommissioned	1976	15	-28	5	0	0	0%	5	0	2019	$ 2,000	$ 133	$ -
LSL-2/LSH-2	Electrical and Instrumentation	1		Primary Effluent Wet Well	Pressure Switches Pump Control and Alarm Circuits								1976	15	-28	4	5	3	0%	4	12	2024	$ 2,000	$ 133	$ 400
LIC-2	Electrical and Instrumentation	1		Primary Effluent Wet Well	Level Controller on BCV 1-1 with output meter							*Part of PLC software	1976	15	-28	4	5	3	0%	4	12	2024	$ -	$ -	$ -
LS-2	Electrical and Instrumentation	1		Primary Effluent Wet Well	Current Switch								1976	15	-28	4	5	4	0%	4	16	2024	$ 500	$ 33	$ 100
LAL-2/LAH-2	Electrical and Instrumentation	1		Primary Effluent Wet Well	Low and High Level Alarm							*Part of PLC software	1976	15	-28	4	5	4	0%	4	16	2024	$ -	$ -	$ -
CR-14	Electrical and Instrumentation	1		Primary Effluent Wet Well	Interlock Relay							*Part of CP	1976	15	-28	4	5	3	0%	4	12	2024	$ -	$ -	$ -
LI-2	Electrical and Instrumentation	1		Primary Effluent Wet Well	Light Indicator for LIT-2							*Part of PLC software	1976	15	-28	4	5	3	0%	4	12	2024	$ -	$ -	$ -
Mechanical																									
UH-1	Mechanical Equipment	1	Service Building	Garage	Hot Water Unit Heater	815 cfm	Trane		60S			Replace as needed	1998	15	-6	5	2	3	0%	3	9	2021	$ 2,300	$ 153	$ 1,150
UH-2	Mechanical Equipment	1	Service Building	Garage	Hot Water Unit Heater	815 cfm	Trane		60S			Replace as needed	1998	15	-6	5	2	3	0%	3	9	2021	$ 2,300	$ 153	$ 1,150
AC-1	Mechanical Equipment	1	Service Building	Room 102	Room Air Conditioning Unit	260-315 cfm	Carrier		ES1153				2017	20	18	1	20	2	0%	3	6	2039	$ 29,500	$ 1,475	$ 1,475
AC-2	Mechanical Equipment	1	Service Building	Room 103	Room Air Conditioning Unit	200-250 cfm	Carrier		ES1101				2017	20	18	1	20	2	0%	3	6	2039	$ 29,500	$ 1,475	$ 1,475
AC-3	Mechanical Equipment	1	Service Building	Room 107	Room Air Conditioning Unit	250-252 cfm	Carrier		ES1123				2016	20	17	2	20	2	0%	2	4	2039	$ 29,500	$ 1,475	$ 1,475
RF-1	Mechanical Equipment	1	Service Building	Garage	Exhaust Fan	707 cfm	Loren-Cook					Motor operated damper	1998	25	4	3	10	4	0%	2	8	2029	$ 1,300	$ 52	$ 130
CE-1	Mechanical Equipment	1	Service Building	Toilet	Exhaust Fan	85 cfm	Loren-Cook						1998	25	4	3	10	2	0%	2	4	2029	$ 500	$ 20	$ 50
FT-1	Mechanical Equipment	1	Service Building	Toilet	Fin Tube Radiator								1998	30	9	3	10	3	0%	3	9	2029	$ 1,000	$ 33	$ 100
FT-2	Mechanical Equipment	1	Service Building	Room 102	Fin Tube Radiator								1998	30	9	3	10	3	0%	3	9	2029	$ 2,000	$ 67	$ 200
FT-3	Mechanical Equipment	1	Service Building	Room 103	Fin Tube Radiator								1998	30	9	3	10	3	0%	3	9	2029	$ 1,000	$ 33	$ 100
FT-4	Mechanical Equipment	1	Service Building	Storage Room	Fin Tube Radiator								1998	30	9	3	10	3	0%	3	9	2029	$ 1,000	$ 33	$ 100
FT-5	Mechanical Equipment	1	Service Building	Room 107	Fin Tube Radiator								1998	30	9	3	10	3	0%	3	9	2029	$ 1,500	$ 50	$ 150

Total Asset Cost	$ 194,900.00		
Total Annual Asset Cost		$ 10,720.33	$ 25,855.00

Total Number of Assets	33
Total Replacement Cost	$ 1,404,464.00

Northfield Township Asset Management Plan
Wastewater Treatment Plant Asset Inventory
Miscellaneous

Current Year 2019

FACILITIES

Asset ID	Building/Process	Location	Equipment Description	Asset Size	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Cascades	Cascades					1976	60	17	3	20	2	0%	3	6	2039	$ 65,000	$ 1,083	$ 3,250
Stick Built Garage				32 ft x 30 ft		2007	30	18	3	20	2	0%	3	6	2039	$ 18,720	$ 624	$ 936
Stick Built Roof					Needs to be replaced; Scheduled for 2019	2007	20	8	4	1	2	0%	4	8	2020	$ 14,400	$ 720	$ 14,400
Ferric Chloride Containment Area	Outside		Concrete Containment	15x15x5'-4" 8" thick		1998	60	39	3	40	5	0%	3	15	2059	$ 28,000	$ 467	$ 700
Metal Storage Shed	Outside			40 ft x 40 ft	New Roof 1990	1976	50	7	3	10	2	0%	3	6	2029	$ 31,200	$ 624	$ 3,120

Total Asset Cost	$ 157,320		
Total Annual Asset Cost		$ 3,518	$ 22,406

EQUIPMENT

Asset ID	Type	Quantity	Building/Process	Location	Equipment Description	Asset Size	Manufacturer	Series	Model	Equip Param 1	Equip Param 2	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition of Equipment (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Process																									
Service Wash Water Pump No. 1	Pump	1	Filter Building No. 1		Pumps	5 hp	Baldor Reliance		85600H12				1976	30	-13	4	2	3	50%	4	6	2021	$ 4,000	$ 133	$ 2,000
Service Wash Water Pump No. 2	Pump	1	Filter Building No. 1		Pumps	5 hp	Baldor Reliance		A9608464 9P116450 002				1976	30	-13	4	2	3	50%	4	6	2021	$ 4,000	$ 133	$ 2,000
Flame Arrestors (3)	Process	3					Varec		59-91				1976	30	-13	4	5	3	0%	4	12	2024	$ 20,625	$ 688	$ 4,125
Lab Oven	Process	1	Service Building	Laboratory	Lab Equipment		FisherScientific	Isotemp 500				Replace as needed	2010	15	6	3	10	3	0%	3	9	2029	$ 1,700	$ 113	$ 170
Spectrophotometer	Process	1	Service Building	Laboratory	Lab Equipment		FisherScientific	Genesys 20				Replace as needed	2015	15	11	3	15	3	0%	3	9	2034	$ 3,000	$ 200	$ 200
BOD Meter	Process	1	Service Building	Laboratory	Lab Equipment		Hach	HQ440D Multimeter				Replace as needed	2015	10	6	3	10	3	0%	3	9	2029	$ 2,800	$ 280	$ 280
Ammonia Meter	Process	1	Service Building	Laboratory	Lab Equipment		FisherScientific	Orion Dual Star pH/ISE Benchtop Meter				Replace as needed	2010	10	1	3	5	3	0%	3	9	2024	$ 3,000	$ 300	$ 600
Analytical Balance	Process	1	Service Building	Laboratory	Lab Equipment		Sartorius					Replace as needed	2010	15	6	3	10	3	0%	3	9	2029	$ 2,200	$ 147	$ 220
pH Meter	Process	1	Service Building	Laboratory	Lab Equipment		FisherScientific	Orion Dual Star pH/ISE Benchtop Meter				Replace as needed	2010	10	1	3	5	3	0%	3	9	2024	$ 1,900	$ 190	$ 380
Autoclave	Process	1	Service Building	Laboratory	Lab Equipment		Bernard/Harvey	MC8				Replace as needed	2010	15	6	3	10	3	0%	3	9	2029	$ 7,000	$ 467	$ 700
Water Bath	Process	1	Service Building	Laboratory	Lab Equipment		Shel Lab	SWBC22		22 L Capacity		Replace as needed	2010	15	6	3	10	3	0%	3	9	2029	$ 1,750	$ 117	$ 175
Muffle Furnace	Process	1	Service Building	Laboratory	Lab Equipment		FisherScientific	Isotemp Muffle Furnace				Replace as needed	2010	15	6	3	10	3	0%	3	9	2029	$ 13,000	$ 867	$ 1,300
BOD Incubator	Process	1	Service Building	Laboratory	Lab Equipment		VWR					Replace as needed	2010	15	6	3	10	3	0%	3	9	2029	$ 6,000	$ 400	$ 600
High Pressure Jetter	Process	1	Stick Built Garage		CS Cleaning?								2002	15	-2	3	5	2	0%	3	6	2024	$ -	$ -	$ -
Backhoe	Process	1	Stick Built Garage		Vehicle		JCB		214			Hardly Used	2000	30	11	3	15	2	0%	3	6	2034	$ -	$ -	$ -
Pipeline Inspection Trailer	Process	1			Vehicle								2005	20	6	3	10	2	0%	3	6	2029	$ -	$ -	$ -
Pipeline Inspection Cameras	Process	1			Vehicle								2015	10	6	2	10	2	0%	2	4	2029	$ -	$ -	$ -
Forklift	Process	1	Metal Storage Shed		Vehicle		Komatsu						2003	20	4	3	10	2	0%	3	6	2029	$ -	$ -	$ -
Ford F350 4x4 Truck with Crane/Utility Box	Process	1	Service Building	Garage	Vehicle		Ford		F350				2014	15	10	2	10	2	0%	2	4	2029	$ -	$ -	$ -
Ford F250 4x4 Snow Plow Truck	Process	1	Service Building	Garage	Vehicle		Ford		F250				2006	15	2	3	5	2	0%	3	6	2024	$ -	$ -	$ -
Ford 250 4x4 with Plow	Process	1	Service Building	Garage	Vehicle		Ford		F250				2016	15	12	2	15	2	0%	2	4	2034	$ -	$ -	$ -
Piping																									
RS - Grit Bldg to Flow Split	Pipework	1	Yard		14" DIP	200							1998	30	9	3	10	3	0%	3	9	2029	$ 340,000	$ 11,333	$ 34,000
RS - Flow Split to Primary 1 & 2	Pipework	1	Yard		12" DIP	25							1992	30	3	3	5	3	0%	3	9	2024	$ 40,000	$ 1,333	$ 8,000
RS - Flow Split to Primary 3 & 4	Pipework	1	Yard		12" DIP	100							1998	30	9	3	10	3	0%	3	9	2029	$ 160,000	$ 5,333	$ 16,000
RS - Flow Split to Intermediate	Pipework	1	Yard		12" DIP	100							1992	30	3	3	5	3	0%	3	9	2024	$ 160,000	$ 5,333	$ 32,000
Service Building Piping	Pipework	1	Service Building		8" DIP	100							1978	30	-11	4	5	3	0%	4	12	2024	$ 80,000	$ 2,667	$ 16,000
PE - 3 & 4 to PE Pumps	Pipework	1	Yard		12" DIP	150							1998	30	9	3	10	3	0%	3	9	2029	$ 240,000	$ 8,000	$ 24,000
PE - 3 & 4 to PE Pumps	Pipework	1	Yard		14" DIP	70							1998	30	9	3	10	3	0%	3	9	2029	$ 119,000	$ 3,967	$ 11,900
PE - Pumps to Trickling	Pipework	1	Yard		8" DIP	175							1978	30	-11	4	5	3	0%	4	12	2024	$ 140,000	$ 4,667	$ 28,000
TFE - Trickling to Intermediate	Pipework	1	Yard		12" DIP	100							1978	30	-11	4	5	3	0%	4	12	2024	$ 160,000	$ 5,333	$ 32,000
TFE - Trickling to Aerators	Pipework	1	Yard		12" DIP	100							1978	30	-11	4	5	3	0%	4	12	2024	$ 160,000	$ 5,333	$ 32,000
Intermediate to Aerators	Pipework	1	Yard		12" DIP	30							1998	30	9	3	10	3	0%	3	9	2029	$ 48,000	$ 1,600	$ 4,800
PE - PE Pumps to Aerators	Pipework	1	Yard		12" DIP	75							1978	30	-11	4	5	3	0%	4	12	2024	$ 120,000	$ 4,000	$ 24,000
FTE - Flume to AT3	Pipework	1	Yard		12" DIP	35							1998	30	9	3	10	3	0%	3	9	2029	$ 56,000	$ 1,867	$ 5,600
ML - AT 3 to FT 3	Pipework	1	Yard		14" DIP	35							1998	30	9	3	10	3	0%	3	9	2029	$ 127,500	$ 4,250	$ 12,750
ML - AT 3 to FT 3	Pipework	1	Yard		12" DIP	25							1998	30	9	3	10	3	0%	3	9	2029	$ 40,000	$ 1,333	$ 4,000
Bypass Piping	Pipework	1	Yard		12" DIP	200							1978	30	-11	4	5	3	0%	4	12	2024	$ 320,000	$ 10,667	$ 64,000
FTE - FT-3 to bypass	Pipework	1	Yard		12" DIP	20							1998	30	9	3	10	3	0%	3	9	2029	$ 32,000	$ 1,067	$ 3,200
FI - Filter Bldg 1 to Filter Bldg 2	Pipework	1	Yard		10" DIP	50							1998	30	9	3	10	3	0%	3	9	2029	$ 75,000	$ 2,500	$ 7,500
FTE - FT-3 to Filter Bldg 1	Pipework	1	Yard		12" DIP	50							1998	30	9	3	10	3	0%	3	9	2029	$ 80,000	$ 2,667	$ 8,000
FE - Filter Bldg 2 to Filter Bldg 1	Pipework	1	Yard		14" DIP	75							1998	30	9	3	10	3	0%	3	9	2029	$ 127,500	$ 4,250	$ 12,750
ML - AT 2 to FT 2	Pipework	1	Yard		10" DIP	60							1998	30	9	3	10	3	0%	3	9	2029	$ 90,000	$ 3,000	$ 9,000
ML - AT 1 to FT 1	Pipework	1	Yard		10" DIP	85							1998	30	9	3	10	3	0%	3	9	2029	$ 127,500	$ 4,250	$ 12,750
FE - Filter Bldg 1 to Cascade	Pipework	1	Yard		16" DIP	150							1978	30	-11	4	5	3	0%	4	12	2024	$ 270,000	$ 9,000	$ 54,000
Sludge decant from storage	Pipework	1	Yard		6" DIP	250							1992	30	3	4	5	3	0%	4	12	2024	$ 150,000	$ 5,000	$ 30,000
Filter Building Piping	Pipework	1	Filter Building 1		6" DIP	500							1978	30	-11	4	5	3	0%	4	12	2024	$ 300,000	$ 10,000	$ 60,000
Electrical																									
MCP	Electrical and Instrumentation	1	Misc. - Service Building		Main Control Panel								1976	20	-23	4	5	5	0%	4	20	2024	$ 95,000	$ 4,750	$ 19,000
MCC-C	Electrical and Instrumentation	1	Misc. - Service Building	Service Building	Motor Control Center								1965	40	-14	4	5	5	0%	4	20	2024	$ 24,000	$ 600	$ 4,800
CP-1	Electrical and Instrumentation	1	Misc. - Filter Building No. 1	Filter Building No. 1	Control Panel							RAS 1998	1976	15	-28	4	5	5	0%	4	20	2024	$ 65,000	$ 4,333	$ 13,000
FFK 1-1	Electrical and Instrumentation	1	Misc. - Service Building - Ferric Chloride Feed Control	on MCP	Ratio Station (linked to FE-1)							*Part of PLC software	1976	15	-28	4	5	5	0%	4	20	2024	$ -	$ -	$ -
FFK 1-2	Electrical and Instrumentation	1	Misc. - Service Building - Polymer Feed Control	on MCP	Ratio Station (linked to FE-1)							*Part of PLC software	1976	15	-28	4	5	3	0%	4	12	2024	$ -	$ -	$ -
MCC-B	Electrical and Instrumentation	1	Misc. Filter Building No. 1	Alternator for Air Compressor	Motor Control Center								1976	40	-3	4	10	4	0%	4	16	2029	$ 72,000	$ 1,800	$ 7,200
MCC-C (Solids)	Electrical and Instrumentation	1	Misc. Service Building		Motor Control Center								1976	40	-3	4	10	5	0%	4	20	2029	$ 30,000	$ 750	$ 3,000
PS-1	Electrical and Instrumentation	1	Misc. - Receiver Tanks	Alternate air compressor operation	Pressure Switch								1976	15	-28	4	5	4	0%	4	16	2024	$ 500	$ 33	$ 100
PS-2	Electrical and Instrumentation	1	Misc. - Receiver Tanks	Alternate air compressor operation	Pressure Switch								1976	15	-28	4	5	4	0%	4	16	2024	$ 500	$ 33	$ 100
High Voltage Switchgear	Electrical and Instrumentation	1	Misc. - Adjacent to Filter Building No. 1							13.2kV, 3-phase			1976	30	-13	4	5	5	0%	4	20	2024	$ 34,100	$ 1,137	$ 6,820
Transformer	Electrical and Instrumentation	1	Misc. - Adjacent to Filter Building No. 1							500 kVA			1976	30	-13	4	5	5	0%	4	20	2024	$ 55,500	$ 1,850	$ 11,100
Automatic Transfer Switch	Electrical and Instrumentation	1	Misc. - Filter Building No. 1	Main Floor									1976	30	-13	4	5	5	0%	4	20	2024	$ 12,000	$ 400	$ 2,400
Generator	Electrical and Instrumentation	1	Misc. - Adjacent to Filter Building No. 1							250 kW diesel electric			1976	30	-13	4	5	5	0%	4	20	2024	$ 58,000	$ 1,933	$ 11,600
MCC-A	Electrical and Instrumentation	1	Misc. Filter Building No. 1		Motor Control Center								1976	40	-3	4	10	5	0%	4	20	2029	$ 72,000	$ 1,800	$ 7,200

Northfield Township Asset Management Plan
Wastewater Treatment Plant Asset Inventory
Miscellaneous

Asset ID	Type	Quantity	Building/Process	Location	Equipment Description	Asset Size	Manufacturer	Series	Model	Equip Param 1	Equip Param 2	Notes	Installation Year	Asset Life (Years)	Remaining Life Based on Installation Date (Years)	Condition	Predicted Remaining Life Based on Condition of Equipment (Years)	Consequence of Failure	Redundancy	Probability of Failure	Business Risk Exposure	Replacement Year	Replacement Cost	Cost Per Year (Based on Asset Life)	Cost Per Year (Based on Remaining Life)
Portable Generator No. 1	Electrical and Instrumentation	1	Misc. - Metal Storage Shed		Generator	125 kW	Katolite						2001	20	2	3	15	4	0%	3	12	2034	$ 55,000	$ 2,750	$ 3,667
Portable Generator No. 2	Electrical and Instrumentation	1	Misc. - Metal Storage Shed		Generator	100 kW	Onan						1985	20	-14	4	15	4	0%	4	16	2034	$ 55,000	$ 2,750	$ 3,667
Panel-D	Electrical and Instrumentation	1	Misc. - Filter Building No. 1										1976	20	-23	4	5	5	0%	4	20	2024	$ 5,000	$ 250	$ 1,000
Panel-A/D Transformer	Electrical and Instrumentation	1	Misc. - Filter Building No. 1		30kVA Delt.Wye								1976	20	-23	4	5	5	0%	4	20	2024	$ 1,500	$ 75	$ 300
Panel A/D Lighting Contactor	Electrical and Instrumentation	1	Misc. - Filter Building No. 1										1976	20	-23	4	5	5	0%	4	20	2024	$ 5,000	$ 250	$ 1,000
Panel-BB	Electrical and Instrumentation	1	Misc. - Service Building - Garage	Garage	s								1998	20	-1	3	10	5	0%	3	15	2029	$ 5,000	$ 250	$ 500
Panel BB Transformer	Electrical and Instrumentation	1	Misc. - Service Building - Garage	Garage	15kVA 1 phase		Cutler-Hammer						1998	20	-1	3	10	5	0%	3	15	2029	$ 2,700	$ 135	$ 270
Power Distribution Cabinet	Electrical and Instrumentation	1	Misc. - Filter Building 1	Next to ATS									1976	20	-23	4	5	5	0%	4	20	2024	$ 18,000	$ 900	$ 3,600
Mechanical																									

Total Asset Cost	$ 4,299,275		
Total Annual Asset Cost		$ 149,564	$ 659,323

Total Number of Assets	$ 75
Total Replacement Cost	$ 4,456,595

APPENDIX F: SANITARY SEWER CAPACITY ANALYSIS REPORT

Sanitary Sewer Capacity Analysis

Tetra Tech Project Number: 200-12748-18002
January 2019

PRESENTED TO

Northfield Township
8350 Main St
Whitmore Lake, MI 48189

PRESENTED BY

Tetra Tech
710 Avis Drive
Suite 100
Ann Arbor, Michigan 48108

P +1-734-665-6000
F +1-734-213-3003
tetratech.com

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Use of Data
This report is intended to be a planning-level document. Additional data are required before implementing recommendations in this document.

EXECUTIVE SUMMARY

In November 2017, Northfield Township was awarded a Stormwater, Asset Management, and Wastewater (SAW) Grant by the Michigan Department of Environmental Quality (MDEQ) to manage its sanitary collection system. The Township decided to use a portion of the SAW Grant to develop a model for the sanitary collection system to assess the system's capacity to convey wastewater. Tetra Tech constructed the model after completing an as-built review and GIS mapping updates. The purpose of this report is to document the modeling approach, results, and recommendations completed for the SAW Grant.

Sanitary Sewer System

The State of Michigan's sanitary sewer overflow (SSO) policy, enforced by MDEQ, is based on the 25-year, 24-hour design storm rainfall (3.9 inches) or the frequency of overflows in a ten-year period. The policy defines a minimum level of service that each community must provide to protect human health, reduce property damage (such as from basement backups), and maintain surface water quality.

Background

Northfield Township's wastewater collection system serves the western portion of the township along US-23 and the areas surrounding Whitmore and Horseshoe Lakes, as well as portion of Green Oak Township to the north. The wastewater treatment plant (WWTP), located on Lemen Road between Eight Mile Road and M-36, serves a total area and population of approximately 4.4 square miles and 6,500 persons, respectively. Three quarters of the tributary population is within Northfield Township. Effluent from the WWTP discharges into the Horseshoe Lake Drain. The Township owns fifteen pump stations, nine of which are in Northfield Township, and six of which are in Green Oak Township. The largest pump station is the Eight Mile Road Pump Station, located on Eight Mile Road east of Emerald Circle, which pumps flow to the WWTP from the entire collection system except for a correctional facility located on M-36.

Flow Monitoring

In many communities in Michigan, including Northfield Township, the flow rate in sanitary sewers increases during and after rainfall. The response can be created by direct connections to the sewer from stormwater sources, like downspouts, or by indirect sources, such as footing drains or infiltration.

In 2017, three temporary flow meters and a temporary rain gauge were installed concurrently from March through June to collect flow and rainfall data. The meters were removed and re-installed the following year when two additional meters also were installed, and the rain gage was replaced by two rain gages in different locations. The data were used to assess the relationship between flow and rainfall and calibrate a numerical model to the measured data. The 2018 meters were located upstream of the Eight Mile Road Pump Station (FM01), on Barker Road measuring flows from both the west and north (FM02 and FM03, respectively), on East Shore Drive at Elizabeth Street (FM04), and on Main Street south of Schrum Drive immediately downstream of Horseshoe Lake Pump Station No. 1 (FM05). Meters FM01, FM02, and FM04 also had been installed in 2017.

Twenty-three (23) rainfall events occurred during the flow monitoring period, three (3) of which were greater than one inch. There were enough rain and flow monitoring data of good quality to calibrate the model at each location.

Flow meter FM-03 had the highest peak flow rates, percent captures, and peaking factors overall. This was the only meter that had an observed peaking factor of at least five during a wet weather event. It had a peaking factor over five (5.3) during only one event, the largest event of May 11, 2018, which measured 2.09 inches of rainfall.

Model Development

A numerical model of the sanitary sewer collection system was created using recent Geographic Information System (GIS) mapping efforts and record drawings. The model was created using Innovyze's InfoSWMM version 14.6 interface, which is compatible with EPA SWMM version 5.1. While the InfoSWMM interface is proprietary, the hydraulic and hydrologic calculations are completed in the well-recognized, industry standard EPA SWMM program. The hydraulic and hydrologic model inputs best represent the conditions that currently exist in the system or may exist during the design storm.

While all sewers for which as-builts were available are in the model, calculations were performed only for the larger interceptors and sewers. Six of the township's fifteen sanitary sewer pump stations are active in the model calculations. The model is setup so that the active elements can be expanded in the future to meet the Township's needs.

After the model network was built, dry and wet weather flows and depths were developed using the data collected during the flow monitoring period. The model was calibrated for volume, flow rate, and depth using industry standards. The wet weather flow and calibration criteria were met at all the meter locations.

Capacity Analysis

A capacity analysis assesses the ability of the sewers in the collection system to convey flow during a design condition. The capacity analysis considers both the peak flow rates and hydraulic grade line. For the sanitary sewer collection system, the 25-year, 24-hour design storm was used.

The capacity analysis identified reaches of sewer where the nominal (full flow) pipe capacity is less than the predicted design storm peak flow rate. If surcharging was projected in the model during the design storm, a distinction was made between manholes that surcharged more than 10 feet below the ground surface, manholes that surcharged within 10 feet of the ground surface where damage to property would be more likely to occur, and manholes projected to have surface flooding.

Findings from the 25-year, 24-hour design storm simulation, excluding projected growth, include:

- Along the primary downstream interceptor, the sewer is not projected to have enough capacity to convey peak flows from Brookside Drive to the Eight Mile Road Pump Station. The surcharging extends along the interceptor and upstream, farther north than Main Street at Cove Circle, and farther south than Main Street and Jennings Road. As shown in Appendix D Figures 12 and 9, surcharging up to several feet above crown is projected. The risk of basement flooding is highest in the lowest-lying areas between Main Street and Barker Roads, specifically on Main Street at Jennings Road, at the north end of Brookside Drive, and at two other low-lying areas between Brookside Drive and Barker Road.
- The model predicts that a few reaches of sewer upstream of FM-03, along the west side of Whitmore Lake, are slightly under capacity. The most significant such reach is the 350-foot most upstream modeled reach along North Main Street. The surcharging in the sewer along the west side of Whitmore Lake is primarily due to the lack of capacity of the interceptor downstream, not local lack of capacity.
- Seven of the fifteen modeled pump stations were actively modeled and evaluated for capacity. One of these (Lake Point Drive Pump Station) could not be evaluated for capacity since no pump curve was available. Of the six actively modeled pump stations, five were determined to have adequate capacity to pump the peak design storm flow rates. The exception was Horseshoe Lake Pump Station No. 1. Unusually large energy losses had to be added to the force main to lower the modeled peak flows enough to match those measured by meter FM-05 immediately downstream. This loss could represent an obstruction in the force main or a partially closed valve at the pump station. The result was that the pump station could not pump the design storm peak flow without backing up the flow upstream of the pump station. The model predicts that the flows would surcharge to the point of surface flooding on Shady

Beach Drive one reach east of Main Street. Basements would be at risk of flooding along Shady Beach Drive as far upstream as Horseshoe Lake Pump Station No. 2.

- Although the WWTP has adequate treatment capacity for the average dry weather flow of 0.7 MGD, it does not have capacity or storage for the projected design storm flow rate. With projected growth of 1.01 MGD, it also would not have capacity to treat the future average dry weather flow of 1.7 MGD.

Recommendations

Recommendations in this report are solely based on modeled capacity and are intended to mitigate projected SSOs and provide adequate capacity for the 25-year, 24-hour design storm, including projected growth. Projected growth was included using the values presented in studies completed by the Township since 2015. The additional projected average flow rate due to growth is 1.01 MGD, which would more than double the existing dry weather flow to the WWTP.

Recommendations for the wastewater system to provide a level of service for the 25-year, 24-hour design storm for existing conditions include:

- Increase capacity between Barker Road and the Eight Mile Road Pump Station. This report outlines the construction of approximately 4,200 feet of 24-inch sewer to replace the existing interceptor in that reach. This recommendation is based on the age of the existing interceptor and the inference that it is approaching the end of its useful life. Cost analyses suggest that the cost to build a pump station and force main is nearly equivalent and may be preferred if the existing sewer is shown to be of good condition or disruption to the existing sewered alignment is not desired.
- Construct approximately 1,700 feet of 18-inch replacement sewer from the north end of Brookside Drive, at its confluence with the sewer flowing across the railroad tracks from East Shore Drive, along the west side of the railroad to Barker Road.
- Inspect the force main and pump station piping at the Horseshoe Lake Pump Station No. 1 for an obstruction or partially closed valve. Remove any obstructions and/or fully open any partially closed valves to restore this pump station to its intended pumping capacity. If the cause(s) of the unexpectedly high energy loss cannot be found, additional pumping capacity will be required to meet the projected flows at the pump station.
- Construct 1.5 million gallons (MG) or more of storage at the WWTP. This will provide the ability to capture wet weather flows until treatment capacity become available. As development occurs, expand the treatment capacity of the WWTP by 1.1 MGD to accommodate the increase in dry weather flow.
- Field verify the pumping capacity of the Main Street Pump Station and update the model within Green Oak Township to improve the flow distribution in the area west of Whitmore Lake. If the pumping capacity is determined to be restrictive of the peak design flow, investigate the area within Northfield Township for one or more significant I/I sources.
- Continue to maintain the sewer system. The system is aging and the impact of infiltration/inflow (I/I) on wet weather flows will only increase with age. The results of this report are based on the magnitude of I/I remaining unchanged from present conditions. The sewer system should be rehabilitated as I/I sources are located.

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ACRONYMS AND ABBREVIATIONS

Term	Definition
EPA SWMM	Environmental Protection Agency Storm Water Management Model
gpcd	gallons per capita per day
GIS	Geographic Information System
HGL	hydraulic grade line
I/I	infiltration and inflow
MDEQ	Michigan Department of Environmental Quality
MG	million gallons
MGD	million gallons per day
NOAA	National Oceanic and Atmospheric Administration
PS	pump station
RDII	Rainfall Dependent Inflow and Infiltration
RTK	hydrologic parameters used to describe inflow and infiltration response to rainfall in sanitary sewers
SAW	Stormwater, Asset Management, and Wastewater
SCS	Soil Conservation Service
SSO	sanitary sewer overflow
SSOAP	Sanitary Sewer Overflow Analysis and Planning
WWTP	wastewater treatment plant

1.0 INTRODUCTION

In 2016, Northfield Township was awarded a Stormwater, Asset Management, and Wastewater (SAW) Grant by the Michigan Department of Environmental Quality (MDEQ) to manage its sanitary collection system. The Township's SAW Grant provides financial assistance for an asset management program, which is a requirement of the Township's wastewater treatment plant (WWTP) discharge permit. The Township decided to use a portion of the SAW Grant to perform flow monitoring and create a calibrated model of the Township's wastewater collection system. The purpose of the model is to evaluate the capacity of each system and provide a planning tool to analyze and prioritize improvements.

The model for the sanitary sewer system was built using InfoSWMM version 14.6, which is compatible with the Environmental Protection Agency Storm Water Management Model (EPA SWMM) version 5.1. While the InfoSWMM interface is proprietary, the hydraulic and hydrologic calculations are completed using the well-recognized, industry standard EPA SWMM code.

2.0 SANITARY SEWER SYSTEM BACKGROUND

Northfield Township has a separate sanitary sewer collection system that, like many communities in Michigan, has increased flow rates during wet weather. There are 178,000 feet of gravity sewer in the system ranging in size from 8 to 30 inches in diameter. There are also fifteen pump stations in the collection system with 46,000 feet of force main.

2.1 EXISTING FACILITIES

Northfield Township's sanitary collection system serves the western portion of the township along US-23 and the areas surrounding Whitmore and Horseshoe Lakes, as well as a southern portion of Green Oak Township in Livingston County. An overview of the collection system is shown in Figure 2-1.

The WWTP, located on Lemen Road between Eight and Nine Mile Roads, has a rated treatment capacity of 1.3 million gallons per day (MGD) with no equalization storage. The average flow rate to the WWTP is approximately 0.7 MGD, but it can be as high as 0.9 MGD during the spring season. Effluent from the WWTP discharges into the Horseshoe Drain.

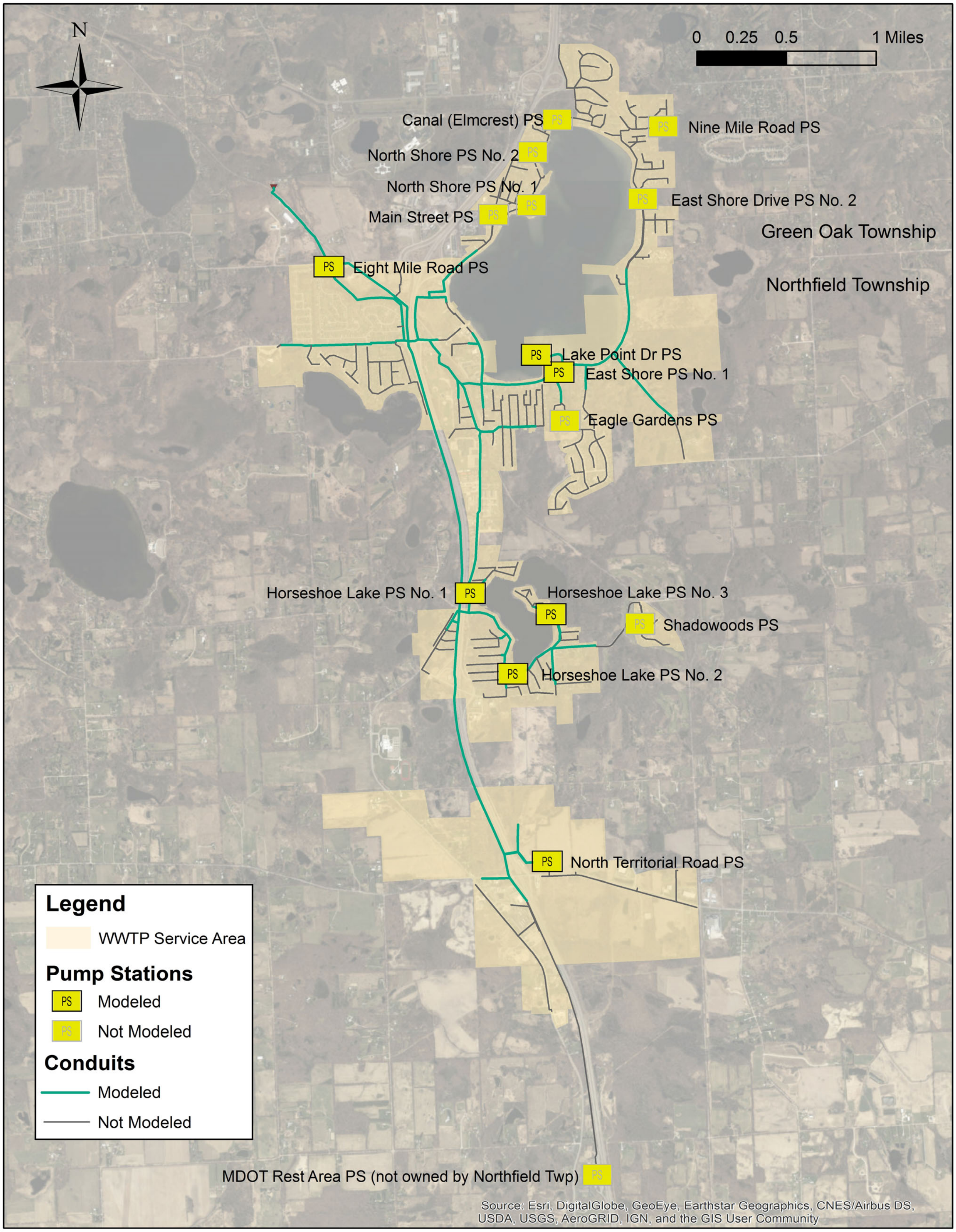
The Township owns fifteen pump stations, the largest of which is in the Eight Mile Road Pump Station. This pump station is located on Eight Mile Road, just west of Lemen Road, at the downstream end of the collection system. The population tributary to the pump stations and their rated capacities are shown in Table 2-1. There is also a pump station owned and operated by the Michigan Department of Transportation (MDOT), which serves the rest area along southbound US-23 at the south end of the collection system.

Table 2-1: Pump Station Summary

Pump Station	Firm Capacity†, (gallons per minute)
Canal (a.k.a. Elmcrest)	100
Eagle Gardens	200
East Shore #1	760
East Shore #2	300
Eight Mile Road	1100
Horseshoe Lake #1	400
Horseshoe Lake #2	150
Horseshoe Lake #3	100
Lake Point Drive	unknown
Main Street	100
N. Territorial Road	760
Nine Mile Road	100
North Shore #1	unknown
North Shore #2	455
Shadowoods	50

† Rated capacity. Actual pumping capacity may be lower or higher than the rated capacity.

Figure 2-1: Sanitary Sewer Collection System Overview



2.2 RAINFALL'S INFLUENCE ON SANITARY SEWER FLOWS

Runoff and infiltration caused by rainfall may enter the sanitary sewers increasing the flow rates in the sewers. The resulting flows can negatively impact the performance of the collection and treatment systems by causing surcharging, basement flooding, sanitary sewer overflows, and higher peak flows and volumes to treat. Sources of inflow and infiltration in the sanitary sewer can be roof drains, footing drains, and pipe defects among others. Common factors that can impact the magnitude of the response of flows in a sewer to rainfall include:

- age (older sewers tend to have a higher wet weather response)
- construction quality
- sewer condition and preventive maintenance
- building codes (particularly with respect to footing drains and downspout connectivity)
- physical properties of the area, such as groundwater table and soil type

Northfield Township's sewer system was constructed primarily of vitrified clay pipe in the 1960s and 1970s. This pipe is brittle and prone to breaks. A large portion of the sewer system is constructed around Whitmore and Horseshoe Lakes beneath the groundwater table. Sewers located below the groundwater table typically experience more infiltration than sewers located above the groundwater elevation.

2.3 REGULATORY REQUIREMENTS

Design storm simulations and recommendations in this report are intended to comply with the State of Michigan's Sanitary Sewer Overflow (SSO) policy issued in December 2002. The policy dictates a minimum level of service that each community must provide with its collection system to protect human health, reduce property damage (such as from basement backups), and maintain surface water quality. The policy is enforced by MDEQ.

The policy says that wastewater collection systems must be able to transport and treat the peak flow rate for the 25-year, 24-hour design storm for normal soil moisture during the vegetative growing season (April through October). The 25-year, 24-hour design storm rainfall volume is defined by MDEQ to be 3.9 inches. MDEQ uses enforcement discretion for overflows that occur because of larger storms.

Alternatively, the policy allows communities to demonstrate that overflows will not occur more frequently than once in ten years. This type of analysis is conducted by simulating flows using a long-term record of rainfall data. This approach requires more engineering than the design storm approach and is generally undertaken to try to minimize infrastructure footprints and construction costs (i.e. the design storm approach is generally more conservative than the once-in-ten-years approach).

3.0 SANITARY SEWER SYSTEM DATA COLLECTION

A major component of the project was to collect the data that would be used to create the model. Geographic Information System (GIS) mapping and record drawings were used as the basis for the sewer connectivity, elevations, and diameters found in the model. Flow and rainfall monitoring were completed to provide data to calibrate modeled flow and depth.

3.1 MANHOLE AND PIPE DATA

The model was imported from the Township's GIS database and supplemented with record drawings. The following pipe and manhole data were used in the model:

- Manhole location, rim elevation, and depth
- Pipe size and invert elevations
- Pipe connectivity

3.2 TEMPORARY RAINFALL MONITORING

Three temporary tipping bucket rain gauges were installed during the two flow monitoring periods to help correlate rainfall to flows measured in the sewer. During 2017, a single rain gauge was installed at the WWTP (RG-2017). During 2018, two rain gauges were installed, one at the school complex on Main Street south of Jennings Road (RG01-Main), and another at the Whitmore Lake Elementary School on Barker Road (RG02-Barker). The locations of the rain gauges are shown in Figure 3-1 in Section 3.3.

Overall, there were twenty-three (23) events with a rainfall depth greater than 0.25 inches, three (3) of which were measured to be greater than one inch. The rainfall during the flow monitoring period is summarized in Table 3-1. These rain events are defined by a 6-hour inter-event duration. When calibrating the model at each flow monitoring location, however, some of the rain event totals are combined with those from subsequent rain events since the events are no longer defined by a 6-hour inter-event duration, but based on when the wet weather response recedes back to dry weather flow.

3.3 TEMPORARY FLOW MONITORING

Five temporary ISCO 2150 flow meters were installed in the collection system to measure flow rates that were used to calibrate the model. All meters were installed in the influent pipe to the manhole. Meters were downloaded once every two weeks and serviced at least once a month.

The flow monitoring locations are shown on Figure 3-1 and are summarized in Table 3-2. The population, parcels, and areas tributary to each meter are also shown in the table. Population is estimated using 2010 census data. Detailed maps of the flow monitoring locations are provided in Appendix A. The rainfall and flow monitoring data collected were sufficient for calibration at all locations.

Table 3-1: Statistics for Rainfall Events Greater than 0.25 inches

Date of Beginning of Rainfall	Total Rainfall† (inches)		Peak Hour Rainfall Intensity† (inches/hour)		Rainfall Duration (hours)	
April 5, 2017	0.93		0.16		34.25	
April 19, 2017	0.80		0.80		3.25	
April 20, 2017	>0.88††		N/A		N/A	
April 26, 2017	0.82		2.12		1.50	
April 30, 2017	0.74		0.40		33.50	
May 4, 2017	0.70		0.16		13.25	
May 16, 2017	0.48		1.00		7.25	
May 21, 2017	1.36		1.88		1.75	
June 22, 2017	0.29		0.32		12.00	
March 27, 2018	0.32	0.32	0.12	0.12	6.58	8.00
April 3, 2018	0.74	0.77	0.84	0.60	9.08	8.00
April 14, 2018	0.67	0.70	0.28	0.28	11.00	10.00
April 15, 2018	0.18	0.61	0.40	1.12	3.75	6.00
May 2, 2018	1.67	1.62	0.88	1.16	29.25	27.50
May 11, 2018	2.09	2.08	1.16	0.76	27.25	27.25
May 13, 2018	0.48	0.46	0.24	0.24	4.00	6.00
May 21, 2018	0.48	0.54	0.44	0.56	3.00	3.00
May 26, 2018	0.22	0.35	0.68	1.00	0.50	0.75
May 30, 2018	0.17	0.27	0.24	0.48	5.25	5.50
June 1, 2018	0.26	0.44	0.80	1.44	0.50	0.75
June 3, 2018	0.26	0.24	0.64	0.56	1.25	1.25
June 9, 2018	0.26	0.33	0.36	0.32	4.00	8.25
June 20, 2018	0.25	0.41	0.64	0.80	2.25	5.75

† The 2018 rainfall data are based on 15-minute data from rain gages RG01 and RG02, respectively.
†† The 2017 rain gage failed during this event.

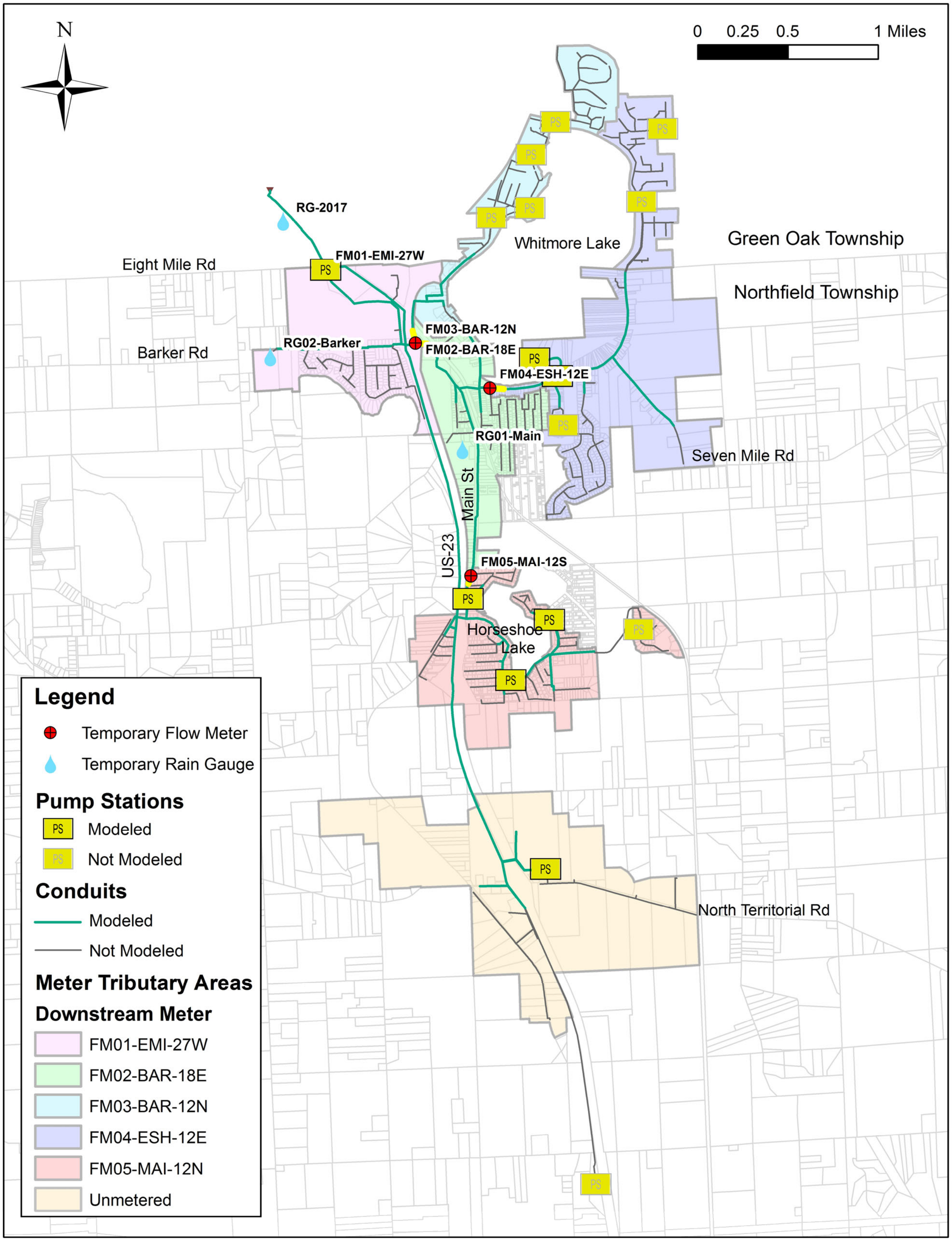
Table 3-2: Temporary Flow Monitoring Locations

Meter	Manhole ID at Meter Location	Location	Pipe Diameter (inches)	Installation Date (2017)	Removal Date (2017)	Installation Date (2018)	Removal Date (2018)	Directly Tributary Meter(s)
FM-01	EIGHT_MILE_PS_WW	Gravity influent to Eight Mile Road PS	27	April 4	July 5	March 19	July 26	FM-02 FM-03
FM-02	MH-406	Barker Road at NB US-23 Exit Ramp, E sewer	18	April 3	July 5	March 19	July 26	FM-04 FM-05
FM-03	MH-406	Barker Road at NB US-23 Exist Ramp, N sewer	12	N/A	N/A	March 19	July 26	None
FM-04	MH-326	East Shore Drive at Elizabeth Street	12	April 3	July 5	March 19	July 26	None
FM-05	MH-527	8185 Main Street at Schrum Drive	12	N/A	N/A	March 19	July 26	None

Table 3-3: Estimated Tributary Populations, Parcels and Areas by Meter

Meter	Meter ID	Total			Northfield Township			Green Oak Township		
		Popu-lation	Area (acres)	Parcels	Popu-lation	Area (acres)	Parcels	Popu-lation	Area (acres)	Parcels
FM-01	EightMile-27	6,490	2,000	2,590	4,960	1,670	1,970	1,530	330	620
FM-03	Barker-12	1,000	220	400	20	40	50	980	180	350
FM-02	Barker-18	3,990	1,390	1,960	3,430	1,250	1,700	550	150	270
FM-04	EastShore-12	1,750	730	760	1200	580	490	550	150	270
FM-05	Main-12	970	380	690	970	380	690	0	0	0
Unmetered		20	840	80	20	840	690	0	0	0
Entire Service Area		6,510	2,830	2,660	4,980	2,500	2,660	1,530	330	620

Figure 3-1: Flow Meter Tributary Areas



3.3.1 Summary of Dry Weather Flow Monitoring Results

The typical range for dry weather flows lies between 70 and 140 gallons per capita per day (gpcd). In all the flow monitoring areas, the dry weather flows within this range. FM-02 had the highest dry weather flows per capita, which may be because its tributary area has a higher percentage of non-residential area (i.e. commercial area along Main Street), which contributes dry weather flow but lacks population.

Table 3-4: Average Dry Weather Flow during the Flow Monitoring Period

	FM-01	FM-02	FM-03	FM-04	FM-05
Flow (MGD)	0.64	0.49	0.10	0.21	0.11
Flow (gpcd)	99	123	100	120	113

3.3.2 Summary of Wet Weather Flow Monitoring Results

Flow data for each meter are provided in Appendix A. A description of the flow monitoring at all the sites is provided in the following paragraphs.

- FM-01 measured flow near the downstream end of the system, in the gravity influent pipe to the Eight Mile Road PS. All other meters were tributary to FM-01; meters FM-02 and FM-03 were directly tributary. The measured flows generally followed a normal depth-flow relationship. The peak flow rates were below the calculated pipe capacity. The manhole surcharged once during the flow monitoring period during dry weather. The cause of the surcharging is not definitively known, but could have been caused if the pumps were temporarily out of service.
- FM-02 measured flows on Barker Road near the NB US-23 exit ramp. It measured flows in the influent sewer from the east. Meters FM-04 and FM-05 were tributary to FM-02. The measured flows generally followed a normal depth-flow relationship. The peak flows were below the calculated pipe capacity, and the meter did not record surcharging during the flow monitoring period. The per capita flow rates for this meter were higher than the other flow meters likely due to the commercial areas along Main Street.
- FM-03 measured flows on Barker Road near the NB US-23 exit ramp. It was installed in the same manhole as FM-02, but measured flows in the influent sewer from the north. It was installed only during the 2018 flow monitoring period. There were no other flow meters tributary to FM-03. The measured flows followed a normal depth-flow relationship. The peak flow rates were below the calculated pipe capacity. The manhole never surcharged during the flow monitoring period.
- FM-04 measured flows on East Shore Drive at Elizabeth Street. There were no other flow meters tributary to FM-04. The measured flows followed a normal depth-flow relationship. The peak flow rates were below the calculated pipe capacity. The manhole never surcharged during the flow monitoring period.
- FM-05 measured flows on Main Street at Schrum Drive. There were no other flow meters tributary to FM-05. The measured flow followed a normal depth-flow relationship. The peak flow rates were below the calculated pipe capacity. The manhole never surcharged during the flow monitoring period.

The measured peak flow rates, rainfall capture, and peaking factors for each meter for the largest rainfalls during the flow monitoring period are shown in Table 3-5. Rainfall capture is an estimate of the amount of rainfall from the tributary area that enters the sanitary sewer. The peaking factor is a measurement quantifying the meter response to rainfall compared to dry weather flows. A peaking factor of five or greater indicates a strong wet weather response. The peaking factor only exceeded five at one meter, FM-03, during one event, the largest event of the flow monitoring period, May 11, 2018. FM-03 also had the largest percent captures and peaking factors.

3.4 FLOW MONITORING CONCLUSIONS

The flow meters and rain gauges were reliable throughout most of the monitoring period and provided good data for calibration of the computer model. Dry weather flows were reasonable for the type of property tributary to each meter. The highest per capita dry weather flows occurred in the area tributary to meter FM-02.

There was a measurable response to rainfall at most meter locations. The May 11, 2018, event, which had the greatest amount of rainfall, caused a peaking factor greater than five at only one of the meters, FM-03. No meter recorded surcharging due to wet weather response during any of the rain events.

Table 3-5: Measured Flow Statistics during Select Rainfall Events

Event Date	FM-01			FM-02			FM-03			FM-04			FM-05		
	Peak Flow (MGD)	Rainfall Capture (%)	Peaking Factor	Peak Flow (MGD)	Rainfall Capture (%)	Peaking Factor	Peak Flow (MGD)	Rainfall Capture (%)	Peaking Factor	Peak Flow (MGD)	Rainfall Capture (%)	Peaking Factor	Peak Flow (MGD)	Rainfall Capture (%)	Peaking Factor
04/05/17	1.36	2.9	2.6	1.01	3.3	1.9	N/A	N/A	N/A	0.55	1.7	1.8	N/A	N/A	N/A
05/21/17	1.35	1.0	2.1	0.95	1.3	2.2	N/A	N/A	N/A	0.53	0.9	2.2	N/A	N/A	N/A
04/03/18	1.28	0.7	2.2	0.80	1.1	1.7	0.18	1.4	3.0	0.50	0.7	2.6	0.23	1.4	2.6
05/02/18	1.41	1.2	2.2	1.00	1.1	1.7	0.19	0.7	2.7	0.44	0.6	1.9	N/A	N/A	N/A
05/11/18	2.28	1.8	2.8	1.52	2.0	2.2	0.53	3.3	5.3	0.61	0.9	2.5	0.51	2.8	2.8

4.0 SANITARY SEWER SYSTEM MODEL DEVELOPMENT

A new model was created by importing the Township's GIS database and utilizing record drawings to fill in gaps. The model was created using Innovyze's InfoSWMM version 14.6, which is compatible with EPA SWMM version 5.1. While the InfoSWMM interface is proprietary, the hydraulic and hydrologic calculations are completed in the well-recognized, industry standard EPA SWMM calculation engine. The model represents the hydraulic and hydrologic conditions that currently exist in the system.

4.1 HYDRAULIC DEVELOPMENT

The dynamic wave routing method was used to calculate the sewer flows and depths in location and time. This method solves the complete one-dimensional St. Venant equations, which account for flow volume continuity and flow momentum. The dynamic wave routing method is required to represent surcharged and pressurized flow, backwater effects, storage in the pipe network, and networks that have parallel sewers, many of which exist in Northfield's sewer system.

4.1.1 Modeled Network

The same sewer network was actively modeled in the calibration and design storm simulations representing the existing conditions. All pipes and manholes in the system are included in the base model, but only sewers downstream of flow meters, or trunk sewers tributary to those meters, are active during the model simulations for these reasons:

- to limit the number of flow inputs to a reasonable number
- not to extrapolate flows too far from the metered data
- to reduce simulation time

For the most part, only local sewers in upstream locations were not actively modeled. Sewers within Green Oak Township were not actively modeled since neither GIS records nor as-built drawings were available for portions of Greek Oak Township, and parcel data were not available. Approximately 36 percent of the sewers and force main by length (80,000 feet out of 224,000 feet) are active during the model simulations.

Pump station force mains were broken into lengths of approximately 500 feet or less to improve model accuracy. They were also broken at high points and low points to account for the largest static lift and highest pressures, respectively.

4.1.2 Pump Station Controls

All fifteen of the pump stations that Northfield Township owns and operates were included in the base model. Of these, seven are active in the calibrated model. The Eight Mile Road, East Shore Drive No. 1, Lake Point Drive, Horseshoe Lake No. 1, Horseshoe Lake No. 2, Horseshoe Lake No. 3, and North Territorial Pump Stations were included in the active model because they are downstream of actively modeled sewers. At the time of calibration, there was no pump curve or pump on/off settings available for the Lake Point Drive Pump Station. Therefore, this pump station was modeled as an ideal pump, meaning that its pumping rate always matches the influent flow rate. The other six pump stations were modeled based on their firm capacity; that is, with its largest pump out-of-service.

4.1.3 Boundary Condition at WWTP

Influent flow and depth data for the WWTP during the flow monitoring period was not available for use during model development. Therefore, a free outfall was assumed at the WWTP during the model calibration and design storm simulations. The boundary condition is not expected to impact that recommendations if the HGL at the discharge remains within four feet of the pipe crown.

4.1.4 Roughness Coefficients

The depth of the flow was calibrated by changing the Manning roughness coefficients of the sewers. Typically accepted Manning roughness coefficients by pipe material were used where no depth data were available for calibration. These typical values are shown in Table 4-1.

Table 4-1: Typical Pipe Roughness Coefficients

Pipe Material	Manning Roughness Coefficient		Pipe Material	Manning Roughness Coefficient
cast iron	0.012		plastic	0.010
concrete	0.013		vitrified clay	0.014
ductile iron	0.013		unknown	0.013

4.2 HYDROLOGIC DEVELOPMENT

After the model network was built, the system hydrology was developed using the data collected during the flow monitoring period. Volume and flow rate were developed for both dry and wet weather flows at each flow monitoring location.

4.2.1 Development of Dry Weather Flows

Dry weather flows for the model were developed by determining periods of dry weather flow using the Environmental Protection Agency's Sanitary Sewer Overflow Analysis and Planning (SSOAP) toolbox. The toolbox was then used to create average weekday and weekend dry weather flow patterns. The dry weather flow patterns created in SSOAP for each meter were entered directly into the model as a time series.

The same dry weather flow pattern was used for the calibration and design storm simulations because it is assumed that the variation in dry weather flows throughout the year (estimated to be approximately 0.2 MGD) is insignificant compared to the wet weather response.

4.2.2 Development of Wet Weather Flows

Wet weather flows were characterized in SSOAP by bounding rainfall events, from the beginning of the rainfall to the end of the wet weather response, and subtracting the average dry weather flow pattern from the measured hydrograph. The remaining portion of the hydrograph is considered the wet weather response.

After the wet weather portions of the measured hydrographs for each storm event were created in SSOAP, unit hydrographs, normalized by rainfall and area, were developed to describe the shape of the measured wet weather hydrograph. Although the unit hydrographs were developed from smaller, more frequent storms, there is assumed to be a linear relationship between the flow rate and rainfall. Therefore, the unit hydrograph is scalable to larger, more infrequent storms like the 25-year, 24-hour design storm. For example, if the distribution of the rainfall is held constant, twice the rainfall doubles the wet weather flow response. Rainfall abstractions are entered into the model to prevent the initial rainfall from creating a wet weather response in the sewer and were used where necessary to match the rising limb of the hydrograph.

The hydrologic methodology defines variables for three unit hydrographs, which when multiplied by the rainfall at each time increment and added together generate the hydrograph flow rate for each time increment of rain. The series of these flow rates at each time increment of rain produce the wet weather hydrograph. The values of the RTK variables that are used to describe the unit hydrographs were first identified using SSOAP, and then refined in the model until the wet weather volume and the peak wet weather flow rate matched the measured values reasonably well.

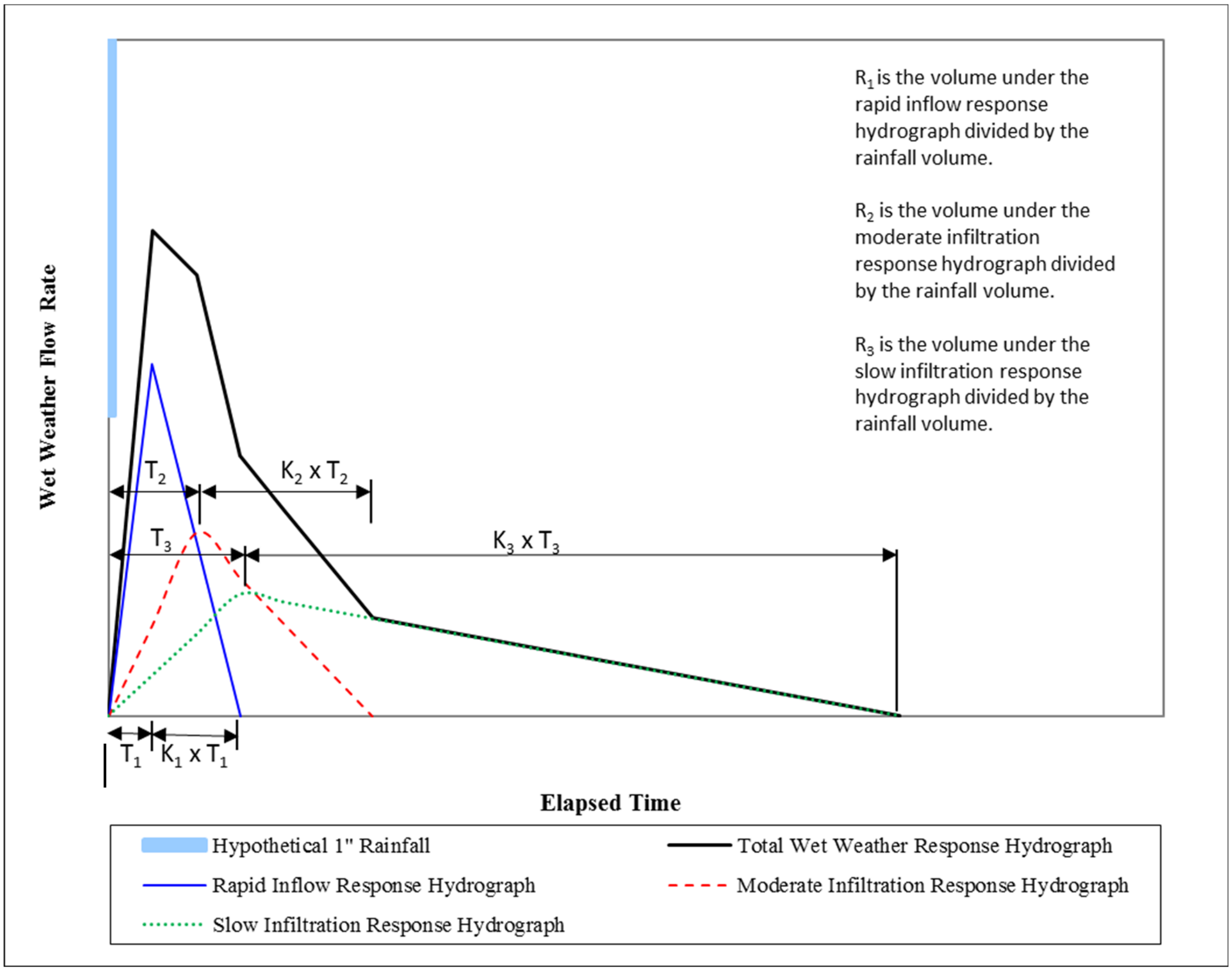
The unit hydrographs represent three hydrograph phases:

- Rapid inflow response (e.g. direct connections to the sewers, such as downspouts and catch basins)
- Moderate infiltration response (e.g. inflow from footing drains)
- Slow infiltration response (e.g. infiltration from sources such as manhole and sewer defects and footing drains)

Each unit hydrograph can be described by three variables, producing a total of nine variables for each flow monitoring location. Figure 4-1 shows a schematic of the unit hydrograph phases and variables, including:

- Fraction of rainfall captured, R
- Time to peak (in hours), T
- Ratio of the recession limb time length to the time to peak, K

Figure 4-1: Schematic of Unit Hydrograph Phases and Variables



4.2.3 Growth

Additional flow from projected future development was added to the model for existing and proposed conditions when developing recommendations. The additional flows from the projected developments were added at the magnitude and locations described in the *Northfield Township WWTP Capacity Evaluation Report* (dated March 18, 2015) or the Technical Memo from Tetra Tech to Northfield Township dated March 22, 2016. This growth represents projected developments in the Township's master land use plan. The total average day flow rate at the WWTP is expected to increase by 1.01 MGD due to projected growth.

The model applies a diurnal pattern, which was based on flow monitoring data from FM-03, to represent dry weather flows from areas of projected future development. The peak hourly dry weather flow at this location was 1.5 times the average dry weather flow. Wet weather flow from new development is assumed to be negligible within the Township's planning period, although this cannot be guaranteed.

4.3 RAINFALL

Two sets of rainfall were simulated in the model. First, the measured rainfall for the flow monitoring period was used in the simulations to calibrate the model. Second, existing system performance and alternatives were evaluated using the prescribed 25-year, 24-hour design storm in the State's SSO policy.

The 25-year, 24-hour design storm is defined by MDEQ to be 3.90 inches. The Soil Conservation Service (SCS) Type II rainfall distribution was used to distribute the rainfall because it combines the rainfall volume with a conservative peak rainfall intensity in the same event. With the SCS Type II distribution, 44 percent of the total rainfall volume (1.71 inches during the design storm) falls during the peak hour. More recent rainfall statistical analyses, such as the National Oceanic and Atmospheric Administration's (NOAA) Atlas 14, have rainfall distributions that are less intense, but more representative of actual rainfall patterns. NOAA Atlas 14 rainfall distributions require multiple permutations and simulations of design rainfall events to find the one that produces the largest peak flow rate.

4.4 CALIBRATION

Calibration is the process of adjusting the model inputs, so that the model results reasonably match the measured data. Dry and wet weather volume and flow rate were calibrated in that order, followed by the calibration of the flow depth.

4.4.1 Dry Weather Calibration Results

Measured and modeled flows for a dry, one-week period in July 2018 (July 3 through July 9) were compared as a sample of the quality of the dry weather flow calibration. This was one of only two weeks of continuous dry weather during the flow monitoring period, both of which occurred during July 2018.

The dry weather calibration at each meter location was considered satisfactory when, on average:

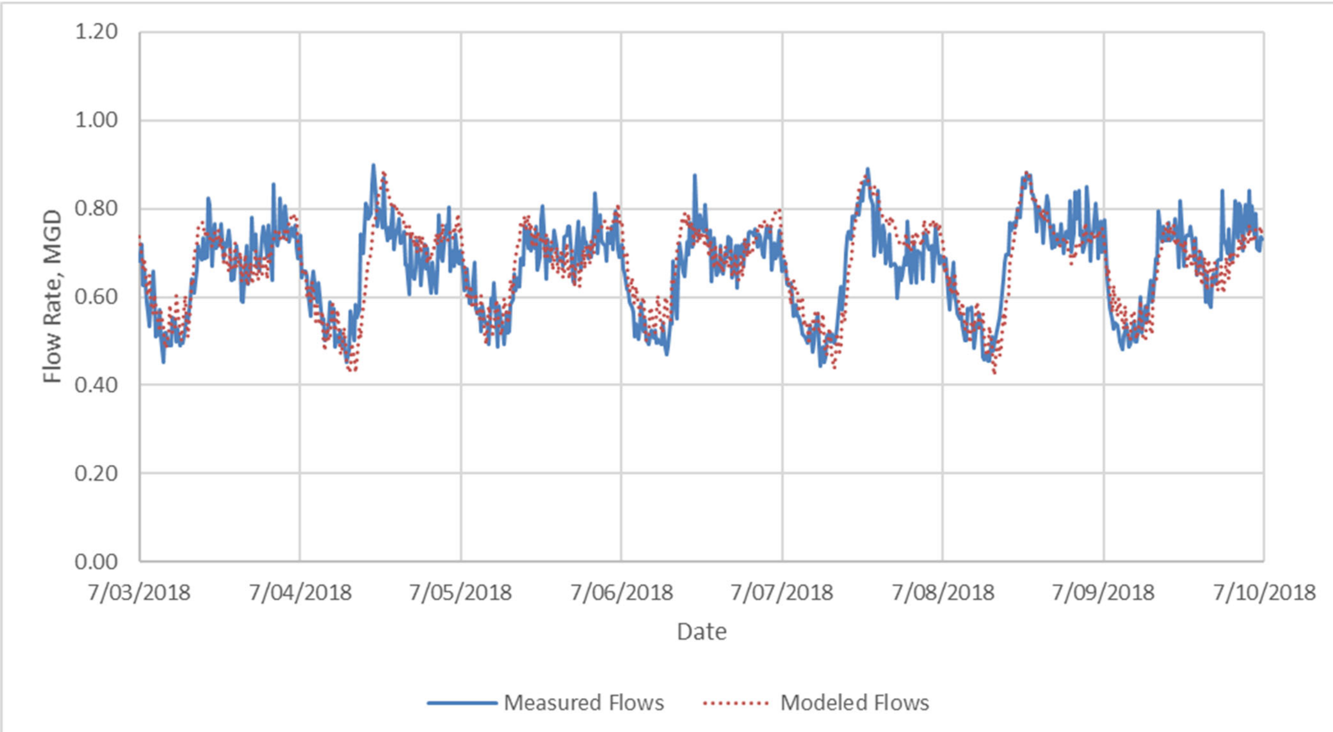
- The modeled dry weather volume (represented by the average dry weather flow rate) is +20 to -10 percent or within +/- 0.05 MGD of the measured dry weather volume.
- The modeled average of the daily peak and minimum hour dry weather flow rates are +25 to -15 percent or within +/- 0.05 MGD of the measured average of the daily peak and minimum hour dry weather flow rates.
- The modeled diurnal pattern is qualitatively similar to the measured pattern.

Table 4-2 shows how the modeled average, peak, and minimum flows compared to the measured flows. A visual comparison of the measured and modeled dry weather flow pattern at FM-01 is shown in Figure 4-2. Plots of the dry weather period used for calibration for all meters are shown in Appendix B.

Table 4-2: Dry Weather Calibration Summary for July 3-9, 2018

	Average Dry Weather Flow (MGD)		Average of Daily Peak Hour Flow (MGD)		Average of Daily Minimum Hour Flow (MGD)	
Meter	**Measured**	**Modeled**	**Measured**	**Modeled**	**Measured**	**Modeled**
FM-01	0.67	0.67	0.70	0.70	0.42	0.43
FM-02	0.49	0.46	0.52	0.50	0.30	0.28
FM-03	0.12	0.12	0.13	0.12	0.07	0.08
FM-04	0.17	0.16	0.19	0.18	0.10	0.09
FM-05	0.08	0.08	0.10	0.11	0.04	0.03

Figure 4-2: Measured and Modeled Dry Weather Flow Hydrograph at FM-01 from July 3 to July 10, 2018



Overall, the model matches the measured dry weather flow rates and volumes well, as can be seen in the plots in Appendix B. However, in general, the modeled dry weather flows are noisier than the measured, except at FM-03. This is because FM-03 is the only meter with no modeled upstream pump stations.

4.4.2 Wet Weather Hydrologic Inputs

The model contains one set of wet weather hydrologic (RTK) variables at each metered location which was identified to represent the wet weather response during both the dormant (spring) and growing (summer) portions of the flow monitoring period. Because one set of hydrologic variables was able to represent the wet weather response from March through July, this set of variables was entered into the model for all twelve months of the year. Because both the 2017 and 2018 flow monitoring periods extended only from spring until mid-summer, these parameters may or may not represent actual conditions that occur during other months of the year. The calibration may also need to be adjusted as the system ages, changes are made to the system (such as sewer replacements or infiltration and inflow (I/I) removal), or as development occurs.

Table 4-3 shows the calibrated total R values, or rainfall capture percentages, for each meter during the flow monitoring period. The total R value represents the rainfall-weighted average fraction of rainfall that is converted to flow in the model upstream of each metered location. The area-weighted rainfall capture for the entire sewer system was approximately 1.4 percent of the total design storm rainfall volume.

Table 4-3: Wet Weather Unit Hydrograph Inputs

Subarea Applied	Response Type	Initial Abstraction (inches)	Capture, R (gallon / gallon)	Time to Peak, T (hours)	Ratio of Recession Limb to Time to Peak, K
FM-01	Rapid Inflow	N/A	0	N/A	N/A
	Moderate Infiltration	N/A	0	N/A	N/A
	Slow Infiltration	0.15	0.0026	6	13
FM-02	Rapid Inflow	0.12	0.0022	2	3
	Moderate Infiltration	0.12	0.0047	4	2
	Slow Infiltration	0.12	0.0344	11	12.5
FM-03	Rapid Inflow	0.40	0.0080	2	2
	Moderate Infiltration	0.40	0.0030	4	2
	Slow Infiltration	0.40	0.0430	4	20
FM-04	Rapid Inflow	0	0.0007	1	3
	Moderate Infiltration	0	0.0006	3	3
	Slow Infiltration	0	0.0083	4	21
FM-05	Rapid Inflow	0.12	0.0030	2	3
	Moderate Infiltration	0.12	0.0010	4	2
	Slow Infiltration	0.12	0.0380	10	12

4.4.3 Wet Weather Calibration Results

The hydrologic variables presented in the previous section were only arrived at after adjusting them until a satisfactory representation of the measured flow volumes and rates was achieved. The wet weather calibration at each meter location was considered satisfactory when, on average:

- The modeled wet weather volume is +20 to -10 percent or within +/- 0.1 MG of the estimated wet weather volume from the measured data.
- The modeled peak wet weather flow rate is +25 to -15 percent or within +/- 0.1 MGD of the estimated wet weather flow rate from the measured data.
- The timing of the modeled peaks matches the timing of the measured peaks.

These calibration metrics are based on industry standard recommendations from the Wastewater Planning Users Group (WaPUG).

The overall results of the calibration are assessed by comparing the model predicted wet weather flow and volume to the calibration tolerance presented above. A trend line through the calibration results should be within the calibration tolerance. A perfect calibration would have a trendline slope of one (1), and a y-intercept of zero (0) and all individual events falling within the calibration tolerance, or WaPUG limits. A good calibration is likely to have individual events that are both under- and over-estimated. The calibration plot for FM-01, shown in Figure 4-3, is an example of a well-calibrated site. The trendline (i.e. “Average”) slopes for both peak flow and volume are close to one, and the intercepts are close to zero. Similar calibration plots for all the meters are provided in Appendix B. For all sites, outlier events are identified that are not used in the calibration. Outliers are explained in Section 4.4.4.

It is more important that the largest events be well-calibrated (i.e. fall within the calibration parameters) in the model because the calibrated model will be used to simulate the peak flows from large design storms to assess pipe capacity. Over- or under-estimating small events typically does not impact recommendations in separate sanitary sewer systems. As shown in Figure 4-3, the event that caused the largest volume and peak flow rates at the site (Event #15 beginning on May 11, 2018) is well calibrated because it plots near the 1:1 calibration line. It is acceptable to have individual events outside of the calibration tolerance if the average of all the events is within tolerance.

The measured and modeled hydrographs for the May 11, 2018, event at FM-01 are shown in Figure 4-4 as a visual comparison of modeled and measured flow rates for a single event. Overall, the model matches the measured hydrograph well. Appendix B includes plots of the measured and modeled hydrographs for calibrated events for all meters.

Figure 4-3: Measured versus Modeled Peak Flow Rates and Volumes for FM-01

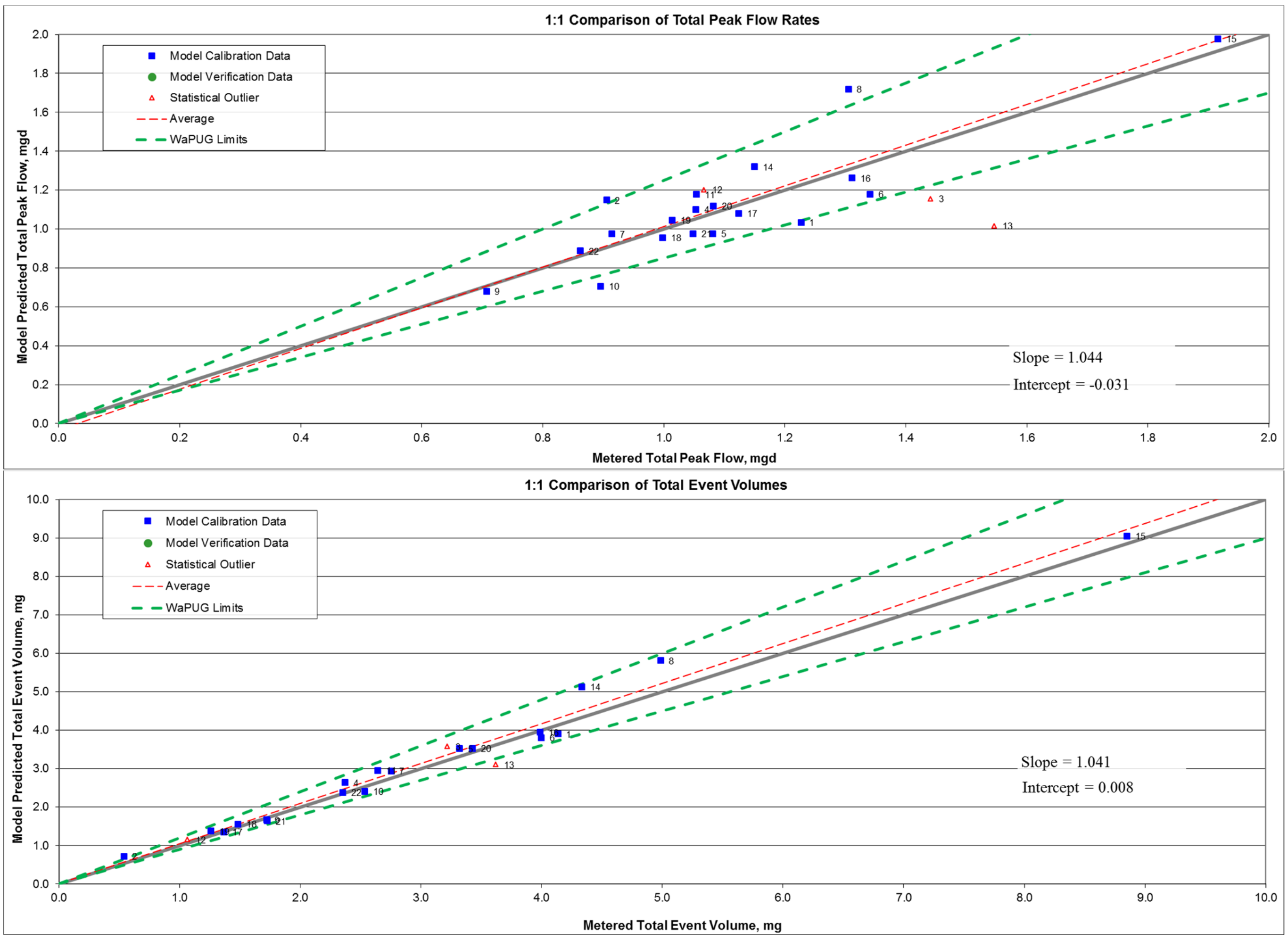
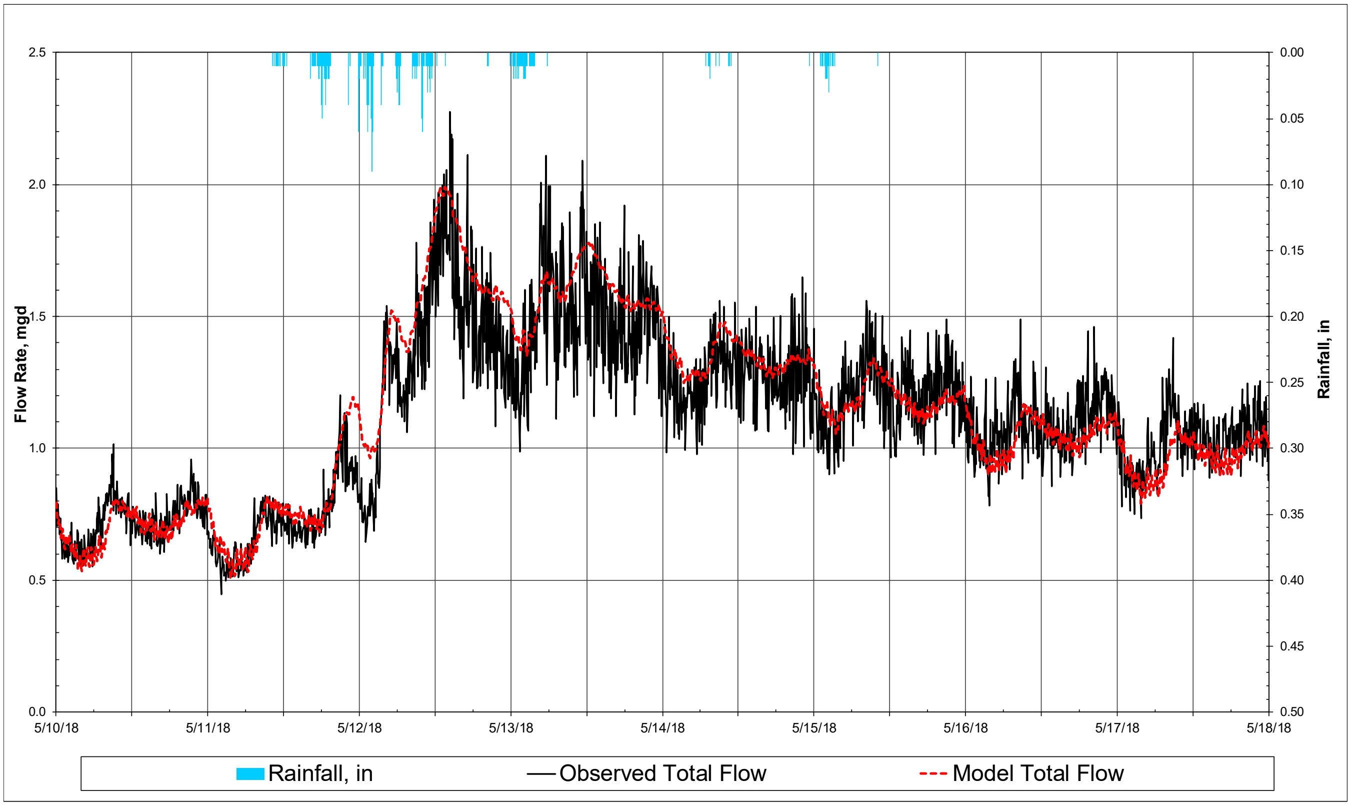


Figure 4-4: Measured and Modeled Hydrographs for May 11-15, 2018 Rainfall at FM-01



4.4.4 Site and Event Outliers

The wet weather flow calibration criteria were met at all the meter locations for both volume and peak flow. Important comments on the wet weather calibration include the following items:

- Three events were consistently not used in the calibration process at any of the five metered locations. The first of these excluded events was April 20, 2017, during which the rain gage appeared to have been clogged. The rainfall volume appeared reasonable compared to other regional rain gages, but its distribution was relatively constant and drawn out, as is typical when an obstruction is present in the throat of the rain gage. The second and third of these excluded events were April 14 and 15, 2018. These two events, on consecutive days, contained snow and hail. These types of precipitation typically exclude an event from calibration because they contribute to I/I at a delayed rate, which cannot be correlated to rainfall since the timing of snow and hail melt is unique to each event.
- Total wet weather volumes and peak flows were calibrated rather than only the wet weather component of these flows for two reasons. First, the system contains many pump stations, which made the subtraction of the simulated dry weather flow from the total flow to get the wet weather flow impossible because the timing of the peaks and valleys during each simulation were offset (i.e. the pumps did not start and stop at the same times in both simulations due to the inherent differences in flow). The subtraction of noisy dry weather flows from noisy total wet weather flows tended to create a wide variation in wet weather component peak flows. Second, the peaking factors at the metered locations tended to be rather low. In a system with much higher peak flows during wet weather than during dry weather, the noisiness in the dry weather flow would have had less of an effect on the wet weather component peak flows calculated by subtraction. When averaged to peak hour flows, each site's total peak flows were well-calibrated.

4.4.5 Flow Depth Calibration Results

Calibrating depth is important for evaluating the hydraulic grade line. The depth was calibrated by comparing the maximum measured depth resulting from a wet weather event to that event's maximum modeled depth. The depths were modified in the model by adjusting pipe roughness coefficients if the data did not meet the following criteria:

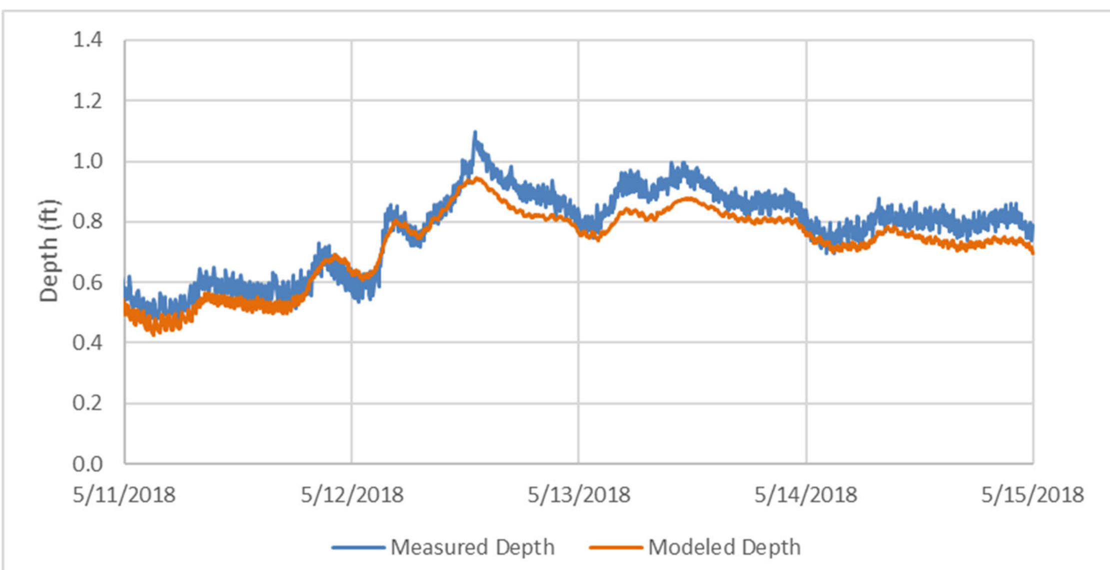
- If the measured depth is not surcharged, the modeled depth should be within +/- 0.33 feet.
- If the measured depth surcharges the pipe, the modeled depth should be in the range of -0.33 feet to +1.5 feet.

At each site, the depth was validated for a rainfall event where the measured and modeled peak flow rates were similar to reduce the impact of differences in flow rate. Since flow rates were most accurately calibrated for the largest event, May 11, 2018, this event was used to validate flow depths. As Table 4-5 shows, the modeled depths are within calibration limits at all meter locations. An example of the modeled and measured depths at FM-02 are shown in Figure 4-5.

Table 4-4: Wet Weather Depth Calibration Summary

Meter	Rainfall Event	Surcharged	Maximum Measured Depth (feet)	Maximum Modeled Depth (feet)	Modeled – Measured Depth (feet)
FM-01	May 11, 2018	no	1.00	0.82	0.18
FM-02	May 11, 2018	no	1.10	0.94	0.16
FM-03	May 11, 2018	no	0.46	0.48	-0.02
FM-04	May 11, 2018	no	0.43	0.31	0.12
FM-05	May 11, 2018	no	0.36	0.44	-0.12

Figure 4-5: Measured and Modeled Depth for May 11, 2018, Event at FM-02



4.5 CALIBRATION ASSUMPTIONS AND LIMITATIONS

The model is well calibrated for its intended purpose of evaluating the hydraulics of the collection system during the design storm, but there are still several assumptions that fill in gaps in the available data or improve the model simulation (e.g. reduce calculation instabilities). The assumptions and limitations of the model are listed below.

- Although the calibration parameters were calibrated to both dormant and growing seasons spanning from March through July, they could not be verified to be calibrated to flow from the other (fall and winter) months. They should be reviewed if a year-round simulation is to be completed in the future. Additional flow monitoring may be warranted for such work.
- One of the seven actively modeled pump stations, Lake Point Drive, was modeled as an ideal pump. This means that the pumping rate equals the influent flow rate. Pump cycling time cannot be modeled with an ideal pump, and peak discharges in the model may not match actual pumping rates.
- The flows in the unmetered, southern-most portion of the collection system near North Territorial Road were estimated. The base wastewater flow was assumed to be 260 gallons per day per REU, distributed hourly based on the diurnal pattern observed at meter FM-03. The GWI was assumed to be one-half of that measured from the directly tributary area to meter FM-01, since these areas have similar lengths of sewer, but the sewers are approximately half the age. The RDII was assumed to be zero, since the sewers are relatively new and the area next farthest from a lake (that of FM-01) had nearly zero RDII.
- The flow pumped from the Michigan Department of Transportation (MDOT) rest area south of the collection system was assumed to average 100 gallons per hour. This flow was entered into the force main discharge manhole.
- The flows are well-calibrated at the flow monitoring locations. Upstream of these locations, the flows are estimated based on distributions of flow components. Base wastewater flow (BWWF) was distributed to upstream nodes based on population. Dry weather ground water infiltration (GWI) and wet weather inflow and infiltration (I/I) were distributed based on the length and diameter of sewers, since longer and larger sewers provide more opportunity for defects.

  Green Oak Township's flow contributions were entered at the two most upstream nodes in Northfield Township, one on either side of Whitmore Lake. On the west side of the lake, approximately eighty percent of the wet weather flow at meter FM-03 is assumed to be originating in Green Oak Township, based on its fraction of the total population and sewers. This assumption may not be accurate because while the model is well-calibrated at meter FM-03, the distribution of flows upstream of the meter are not precisely known. If the assumption is not correct, the model-predicted peak flows in the sewer along North Main Street, just south of Green Oak Township, may be overly conservative, and there may be one or more significant I/I sources upstream of meter FM-03.

  The model predicts a peak flow from the calibration period of 0.46 MGD on North Main Street where the sewer enters Northfield Township, and a peak flow of 0.57 MGD at downstream meter FM-03. While it is reasonable that the peak flows at a location downstream of eighty percent of the area, population, and sewer length would be approximately eighty percent of the peak flow at meter FM-03, it seems unusually high considering that the vast majority of flow entering Northfield Township at this location must pass through the Main Street Pump Station, which is reported by Northfield Township to have a firm pumping capacity of only 100 gpm, or 0.14 MGD.

  It is therefore recommended that the actual pumping capacity of the Main Street Pump Station be confirmed by a fill-draw test. If it is determined to be low enough to limit the peak flow from Greek Oak Township, then a significant I/I source would be suspected between the pump station and FM-03. Follow-up investigation (i.e. flow monitoring, smoke testing, and/or televising) would be recommended to locate any such sources. Also, the peak flows and resulting maximum HGL along the modeled sewer upstream of FM-03 would be overly conservative.

4.6 CALIBRATION CONCLUSIONS

The model is calibrated for planning uses in the trunk sewers that were modeled. For all the flow monitoring locations, the model results are within the calibration tolerances for volume, flow rate, and flow depth.

5.0 SANITARY SEWER SYSTEM CAPACITY ANALYSIS

The capacity analysis uses the dry weather flows measured during the 2018 flow monitoring period and the calibrated RTK parameters to describe the wet weather flow response during the 25-year, 24-hour design storm. The 2018 dry weather flows were selected because they were more conservative (i.e. greater) than those of the 2017 monitoring period.

5.1 LEVEL OF SERVICE

Level of service is a measurement of the quality of the service provided by the collection system and individual sewers. The level of service may consist of multiple elements, but this report focuses on the hydraulic level of service. The hydraulic level of service is commonly defined by the design storm that the sewers can convey.

The Northfield Township sanitary sewer collection system must transport and treat without overflow the 25-year, 24-hour design storm, as required by the State of Michigan. Therefore, the 25-year, 24-hour design storm is the level of service provided by the Township's collection system. The Township considers basement flooding to be an overflow, so sanitary sewers that are projected be surcharged to the typical level of basements do not meet the Township's level of service.

The capacity analysis was used to identify reaches of sewer that do not meet the targeted level of service, particularly where the nominal (full flow) pipe capacity is less than the predicted design storm peak flow rate and / or significant surcharging occurs. A distinction is made between manholes that surcharge more than 10 feet below the ground surface, manholes that surcharge within 10 feet of the ground surface, and manholes that may have surface flooding. The distinction allows for the asset management program to distinguish consequences of failure.

The model is a representation of the collection system and the data available, so surface flooding and basement backups could still occur along sewers projected to have adequate capacity. Structural or maintenance failures are other factors that contribute to basement and surface flooding that cannot be predicted by the model.

5.2 CAPACITY ANALYSIS FOR EXISTING CONDITIONS

During the 25-year, 24-hour design storm, approximately 17 percent of the sanitary sewers had a projected peak flow greater than the nominal capacity of the sewer, and about 29 percent of manholes surcharged within 10 feet of the ground surface. Table 5-1 shows the total number of sewers with a nominal capacity less than the projected peak flow rate and the number of manholes that surcharged or flooded during the simulation. A map showing the capacity of the sewers relative to the projected design storm peak flow rate along with manholes projected to surcharge and flood is shown in Figure 5-1. The projected design storm peak flow rates and the nominal capacity are shown in Table 5-3 for major trunk sewers.

Table 5-1: Summary of Projected Pipe Capacity, Surcharging, and Flooding during 25-year, 24-hour Design Storm for Existing Conditions

Total Length of Modeled Gravity Sewer, feet	Length of Sewer with Projected Peak Flow Greater than Nominal Capacity, feet	Total Number of Modeled Manholes	Manholes Projected to Surcharge	Manholes Projected to Surcharge within 10 feet of Ground Surface	Manholes Projected to have Surface Flooding
52,100	8,700 (17%)	222	84 (38%)	65 (29%)	1 (0.5%)

Hydraulic profiles of major sewer branches are provided in Appendix C. The profiles are useful in evaluating risk of surcharging and surface flooding because they show the elevation of the hydraulic grade line relative to the sewer and the ground surface. The profiles show the maximum hydraulic grade line (HGL) projected during the 2017 flow monitoring period and the 25-year, 24-hour design storm simulation. The maximum HGL during the 2017 flow monitoring period is an example of the HGL during more frequent, but less intense rainfalls.

A single segment of sewer that has a capacity less than the design storm peak flow rate is not likely to cause basement backups or overflows from the system because the surcharge is often limited to a small distance above the pipe crown. When the capacity limitations extend along several segments of sewer there is greater risk for basement backups or overflows. A list of findings from the 25-year, 24-hour design storm simulation for each trunk sewer is provided below.

- Along the downstream interceptor, the sewer is not projected to have enough capacity to convey peak flows from Brookside Drive (where flow from the East Shore Drive PS No. 1 crosses the railroad track and enters the interceptor) to the Eight Mile Road Pump Station. The resultant surcharging extends along the interceptor and upstream, farther north than Main Street at Cove Circle, and farther south than Main Street and Jennings Road. The risk of basement flooding is highest in the lowest-lying areas between Main Street and Barker Roads, specifically on Main Street at Jennings Road, at the north end of Brookside Drive, and at two other low-lying areas between Brookside Drive and Barker Road.
- The model predicts that a few reaches of sewer upstream of FM-03, along the west side of Whitmore Lake, are slightly under capacity. The most significant such reach is the most upstream modeled reach along North Main Street, the only reach of modeled sewer entirely within Green Oak. Since the sewers upstream of this were outside Northfield Township, where as-built drawings and parcel boundaries were not consistently available, it is not known whether additional reaches of sewer upstream of this point may also have inadequate capacity and/or surcharging. The surcharging along North Main Street and downstream to meter FM-03 is primarily due to the lack of capacity of the interceptor downstream, not local lack of capacity.
- Two of the six modeled pump stations could not be evaluated for capacity during the design storm, since no pump curve was provided; these were assumed to have adequate capacity. Of the other four modeled with pump curves, which were evaluated for capacity, three were found to have adequate capacity to pump the peak design storm flow rates. The exception was Horseshoe Lake Pump Station No. 1. To calibrate the peak flows at this location, a loss coefficient of 60 had to be added to the force main entrance to lower the modeled peak flows enough to match the measured peak flows immediately downstream at FM-05. This unusually high energy loss could represent an obstruction in the force main or a partially closed valve at the pump station. Whatever the source of the hydraulic loss, it was assumed to remain present in the existing design storm simulation. The result was that the pump station could not pump the design storm peak flow without backing up the flow behind the station. The model predicts that the flows would surcharge to the point of surface flooding on Shady Beach Drive one reach east of Main Street. Basements would be at risk of flooding along Shady Beach Drive as far upstream as Horseshoe Lake Pump Station No. 2.

5.3 CAPACITY ANALYSIS WITH PROJECTED GROWTH

Additional flow from projected development was added to the model for existing conditions to assess if it would cause additional capacity concerns. Projected growth within the existing service area was included using the values presented in studies completed for the Township since 2015. The values from these studies are shown in Table 5-3. The additional projected average flow rate due to growth is 1.01 MGD. This represents 1.4 times the existing average dry weather flow rate (0.7 MGD), or approximately 31 percent of the existing projected 25-year, 24-hour design storm peak hour flow rate, at the WWTP (3.3 MGD).

Table 5-2: Projected Future Development Flow Rates

Area	Future Development Area (acres)	Future REUs	Average Daily Flow (MGD)
Green Oak Twp. around Whitmore Lake (west)	N/A	52	0.014
Green Oak Twp. around Whitmore Lake (east)	N/A	52	0.014
Green Oak Twp. west of US-23	N/A	769	0.200
Kelly Farm	39	123	0.032
Leland Farm	171	547	0.142
North Territorial SAD	595	1620	0.421
Seven Mile Road	120	386	0.100
Whitmore Lake Road SAD	116	76	0.020
Wildwood	79	253	0.066

† This is the outfall manhole, which represents the WWTP. It was assumed that the Green Oak Township development west of US-23 would utilize future sewers and pump stations not currently in the model.

A map showing the capacity of the sewers relative to the projected future design storm peak flow rate along with manholes projected to surcharge and flood is shown in Figure 5-2. The projected design storm peak flow rates and the nominal capacity are shown in Table 5-3 for major trunk sewers. There are two primary areas with surcharging that is worsened by projected growth, including:

- Along the downstream trunk sewer, and tributary upstream sewers along Main Street, North Main Street, and Ash Drive.
- Along the west side of Whitmore Lake. Since some of the modeled sewers on the west side of Whitmore Lake were conveying existing peak flows near or at capacity, the small amount of projected growth in Green Oak Township on the west side of Whitmore Lake causes a slight surcharge along this reach even if additional downstream conveyance capacity was provided.

Future growth does not warrant any additional improvements beyond those recommended to accommodate existing peak flows. This is because most of the projected growth is expected to occur either:

- at the southern end of the system tributary to the North Territorial Road Pump Station, which has adequate capacity for this growth, or
- at the northwestern end of the system, directly tributary to the WWTP. Flows from these developments would not utilize any of the existing sewers or pump stations, but would need new sewers and pump stations to be constructed.

Table 5-3: Sewer Capacity and Peak Flow Rates

Sewer Seg-ment†	Sewer Reach	Pipe Dia-meter (in)	Nominal Capacity Range (MGD)	Peak Flow Rate for Existing Conditions (MGD)	Peak Flow Rate with Projected Growth (MGD)
A	Barker Rd to Eight Mile PS	18	2.7	3.3††	3.5††
B	Barker Rd across US-23	18	2.4-2.7	3.2††	3.4††
C	Barker Road to East Shore Drive (extended)	15	1.4-1.8	2.0††	2.2††
D	East Shore Drive (extended) west of Main Street	12	1.0-1.2	0.9	1.1
E	East Shore Drive east of Main Street, to East Shore Drive PS No. 1	12	1.0-3.0	0.9	1.1
	East Shore Drive from county line to East Shore Drive PS No. 1	12	0.8-1.5	0.4	0.5
	Seven Mile Rd one-quarter mile north of Donna Ln to East Shore Drive	8-12	0.5-1.5	0.04	0.2
	Main St at Jennings Rd, along Brookside and railroad, to Barker Rd	15	1.4-2.0	2.1††	2.2††
	Main St from Greenland Dr to Jennings Rd	12	0.6-2.3	0.7††	0.8††
	Horseshoe Lake PS No.2 to Horseshoe Lake PS No. 1	10-12	0.8-1.6	0.5††	0.5††
	Horseshoe Lake PS No. 3 to Horseshoe Lake PS No. 2	10	0.6-0.9	0.3	0.3
	North Territorial east of Whitmore Lake Rd to North Territorial Rd PS	12-30	1.1-33.5	0.1	0.9
	Barker Rd from Whitmore Lake Elementary School to Jennings Rd	10	0.6-1.4	0.1	0.2
	North Main St south of Fulton to Barker Rd	10-12	0.7-1.4	1.3	1.3

† From Table 2 of the March 22, 2016 memorandum.

†† The model projects upstream flooding, which attenuates the peak flow rates relative to a non-flooding condition.

Figure 5-1: Sanitary Sewer Capacity Analysis for Existing Conditions for 25-year, 24-hour Design Storm

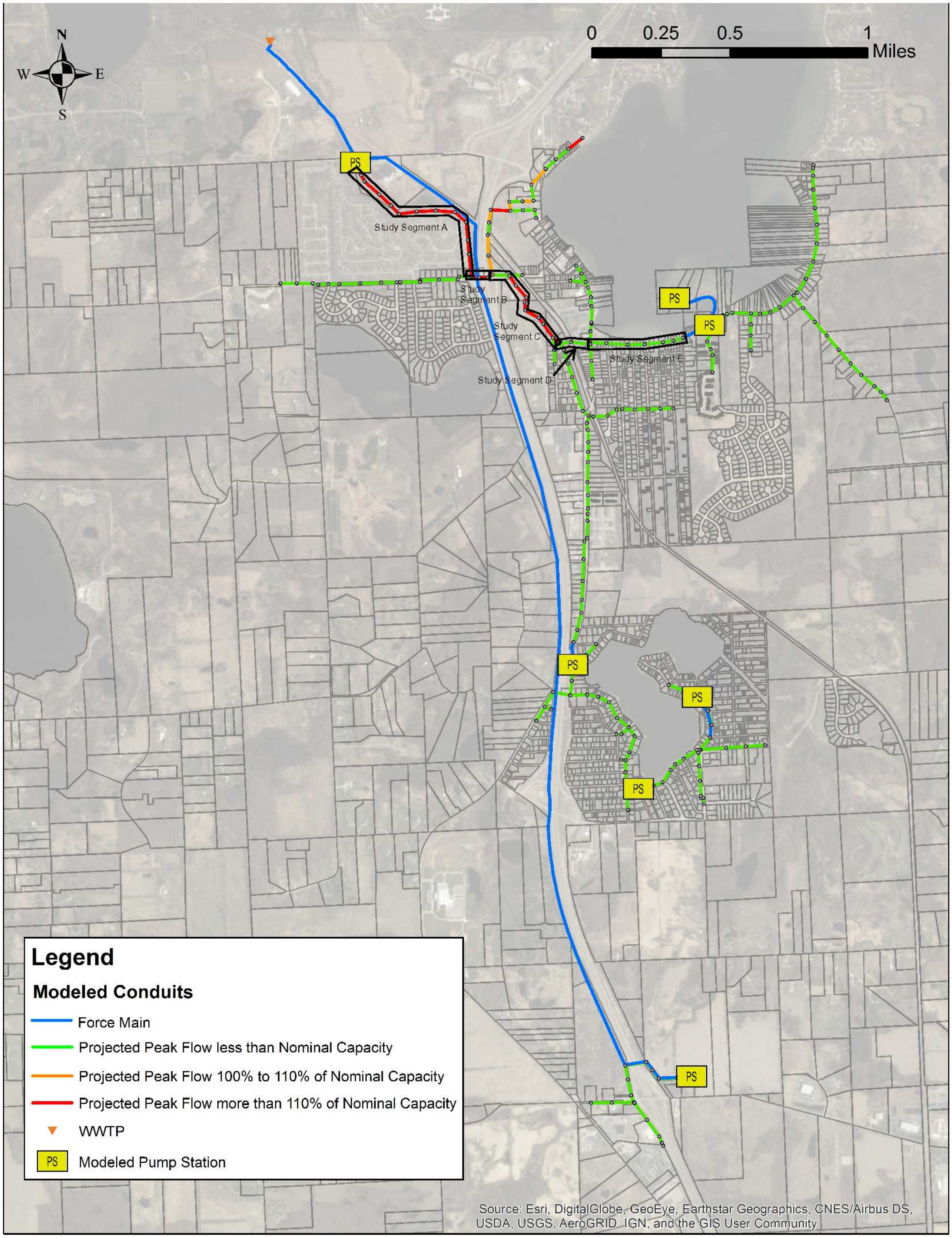
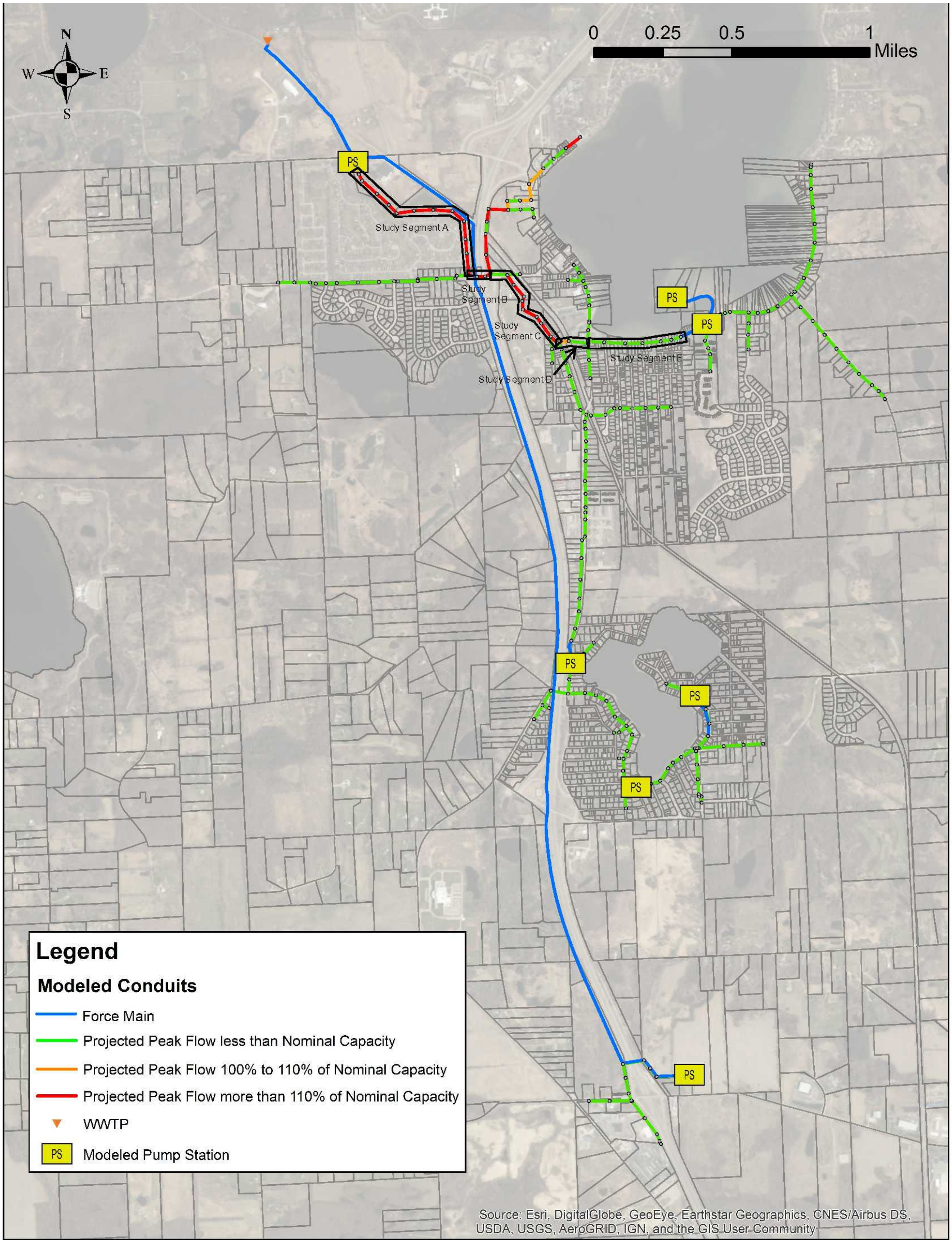


Figure 5-2: Sanitary Sewer Capacity Analysis with Projected Growth for 25-year, 24-hour Design Storm



5.4 WASTEWATER TREATMENT PLANT

Storage at the WWTP was evaluated in 2015 with flow monitoring data collected at the WWTP using two approaches identified in the State of Michigan's SSO Policy. The first, summarized in the *Northfield Township WWTP Capacity Evaluation Report (March 2015)*, projected the growing season 25-year, 24-hour design storm hydrograph at the WWTP in accordance with the State of Michigan's SSO Policy. It recommended 1.7 MG of storage to accommodate peak flows from the system. The second, summarized in a Technical Memorandum dated October 12, 2015, involved completing an alternative, but more detailed, analysis involving more than fifty years of rainfall record to determine the storage required to limit overflows to no more than once in ten years. It determined that 1.5 MG of storage would meet this standard. Both analyses assumed up to 20 percent of the projected growth described in Section 5.3, or an estimated 800 REUs. Beyond 800 REUs, it was assumed that the WWTP be expanded thereby providing more treatment capacity for both dry and wet weather flows.

The previous analysis is defendable and used large storms as the basis for its projections. However, the newly developed computer model predicts a higher volume tank may be warranted. Depending upon the tank material selected, additional storage volume may be able to be added to the system with minimal additional cost. We recommend that the tank size be revisited during the design phase.

6.0 RECOMMENDATIONS

Recommendations in this report are based on modeled capacity, peak flow rate, and hydraulic grade line. Recommendations for the sanitary sewer system intend to mitigate projected SSOs and provide capacity for the 25-year, 24-hour design storm, including projected flow increases from future development.

6.1 WWTP RECOMMENDATIONS

The treatment capacity of the WWTP is less than the projected design storm peak flow rate for existing and future conditions. An equalization tank of 1.5 MG or larger is recommended to store wet weather flow until treatment capacity becomes available. This tank will allow approximately 800 REUs of new connections to be made until an improvement to the treatment capacity is needed.

The average DWF with projected growth is 1.7 MGD, up to 1.9 MGD during springtime, which is greater than the rated capacity of the WWTP. An expansion of the treatment capacity of the WWTP is recommended before average dry weather flows reach 1.1 MGD, 85 percent of the WWTP's rated capacity.

6.2 SEWER RECOMMENDATIONS

The downstream trunk sewer from Brookside Drive to the Eight Mile Road Pump Station does not have adequate capacity to convey the peak flows during a 25-year, 24-hour design storm. The model predicts surcharging within ten feet of the ground surface along this trunk sewer. The model predicts surface flooding (or SSOs) at one location upstream of Horseshoe Lake Pump Station No. 1, on Shady Beach Drive one reach east of Main Street, due to the pump station not operating at its design capacity.

The following improvements, also shown in Figure 6-1, are recommended to improve conveyance capacity during the 25-year, 24-hour design storm:

- Increase capacity between Barker Road and the Eight Mile Road Pump Station. This report outlines the construction of approximately 4,200 feet of 24-inch sewer to replace the existing interceptor in that reach. This recommendation is based on the age of the existing interceptor and the inference that it is approaching the end of its useful life. Cost analyses suggest that the cost to build a pump station and force main is nearly equivalent and may be preferred if the existing sewer is shown to be of good condition or disruption to the existing sewered alignment is not desired.
- Construct approximately 1,700 feet of 18-inch replacement sewer from the north end of Brookside Drive, at its confluence with the sewer flowing across the railroad tracks from East Shore Drive, along the west side of the railroad to Barker Road.
- Inspect the force main and pump station piping at the Horseshoe Lake Pump Station No. 1 for an obstruction or partially closed valve. Remove any obstructions and/or fully open any partially closed valves to restore this pump station to its intended pumping capacity.

This analysis and the recommended improvements assumed that the magnitude of I/I will not increase. This assumption will require the Township to be diligent in providing maintenance of the system, which may include efforts to control I/I originating on private property.

We also recommend that the Township gather additional data from the Green Oak Township sewer system so that part of the system can be added to the model.

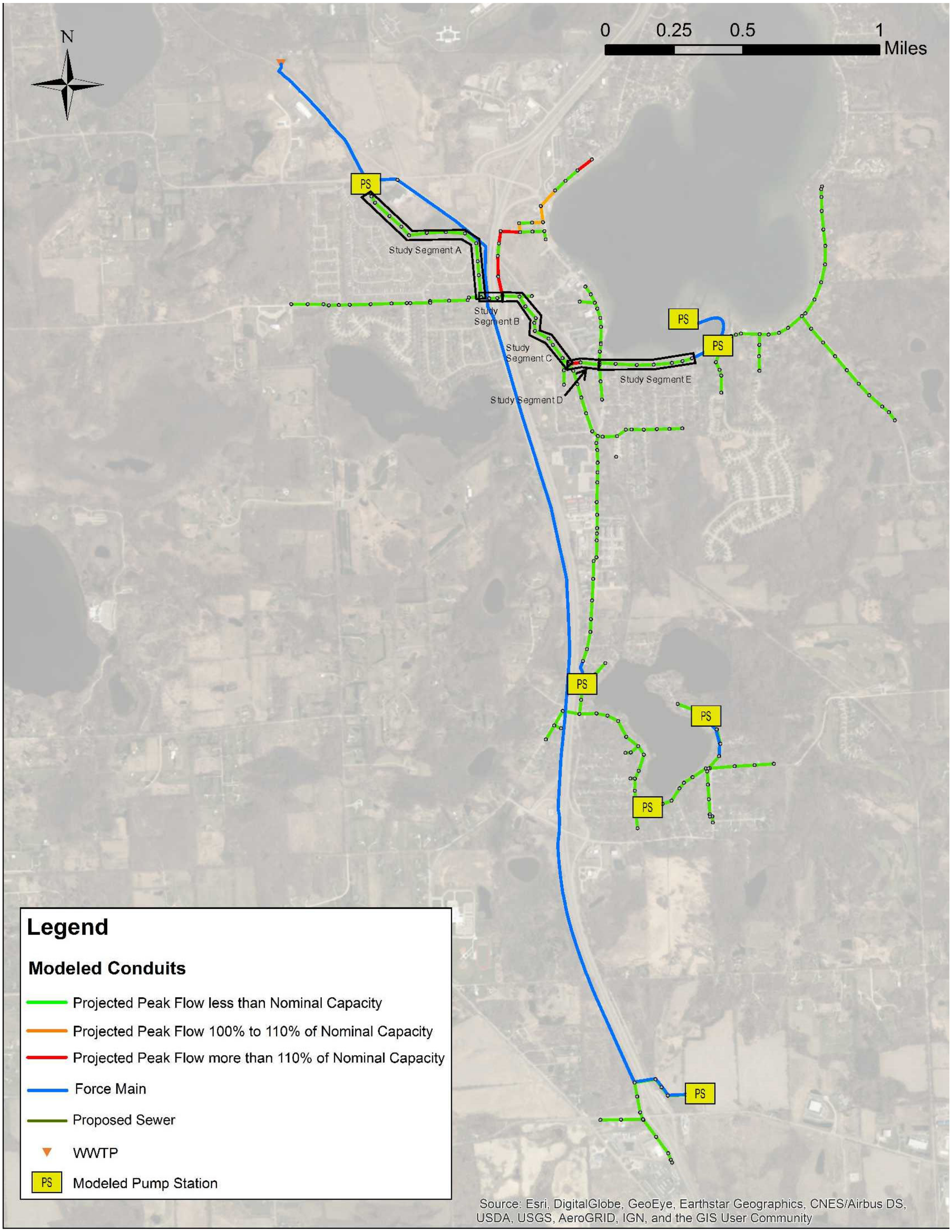
6.3 SUMMARY OF HYDRAULIC IMPROVEMENTS

If the recommendations along the downstream trunk sewer are implemented, there would be a reduction in the hydraulic grade line and the risk of basement and surface flooding during the 25-year, 24-hour design storm. The impacts of these recommendations are seen in the hydraulic profiles in Appendix C, where the hydraulic grade line that was surcharged is projected to remain almost entirely within the pipe crown. Figure 6-2 shows a map of sewer capacity relative to projected peak flow rate and projected surcharging for the future growth conditions during the 25-year, 24-hour design storm.

As Figure 6-2 shows, even with the recommended conveyance improvements, there would be a few remaining sewers with design storm peak flow rates that exceed the pipe capacities, mostly along the sewers west of Whitmore Lake tributary to meter FM-03. These result in two locations surcharging within ten feet of the ground surface that are expected to be low priority concerns for capital improvements until the investigation work described in Section 4.5 is complete. One of these locations is at the rear of the property at 9815 Main Street. Here the maximum surcharge would be two inches above crown of pipe, but the pipe is buried only approximately eight feet below the ground surface. The other is at the most upstream modeled manhole on the sewer along the west side of Whitmore Lake. The surcharge at this location reaches one foot above crown of pipe, which is approximately nine feet below the ground surface.

Figure 6-1: Recommended Improvements

Figure 6-2: Sanitary Sewer Capacity Analysis with Projected Growth for 25-year, 24-hour Design Storm with Proposed Improvements



APPENDIX A – FLOW MONITORING MAPS

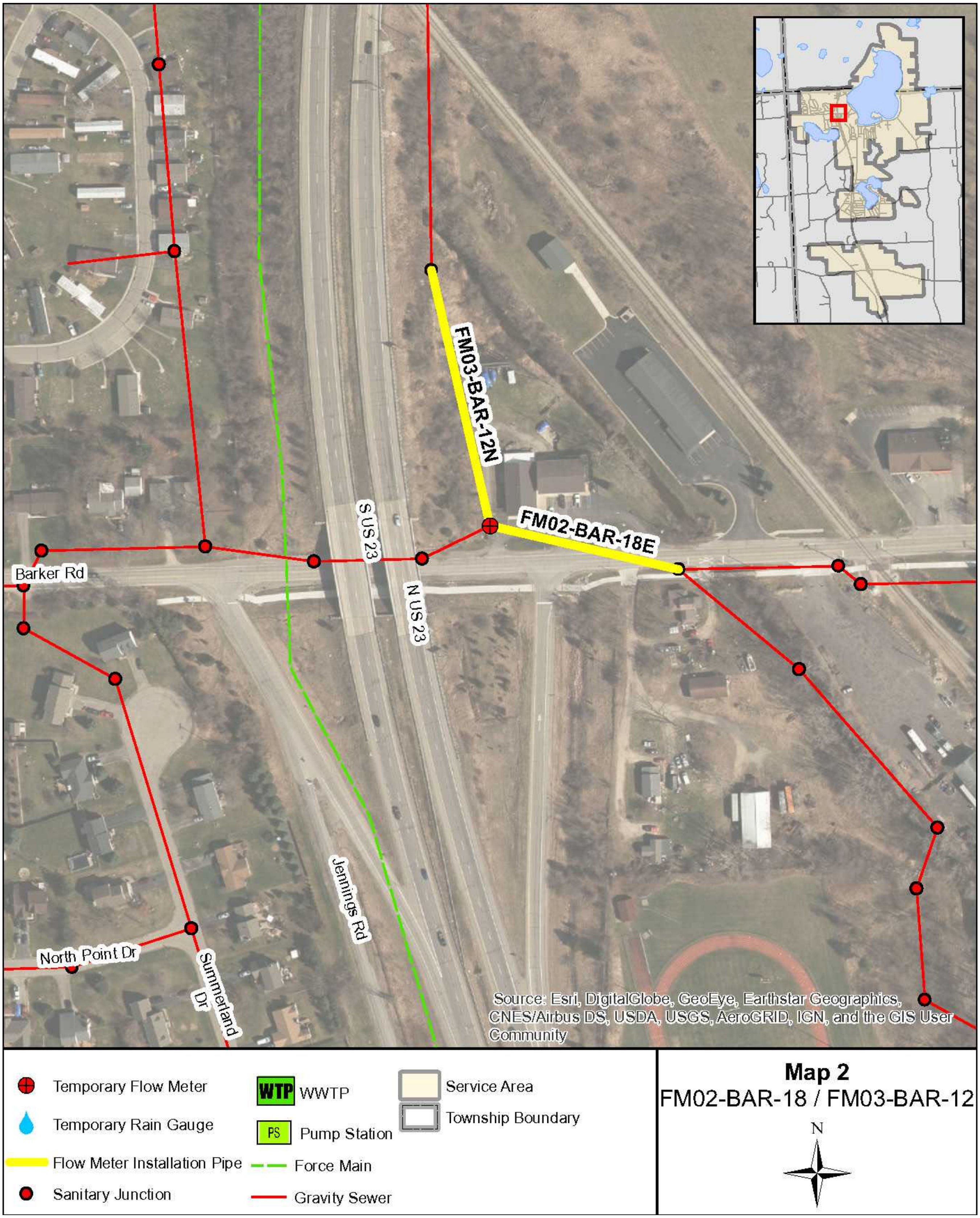
Appendix A Contents

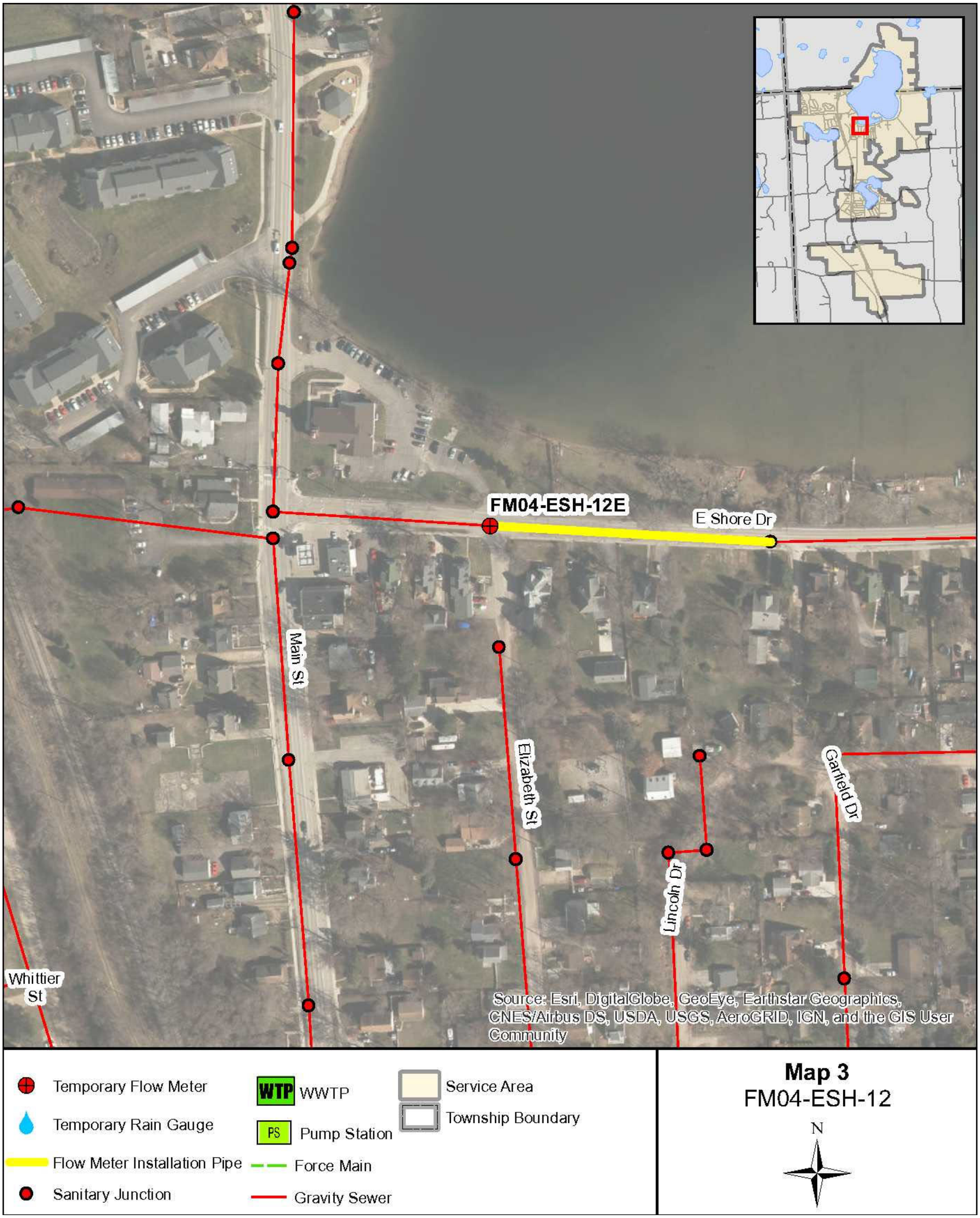
- Map A1 – Location of FM-01
- Map A2 – Location of FM-02 and FM-03
- Map A3 – Location of FM-04
- Map A4 – Location of FM-05

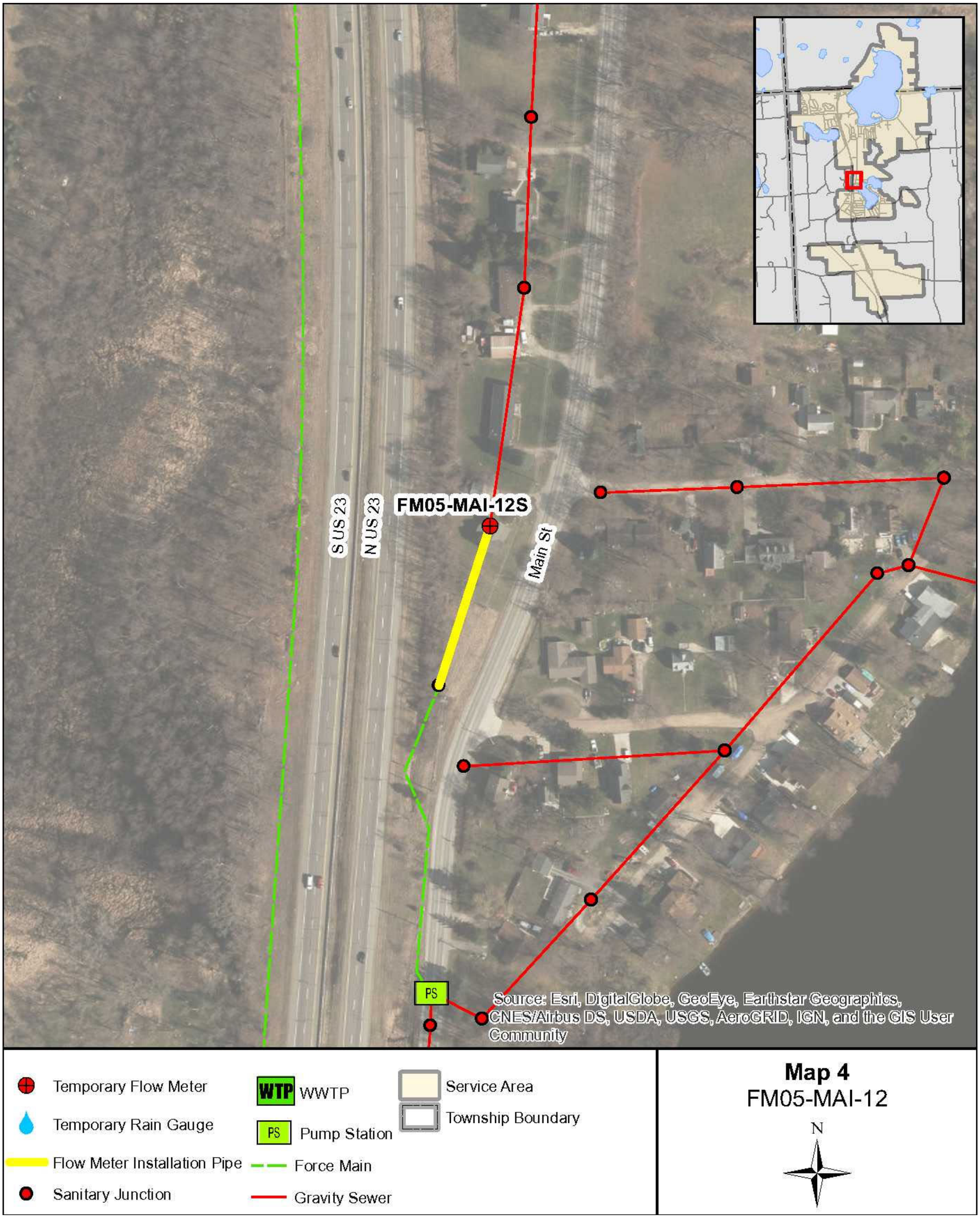
Temporary Flow Meter
Temporary Rain Gauge
Flow Meter Installation Pipe
Sanitary Junction
WTP WWTP
PS Pump Station
Force Main
Gravity Sewer
Service Area
Township Boundary

Map 1
FM01-EMI-27

N


FM03-BAR-12N
FM02-BAR-18E
Barker Rd
S US 23
N US 23
Jennings Rd
North Point Dr
Summerland Dr
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Temporary Flow Meter
Temporary Rain Gauge
Flow Meter Installation Pipe
Sanitary Junction
WTP WWTP
PS Pump Station
Force Main
Gravity Sewer
Service Area
Township Boundary
Map 2
FM02-BAR-18 / FM03-BAR-12
N


FM04-ESH-12E
E Shore Dr
Main St
Elizabeth St
Lincoln Dr
Garfield Dr
Whittier St
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Temporary Flow Meter
Temporary Rain Gauge
Flow Meter Installation Pipe
Sanitary Junction
WTP WWTP
PS Pump Station
Force Main
Gravity Sewer
Service Area
Township Boundary
Map 3
FM04-ESH-12
N


S US 23
N US 23
FM05-MAI-12S
Main St
PS
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Temporary Flow Meter
Temporary Rain Gauge
Flow Meter Installation Pipe
Sanitary Junction
WTP
WWTP
PS
Pump Station
Force Main
Gravity Sewer
Service Area
Township Boundary
Map 4
FM05-MAI-12
N

APPENDIX B – FLOW MONITORING DATA

Northfield Township, Michigan
Northfield Interceptor
2017 Flow Monitoring Data

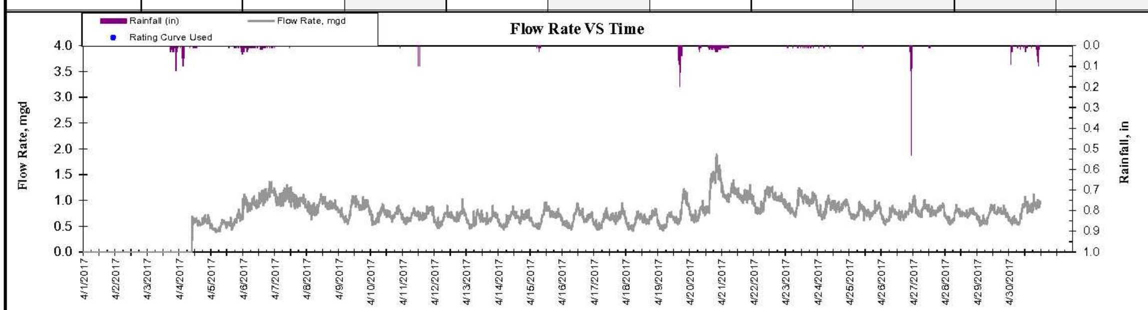
Flow Data for FM01-EMI-27W

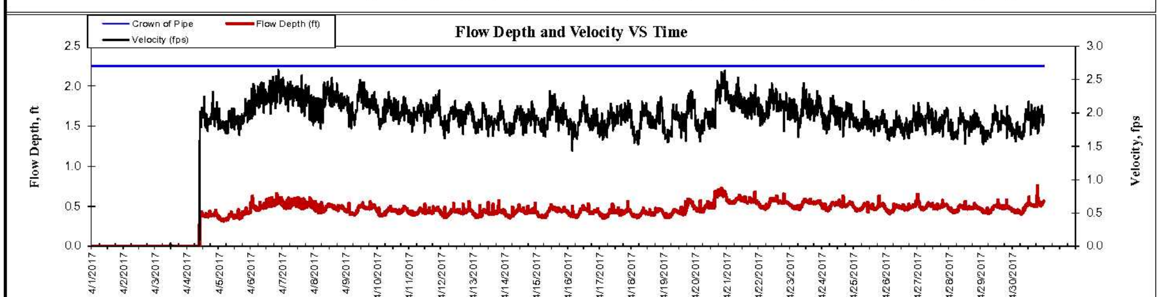
Meter Location: Gravity Influent to 8 Mile Road PS

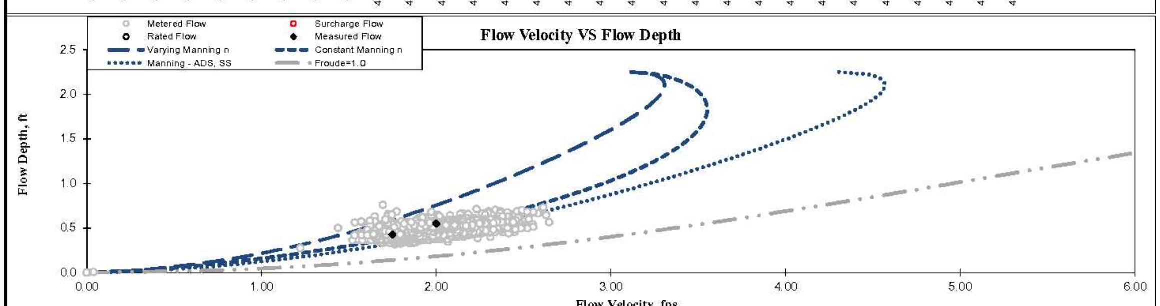
Diameter = 27 in
Slope = 0.16%
Capacity = 8.01 mgd

Area: 1,995 acres Population: 5,609 Parcels: 2,585 Rain Gage: RG-2017

Date	Daily Rainfall, in	Average Day		Maximum Hour			Minimum Hour		SSOAP RDII Analysis	
		Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Apr-17										
2-Apr-17										
3-Apr-17										
4-Apr-17	0.47	0.35	62	0.72	128	0.45	0.00	0		
5-Apr-17	0.27	0.54	97	0.82	147	0.55	0.39	69		
6-Apr-17	0.66	1.02	182	1.36	243	0.66	0.67	120		
7-Apr-17	0.01	1.03	184	1.30	231	0.61	0.85	151		
8-Apr-17	0.00	0.88	157	1.12	201	0.55	0.63	112		
9-Apr-17	0.00	0.83	148	1.09	194	0.56	0.54	97		
10-Apr-17	0.01	0.72	128	0.92	164	0.50	0.52	93		
11-Apr-17	0.21	0.71	126	0.88	158	0.53	0.53	95		
12-Apr-17	0.00	0.67	120	1.02	182	0.56	0.46	81		
13-Apr-17	0.00	0.63	113	0.89	159	0.57	0.45	81		
14-Apr-17	0.00	0.65	115	0.89	158	0.55	0.44	78		
15-Apr-17	0.08	0.68	121	0.96	171	0.52	0.45	80		
16-Apr-17	0.00	0.65	116	0.94	168	0.53	0.44	78		
17-Apr-17	0.00	0.64	114	0.94	168	0.56	0.43	77		
18-Apr-17	0.00	0.62	111	0.84	150	0.48	0.41	73		
19-Apr-17	0.80	0.70	125	1.22	218	0.59	0.42	75		
20-Apr-17	0.73	1.03	183	1.89	336	0.73	0.58	103		
21-Apr-17	0.15	1.11	198	1.39	248	0.68	0.93	166		
22-Apr-17	0.00	1.01	179	1.27	226	0.66	0.74	132		
23-Apr-17	0.10	0.96	171	1.24	220	0.59	0.68	121		
24-Apr-17	0.03	0.87	155	1.10	196	0.63	0.63	112		
25-Apr-17	0.01	0.78	138	0.99	176	0.63	0.61	109		
26-Apr-17	0.82	0.72	129	0.95	169	0.65	0.53	95		
27-Apr-17	0.03	0.83	147	1.09	195	0.58	0.67	119		
28-Apr-17	0.00	0.72	128	0.92	164	0.56	0.53	94		
29-Apr-17	0.00	0.72	128	0.92	164	0.58	0.51	90		
30-Apr-17	0.69	0.78	138	1.12	199	0.76	0.52	93		







Northfield Township, Michigan
Northfield Interceptor
2017 Flow Monitoring Data

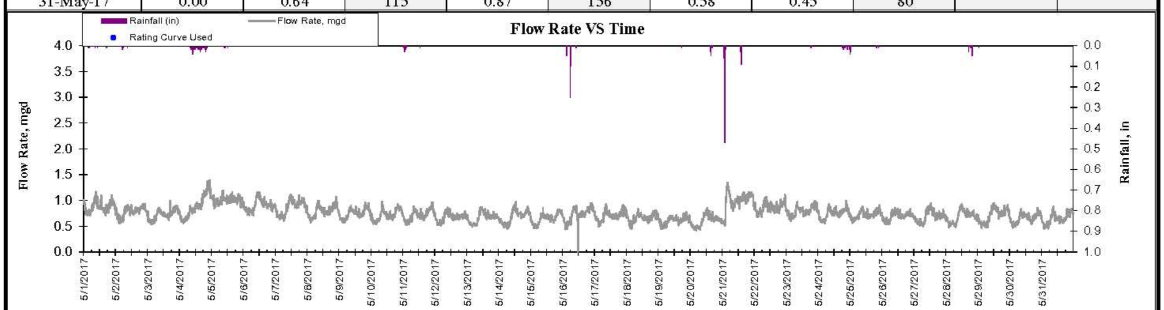
Flow Data for FM01-EMI-27W

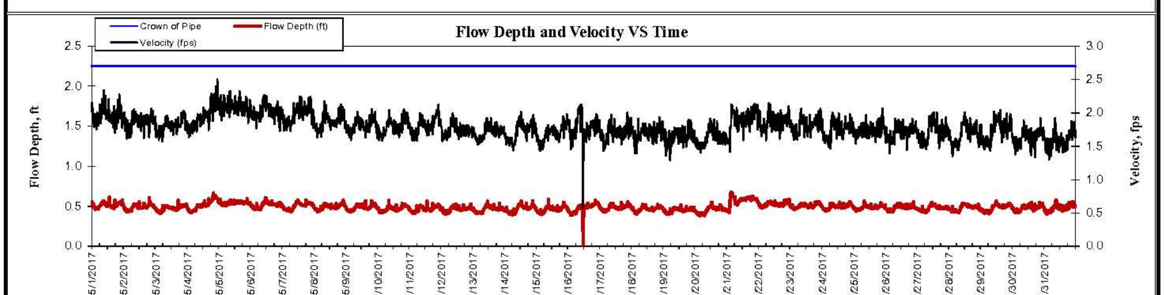
Meter Location: Gravity Influent to 8 Mile Road PS

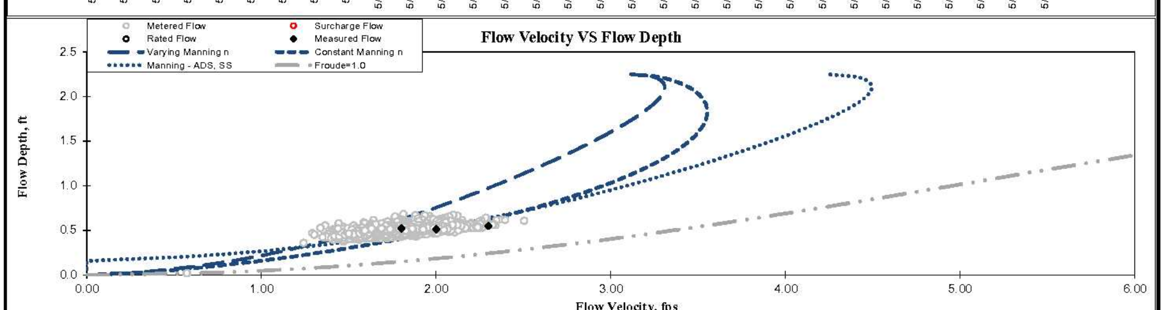
Diameter = 27 in
Slope = 0.16%
Capacity = 8.01 mgd

Area: 1,995 acres Population: 5,609 Parcels: 2,585 Rain Gage: RG-2017

Date	Daily	Average Day		Maximum Hour			Minimum Hour		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-May-17	0.08	0.88	157	1.17	208	0.62	0.71	126		
2-May-17	0.04	0.78	139	0.94	167	0.61	0.56	99		
3-May-17	0.00	0.73	129	0.99	176	0.58	0.54	96		
4-May-17	0.70	0.89	158	1.39	248	0.67	0.56	100		
5-May-17	0.03	1.01	180	1.19	212	0.60	0.85	152		
6-May-17	0.00	0.91	161	1.16	206	0.61	0.71	127		
7-May-17	0.00	0.87	154	1.12	199	0.58	0.61	108		
8-May-17	0.00	0.79	141	1.07	190	0.58	0.56	101		
9-May-17	0.00	0.75	133	0.96	171	0.57	0.56	101		
10-May-17	0.00	0.72	128	0.98	174	0.58	0.54	96		
11-May-17	0.14	0.71	127	0.97	172	0.57	0.53	94		
12-May-17	0.00	0.67	120	0.86	154	0.53	0.51	91		
13-May-17	0.00	0.67	119	0.87	156	0.57	0.49	88		
14-May-17	0.00	0.68	122	0.97	173	0.57	0.44	79		
15-May-17	0.00	0.65	117	0.85	151	0.59	0.46	81		
16-May-17	0.48	0.72	128	0.95	169	0.58	0.00	1		
17-May-17	0.00	0.71	126	0.94	167	0.56	0.50	88		
18-May-17	0.00	0.66	118	0.83	149	0.53	0.44	79		
19-May-17	0.02	0.61	109	0.77	138	0.52	0.44	79		
20-May-17	0.14	0.60	108	0.85	151	0.68	0.42	75		
21-May-17	1.52	0.99	177	1.35	240	0.63	0.52	92		
22-May-17	0.00	0.86	154	1.11	198	0.59	0.68	120		
23-May-17	0.01	0.79	142	0.98	175	0.56	0.60	107		
24-May-17	0.10	0.74	133	0.99	177	0.56	0.55	98		
25-May-17	0.13	0.73	129	0.91	162	0.57	0.56	100		
26-May-17	0.00	0.70	124	0.85	152	0.56	0.53	95		
27-May-17	0.00	0.69	123	0.94	167	0.55	0.50	89		
28-May-17	0.15	0.68	122	0.92	164	0.54	0.47	85		
29-May-17	0.01	0.71	127	0.95	169	0.57	0.47	84		
30-May-17	0.00	0.66	117	0.86	153	0.55	0.47	83		
31-May-17	0.00	0.64	115	0.87	156	0.58	0.45	80		







Northfield Township, Michigan
Northfield Interceptor
2017 Flow Monitoring Data

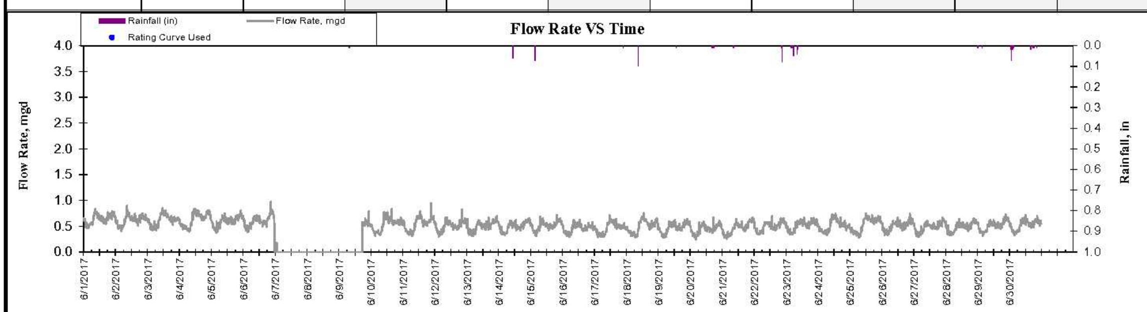
Flow Data for FM01-EMI-27W

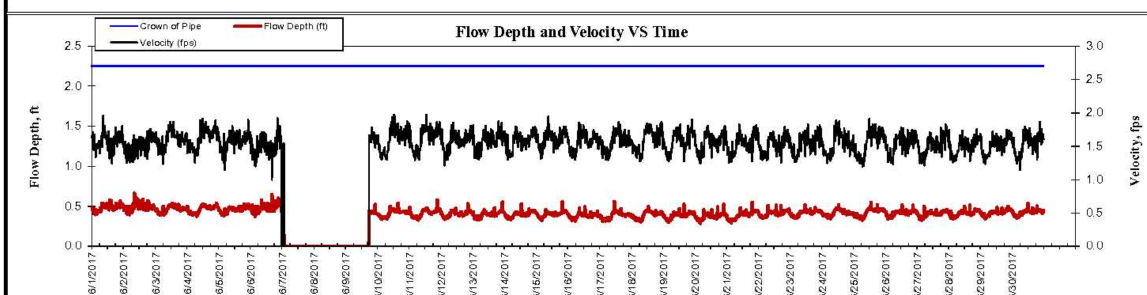
Diameter = 27 in
Slope = 0.16%
Capacity = 8.01 mgd

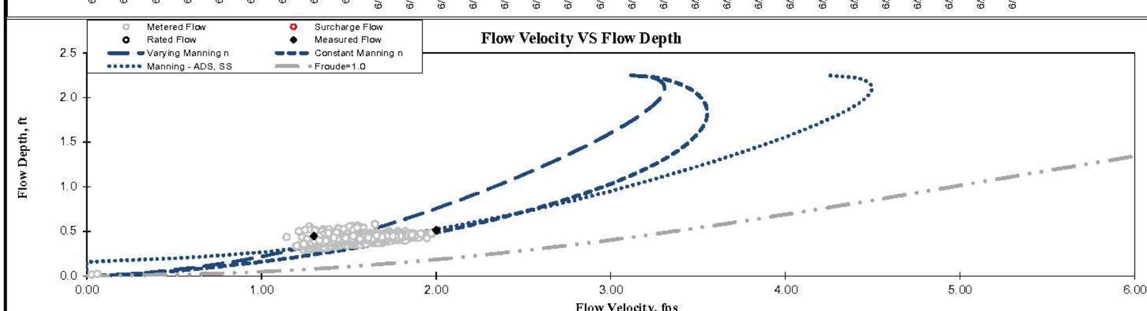
Meter Location: Gravity Influent to 8 Mile Road PS

Area: 1,995 acres Population: 5,609 Parcels: 2,585 Rain Gage: RG-2017

Date	Daily Rainfall, in	Average Day Flow, mgd	Average Day Flow, gpcd	Maximum Hour Flow, mgd	Maximum Hour Flow, gpcd	Maximum Hour Depth, ft	Minimum Hour Flow, mgd	Minimum Hour Flow, gpcd	SSOAP RDII Analysis Peak Flow, mgd	SSOAP RDII Analysis Volume, MG
1-Jun-17	0.00	0.64	114	0.83	148	0.58	0.46	83		
2-Jun-17	0.00	0.62	111	0.89	160	0.66	0.40	72		
3-Jun-17	0.00	0.62	110	0.85	152	0.54	0.42	74		
4-Jun-17	0.00	0.63	112	0.84	149	0.54	0.39	70		
5-Jun-17	0.00	0.60	107	0.81	145	0.53	0.37	66		
6-Jun-17	0.00	0.59	106	0.97	173	0.65	0.00	0		
7-Jun-17	0.00	0.00	1	0.20	35	0.00	0.00	0		
8-Jun-17	0.00	0.00	0	0.00	0	0.00	0.00	0		
9-Jun-17	0.02	0.15	26	0.78	140	0.53	0.00	0		
10-Jun-17	0.00	0.53	95	0.83	148	0.54	0.32	56		
11-Jun-17	0.00	0.55	97	0.94	168	0.58	0.31	56		
12-Jun-17	0.00	0.51	90	0.83	147	0.54	0.30	53		
13-Jun-17	0.00	0.50	89	0.69	124	0.56	0.31	56		
14-Jun-17	0.06	0.50	88	0.65	116	0.53	0.33	59		
15-Jun-17	0.08	0.51	91	0.72	128	0.56	0.31	55		
16-Jun-17	0.00	0.46	82	0.63	112	0.50	0.29	52		
17-Jun-17	0.01	0.47	84	0.71	127	0.56	0.29	51		
18-Jun-17	0.10	0.49	88	0.75	135	0.50	0.28	51		
19-Jun-17	0.01	0.47	84	0.64	115	0.53	0.27	49		
20-Jun-17	0.05	0.45	80	0.67	120	0.53	0.24	43		
21-Jun-17	0.01	0.47	83	0.66	118	0.55	0.26	46		
22-Jun-17	0.12	0.50	89	0.69	123	0.52	0.34	60		
23-Jun-17	0.17	0.52	92	0.67	119	0.52	0.33	60		
24-Jun-17	0.00	0.51	91	0.74	132	0.52	0.33	59		
25-Jun-17	0.00	0.53	94	0.75	133	0.55	0.28	50		
26-Jun-17	0.00	0.51	91	0.74	132	0.52	0.32	57		
27-Jun-17	0.00	0.49	87	0.66	118	0.46	0.29	52		
28-Jun-17	0.00	0.49	88	0.66	118	0.52	0.32	57		
29-Jun-17	0.02	0.51	91	0.74	131	0.50	0.31	55		
30-Jun-17	0.27	0.52	93	0.72	128	0.54	0.33	58		







Northfield Township, Michigan
Northfield Interceptor
2017 Flow Monitoring Data

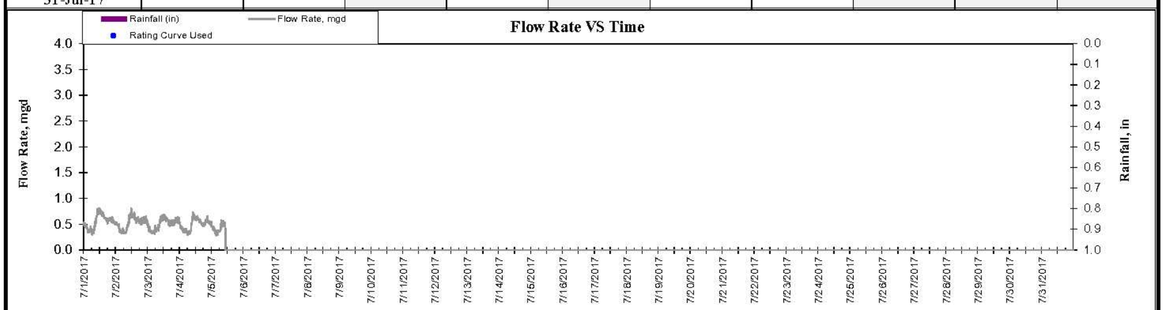
Flow Data for FM01-EMI-27W

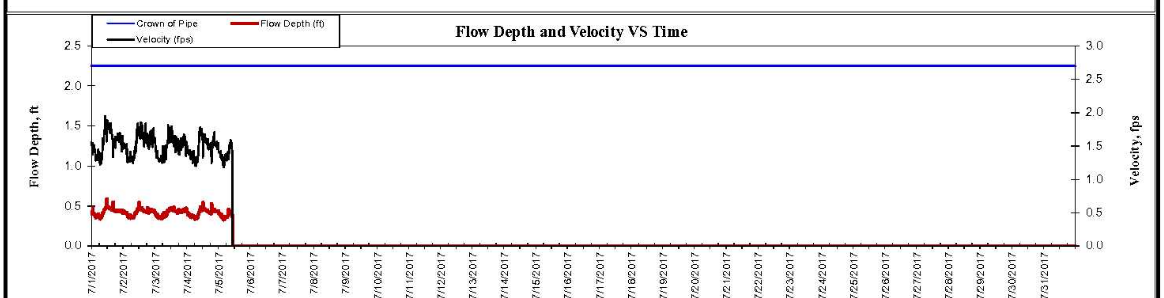
Diameter = 27 in
Slope = 0.16%
Capacity = 8.01 mgd

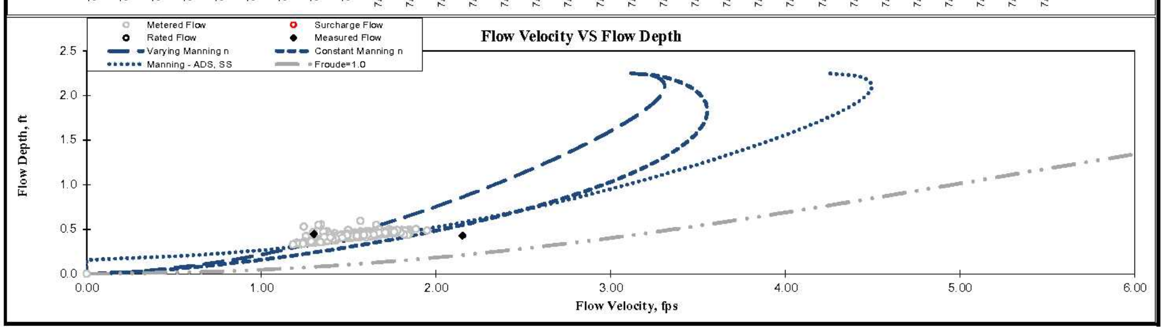
Meter Location: Gravity Influent to 8 Mile Road PS

Area: 1,995 acres Population: 5,609 Parcels: 2,585 Rain Gage: RG-2017

Date	Daily	Average Day		Maximum Hour			Minimum Hour		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Jul-17	0.00	0.55	98	0.81	144	0.59	0.30	53		
2-Jul-17	0.00	0.53	94	0.80	143	0.55	0.33	58		
3-Jul-17	0.00	0.51	90	0.69	123	0.49	0.31	56		
4-Jul-17	0.00	0.50	89	0.73	131	0.55	0.30	53		
5-Jul-17	0.00	0.19	33	0.58	104	0.47	0.00	0		
6-Jul-17										
7-Jul-17										
8-Jul-17										
9-Jul-17										
10-Jul-17										
11-Jul-17										
12-Jul-17										
13-Jul-17										
14-Jul-17										
15-Jul-17										
16-Jul-17										
17-Jul-17										
18-Jul-17										
19-Jul-17										
20-Jul-17										
21-Jul-17										
22-Jul-17										
23-Jul-17										
24-Jul-17										
25-Jul-17										
26-Jul-17										
27-Jul-17										
28-Jul-17										
29-Jul-17										
30-Jul-17										
31-Jul-17										







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

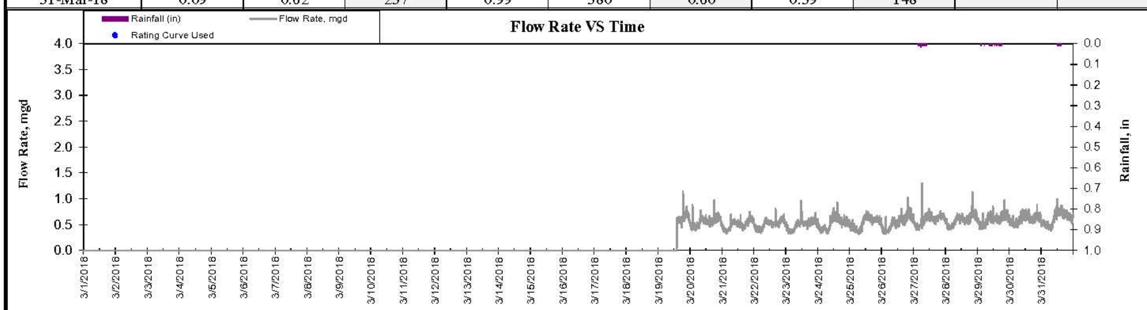
Flow Data for FM01-EMI-27W

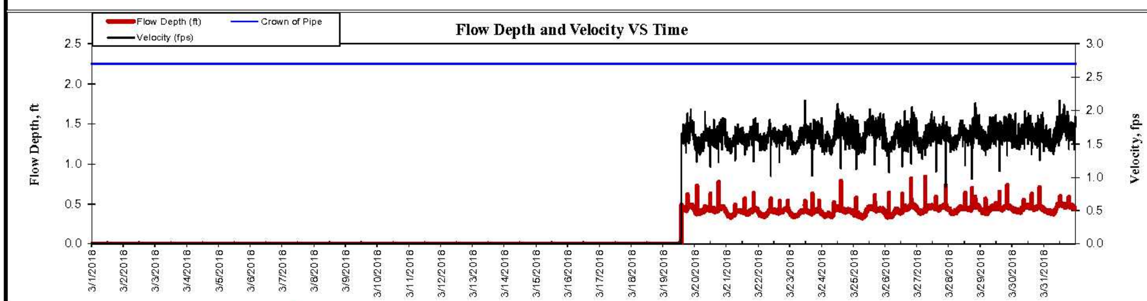
Meter Location: Gravity Influent to 8 Mile Road PS

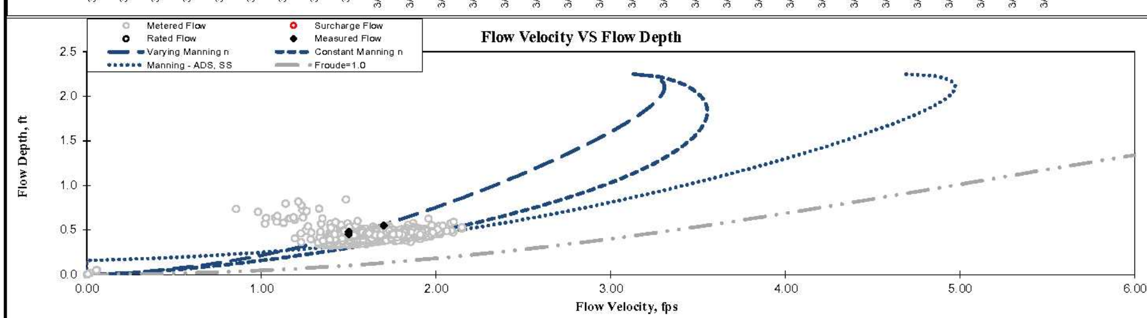
Diameter = 27 in
Slope = 0.16%
Capacity = 8.01 mgd

Area: 1,995 acres Population: 2,609 Parcels: 2,585 Rain Gage: RG02-Barker

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Mar-18										
2-Mar-18										
3-Mar-18										
4-Mar-18										
5-Mar-18										
6-Mar-18										
7-Mar-18										
8-Mar-18										
9-Mar-18										
10-Mar-18										
11-Mar-18										
12-Mar-18										
13-Mar-18										
14-Mar-18										
15-Mar-18										
16-Mar-18										
17-Mar-18										
18-Mar-18										
19-Mar-18	0.00	0.26	100	1.14	438	0.63	0.00	0		
20-Mar-18	0.00	0.55	212	0.97	371	0.78	0.39	148		
21-Mar-18	0.00	0.50	192	0.75	287	0.64	0.32	124		
22-Mar-18	0.00	0.51	194	0.81	310	0.57	0.35	132		
23-Mar-18	0.00	0.50	193	0.96	369	0.64	0.33	126		
24-Mar-18	0.00	0.52	201	0.92	354	0.79	0.33	125		
25-Mar-18	0.00	0.53	204	0.77	293	0.62	0.32	122		
26-Mar-18	0.00	0.54	207	1.02	392	0.82	0.33	125		
27-Mar-18	0.32	0.59	228	1.30	499	0.84	0.39	149		
28-Mar-18	0.00	0.59	228	1.13	435	0.70	0.40	154		
29-Mar-18	0.17	0.60	230	0.98	374	0.74	0.42	160		
30-Mar-18	0.00	0.61	234	0.88	337	0.71	0.45	171		
31-Mar-18	0.09	0.62	237	0.99	380	0.60	0.39	148		







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

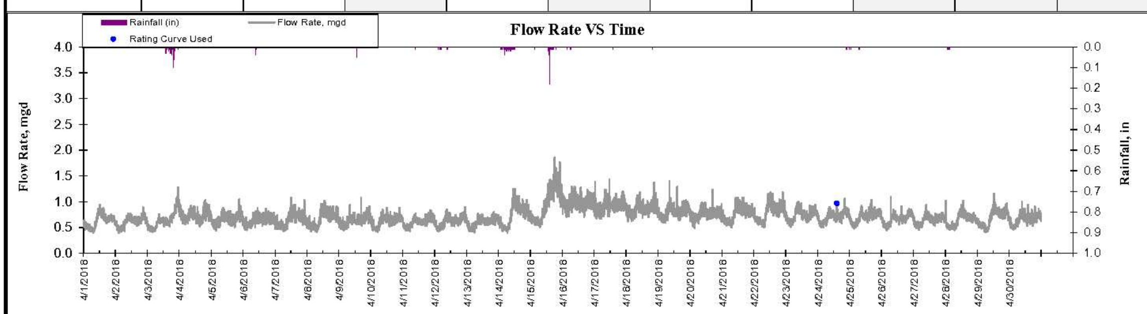
Flow Data for FM01-EMI-27W

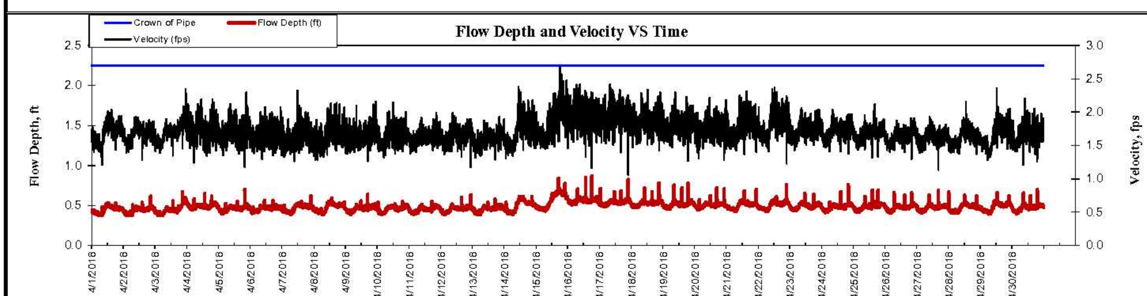
Meter Location: Gravity Influent to 8 Mile Road PS

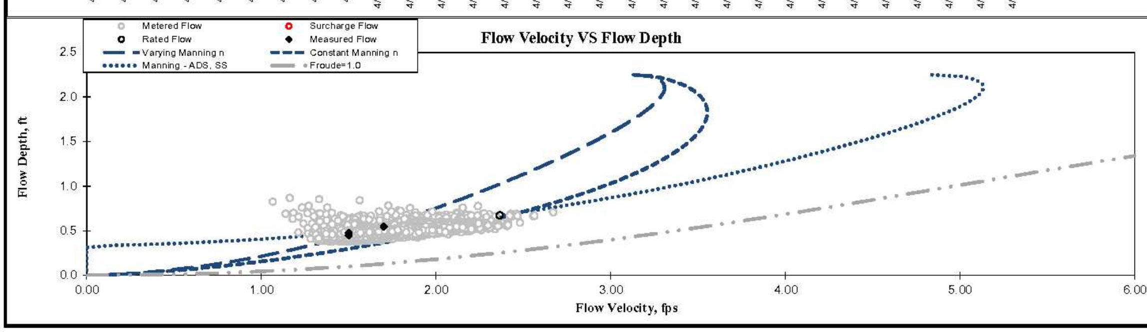
Diameter = 27 in
Slope = 0.16%
Capacity = 8.01 mgd

Area: 1,995 acres Population: 2,609 Parcels: 2,585 Rain Gage: RG02-Barker

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Apr-18	0.00	0.63	240	0.94	362	0.53	0.40	152		
2-Apr-18	0.00	0.61	233	0.90	344	0.62	0.40	152		
3-Apr-18	0.74	0.64	247	1.28	490	0.68	0.41	157		
4-Apr-18	0.00	0.73	280	1.03	394	0.65	0.53	202		
5-Apr-18	0.00	0.66	252	1.04	400	0.70	0.44	169		
6-Apr-18	0.12	0.63	243	0.88	338	0.56	0.45	172		
7-Apr-18	0.00	0.65	249	1.08	413	0.62	0.43	165		
8-Apr-18	0.00	0.67	256	1.02	390	0.59	0.41	158		
9-Apr-18	0.07	0.64	244	1.08	414	0.64	0.44	168		
10-Apr-18	0.00	0.62	238	0.88	338	0.55	0.41	159		
11-Apr-18	0.01	0.61	233	0.84	321	0.55	0.43	166		
12-Apr-18	0.04	0.62	238	0.89	342	0.64	0.42	163		
13-Apr-18	0.00	0.60	231	0.80	306	0.58	0.40	155		
14-Apr-18	0.67	0.74	284	1.25	480	0.62	0.40	155		
15-Apr-18	0.62	0.96	366	1.85	710	0.84	0.51	195		
16-Apr-18	0.02	0.99	378	1.30	498	0.87	0.70	269		
17-Apr-18	0.01	0.92	353	1.43	547	0.83	0.67	255		
18-Apr-18	0.01	0.86	330	1.37	526	0.78	0.62	237		
19-Apr-18	0.00	0.81	310	1.40	538	0.78	0.59	227		
20-Apr-18	0.00	0.76	291	1.24	473	0.72	0.49	188		
21-Apr-18	0.00	0.77	295	1.08	415	0.70	0.50	191		
22-Apr-18	0.00	0.80	306	1.18	454	0.76	0.50	191		
23-Apr-18	0.00	0.74	283	1.00	383	0.66	0.51	196		
24-Apr-18	0.02	0.71	272	1.06	405	0.76	0.50	191		
25-Apr-18	0.02	0.70	270	1.03	394	0.69	0.48	184		
26-Apr-18	0.00	0.66	254	1.09	418	0.66	0.45	173		
27-Apr-18	0.00	0.65	247	0.93	358	0.69	0.45	174		
28-Apr-18	0.08	0.65	249	1.02	391	0.63	0.45	171		
29-Apr-18	0.00	0.69	265	1.15	442	0.66	0.41	156		
30-Apr-18	0.00	0.66	254	0.99	381	0.70	0.46	177		







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

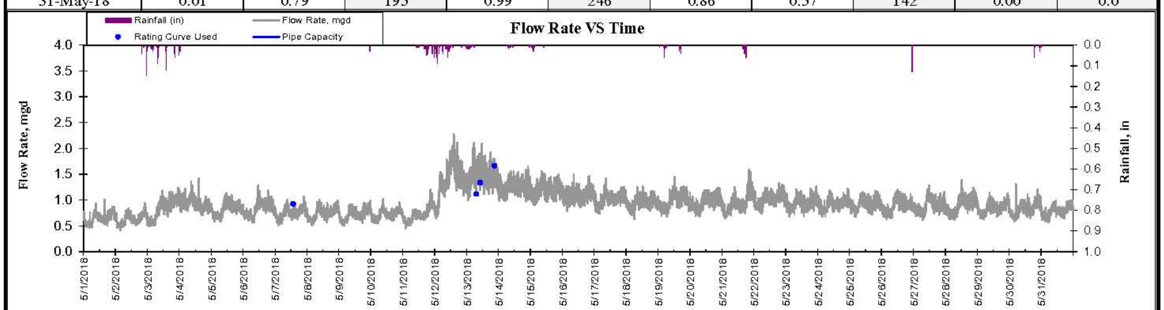
Flow Data for FM01-EMI-27W

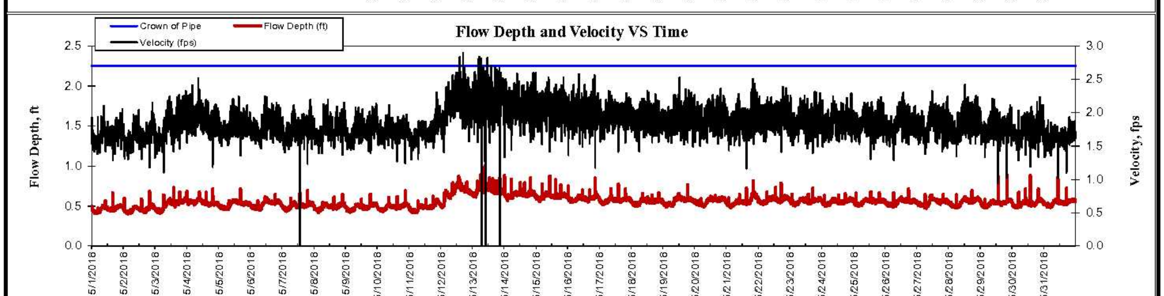
Meter Location: Gravity Influent to 8 Mile Road PS

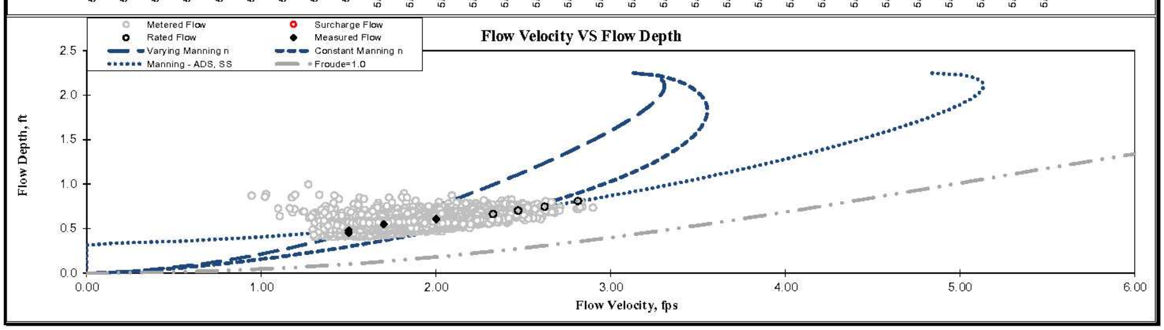
Diameter = 27 in
Slope = 0.16%
Capacity = 8.01 mgd

Area: 1,995 acres Population: 2,609 Parcels: 2,585 Rain Gage: RG02-Barker

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-May-18	0.00	0.65	161	1.01	250	0.67	0.47	115	0.00	0.0
2-May-18	0.41	0.64	158	0.95	235	0.68	0.41	102	0.00	0.0
3-May-18	1.18	0.83	207	1.24	307	0.73	0.49	122	0.00	0.0
4-May-18	0.07	0.94	233	1.41	350	0.72	0.70	174	0.00	0.0
5-May-18	0.00	0.82	204	1.13	281	0.71	0.59	145	0.00	0.0
6-May-18	0.00	0.83	206	1.28	317	0.65	0.56	139	0.00	0.0
7-May-18	0.00	0.75	186	1.06	264	0.69	0.51	127	0.00	0.0
8-May-18	0.00	0.74	184	1.00	248	0.65	0.51	126	0.00	0.0
9-May-18	0.18	0.73	180	0.99	244	0.65	0.50	125	0.00	0.0
10-May-18	0.00	0.72	179	1.02	252	0.69	0.55	137	0.00	0.0
11-May-18	0.76	0.72	178	1.20	298	0.62	0.45	111	0.00	0.0
12-May-18	1.36	1.39	344	2.28	564	0.87	0.65	160	0.00	0.0
13-May-18	0.45	1.49	370	2.11	523	1.00	0.99	245	0.00	0.0
14-May-18	0.13	1.28	316	1.65	408	0.85	0.98	242	0.00	0.0
15-May-18	0.22	1.20	298	1.56	386	0.88	0.90	223	0.00	0.0
16-May-18	0.00	1.09	270	1.49	369	0.85	0.78	194	0.00	0.0
17-May-18	0.00	1.03	254	1.42	351	0.77	0.74	182	0.00	0.0
18-May-18	0.00	0.96	237	1.27	314	0.67	0.62	155	0.00	0.0
19-May-18	0.39	0.98	243	1.44	357	0.77	0.68	169	0.00	0.0
20-May-18	0.00	0.96	238	1.23	305	0.63	0.68	169	0.00	0.0
21-May-18	0.54	0.95	235	1.58	391	0.81	0.65	161	0.00	0.0
22-May-18	0.00	1.02	253	1.33	329	0.79	0.74	182	0.00	0.0
23-May-18	0.00	0.95	236	1.26	313	0.72	0.69	170	0.00	0.0
24-May-18	0.00	0.92	228	1.22	303	0.66	0.67	167	0.00	0.0
25-May-18	0.00	0.92	229	1.18	292	0.68	0.67	167	0.00	0.0
26-May-18	0.35	0.90	222	1.21	299	0.71	0.64	157	0.00	0.0
27-May-18	0.00	0.89	222	1.28	317	0.65	0.61	152	0.00	0.0
28-May-18	0.00	0.91	224	1.38	343	0.70	0.62	154	0.00	0.0
29-May-18	0.00	0.85	210	1.14	283	0.89	0.63	155	0.00	0.0
30-May-18	0.26	0.83	205	1.31	324	0.88	0.58	145	0.00	0.0
31-May-18	0.01	0.79	195	0.99	246	0.86	0.57	142	0.00	0.0







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

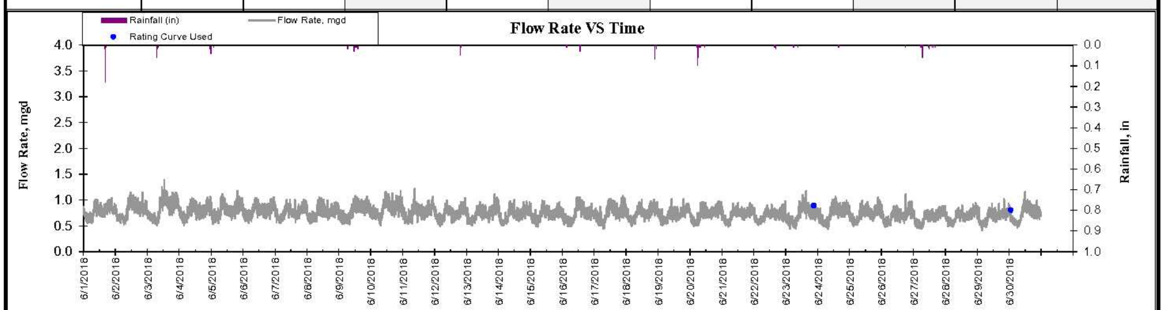
Flow Data for FM01-EMI-27W

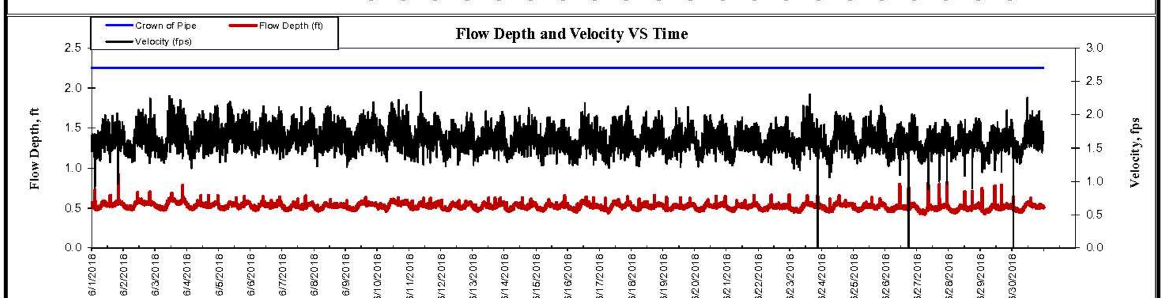
Meter Location: Gravity Influent to 8 Mile Road PS

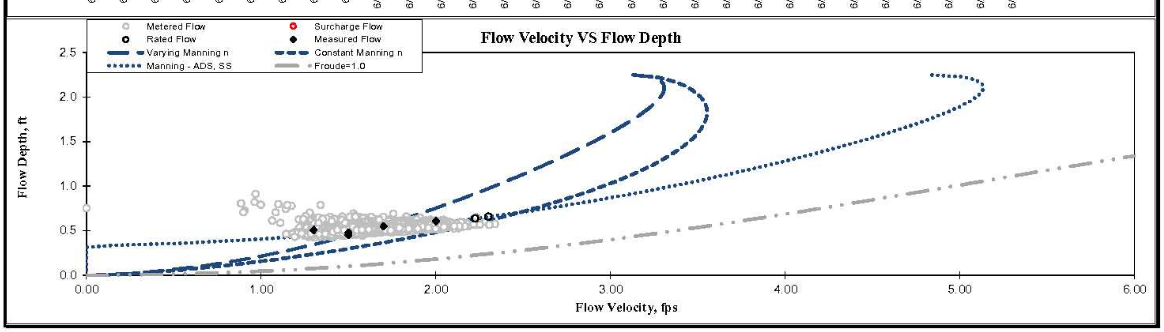
Diameter = 27 in
Slope = 0.16%
Capacity = 8.01 mgd

Area: 1,995 acres Population: 2,609 Parcels: 2,585 Rain Gage: RG02-Barker

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Jun-18	0.44	0.78	193	1.04	257	0.91	0.55	137	0.00	0.0
2-Jun-18	0.00	0.80	198	1.15	284	0.70	0.52	130	0.00	0.0
3-Jun-18	0.24	0.84	209	1.39	343	0.79	0.52	128	0.00	0.0
4-Jun-18	0.15	0.79	195	1.06	264	0.66	0.51	125	0.00	0.0
5-Jun-18	0.01	0.81	201	1.17	290	0.65	0.53	132	0.00	0.0
6-Jun-18	0.00	0.79	197	1.05	261	0.64	0.56	139	0.00	0.0
7-Jun-18	0.00	0.77	190	1.01	250	0.65	0.55	137	0.00	0.0
8-Jun-18	0.00	0.76	188	1.05	260	0.61	0.55	136	0.00	0.0
9-Jun-18	0.33	0.79	196	1.08	268	0.63	0.53	131	0.00	0.0
10-Jun-18	0.00	0.84	207	1.17	291	0.63	0.51	127	0.00	0.0
11-Jun-18	0.00	0.78	194	1.22	301	0.62	0.53	132	0.00	0.0
12-Jun-18	0.16	0.75	185	1.04	258	0.59	0.49	122	0.00	0.0
13-Jun-18	0.00	0.74	184	1.11	274	0.63	0.51	126	0.00	0.0
14-Jun-18	0.00	0.73	180	1.00	248	0.63	0.51	126	0.00	0.0
15-Jun-18	0.00	0.72	179	1.00	247	0.65	0.48	120	0.00	0.0
16-Jun-18	0.07	0.73	182	1.06	262	0.64	0.49	122	0.00	0.0
17-Jun-18	0.00	0.75	186	1.08	266	0.64	0.45	111	0.00	0.0
18-Jun-18	0.23	0.75	185	1.01	251	0.66	0.50	123	0.00	0.0
19-Jun-18	0.00	0.72	178	1.02	253	0.64	0.51	127	0.00	0.0
20-Jun-18	0.41	0.73	181	0.98	243	0.65	0.50	123	0.00	0.0
21-Jun-18	0.00	0.72	178	0.94	233	0.66	0.48	120	0.00	0.0
22-Jun-18	0.06	0.70	174	0.98	243	0.67	0.51	127	0.00	0.0
23-Jun-18	0.02	0.72	179	1.17	291	0.66	0.44	110	0.00	0.0
24-Jun-18	0.01	0.74	183	1.06	263	0.66	0.44	109	0.00	0.0
25-Jun-18	0.00	0.73	180	1.05	259	0.63	0.49	123	0.00	0.0
26-Jun-18	0.01	0.70	172	1.11	275	0.80	0.48	119	0.00	0.0
27-Jun-18	0.21	0.67	165	0.89	220	0.82	0.44	109	0.00	0.0
28-Jun-18	0.00	0.68	169	0.95	235	0.75	0.48	120	0.00	0.0
29-Jun-18	0.00	0.68	169	1.02	252	0.79	0.41	102	0.00	0.0
30-Jun-18	0.00	0.72	179	1.15	285	0.62	0.47	115	0.00	0.0







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

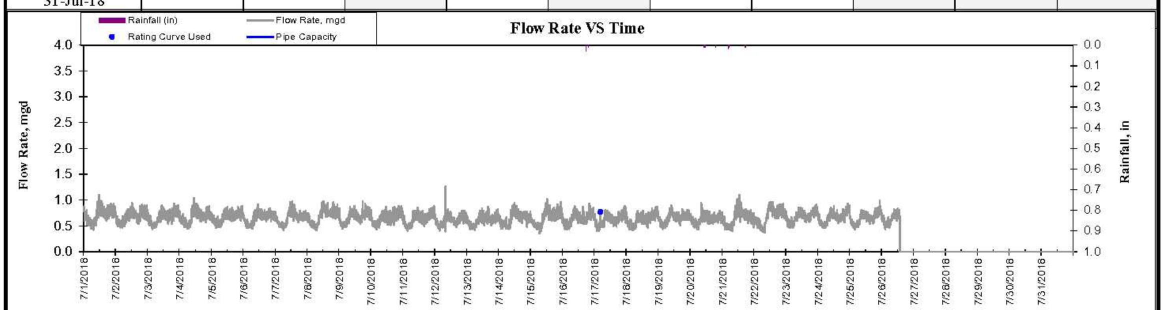
Flow Data for FM01-EMI-27W

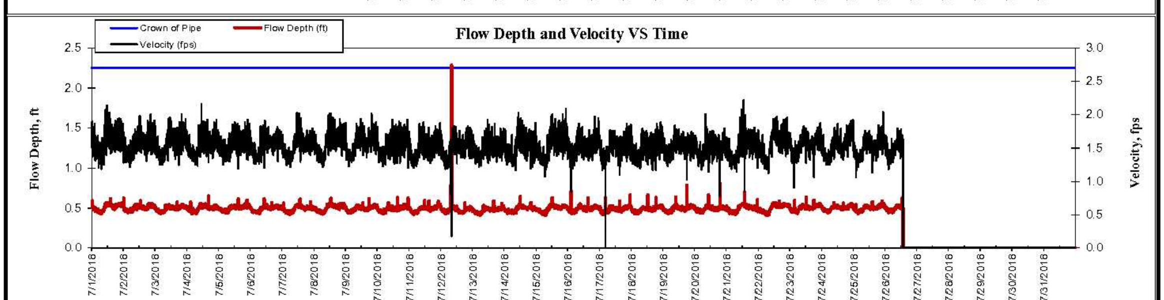
Meter Location: Gravity Influent to 8 Mile Road PS

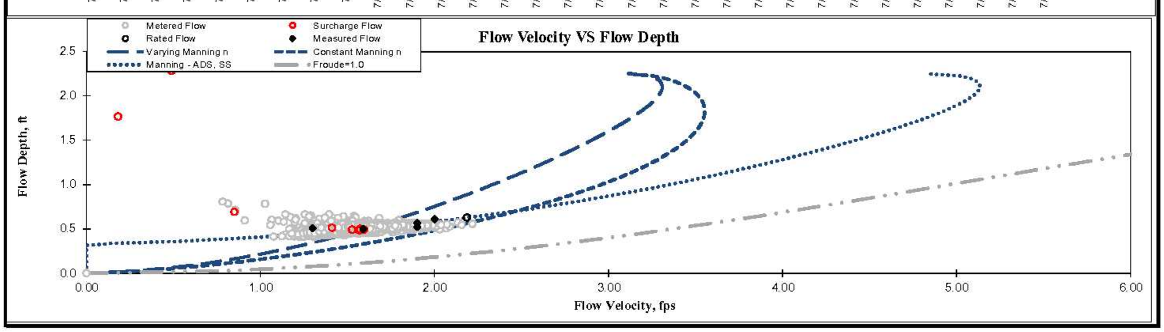
Diameter = 27 in
Slope = 0.16%
Capacity = 8.01 mgd

Area: 1,995 acres Population: 2,609 Parcels: 2,585 Rain Gage: RG02-Barker

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Jul-18	0.00	0.71	176	1.10	271	0.62	0.42	105	0.00	0.0
2-Jul-18	0.00	0.68	169	0.94	232	0.62	0.47	115	0.00	0.0
3-Jul-18	0.00	0.66	164	0.93	230	0.57	0.44	109	0.00	0.0
4-Jul-18	0.00	0.67	165	1.04	257	0.65	0.44	110	0.00	0.0
5-Jul-18	0.00	0.67	166	0.88	218	0.62	0.46	114	0.00	0.0
6-Jul-18	0.00	0.66	162	0.92	227	0.61	0.45	112	0.00	0.0
7-Jul-18	0.00	0.66	162	0.97	240	0.61	0.42	105	0.00	0.0
8-Jul-18	0.00	0.69	170	0.97	241	0.62	0.42	103	0.00	0.0
9-Jul-18	0.00	0.67	166	0.97	241	0.62	0.44	110	0.00	0.0
10-Jul-18	0.00	0.65	160	0.89	220	0.63	0.43	106	0.00	0.0
11-Jul-18	0.00	0.64	157	0.88	218	0.60	0.41	101	0.00	0.0
12-Jul-18	0.00	0.61	151	1.26	312	2.28	0.39	98	0.00	0.0
13-Jul-18	0.00	0.61	150	0.87	216	0.59	0.42	103	0.00	0.0
14-Jul-18	0.00	0.64	159	0.94	233	0.65	0.44	109	0.00	0.0
15-Jul-18	0.00	0.66	162	1.02	253	0.63	0.35	87	0.00	0.0
16-Jul-18	0.04	0.64	159	0.93	231	0.71	0.43	107	0.00	0.0
17-Jul-18	0.00	0.62	154	0.89	219	0.66	0.40	98	0.00	0.0
18-Jul-18	0.00	0.62	153	0.87	216	0.66	0.42	105	0.00	0.0
19-Jul-18	0.00	0.64	160	0.89	221	0.78	0.44	109	0.00	0.0
20-Jul-18	0.03	0.63	156	0.94	233	0.81	0.43	106	0.00	0.0
21-Jul-18	0.07	0.65	161	1.10	272	0.70	0.40	99	0.00	0.0
22-Jul-18	0.00	0.68	169	0.96	238	0.59	0.37	91	0.00	0.0
23-Jul-18	0.00	0.67	167	0.91	226	0.64	0.47	116	0.00	0.0
24-Jul-18	0.00	0.66	165	0.93	231	0.57	0.46	113	0.00	0.0
25-Jul-18	0.00	0.66	162	0.98	244	0.59	0.43	106	0.00	0.0
26-Jul-18	0.00	0.37	90	0.83	207	0.63	0.00	0	0.00	0.0
27-Jul-18										
28-Jul-18										
29-Jul-18										
30-Jul-18										
31-Jul-18										







Northfield Township, Michigan
Northfield Interceptor
2017 Flow Monitoring Data

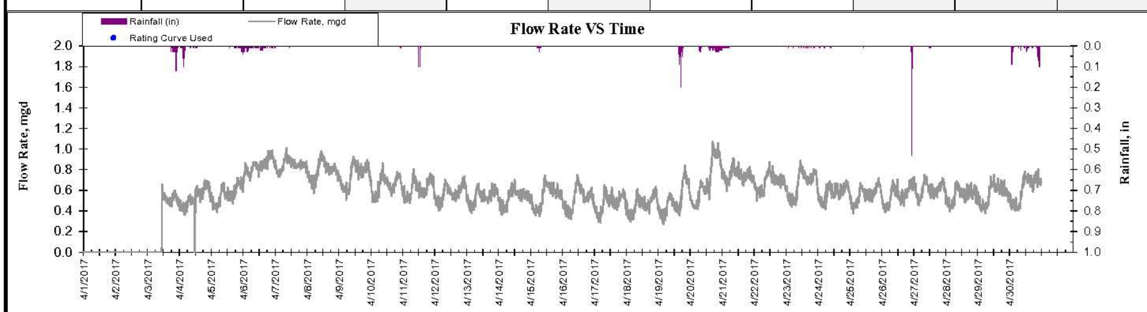
Flow Data for FM02-BAR-18E

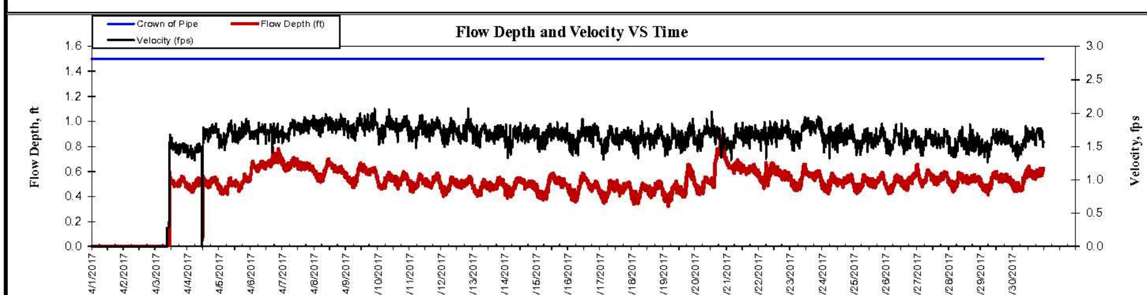
Diameter = 18 in
Slope = 0.13%
Capacity = 2.45 mgd

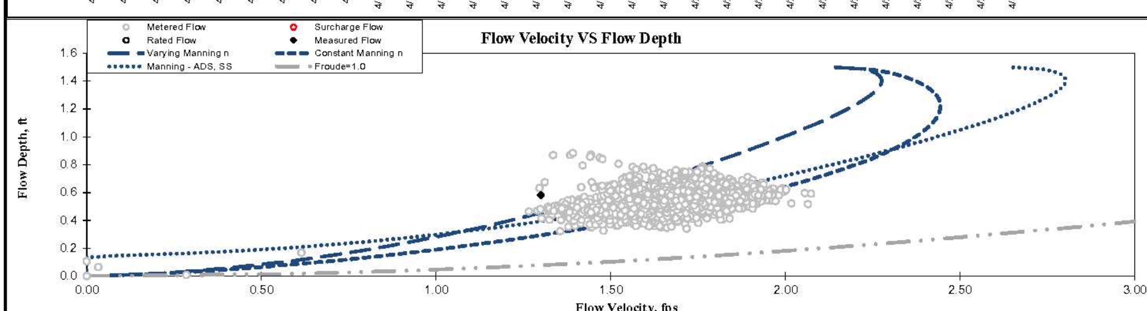
Meter Location: Barker Road at NB US-23 Exit Ramp

Area: 1,393 acres Population: 3,341 Parcels: 1,963 Rain Gage: RG-2017

Date	Daily Rainfall, in	Average Day Flow, mgd	Average Day Flow, gpcd	Maximum Hour Flow, mgd	Maximum Hour Flow, gpcd	Maximum Hour Depth, ft	Minimum Hour Flow, mgd	Minimum Hour Flow, gpcd	SSOAP RDII Analysis Peak Flow, mgd	SSOAP RDII Analysis Volume, MG
1-Apr-17	0.00	0.00		0.00		0.00	0.00			
2-Apr-17	0.00	0.00		0.00		0.00	0.00			
3-Apr-17	0.50	0.28	85	0.66	197	0.60	0.00	0		
4-Apr-17	0.47	0.53	158	0.70	209	0.56	0.00	0		
5-Apr-17	0.27	0.56	168	0.72	217	0.63	0.39	116		
6-Apr-17	0.66	0.84	251	0.98	295	0.79	0.68	202		
7-Apr-17	0.01	0.84	253	1.01	303	0.71	0.73	219		
8-Apr-17	0.00	0.79	237	0.98	292	0.70	0.57	171		
9-Apr-17	0.00	0.74	223	0.92	277	0.67	0.50	151		
10-Apr-17	0.01	0.65	194	0.87	260	0.60	0.48	145		
11-Apr-17	0.21	0.61	183	0.80	240	0.59	0.48	143		
12-Apr-17	0.00	0.57	171	0.74	221	0.56	0.40	121		
13-Apr-17	0.00	0.54	161	0.67	200	0.55	0.38	113		
14-Apr-17	0.00	0.53	159	0.70	211	0.55	0.36	108		
15-Apr-17	0.08	0.54	162	0.75	223	0.59	0.35	106		
16-Apr-17	0.00	0.52	155	0.75	224	0.59	0.32	96		
17-Apr-17	0.00	0.48	144	0.65	194	0.53	0.29	87		
18-Apr-17	0.00	0.46	139	0.64	190	0.53	0.30	89		
19-Apr-17	0.80	0.50	150	0.84	251	0.66	0.27	81		
20-Apr-17	0.73	0.69	206	1.07	320	0.88	0.42	125		
21-Apr-17	0.15	0.75	224	0.91	272	0.69	0.59	177		
22-Apr-17	0.00	0.68	203	0.87	261	0.67	0.50	149		
23-Apr-17	0.10	0.66	198	0.89	265	0.66	0.44	132		
24-Apr-17	0.03	0.57	172	0.70	208	0.59	0.42	124		
25-Apr-17	0.01	0.56	166	0.72	216	0.59	0.38	112		
26-Apr-17	0.82	0.55	164	0.72	215	0.66	0.39	117		
27-Apr-17	0.03	0.61	183	0.75	225	0.61	0.45	136		
28-Apr-17	0.00	0.55	166	0.69	206	0.59	0.40	119		
29-Apr-17	0.00	0.56	168	0.75	226	0.60	0.38	113		
30-Apr-17	0.69	0.61	182	0.81	241	0.64	0.41	121		







Northfield Township, Michigan
Northfield Interceptor
2017 Flow Monitoring Data

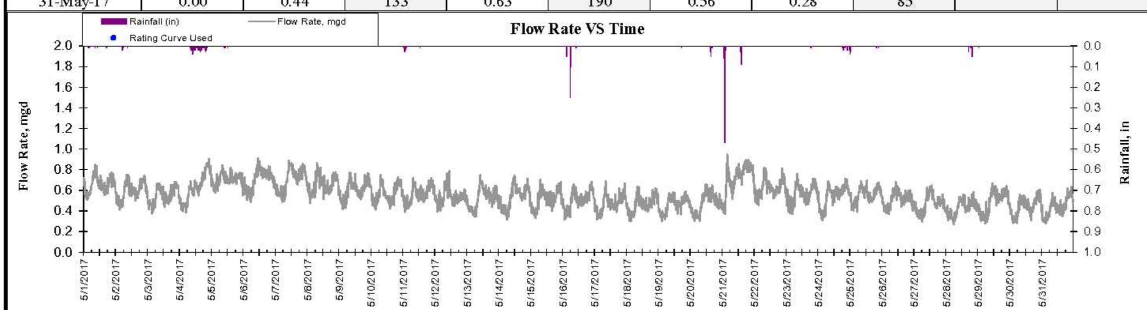
Flow Data for FM02-BAR-18E

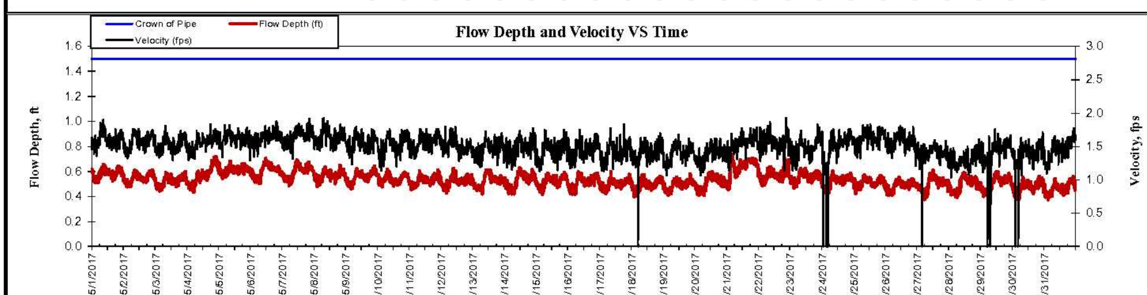
Meter Location: Barker Road at NB US-23 Exit Ramp

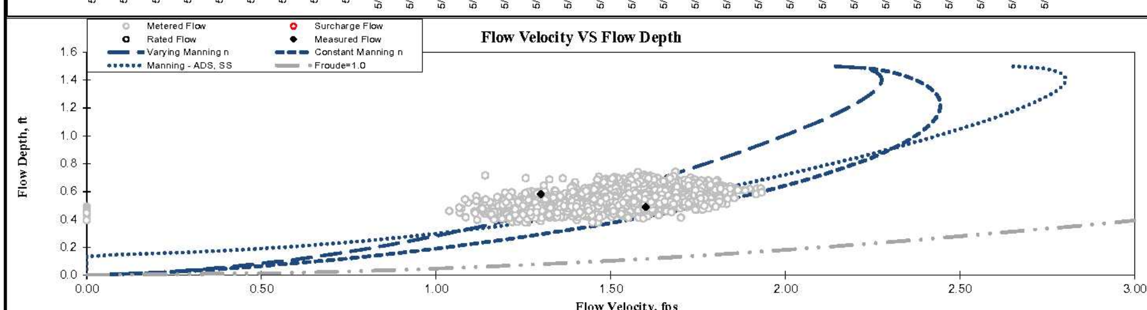
Area: 1,393 acres Population: 3,341 Parcels: 1,963 Rain Gage: RG-2017

Diameter = 18 in
Slope = 0.13%
Capacity = 2.45 mgd

Date	Daily	Average Day		Maximum Hour			Minimum Hour		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-May-17	0.08	0.66	198	0.85	255	0.66	0.51	152		
2-May-17	0.04	0.60	179	0.75	226	0.61	0.41	124		
3-May-17	0.00	0.55	164	0.68	204	0.60	0.38	112		
4-May-17	0.70	0.63	187	0.90	270	0.72	0.38	115		
5-May-17	0.03	0.71	212	0.84	252	0.68	0.55	165		
6-May-17	0.00	0.71	212	0.91	272	0.71	0.49	146		
7-May-17	0.00	0.70	211	0.89	266	0.70	0.49	146		
8-May-17	0.00	0.65	195	0.86	259	0.65	0.48	143		
9-May-17	0.00	0.61	181	0.77	232	0.65	0.42	125		
10-May-17	0.00	0.57	171	0.75	224	0.62	0.41	124		
11-May-17	0.14	0.56	169	0.72	216	0.62	0.39	116		
12-May-17	0.00	0.53	160	0.79	235	0.63	0.39	118		
13-May-17	0.00	0.52	156	0.75	224	0.62	0.34	103		
14-May-17	0.00	0.54	160	0.74	222	0.63	0.32	95		
15-May-17	0.00	0.51	153	0.70	210	0.60	0.33	99		
16-May-17	0.48	0.51	153	0.68	204	0.60	0.32	94		
17-May-17	0.00	0.48	143	0.69	206	0.60	0.32	96		
18-May-17	0.00	0.47	140	0.64	190	0.58	0.30	90		
19-May-17	0.02	0.46	139	0.59	176	0.58	0.30	91		
20-May-17	0.14	0.48	142	0.66	197	0.74	0.31	92		
21-May-17	1.52	0.72	216	0.95	283	0.71	0.37	110		
22-May-17	0.00	0.63	188	0.82	245	0.72	0.46	138		
23-May-17	0.01	0.57	170	0.76	227	0.63	0.37	111		
24-May-17	0.10	0.54	163	0.71	213	0.61	0.31	93		
25-May-17	0.13	0.56	167	0.69	208	0.58	0.39	117		
26-May-17	0.00	0.51	153	0.68	203	0.55	0.37	110		
27-May-17	0.00	0.47	140	0.65	194	0.61	0.30	89		
28-May-17	0.15	0.43	130	0.58	175	0.59	0.27	81		
29-May-17	0.01	0.49	146	0.67	200	0.60	0.28	83		
30-May-17	0.00	0.44	133	0.61	182	0.57	0.28	84		
31-May-17	0.00	0.44	133	0.63	190	0.56	0.28	85		







Northfield Township, Michigan
Northfield Interceptor
2017 Flow Monitoring Data

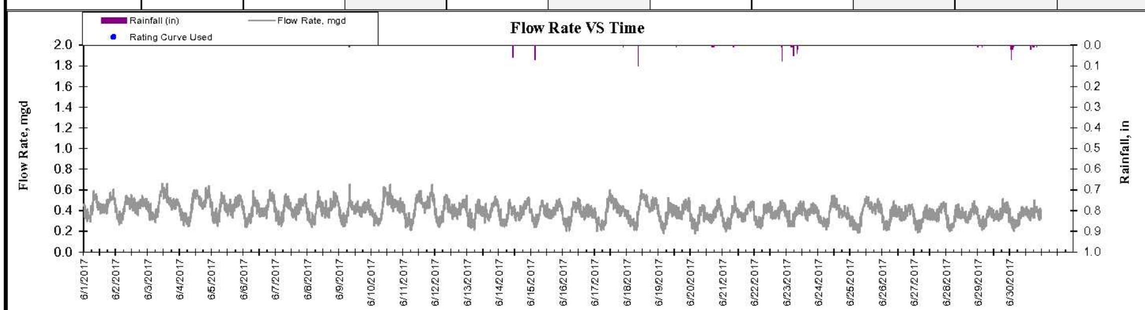
Flow Data for FM02-BAR-18E

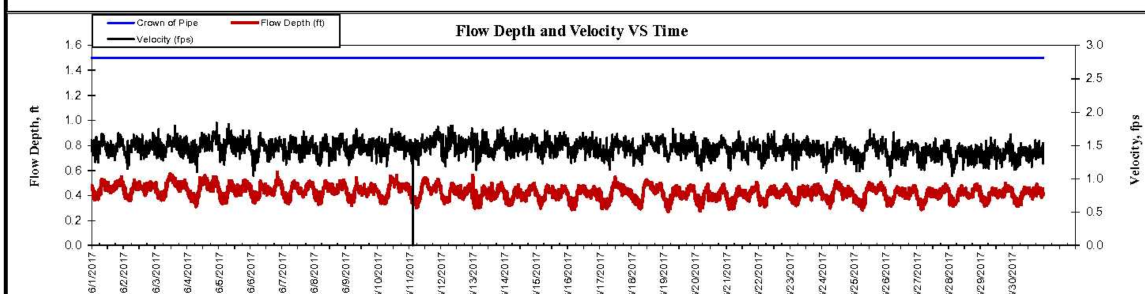
Diameter = 18 in
Slope = 0.13%
Capacity = 2.45 mgd

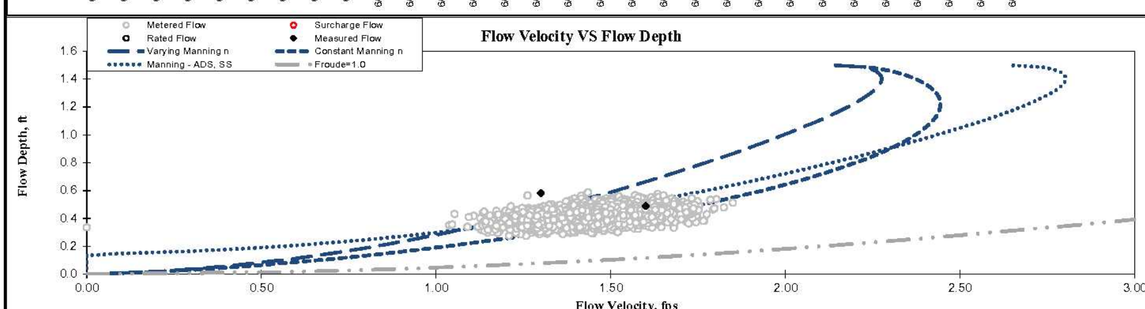
Meter Location: Barker Road at NB US-23 Exit Ramp

Area: 1,393 acres Population: 3,341 Parcels: 1,963 Rain Gage: RG-2017

Date	Daily	Average Day		Maximum Hour			Minimum Hour		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Jun-17	0.00	0.45	134	0.60	180	0.55	0.29	88		
2-Jun-17	0.00	0.43	129	0.55	165	0.53	0.27	80		
3-Jun-17	0.00	0.46	138	0.66	198	0.58	0.29	87		
4-Jun-17	0.00	0.45	134	0.64	191	0.56	0.25	75		
5-Jun-17	0.00	0.43	128	0.57	171	0.52	0.25	76		
6-Jun-17	0.00	0.42	124	0.60	178	0.59	0.24	73		
7-Jun-17	0.00	0.41	124	0.56	166	0.52	0.25	74		
8-Jun-17	0.00	0.41	123	0.59	176	0.52	0.24	72		
9-Jun-17	0.02	0.40	121	0.65	195	0.54	0.25	75		
10-Jun-17	0.00	0.43	130	0.65	195	0.56	0.26	76		
11-Jun-17	0.00	0.43	128	0.65	194	0.54	0.21	63		
12-Jun-17	0.00	0.40	120	0.55	166	0.56	0.24	71		
13-Jun-17	0.00	0.38	115	0.54	162	0.50	0.21	64		
14-Jun-17	0.06	0.38	114	0.53	158	0.50	0.24	73		
15-Jun-17	0.08	0.39	116	0.51	153	0.48	0.24	71		
16-Jun-17	0.00	0.38	112	0.52	157	0.48	0.20	61		
17-Jun-17	0.01	0.39	116	0.60	178	0.55	0.20	61		
18-Jun-17	0.10	0.41	122	0.59	178	0.53	0.21	64		
19-Jun-17	0.01	0.38	112	0.52	157	0.49	0.18	54		
20-Jun-17	0.05	0.35	105	0.51	152	0.49	0.18	53		
21-Jun-17	0.01	0.36	108	0.54	160	0.51	0.20	59		
22-Jun-17	0.12	0.37	111	0.50	149	0.49	0.23	69		
23-Jun-17	0.17	0.38	113	0.49	146	0.50	0.25	74		
24-Jun-17	0.00	0.37	111	0.54	163	0.52	0.22	65		
25-Jun-17	0.00	0.38	113	0.53	160	0.50	0.19	55		
26-Jun-17	0.00	0.36	107	0.49	146	0.48	0.21	62		
27-Jun-17	0.00	0.35	104	0.48	144	0.49	0.19	57		
28-Jun-17	0.00	0.35	104	0.49	147	0.49	0.20	60		
29-Jun-17	0.02	0.35	106	0.51	153	0.50	0.22	64		
30-Jun-17	0.27	0.35	106	0.50	150	0.49	0.21	62		







Northfield Township, Michigan
Northfield Interceptor
2017 Flow Monitoring Data

Flow Data for FM02-BAR-18E

Diameter = 18 in
Slope = 0.13%
Capacity = 2.45 mgd

Meter Location: Barker Road at NB US-23 Exit Ramp
Area: 1,393 acres Population: 3,341 Parcels: 1,963 Rain Gage: RG-2017

Date	Daily	Average Day		Maximum Hour			Minimum Hour		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Jul-17	0.00	0.39	116	0.57	170	0.55	0.18	55		
2-Jul-17	0.00	0.38	114	0.54	161	0.54	0.22	65		
3-Jul-17	0.00	0.38	112	0.55	164	0.53	0.21	62		
4-Jul-17	0.00	0.38	113	0.55	166	0.51	0.20	61		
5-Jul-17	0.00	0.16	49	0.45	134	0.46	0.00	0		
6-Jul-17										
7-Jul-17										
8-Jul-17										
9-Jul-17										
10-Jul-17										
11-Jul-17										
12-Jul-17										
13-Jul-17										
14-Jul-17										
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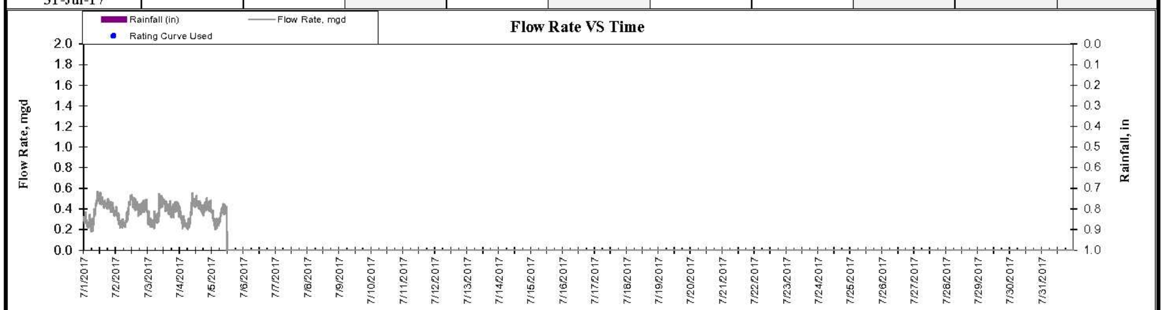
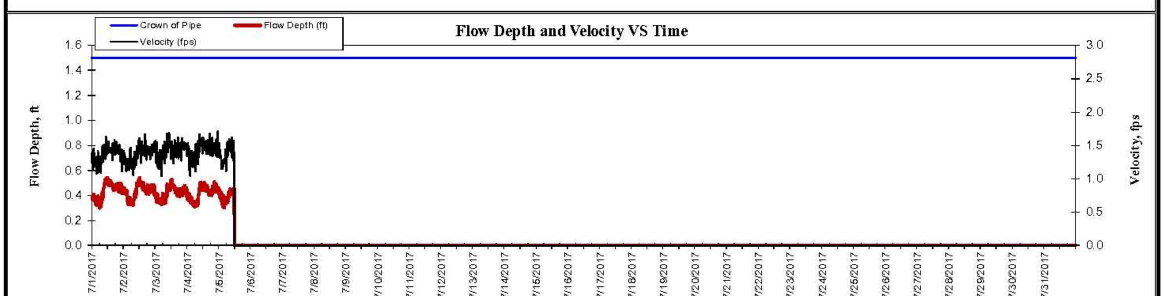
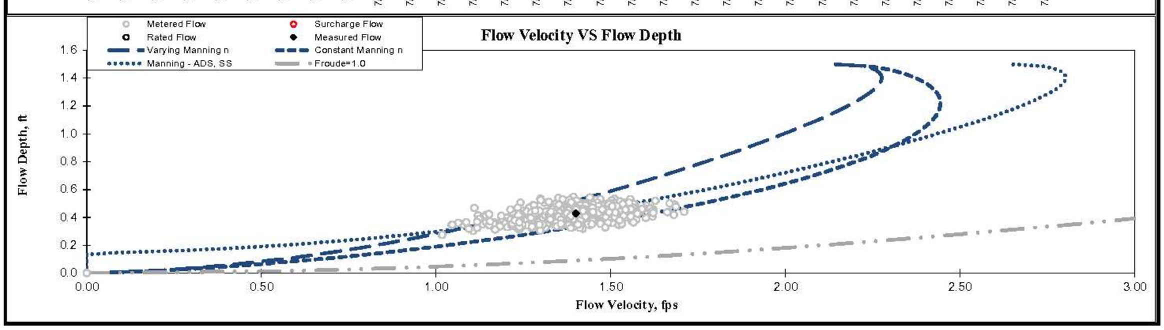
31-Jul-17										







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

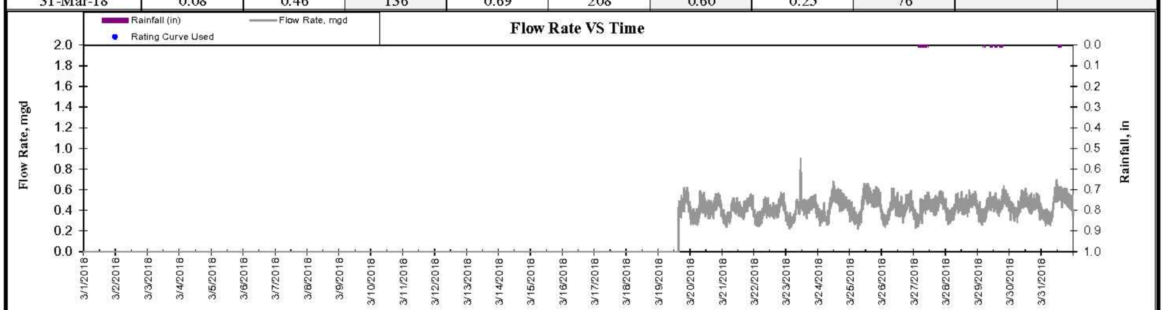
Flow Data for FM02-BAR-18E

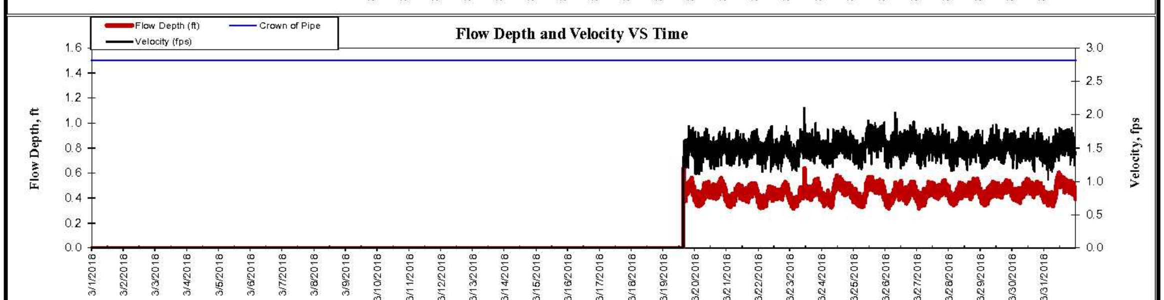
Meter Location: Barker Road at NB US-23 Exit Ramp

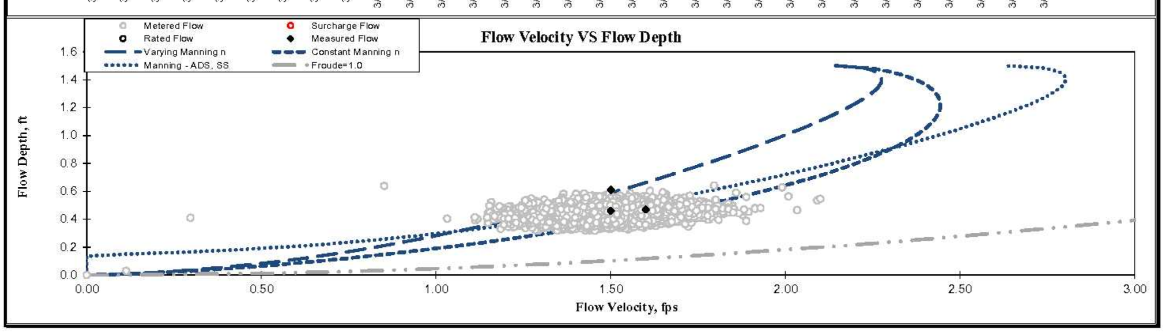
Diameter = 18 in
Slope = 0.13%
Capacity = 2.45 mgd

Area: 1,393 acres Population: 3,341 Parcels: 1,963 Rain Gage: RG01-Main

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
2-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
3-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
4-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
5-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
6-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
7-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
8-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
9-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
10-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
11-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
12-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
13-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
14-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
15-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
16-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
17-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
18-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
19-Mar-18	0.00	0.16	49	0.62	185	0.64	0.00	0		
20-Mar-18	0.00	0.42	124	0.59	175	0.56	0.26	78		
21-Mar-18	0.00	0.40	120	0.56	167	0.52	0.24	72		
22-Mar-18	0.00	0.39	118	0.57	170	0.53	0.25	74		
23-Mar-18	0.00	0.41	124	0.90	270	0.64	0.23	68		
24-Mar-18	0.00	0.44	132	0.68	203	0.58	0.25	75		
25-Mar-18	0.00	0.45	136	0.66	197	0.57	0.22	66		
26-Mar-18	0.00	0.42	124	0.61	183	0.54	0.24	72		
27-Mar-18	0.32	0.43	129	0.59	175	0.55	0.23	69		
28-Mar-18	0.00	0.43	129	0.60	178	0.56	0.27	79		
29-Mar-18	0.18	0.44	131	0.63	189	0.54	0.26	78		
30-Mar-18	0.00	0.44	132	0.61	182	0.55	0.29	85		
31-Mar-18	0.08	0.46	136	0.69	208	0.60	0.25	76		







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

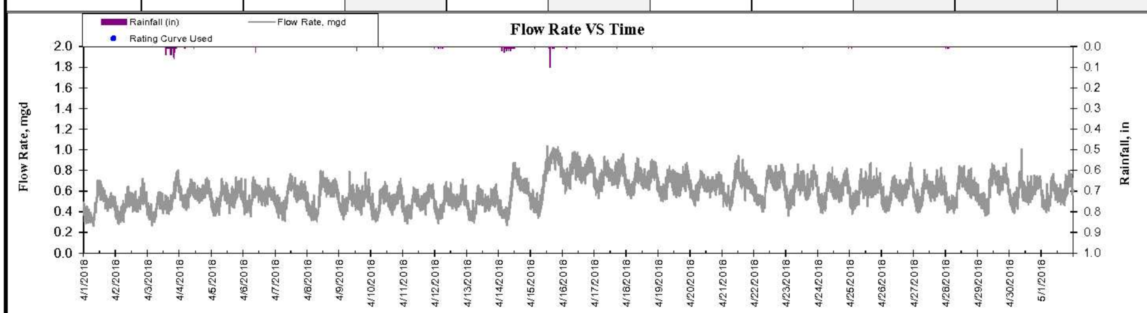
Flow Data for FM02-BAR-18E

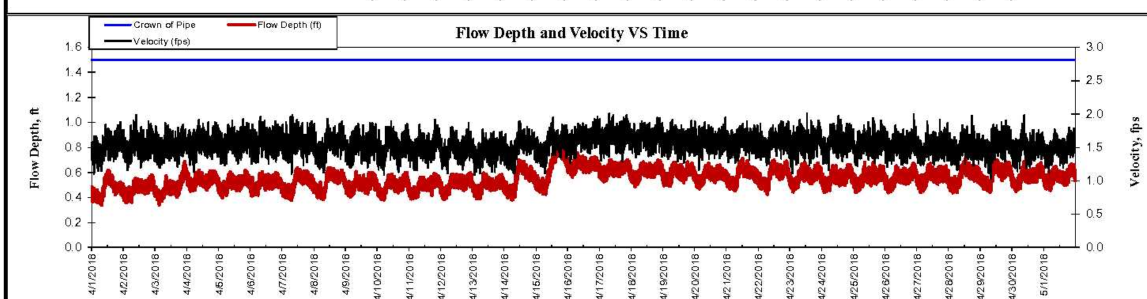
Diameter = 18 in
Slope = 0.13%
Capacity = 2.45 mgd

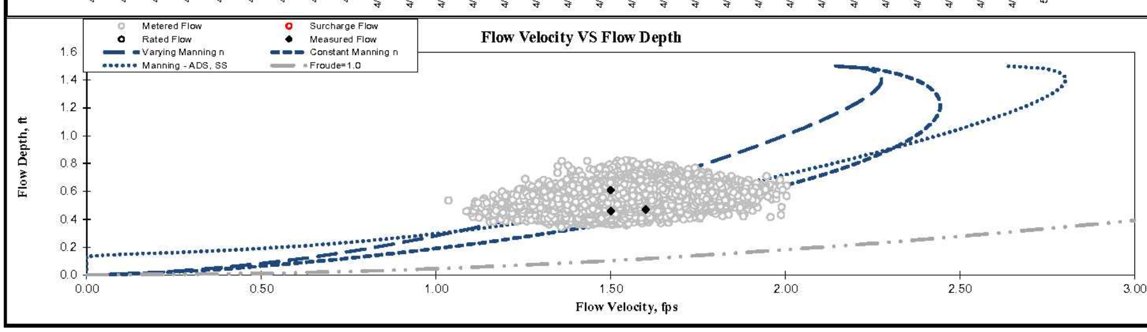
Meter Location: Barker Road at NB US-23 Exit Ramp

Area: 1,393 acres Population: 3,341 Parcels: 1,963 Rain Gage: RG01-Main

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Apr-18	0.00	0.47	140	0.70	210	0.62	0.26	79		
2-Apr-18	0.00	0.47	139	0.72	214	0.58	0.28	84		
3-Apr-18	0.77	0.49	145	0.80	239	0.69	0.27	80		
4-Apr-18	0.02	0.58	172	0.73	218	0.62	0.42	126		
5-Apr-18	0.00	0.54	161	0.73	220	0.62	0.36	109		
6-Apr-18	0.10	0.54	163	0.73	219	0.60	0.36	106		
7-Apr-18	0.00	0.54	163	0.77	230	0.64	0.31	93		
8-Apr-18	0.00	0.55	166	0.79	237	0.64	0.31	91		
9-Apr-18	0.05	0.51	153	0.79	236	0.61	0.33	99		
10-Apr-18	0.01	0.50	148	0.72	216	0.60	0.31	91		
11-Apr-18	0.01	0.49	147	0.67	200	0.59	0.29	86		
12-Apr-18	0.03	0.50	149	0.71	214	0.60	0.29	86		
13-Apr-18	0.00	0.48	144	0.66	198	0.60	0.29	88		
14-Apr-18	0.70	0.57	172	0.88	262	0.70	0.27	81		
15-Apr-18	0.19	0.72	215	1.04	310	0.83	0.34	103		
16-Apr-18	0.02	0.79	236	0.98	293	0.75	0.58	173		
17-Apr-18	0.01	0.75	223	0.96	287	0.70	0.53	159		
18-Apr-18	0.01	0.71	214	0.92	275	0.70	0.53	159		
19-Apr-18	0.00	0.67	201	0.87	261	0.68	0.50	151		
20-Apr-18	0.00	0.64	192	0.80	239	0.67	0.46	138		
21-Apr-18	0.00	0.64	193	0.94	283	0.71	0.42	126		
22-Apr-18	0.00	0.65	195	0.86	258	0.70	0.40	120		
23-Apr-18	0.01	0.63	189	0.86	257	0.68	0.36	108		
24-Apr-18	0.01	0.61	182	0.82	247	0.66	0.39	116		
25-Apr-18	0.01	0.61	182	0.87	260	0.68	0.38	113		
26-Apr-18	0.00	0.59	177	0.87	260	0.68	0.39	118		
27-Apr-18	0.00	0.60	179	0.82	247	0.67	0.39	118		
28-Apr-18	0.07	0.60	180	0.84	252	0.72	0.39	116		
29-Apr-18	0.00	0.63	190	0.87	260	0.70	0.36	108		
30-Apr-18	0.00	0.59	178	1.01	301	0.69	0.39	116		







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

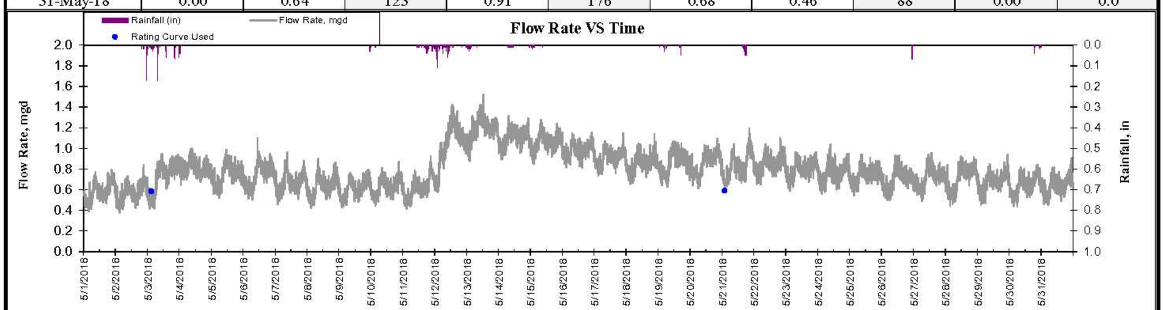
Flow Data for FM02-BAR-18E

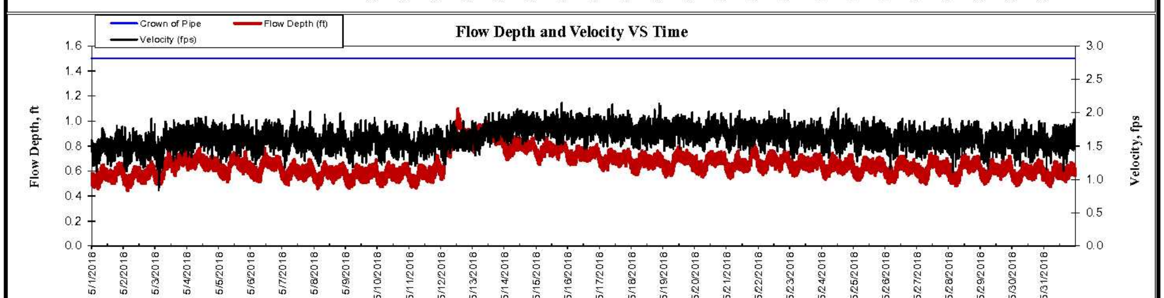
Meter Location: Barker Road at NB US-23 Exit Ramp

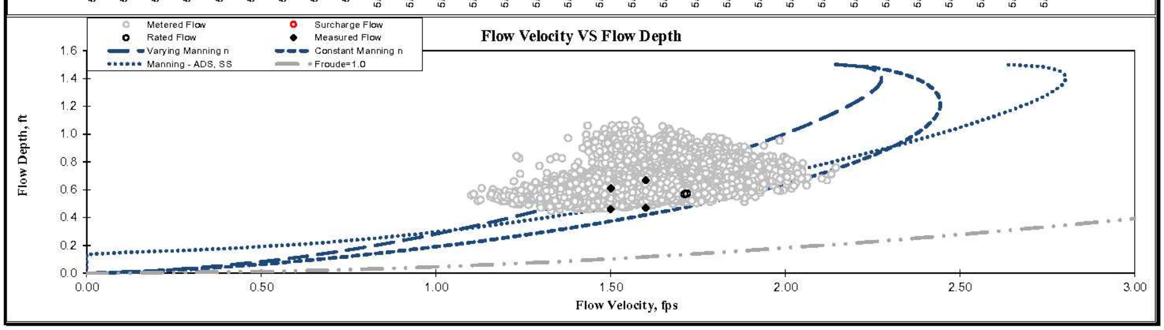
Area: 1,393 acres Population: 3,341 Parcels: 1,963 Rain Gage: RG01-Main

Diameter = 18 in
Slope = 0.13%
Capacity = 2.45 mgd

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-May-18	0.00	0.58	113	0.80	154	0.66	0.39	76	0.00	0.0
2-May-18	0.34	0.58	112	0.84	162	0.68	0.38	73	0.00	0.0
3-May-18	1.24	0.72	139	0.95	183	0.78	0.42	81	0.00	0.0
4-May-18	0.09	0.82	158	1.00	194	0.78	0.65	125	0.00	0.0
5-May-18	0.00	0.74	144	0.99	191	0.76	0.52	101	0.00	0.0
6-May-18	0.00	0.74	144	1.10	212	0.78	0.50	97	0.00	0.0
7-May-18	0.00	0.67	130	0.96	185	0.69	0.46	89	0.00	0.0
8-May-18	0.00	0.64	123	0.90	174	0.67	0.43	83	0.00	0.0
9-May-18	0.14	0.61	119	0.79	153	0.69	0.43	83	0.00	0.0
10-May-18	0.01	0.63	122	0.87	168	0.67	0.45	87	0.00	0.0
11-May-18	0.70	0.62	120	0.92	178	0.73	0.42	81	0.00	0.0
12-May-18	1.42	1.04	201	1.42	274	1.10	0.58	111	0.00	0.0
13-May-18	0.47	1.19	230	1.52	294	1.00	0.88	170	0.00	0.0
14-May-18	0.13	1.11	214	1.32	254	0.88	0.89	173	0.00	0.0
15-May-18	0.23	1.05	204	1.28	247	0.87	0.85	165	0.00	0.0
16-May-18	0.00	0.99	191	1.15	223	0.81	0.81	157	0.00	0.0
17-May-18	0.00	0.91	177	1.15	222	0.78	0.74	143	0.00	0.0
18-May-18	0.00	0.85	165	1.14	220	0.76	0.66	127	0.00	0.0
19-May-18	0.33	0.87	168	1.07	207	0.79	0.63	122	0.00	0.0
20-May-18	0.00	0.86	166	1.10	212	0.76	0.61	119	0.00	0.0
21-May-18	0.48	0.83	161	1.19	231	0.84	0.59	114	0.00	0.0
22-May-18	0.00	0.85	164	1.10	213	0.76	0.65	126	0.00	0.0
23-May-18	0.00	0.79	154	0.96	187	0.74	0.59	114	0.00	0.0
24-May-18	0.00	0.76	147	1.04	201	0.74	0.56	109	0.00	0.0
25-May-18	0.00	0.74	143	0.94	181	0.71	0.54	105	0.00	0.0
26-May-18	0.22	0.70	135	0.93	180	0.72	0.50	97	0.00	0.0
27-May-18	0.00	0.71	138	0.96	185	0.74	0.49	95	0.00	0.0
28-May-18	0.00	0.72	139	0.92	178	0.73	0.44	85	0.00	0.0
29-May-18	0.00	0.67	130	0.94	181	0.72	0.45	87	0.00	0.0
30-May-18	0.17	0.64	124	0.84	162	0.69	0.44	85	0.00	0.0
31-May-18	0.00	0.64	123	0.91	176	0.68	0.46	88	0.00	0.0







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

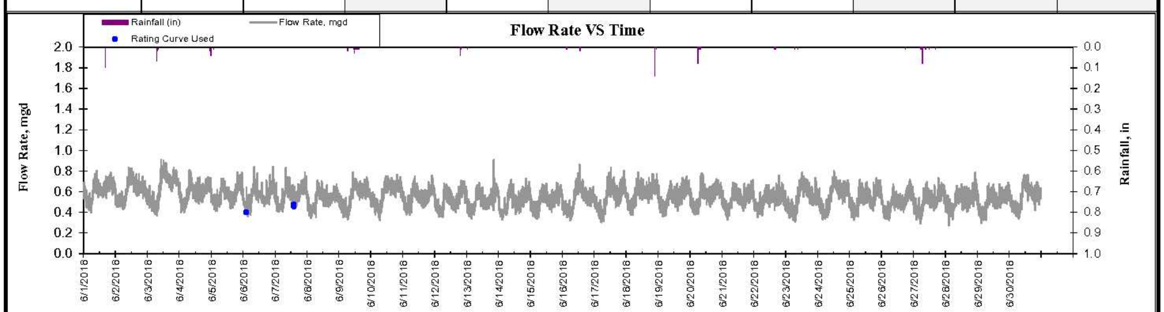
Flow Data for FM02-BAR-18E

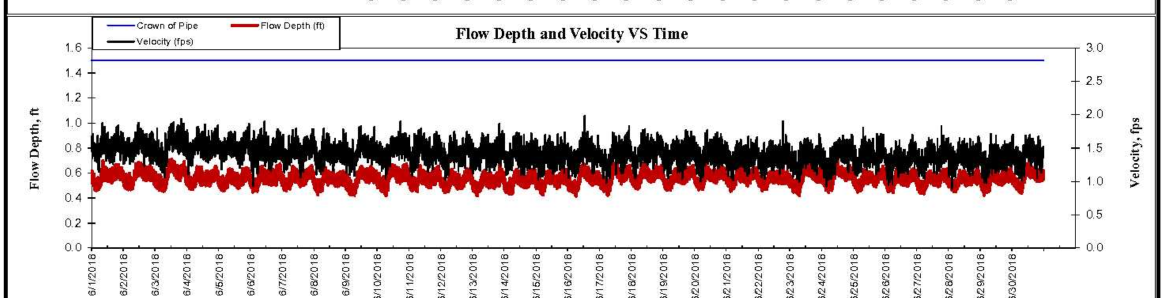
Meter Location: Barker Road at NB US-23 Exit Ramp

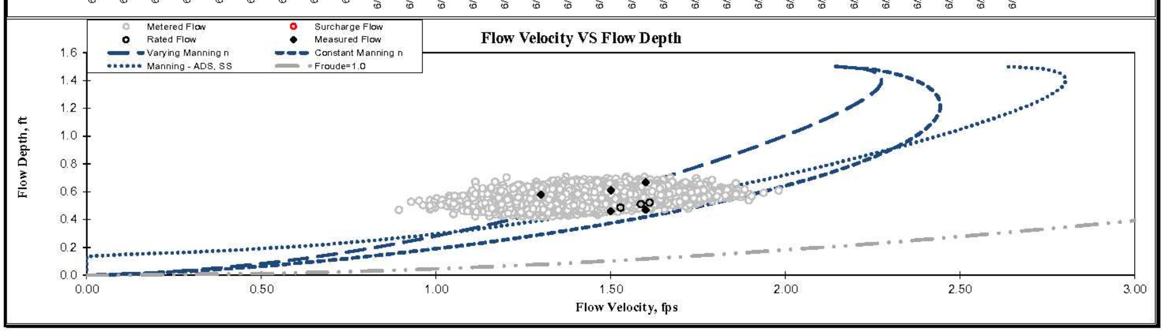
Diameter = 18 in
Slope = 0.13%
Capacity = 2.45 mgd

Area: 1,393 acres Population: 3,341 Parcels: 1,963 Rain Gage: RG01-Main

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Jun-18	0.26	0.61	117	0.80	155	0.70	0.40	77	0.00	0.0
2-Jun-18	0.00	0.61	118	0.83	160	0.69	0.43	84	0.00	0.0
3-Jun-18	0.26	0.64	123	0.91	176	0.71	0.37	72	0.00	0.0
4-Jun-18	0.14	0.59	115	0.81	156	0.66	0.40	77	0.00	0.0
5-Jun-18	0.02	0.57	111	0.78	152	0.64	0.41	80	0.00	0.0
6-Jun-18	0.00	0.56	109	0.84	163	0.67	0.36	71	0.00	0.0
7-Jun-18	0.00	0.56	109	0.83	161	0.66	0.41	79	0.00	0.0
8-Jun-18	0.00	0.53	103	0.71	137	0.64	0.35	67	0.00	0.0
9-Jun-18	0.30	0.55	107	0.79	152	0.65	0.33	64	0.00	0.0
10-Jun-18	0.00	0.58	112	0.76	148	0.67	0.33	63	0.00	0.0
11-Jun-18	0.00	0.55	107	0.76	146	0.66	0.38	73	0.00	0.0
12-Jun-18	0.10	0.52	101	0.71	137	0.63	0.35	68	0.00	0.0
13-Jun-18	0.01	0.52	100	0.91	176	0.68	0.34	66	0.00	0.0
14-Jun-18	0.00	0.51	98	0.73	141	0.63	0.33	64	0.00	0.0
15-Jun-18	0.00	0.51	99	0.69	133	0.65	0.34	65	0.00	0.0
16-Jun-18	0.04	0.53	103	0.86	167	0.67	0.32	62	0.00	0.0
17-Jun-18	0.00	0.55	107	0.83	161	0.68	0.30	59	0.00	0.0
18-Jun-18	0.30	0.58	112	0.79	152	0.68	0.38	73	0.00	0.0
19-Jun-18	0.00	0.54	105	0.75	145	0.66	0.36	70	0.00	0.0
20-Jun-18	0.25	0.56	108	0.78	150	0.67	0.38	73	0.00	0.0
21-Jun-18	0.00	0.53	103	0.71	138	0.65	0.33	64	0.00	0.0
22-Jun-18	0.06	0.52	100	0.76	146	0.64	0.35	68	0.00	0.0
23-Jun-18	0.02	0.53	103	0.78	151	0.71	0.31	59	0.00	0.0
24-Jun-18	0.00	0.55	107	0.80	155	0.70	0.33	64	0.00	0.0
25-Jun-18	0.00	0.53	102	0.73	141	0.66	0.33	63	0.00	0.0
26-Jun-18	0.01	0.50	97	0.72	139	0.63	0.32	63	0.00	0.0
27-Jun-18	0.17	0.51	99	0.73	142	0.64	0.29	57	0.00	0.0
28-Jun-18	0.00	0.51	99	0.78	151	0.65	0.27	53	0.00	0.0
29-Jun-18	0.00	0.51	98	0.69	133	0.67	0.30	57	0.00	0.0
30-Jun-18	0.00	0.55	107	0.76	147	0.68	0.34	66	0.00	0.0







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

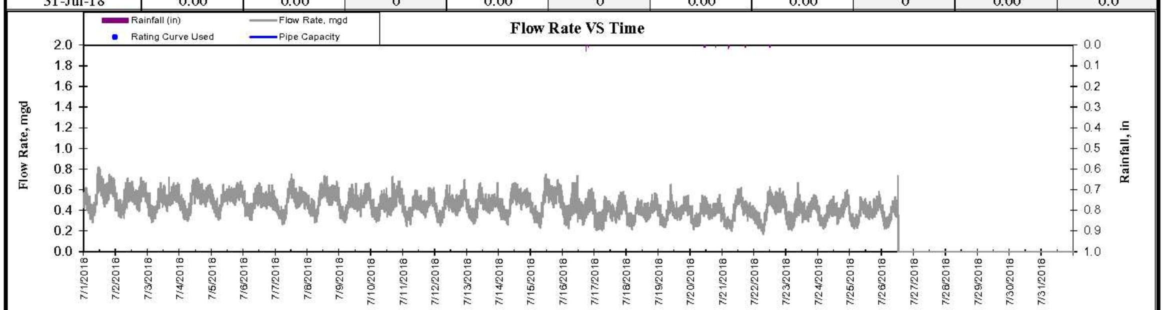
Flow Data for FM02-BAR-18E

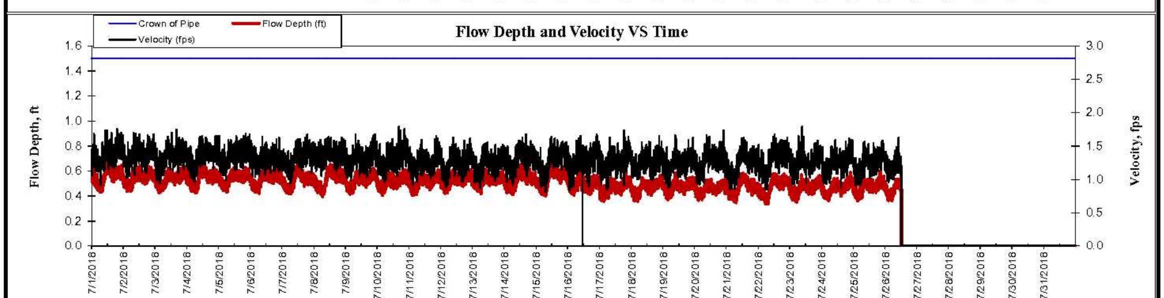
Meter Location: Barker Road at NB US-23 Exit Ramp

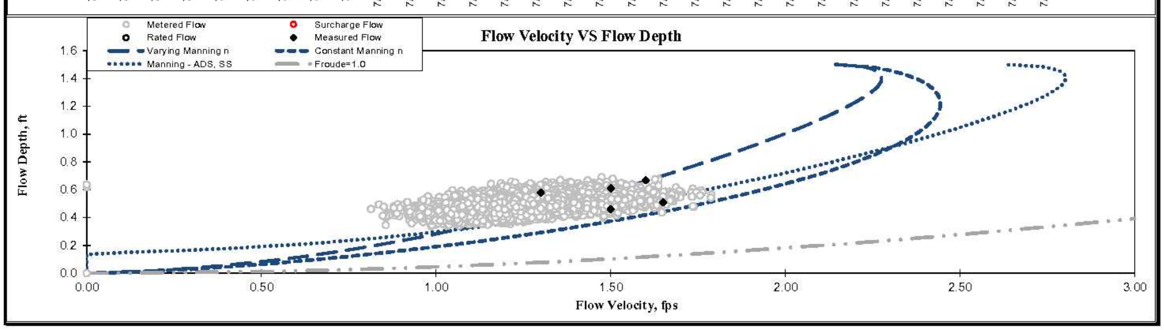
Diameter = 18 in
Slope = 0.13%
Capacity = 2.45 mgd

Area: 1,393 acres Population: 3,341 Parcels: 1,963 Rain Gage: RG01-Main

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Jul-18	0.00	0.54	105	0.82	158	0.69	0.28	55	0.00	0.0
2-Jul-18	0.00	0.51	99	0.71	138	0.65	0.33	63	0.00	0.0
3-Jul-18	0.00	0.49	95	0.71	138	0.64	0.29	56	0.00	0.0
4-Jul-18	0.00	0.51	98	0.71	137	0.66	0.30	58	0.00	0.0
5-Jul-18	0.00	0.51	98	0.68	131	0.63	0.31	60	0.00	0.0
6-Jul-18	0.00	0.48	93	0.66	128	0.66	0.31	59	0.00	0.0
7-Jul-18	0.00	0.48	93	0.74	144	0.67	0.26	51	0.00	0.0
8-Jul-18	0.00	0.51	98	0.73	141	0.65	0.29	55	0.00	0.0
9-Jul-18	0.00	0.48	92	0.66	128	0.62	0.28	55	0.00	0.0
10-Jul-18	0.00	0.46	89	0.72	140	0.61	0.29	56	0.00	0.0
11-Jul-18	0.00	0.44	85	0.62	120	0.61	0.25	48	0.00	0.0
12-Jul-18	0.00	0.45	87	0.69	134	0.61	0.25	48	0.00	0.0
13-Jul-18	0.00	0.45	87	0.66	129	0.61	0.27	52	0.00	0.0
14-Jul-18	0.00	0.47	91	0.66	128	0.65	0.27	51	0.00	0.0
15-Jul-18	0.00	0.48	93	0.75	144	0.67	0.23	45	0.00	0.0
16-Jul-18	0.04	0.43	84	0.73	142	0.62	0.23	44	0.00	0.0
17-Jul-18	0.00	0.39	75	0.58	112	0.58	0.21	40	0.00	0.0
18-Jul-18	0.00	0.38	74	0.56	109	0.56	0.22	42	0.00	0.0
19-Jul-18	0.00	0.39	75	0.65	125	0.59	0.24	47	0.00	0.0
20-Jul-18	0.03	0.38	73	0.55	106	0.55	0.22	42	0.00	0.0
21-Jul-18	0.07	0.39	75	0.61	119	0.58	0.20	39	0.00	0.0
22-Jul-18	0.01	0.41	79	0.63	121	0.58	0.17	33	0.00	0.0
23-Jul-18	0.00	0.39	75	0.67	129	0.57	0.21	41	0.00	0.0
24-Jul-18	0.00	0.39	75	0.59	114	0.59	0.23	44	0.00	0.0
25-Jul-18	0.00	0.39	75	0.58	111	0.60	0.23	44	0.00	0.0
26-Jul-18	0.00	0.18	36	0.73	141	0.64	0.00	0	0.00	0.0
27-Jul-18	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00	0.0
28-Jul-18	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00	0.0
29-Jul-18	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00	0.0
30-Jul-18	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00	0.0
31-Jul-18	0.00	0.00	0	0.00	0	0.00	0.00	0	0.00	0.0







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

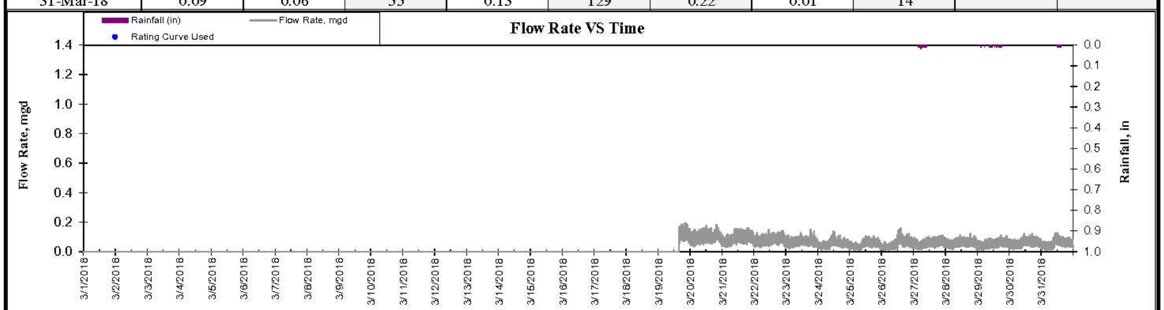
Flow Data for FM03-BAR-12N

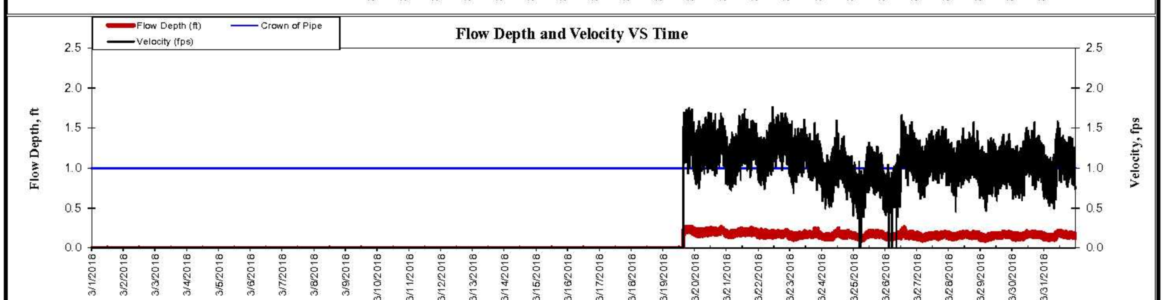
Meter Location: Barker Rd

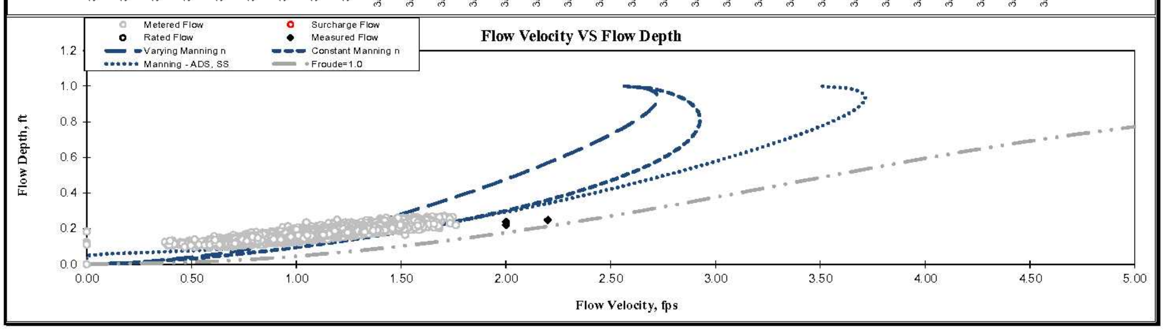
Diameter = 12 in
Slope = 0.32%
Capacity = 1.31 mgd

Area: 224 acres Population: 1,001 Parcels: 401 Rain Gage: RG02-Barker

Date	Daily Rainfall, in	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
		Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Mar-18										
2-Mar-18										
3-Mar-18										
4-Mar-18										
5-Mar-18										
6-Mar-18										
7-Mar-18										
8-Mar-18										
9-Mar-18										
10-Mar-18										
11-Mar-18										
12-Mar-18										
13-Mar-18										
14-Mar-18										
15-Mar-18										
16-Mar-18										
17-Mar-18										
18-Mar-18										
19-Mar-18	0.00	0.04	42	0.19	189	0.27	0.00	0		
20-Mar-18	0.00	0.09	95	0.18	179	0.26	0.04	35		
21-Mar-18	0.00	0.09	86	0.16	159	0.25	0.03	31		
22-Mar-18	0.00	0.08	76	0.15	147	0.24	0.03	30		
23-Mar-18	0.00	0.07	65	0.15	150	0.25	0.02	20		
24-Mar-18	0.00	0.05	52	0.14	135	0.25	0.01	15		
25-Mar-18	0.00	0.05	46	0.11	108	0.22	0.01	11		
26-Mar-18	0.00	0.05	54	0.16	158	0.26	0.01	11		
27-Mar-18	0.32	0.06	55	0.11	108	0.21	0.02	17		
28-Mar-18	0.00	0.06	56	0.12	119	0.21	0.02	15		
29-Mar-18	0.17	0.05	51	0.11	109	0.21	0.01	12		
30-Mar-18	0.00	0.06	57	0.12	120	0.21	0.02	19		
31-Mar-18	0.09	0.06	55	0.13	129	0.22	0.01	14		







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

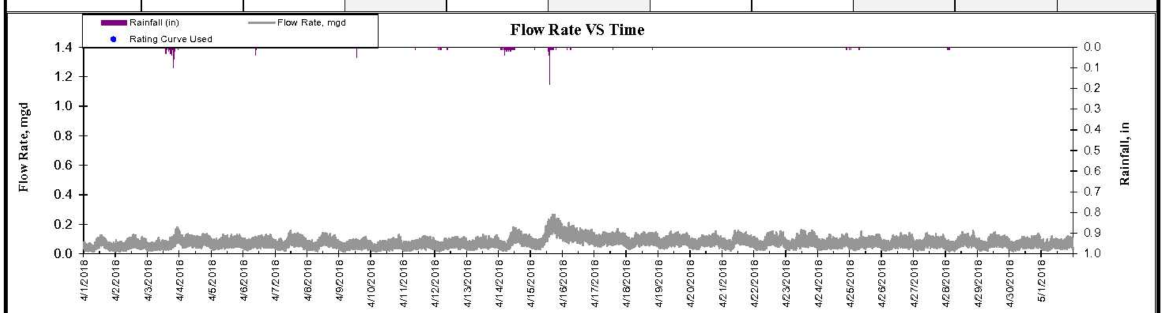
Flow Data for FM03-BAR-12N

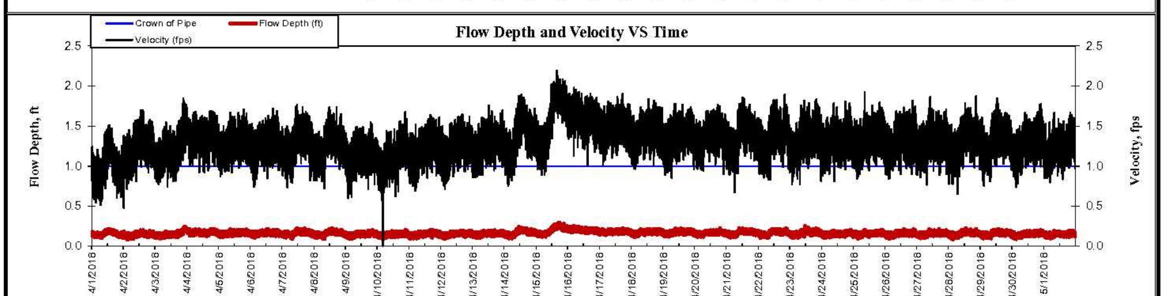
Meter Location: Barker Rd

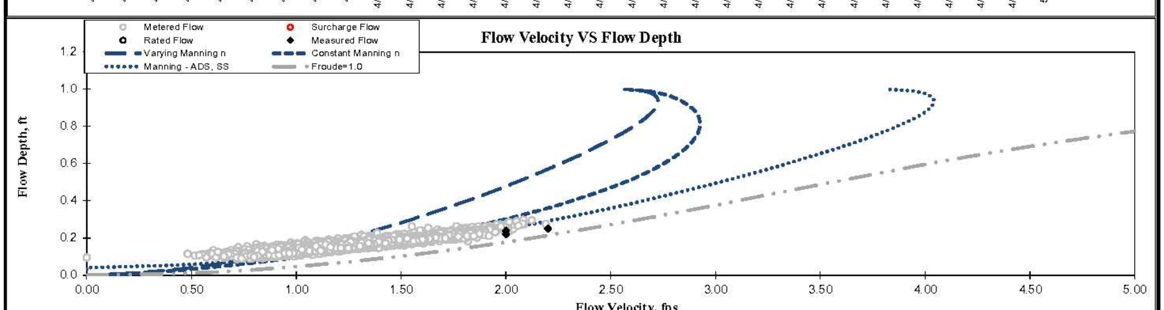
Diameter = 12 in
Slope = 0.32%
Capacity = 1.31 mgd

Area: 224 acres Population: 1,001 Parcels: 401 Rain Gage: RG02-Barker

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Apr-18	0.00	0.05	52	0.13	125	0.22	0.01	15		
2-Apr-18	0.00	0.06	58	0.13	128	0.21	0.02	15		
3-Apr-18	0.74	0.06	63	0.18	178	0.25	0.02	21		
4-Apr-18	0.00	0.08	82	0.15	150	0.22	0.04	38		
5-Apr-18	0.00	0.07	70	0.13	132	0.21	0.03	27		
6-Apr-18	0.12	0.07	68	0.13	129	0.21	0.02	22		
7-Apr-18	0.00	0.07	71	0.15	155	0.23	0.02	20		
8-Apr-18	0.00	0.07	68	0.14	143	0.23	0.02	17		
9-Apr-18	0.07	0.06	55	0.11	113	0.21	0.02	15		
10-Apr-18	0.00	0.05	52	0.13	128	0.21	0.01	14		
11-Apr-18	0.01	0.06	58	0.12	122	0.21	0.02	19		
12-Apr-18	0.04	0.06	61	0.12	115	0.20	0.02	17		
13-Apr-18	0.00	0.06	64	0.13	128	0.20	0.02	25		
14-Apr-18	0.67	0.08	82	0.18	180	0.24	0.02	22		
15-Apr-18	0.62	0.12	123	0.26	265	0.30	0.03	30		
16-Apr-18	0.02	0.12	121	0.21	209	0.26	0.06	57		
17-Apr-18	0.01	0.09	94	0.17	167	0.23	0.05	46		
18-Apr-18	0.01	0.09	86	0.15	149	0.22	0.03	32		
19-Apr-18	0.00	0.08	82	0.15	150	0.22	0.03	34		
20-Apr-18	0.00	0.08	78	0.15	152	0.23	0.03	32		
21-Apr-18	0.00	0.08	80	0.16	159	0.23	0.02	21		
22-Apr-18	0.00	0.08	79	0.15	153	0.23	0.02	25		
23-Apr-18	0.00	0.08	77	0.16	165	0.26	0.02	24		
24-Apr-18	0.02	0.07	67	0.13	134	0.21	0.03	26		
25-Apr-18	0.02	0.07	68	0.15	150	0.21	0.02	22		
26-Apr-18	0.00	0.07	68	0.14	141	0.22	0.02	20		
27-Apr-18	0.00	0.07	68	0.14	142	0.22	0.02	23		
28-Apr-18	0.08	0.07	69	0.16	157	0.23	0.02	17		
29-Apr-18	0.00	0.07	71	0.15	149	0.22	0.02	19		
30-Apr-18	0.00	0.06	64	0.14	135	0.21	0.02	16		







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

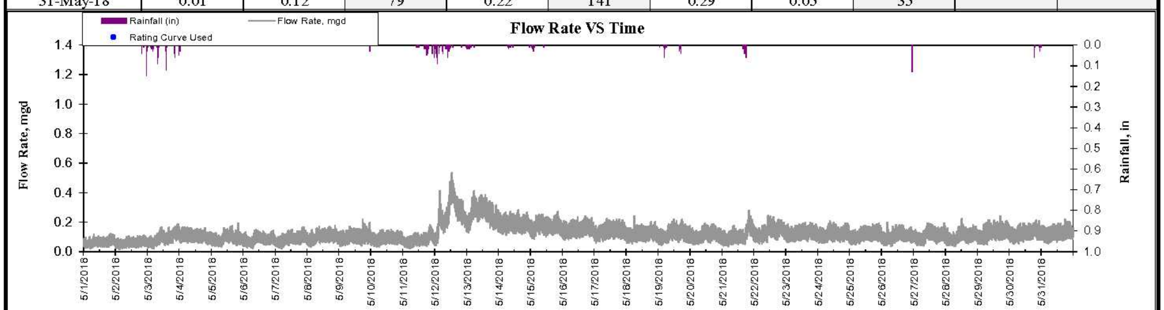
Flow Data for FM03-BAR-12N

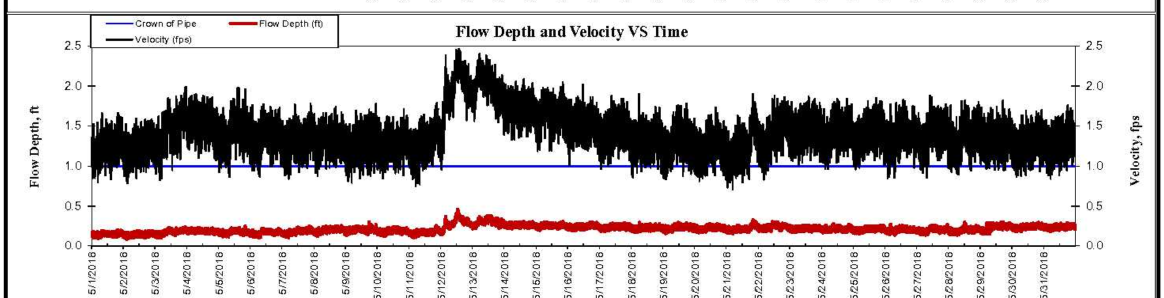
Diameter = 12 in
Slope = 0.32%
Capacity = 1.31 mgd

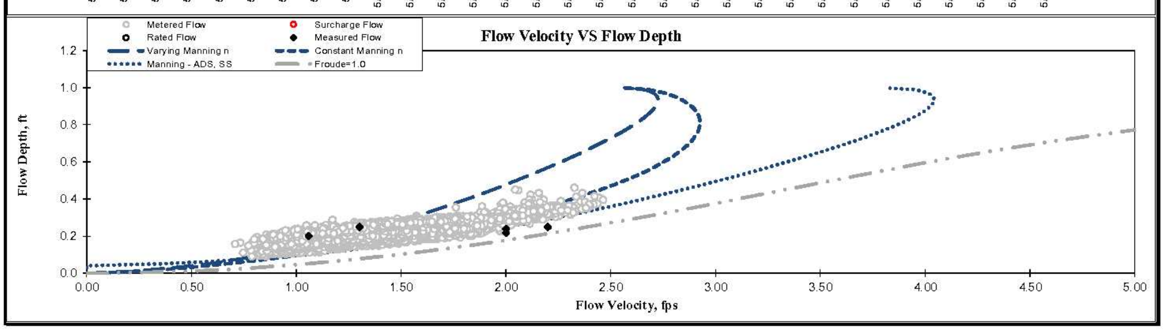
Meter Location: Barker Rd

Area: 224 acres Population: 1,001 Parcels: 401 Rain Gage: RG02-Barker

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-May-18	0.00	0.06	40	0.12	78	0.20	0.02	13		
2-May-18	0.41	0.06	37	0.11	72	0.20	0.02	12		
3-May-18	1.18	0.09	60	0.19	122	0.24	0.02	15		
4-May-18	0.07	0.10	67	0.17	107	0.23	0.05	34		
5-May-18	0.00	0.09	57	0.19	124	0.25	0.03	22		
6-May-18	0.00	0.08	51	0.15	94	0.22	0.03	16		
7-May-18	0.00	0.08	54	0.17	107	0.25	0.02	15		
8-May-18	0.00	0.10	63	0.17	112	0.26	0.03	21		
9-May-18	0.18	0.10	63	0.22	141	0.30	0.04	24		
10-May-18	0.00	0.09	55	0.15	95	0.25	0.03	21		
11-May-18	0.76	0.08	50	0.18	118	0.26	0.02	15		
12-May-18	1.36	0.25	163	0.53	344	0.46	0.04	27		
13-May-18	0.45	0.26	168	0.41	264	0.38	0.13	84		
14-May-18	0.13	0.19	121	0.28	181	0.31	0.11	73		
15-May-18	0.22	0.17	110	0.27	177	0.31	0.09	56		
16-May-18	0.00	0.15	98	0.24	154	0.30	0.08	50		
17-May-18	0.00	0.14	88	0.23	145	0.29	0.06	40		
18-May-18	0.00	0.12	76	0.24	156	0.30	0.05	35		
19-May-18	0.39	0.12	77	0.22	142	0.30	0.04	29		
20-May-18	0.00	0.11	69	0.19	122	0.28	0.05	32		
21-May-18	0.54	0.11	70	0.28	178	0.33	0.04	23		
22-May-18	0.00	0.13	86	0.25	158	0.31	0.05	35		
23-May-18	0.00	0.12	78	0.20	126	0.27	0.07	42		
24-May-18	0.00	0.12	74	0.21	133	0.28	0.06	38		
25-May-18	0.00	0.11	70	0.19	122	0.26	0.05	31		
26-May-18	0.35	0.10	67	0.20	128	0.27	0.04	24		
27-May-18	0.00	0.10	68	0.19	124	0.27	0.04	27		
28-May-18	0.00	0.10	64	0.22	143	0.30	0.04	25		
29-May-18	0.00	0.12	78	0.24	154	0.31	0.05	31		
30-May-18	0.26	0.12	78	0.21	136	0.30	0.06	36		
31-May-18	0.01	0.12	79	0.22	141	0.29	0.05	35		







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

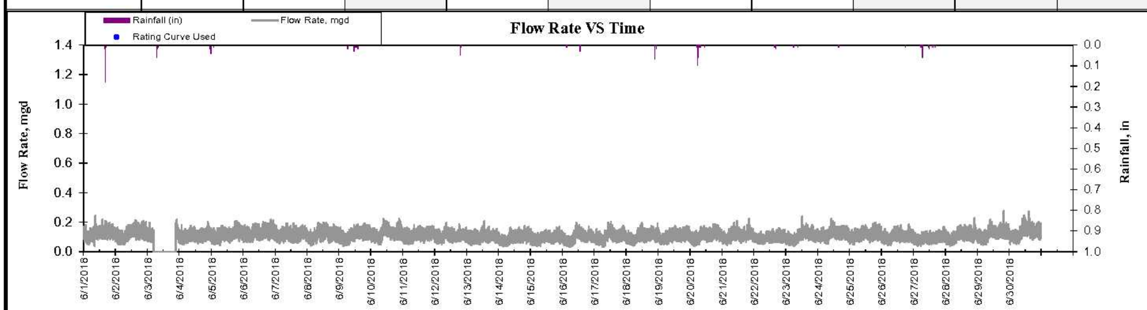
Flow Data for FM03-BAR-12N

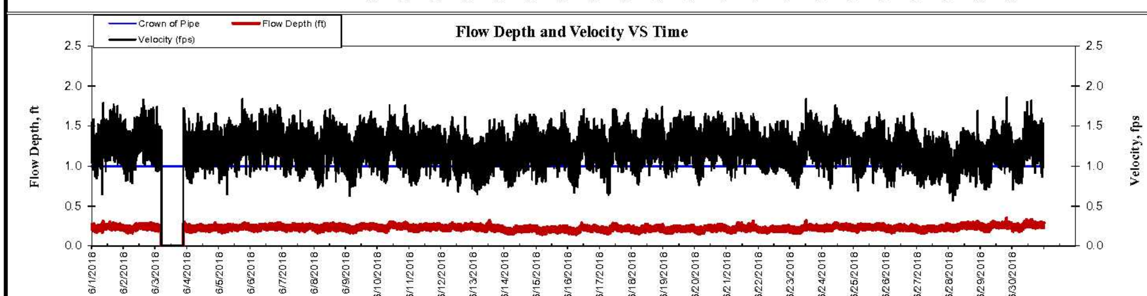
Meter Location: Barker Rd

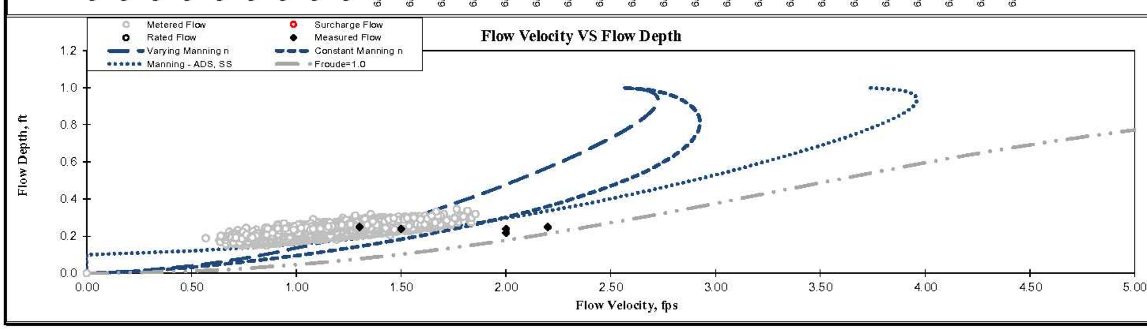
Diameter = 12 in
Slope = 0.32%
Capacity = 1.31 mgd

Area: 224 acres Population: 1,001 Parcels: 401 Rain Gage: RG02-Barker

Date	Daily Rainfall, in	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
		Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Jun-18	0.44	0.12	78	0.24	156	0.31	0.04	26		
2-Jun-18	0.00	0.12	78	0.21	138	0.29	0.05	31		
3-Jun-18	0.24	0.04	23	0.22	139	0.30	0.00	0		
4-Jun-18	0.15	0.10	67	0.20	129	0.29	0.05	31		
5-Jun-18	0.01	0.12	75	0.21	134	0.29	0.04	28		
6-Jun-18	0.00	0.12	80	0.22	139	0.29	0.06	41		
7-Jun-18	0.00	0.11	73	0.19	125	0.28	0.06	37		
8-Jun-18	0.00	0.11	70	0.20	128	0.29	0.04	27		
9-Jun-18	0.33	0.11	72	0.19	124	0.28	0.04	25		
10-Jun-18	0.00	0.12	79	0.23	145	0.30	0.05	31		
11-Jun-18	0.00	0.11	70	0.18	115	0.28	0.05	32		
12-Jun-18	0.16	0.11	68	0.20	127	0.29	0.05	33		
13-Jun-18	0.00	0.10	63	0.21	133	0.32	0.05	29		
14-Jun-18	0.00	0.09	58	0.17	112	0.26	0.04	23		
15-Jun-18	0.00	0.09	57	0.17	109	0.25	0.04	25		
16-Jun-18	0.07	0.10	62	0.20	126	0.29	0.03	21		
17-Jun-18	0.00	0.10	65	0.20	131	0.29	0.03	22		
18-Jun-18	0.23	0.10	66	0.19	125	0.27	0.04	26		
19-Jun-18	0.00	0.10	65	0.17	112	0.26	0.05	31		
20-Jun-18	0.41	0.11	69	0.19	121	0.27	0.04	24		
21-Jun-18	0.00	0.11	70	0.22	144	0.31	0.04	29		
22-Jun-18	0.06	0.09	60	0.16	102	0.26	0.05	33		
23-Jun-18	0.02	0.10	67	0.24	154	0.32	0.04	26		
24-Jun-18	0.01	0.12	75	0.22	143	0.30	0.05	34		
25-Jun-18	0.00	0.11	72	0.20	127	0.29	0.05	31		
26-Jun-18	0.01	0.10	64	0.19	120	0.27	0.04	28		
27-Jun-18	0.21	0.09	57	0.17	108	0.29	0.04	26		
28-Jun-18	0.00	0.10	67	0.23	146	0.31	0.04	24		
29-Jun-18	0.00	0.12	77	0.28	178	0.35	0.05	30		
30-Jun-18	0.00	0.13	82	0.27	176	0.34	0.05	31		







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

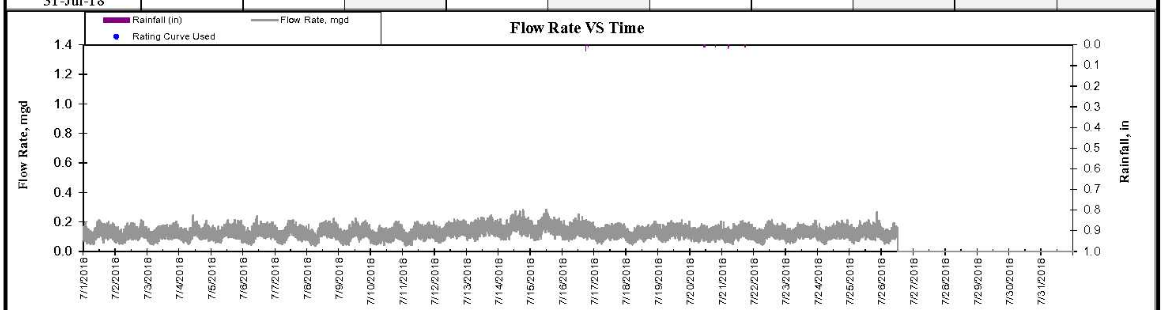
Flow Data for FM03-BAR-12N

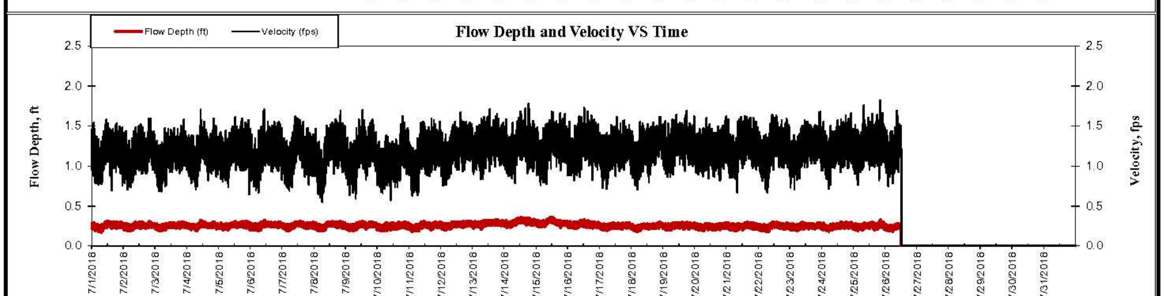
Meter Location: Barker Rd

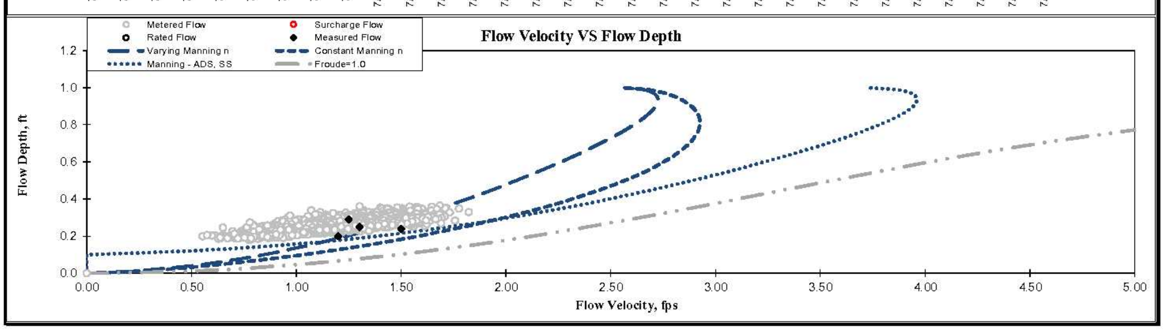
Diameter = 12 in
Slope = 0.32%
Capacity = 1.31 mgd

Area: 224 acres Population: 1,001 Parcels: 401 Rain Gage: RG02-Barker

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Jul-18	0.00	0.12	77	0.21	136	0.32	0.05	31		
2-Jul-18	0.00	0.12	75	0.21	138	0.31	0.05	33		
3-Jul-18	0.00	0.11	74	0.20	131	0.30	0.05	30		
4-Jul-18	0.00	0.12	77	0.24	158	0.33	0.05	33		
5-Jul-18	0.00	0.12	80	0.21	138	0.31	0.06	38		
6-Jul-18	0.00	0.12	79	0.24	154	0.33	0.05	30		
7-Jul-18	0.00	0.12	78	0.21	138	0.31	0.05	32		
8-Jul-18	0.00	0.12	79	0.22	142	0.31	0.04	26		
9-Jul-18	0.00	0.12	77	0.23	146	0.31	0.04	29		
10-Jul-18	0.00	0.11	68	0.20	131	0.30	0.04	28		
11-Jul-18	0.00	0.11	74	0.20	132	0.31	0.04	26		
12-Jul-18	0.00	0.13	85	0.22	140	0.32	0.06	39		
13-Jul-18	0.00	0.15	95	0.24	158	0.33	0.07	44		
14-Jul-18	0.00	0.16	102	0.28	181	0.36	0.08	53		
15-Jul-18	0.00	0.16	102	0.28	182	0.36	0.08	49		
16-Jul-18	0.04	0.14	89	0.25	162	0.33	0.07	45		
17-Jul-18	0.00	0.12	78	0.19	122	0.29	0.05	33		
18-Jul-18	0.00	0.12	74	0.20	131	0.30	0.05	30		
19-Jul-18	0.00	0.13	83	0.21	138	0.30	0.07	42		
20-Jul-18	0.03	0.11	74	0.20	131	0.30	0.06	39		
21-Jul-18	0.07	0.12	78	0.20	132	0.30	0.05	31		
22-Jul-18	0.00	0.12	76	0.21	136	0.30	0.04	29		
23-Jul-18	0.00	0.12	79	0.21	134	0.30	0.06	36		
24-Jul-18	0.00	0.12	79	0.21	136	0.30	0.05	31		
25-Jul-18	0.00	0.13	82	0.26	171	0.33	0.05	35		
26-Jul-18	0.00	0.06	38	0.19	124	0.28	0.00	0		
27-Jul-18										
28-Jul-18										
29-Jul-18										
30-Jul-18										
31-Jul-18										







Northfield Township, Michigan
Northfield Interceptor
2017 Flow Monitoring Data

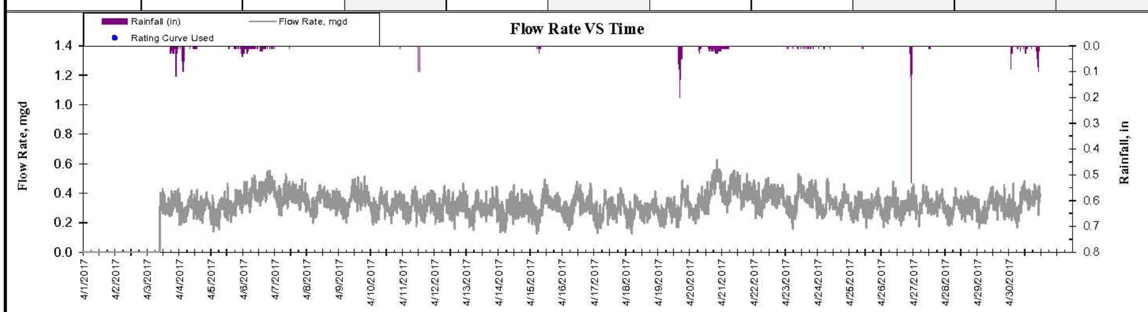
Flow Data for FM04-ESH-12E

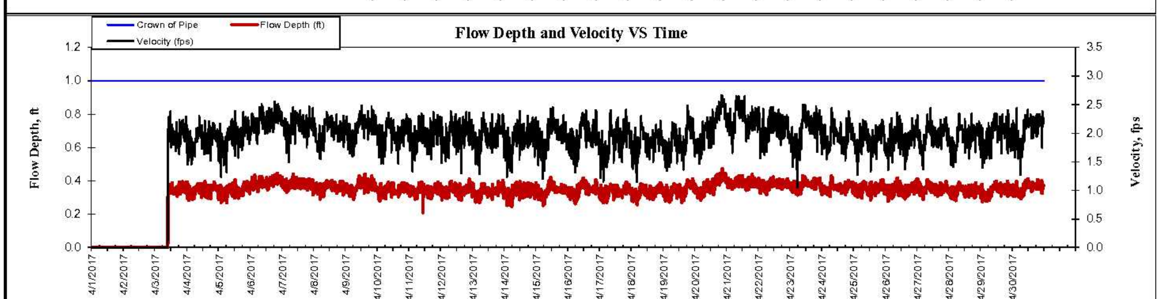
Diameter = 12 in
Slope = 0.30%
Capacity = 1.26 mgd

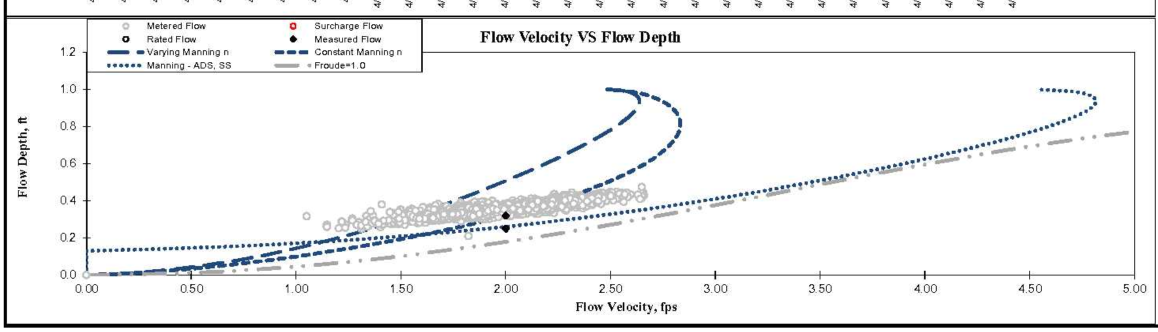
Meter Location: East Shore Drive at Elizabeth Street

Area: 730 acres Population: 1,753 Parcels: 758 Rain Gage: RG-2017

Date	Daily Rainfall, in	Average Day Flow, mgd	Average Day Flow, gpcd	Maximum Hour Flow, mgd	Maximum Hour Flow, gpcd	Maximum Hour Depth, ft	Minimum Hour Flow, mgd	Minimum Hour Flow, gpcd	SSOAP RDII Analysis Peak Flow, mgd	SSOAP RDII Analysis Volume, MG
1-Apr-17			0		0			0		
2-Apr-17			0		0			0		
3-Apr-17	0.50	0.19	109	0.43	246	0.40	0.00	0		
4-Apr-17	0.47	0.30	170	0.42	240	0.40	0.18	105		
5-Apr-17	0.27	0.30	172	0.46	265	0.41	0.14	81		
6-Apr-17	0.66	0.41	236	0.55	316	0.45	0.27	155		
7-Apr-17	0.01	0.38	217	0.53	302	0.44	0.25	142		
8-Apr-17	0.00	0.34	193	0.45	259	0.41	0.20	113		
9-Apr-17	0.00	0.36	204	0.52	294	0.44	0.20	115		
10-Apr-17	0.01	0.31	179	0.44	250	0.39	0.19	107		
11-Apr-17	0.21	0.31	177	0.44	253	0.39	0.17	98		
12-Apr-17	0.00	0.32	180	0.46	265	0.41	0.16	91		
13-Apr-17	0.00	0.30	172	0.45	254	0.40	0.15	85		
14-Apr-17	0.00	0.29	168	0.45	259	0.40	0.13	76		
15-Apr-17	0.08	0.31	179	0.49	280	0.42	0.13	73		
16-Apr-17	0.00	0.31	179	0.48	273	0.42	0.15	87		
17-Apr-17	0.00	0.29	165	0.44	248	0.39	0.13	74		
18-Apr-17	0.00	0.28	162	0.41	234	0.39	0.13	73		
19-Apr-17	0.80	0.30	169	0.49	277	0.41	0.17	96		
20-Apr-17	0.73	0.38	214	0.63	358	0.47	0.20	112		
21-Apr-17	0.15	0.42	238	0.55	315	0.44	0.27	153		
22-Apr-17	0.00	0.37	213	0.51	289	0.43	0.23	132		
23-Apr-17	0.10	0.36	203	0.53	301	0.43	0.16	91		
24-Apr-17	0.03	0.32	184	0.50	284	0.43	0.22	125		
25-Apr-17	0.01	0.31	176	0.43	247	0.41	0.17	95		
26-Apr-17	0.82	0.30	173	0.48	272	0.42	0.17	98		
27-Apr-17	0.03	0.32	184	0.46	263	0.41	0.17	98		
28-Apr-17	0.00	0.30	172	0.43	247	0.39	0.18	102		
29-Apr-17	0.00	0.31	177	0.45	259	0.40	0.16	94		
30-Apr-17	0.69	0.34	194	0.48	274	0.41	0.17	97		







Northfield Township, Michigan
Northfield Interceptor
2017 Flow Monitoring Data

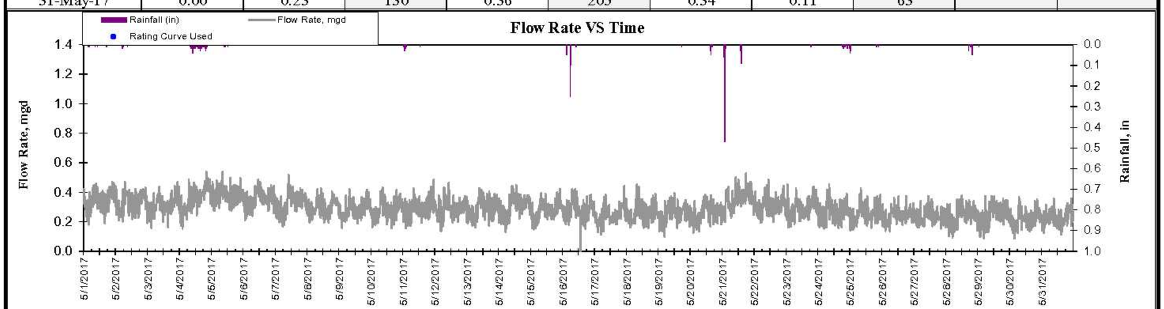
Flow Data for FM04-ESH-12E

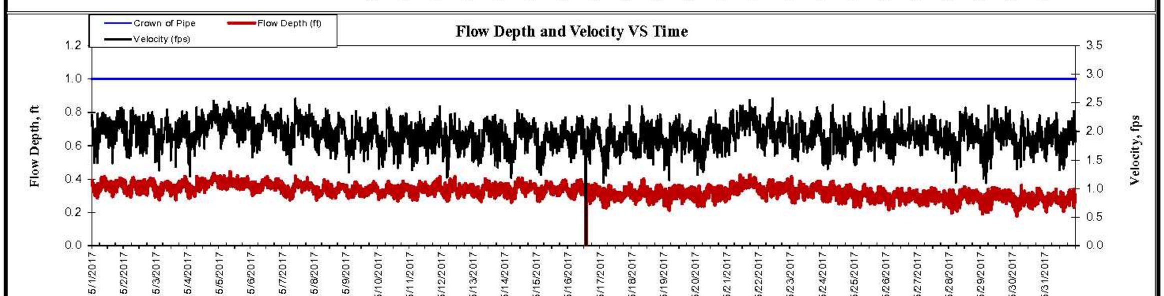
Diameter = 12 in
Slope = 0.30%
Capacity = 1.26 mgd

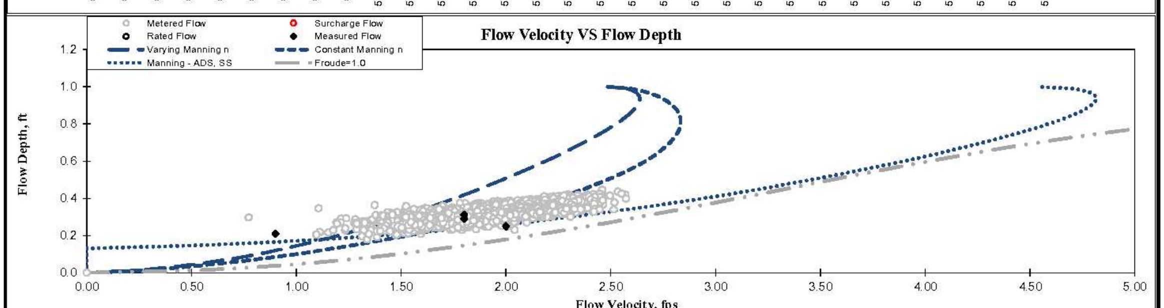
Meter Location: East Shore Drive at Elizabeth Street

Area: 730 acres Population: 1,753 Parcels: 758 Rain Gage: RG-2017

Date	Daily	Average Day		Maximum Hour			Minimum Hour		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-May-17	0.08	0.34	194	0.47	268	0.41	0.18	102		
2-May-17	0.04	0.33	191	0.47	267	0.41	0.20	115		
3-May-17	0.00	0.31	179	0.47	267	0.42	0.16	89		
4-May-17	0.70	0.35	202	0.54	307	0.44	0.15	87		
5-May-17	0.03	0.38	217	0.54	307	0.45	0.27	157		
6-May-17	0.00	0.35	202	0.49	278	0.41	0.21	119		
7-May-17	0.00	0.33	188	0.52	295	0.42	0.17	97		
8-May-17	0.00	0.30	170	0.43	244	0.40	0.19	111		
9-May-17	0.00	0.29	163	0.42	240	0.39	0.16	89		
10-May-17	0.00	0.29	163	0.43	245	0.39	0.15	88		
11-May-17	0.14	0.30	169	0.49	278	0.41	0.15	88		
12-May-17	0.00	0.29	167	0.47	266	0.42	0.14	78		
13-May-17	0.00	0.29	167	0.43	244	0.40	0.16	93		
14-May-17	0.00	0.30	173	0.45	256	0.41	0.13	75		
15-May-17	0.00	0.28	161	0.42	242	0.39	0.15	84		
16-May-17	0.48	0.28	160	0.42	241	0.40	0.00	0		
17-May-17	0.00	0.25	141	0.44	252	0.38	0.11	65		
18-May-17	0.00	0.26	150	0.45	258	0.40	0.16	89		
19-May-17	0.02	0.26	146	0.39	224	0.36	0.10	57		
20-May-17	0.14	0.26	146	0.38	218	0.39	0.12	71		
21-May-17	1.52	0.35	200	0.53	300	0.42	0.20	113		
22-May-17	0.00	0.31	177	0.48	276	0.41	0.19	111		
23-May-17	0.01	0.30	169	0.46	260	0.39	0.16	91		
24-May-17	0.10	0.27	154	0.45	257	0.39	0.15	88		
25-May-17	0.13	0.26	149	0.43	244	0.37	0.14	81		
26-May-17	0.00	0.24	138	0.37	214	0.35	0.14	78		
27-May-17	0.00	0.24	138	0.37	213	0.35	0.15	88		
28-May-17	0.15	0.24	138	0.38	215	0.36	0.09	53		
29-May-17	0.01	0.25	143	0.38	214	0.35	0.09	50		
30-May-17	0.00	0.22	127	0.37	211	0.35	0.09	49		
31-May-17	0.00	0.23	130	0.36	205	0.34	0.11	63		







Northfield Township, Michigan
Northfield Interceptor
2017 Flow Monitoring Data

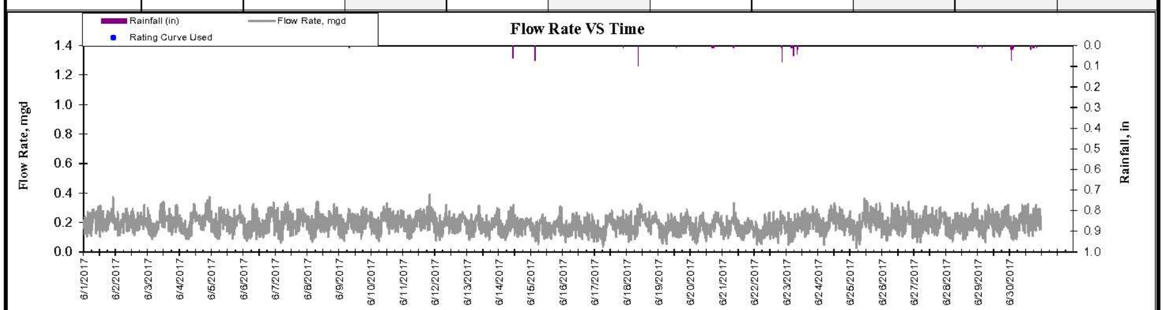
Flow Data for FM04-ESH-12E

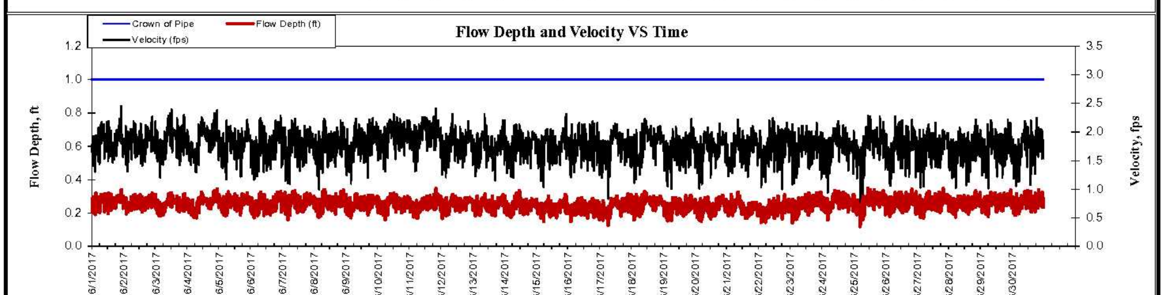
Diameter = 12 in
Slope = 0.30%
Capacity = 1.26 mgd

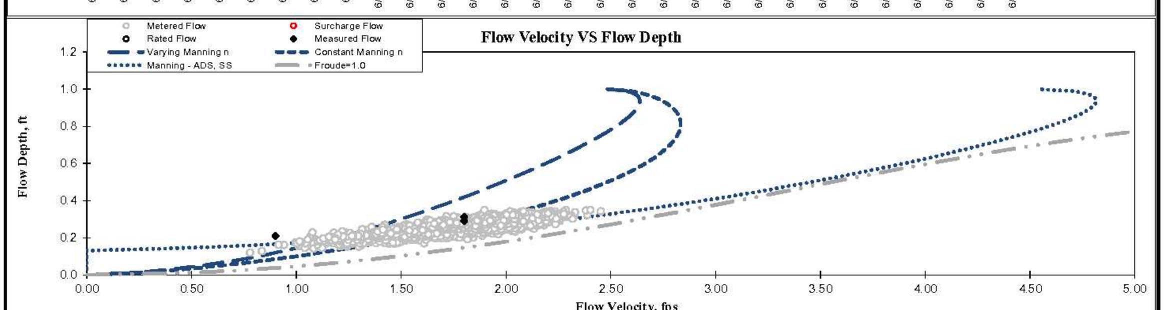
Meter Location: East Shore Drive at Elizabeth Street

Area: 730 acres Population: 1,753 Parcels: 758 Rain Gage: RG-2017

Date	Daily	Average Day		Maximum Hour			Minimum Hour		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Jun-17	0.00	0.21	119	0.38	214	0.34	0.10	59		
2-Jun-17	0.00	0.20	114	0.32	182	0.32	0.11	63		
3-Jun-17	0.00	0.20	116	0.34	196	0.32	0.09	50		
4-Jun-17	0.00	0.21	119	0.37	213	0.35	0.09	49		
5-Jun-17	0.00	0.20	116	0.31	179	0.33	0.09	50		
6-Jun-17	0.00	0.19	108	0.34	193	0.33	0.07	42		
7-Jun-17	0.00	0.20	116	0.34	192	0.33	0.06	35		
8-Jun-17	0.00	0.20	114	0.34	195	0.34	0.07	38		
9-Jun-17	0.02	0.20	112	0.30	172	0.32	0.08	43		
10-Jun-17	0.00	0.21	118	0.33	188	0.32	0.07	42		
11-Jun-17	0.00	0.21	119	0.39	221	0.35	0.09	50		
12-Jun-17	0.00	0.19	107	0.32	181	0.31	0.08	44		
13-Jun-17	0.00	0.18	105	0.32	180	0.32	0.08	46		
14-Jun-17	0.06	0.18	101	0.32	181	0.33	0.08	45		
15-Jun-17	0.08	0.17	97	0.31	175	0.31	0.05	30		
16-Jun-17	0.00	0.16	94	0.27	152	0.29	0.07	37		
17-Jun-17	0.01	0.17	99	0.28	160	0.32	0.03	19		
18-Jun-17	0.10	0.20	112	0.33	186	0.33	0.07	38		
19-Jun-17	0.01	0.17	98	0.29	163	0.31	0.06	32		
20-Jun-17	0.05	0.17	98	0.27	156	0.31	0.06	32		
21-Jun-17	0.01	0.17	94	0.33	189	0.33	0.08	45		
22-Jun-17	0.12	0.16	90	0.28	157	0.31	0.05	29		
23-Jun-17	0.17	0.19	107	0.31	175	0.33	0.05	29		
24-Jun-17	0.00	0.20	113	0.33	188	0.34	0.05	29		
25-Jun-17	0.00	0.20	116	0.36	207	0.35	0.03	15		
26-Jun-17	0.00	0.19	111	0.34	196	0.34	0.08	44		
27-Jun-17	0.00	0.19	111	0.31	177	0.35	0.07	37		
28-Jun-17	0.00	0.19	109	0.33	190	0.34	0.07	39		
29-Jun-17	0.02	0.20	113	0.32	183	0.34	0.07	37		
30-Jun-17	0.27	0.20	114	0.32	184	0.34	0.08	47		







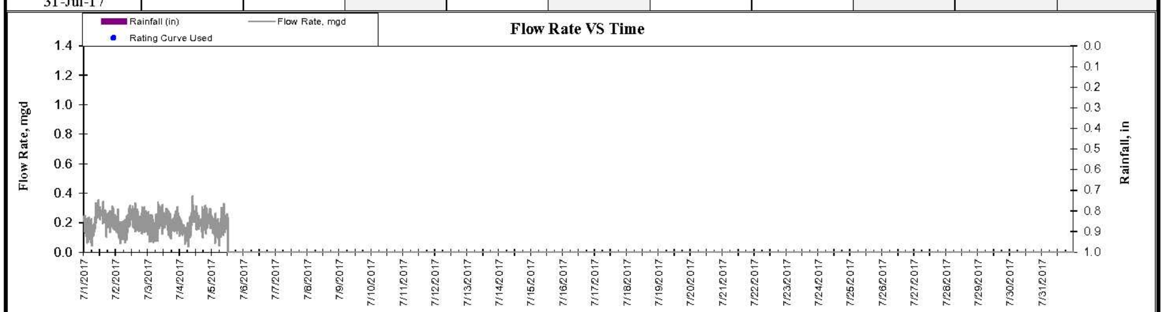
Northfield Township, Michigan
Northfield Interceptor
2017 Flow Monitoring Data

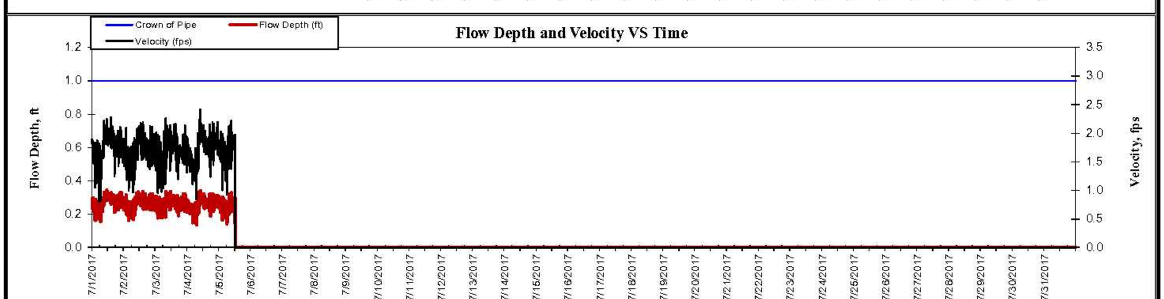
Flow Data for FM04-ESH-12E

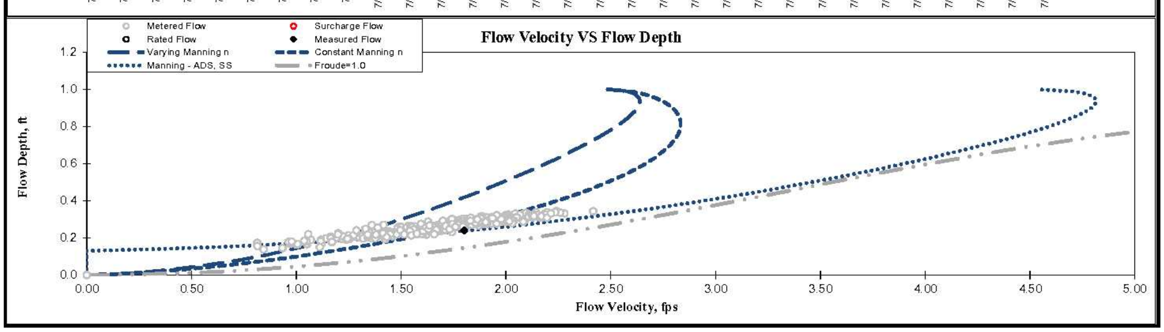
Diameter = 12 in
Slope = 0.30%
Capacity = 1.26 mgd

Meter Location: East Shore Drive at Elizabeth Street
Area: 730 acres Population: 1,753 Parcels: 758 Rain Gage: RG-2017

Date	Daily	Average Day		Maximum Hour			Minimum Hour		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Jul-17	0.00	0.21	120	0.35	201	0.35	0.04	25		
2-Jul-17	0.00	0.20	114	0.33	190	0.34	0.06	34		
3-Jul-17	0.00	0.19	110	0.34	193	0.34	0.07	38		
4-Jul-17	0.00	0.19	110	0.38	218	0.34	0.04	22		
5-Jul-17	0.00	0.09	54	0.33	186	0.33	0.00	0		
6-Jul-17										
7-Jul-17										
8-Jul-17										
9-Jul-17										
10-Jul-17										
11-Jul-17										
12-Jul-17										
13-Jul-17										
14-Jul-17										
15-Jul-17										
16-Jul-17										
17-Jul-17										
18-Jul-17										
19-Jul-17										
20-Jul-17										
21-Jul-17										
22-Jul-17										
23-Jul-17										
24-Jul-17										
25-Jul-17										
26-Jul-17										
27-Jul-17										
28-Jul-17										
29-Jul-17										
30-Jul-17										
31-Jul-17										







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

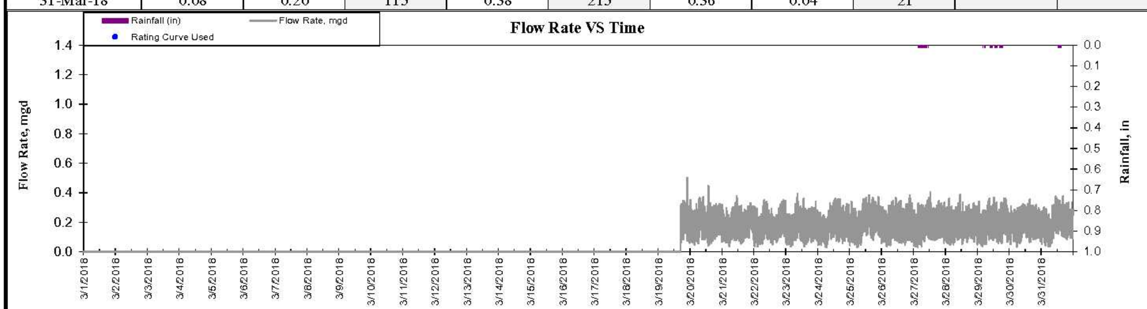
Flow Data for FM04-ESH-12E

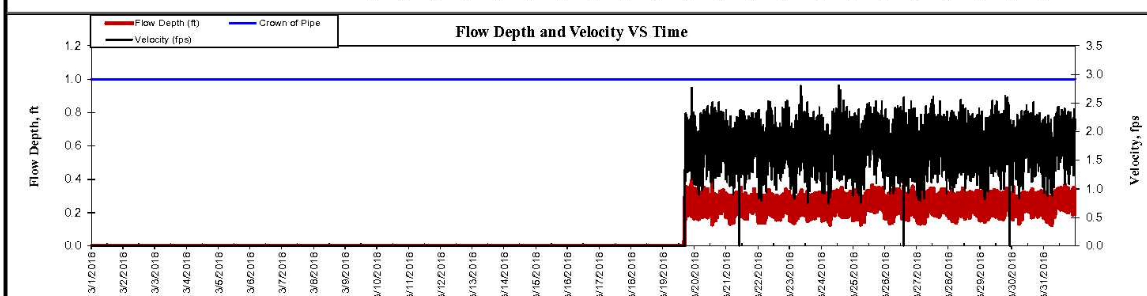
Diameter = 12 in
Slope = 0.30%
Capacity = 1.26 mgd

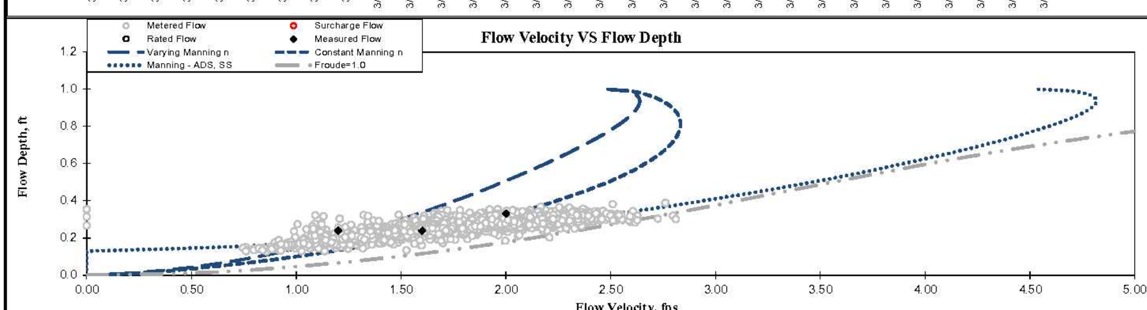
Meter Location: East Shore Drive at Elizabeth Street

Area: 730 acres Population: 1,753 Parcels: 758 Rain Gage: RG01-Main

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Mar-18										
2-Mar-18										
3-Mar-18										
4-Mar-18										
5-Mar-18										
6-Mar-18										
7-Mar-18										
8-Mar-18										
9-Mar-18										
10-Mar-18										
11-Mar-18										
12-Mar-18										
13-Mar-18										
14-Mar-18										
15-Mar-18										
16-Mar-18										
17-Mar-18										
18-Mar-18										
19-Mar-18	0.00	0.07	37	0.50	287	0.39	0.00	0		
20-Mar-18	0.00	0.20	114	0.45	254	0.38	0.04	25		
21-Mar-18	0.00	0.19	107	0.38	215	0.35	0.04	22		
22-Mar-18	0.00	0.18	104	0.35	201	0.34	0.03	20		
23-Mar-18	0.00	0.19	106	0.39	223	0.33	0.04	21		
24-Mar-18	0.00	0.19	109	0.36	206	0.35	0.03	18		
25-Mar-18	0.00	0.21	117	0.38	219	0.36	0.03	17		
26-Mar-18	0.00	0.20	111	0.38	219	0.36	0.04	22		
27-Mar-18	0.32	0.20	112	0.40	231	0.34	0.03	18		
28-Mar-18	0.00	0.19	108	0.39	220	0.35	0.05	26		
29-Mar-18	0.18	0.19	109	0.37	208	0.35	0.04	21		
30-Mar-18	0.00	0.20	112	0.35	202	0.34	0.03	20		
31-Mar-18	0.08	0.20	115	0.38	215	0.36	0.04	21		







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

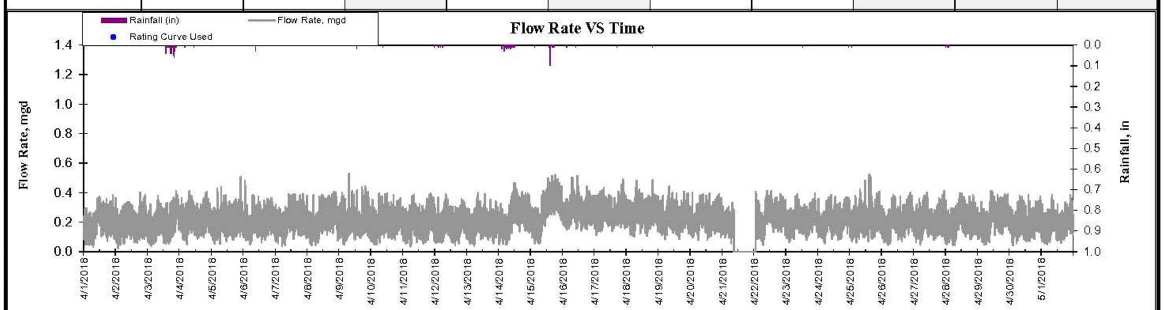
Flow Data for FM04-ESH-12E

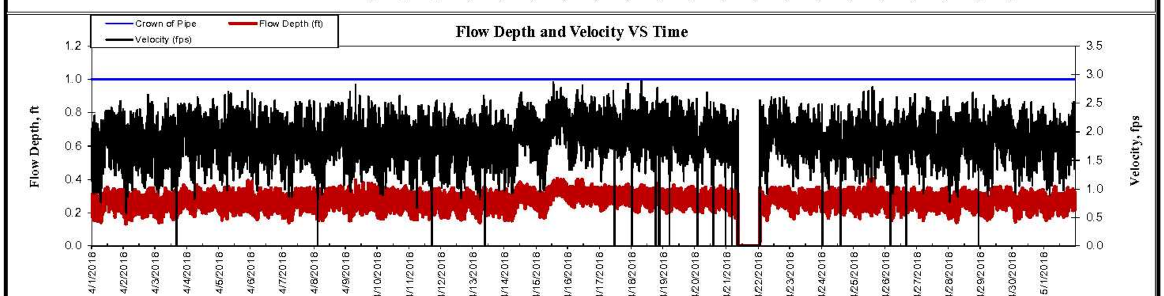
Meter Location: East Shore Drive at Elizabeth Street

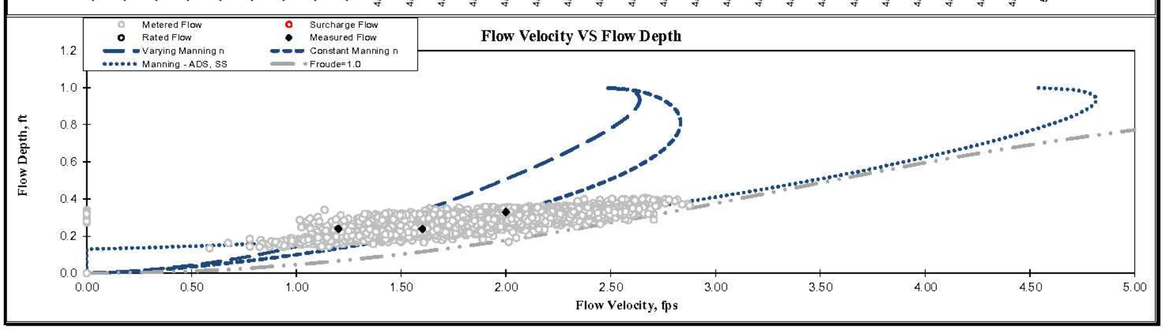
Diameter = 12 in
Slope = 0.30%
Capacity = 1.26 mgd

Area: 730 acres Population: 1,753 Parcels: 758 Rain Gage: RG01-Main

Date	Daily Rainfall, in	Average Day Flow, mgd	Average Day Flow, gpcd	Maximum Values Flow, mgd	Maximum Values Flow, gpcd	Maximum Values Depth, ft	Minimum Values Flow, mgd	Minimum Values Flow, gpcd	SSOAP RDII Analysis Peak Flow, mgd	SSOAP RDII Analysis Volume, MG
1-Apr-18	0.00	0.20	114	0.39	220	0.35	0.04	20		
2-Apr-18	0.00	0.20	113	0.40	229	0.35	0.02	14		
3-Apr-18	0.77	0.20	115	0.41	234	0.37	0.04	24		
4-Apr-18	0.02	0.23	129	0.41	234	0.37	0.05	29		
5-Apr-18	0.00	0.22	124	0.50	288	0.39	0.05	31		
6-Apr-18	0.10	0.21	122	0.48	273	0.39	0.05	29		
7-Apr-18	0.00	0.21	119	0.39	223	0.35	0.04	22		
8-Apr-18	0.00	0.22	125	0.40	230	0.36	0.04	24		
9-Apr-18	0.05	0.21	119	0.53	300	0.40	0.05	27		
10-Apr-18	0.01	0.21	119	0.40	226	0.36	0.05	28		
11-Apr-18	0.01	0.20	115	0.39	225	0.35	0.04	21		
12-Apr-18	0.03	0.20	112	0.39	223	0.35	0.04	25		
13-Apr-18	0.00	0.20	112	0.40	229	0.35	0.04	21		
14-Apr-18	0.70	0.24	136	0.47	266	0.38	0.05	28		
15-Apr-18	0.19	0.29	165	0.52	297	0.41	0.06	32		
16-Apr-18	0.02	0.28	160	0.51	292	0.40	0.14	82		
17-Apr-18	0.01	0.26	149	0.49	279	0.37	0.11	63		
18-Apr-18	0.01	0.25	145	0.48	276	0.38	0.10	58		
19-Apr-18	0.00	0.24	136	0.44	251	0.37	0.08	48		
20-Apr-18	0.00	0.23	131	0.40	229	0.36	0.08	46		
21-Apr-18	0.00	0.07	42	0.33	190	0.35	0.00	0		
22-Apr-18	0.00	0.23	132	0.41	235	0.36	0.00	0		
23-Apr-18	0.01	0.22	127	0.39	224	0.35	0.07	38		
24-Apr-18	0.01	0.21	120	0.38	219	0.35	0.06	33		
25-Apr-18	0.01	0.23	134	0.52	298	0.40	0.06	35		
26-Apr-18	0.00	0.21	120	0.40	228	0.35	0.05	27		
27-Apr-18	0.00	0.21	121	0.41	236	0.35	0.05	26		
28-Apr-18	0.07	0.21	122	0.39	225	0.35	0.04	25		
29-Apr-18	0.00	0.23	131	0.41	235	0.36	0.05	29		
30-Apr-18	0.00	0.20	117	0.39	220	0.35	0.04	25		







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

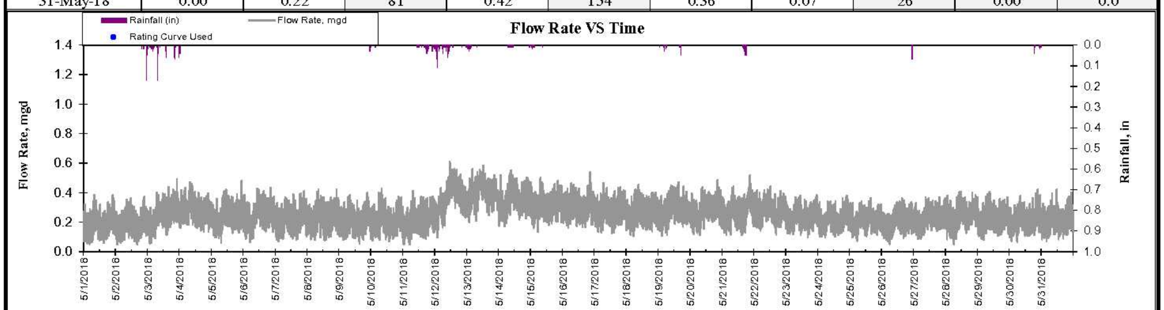
Flow Data for FM04-ESH-12E

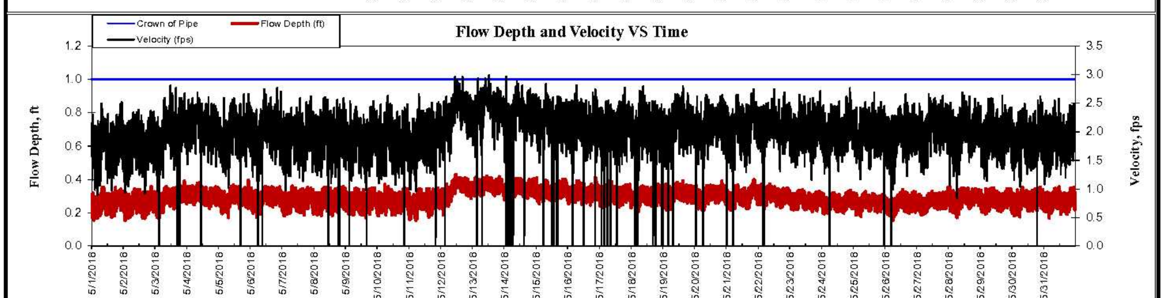
Meter Location: East Shore Drive at Elizabeth Street

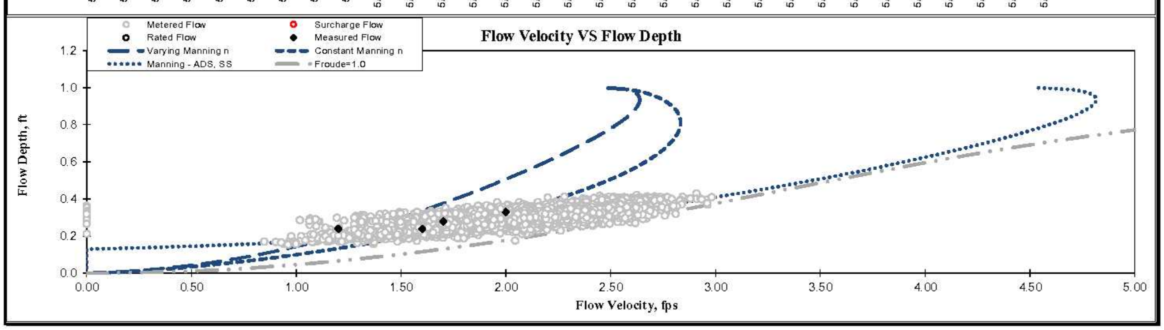
Diameter = 12 in
Slope = 0.30%
Capacity = 1.26 mgd

Area: 730 acres Population: 1,753 Parcels: 758 Rain Gage: RG01-Main

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-May-18	0.00	0.20	75	0.39	142	0.36	0.05	19	0.00	0.0
2-May-18	0.34	0.20	73	0.37	137	0.36	0.05	18	0.00	0.0
3-May-18	1.24	0.25	92	0.49	180	0.39	0.06	21	0.00	0.0
4-May-18	0.09	0.28	102	0.47	174	0.38	0.14	50	0.00	0.0
5-May-18	0.00	0.24	90	0.48	176	0.39	0.06	22	0.00	0.0
6-May-18	0.00	0.25	92	0.43	160	0.36	0.07	24	0.00	0.0
7-May-18	0.00	0.22	83	0.41	151	0.36	0.07	26	0.00	0.0
8-May-18	0.00	0.23	85	0.42	155	0.36	0.08	28	0.00	0.0
9-May-18	0.14	0.21	78	0.40	147	0.35	0.06	21	0.00	0.0
10-May-18	0.01	0.21	79	0.43	158	0.37	0.07	26	0.00	0.0
11-May-18	0.70	0.21	78	0.41	151	0.35	0.05	18	0.00	0.0
12-May-18	1.42	0.36	132	0.61	224	0.43	0.10	36	0.00	0.0
13-May-18	0.47	0.39	145	0.58	215	0.42	0.20	74	0.00	0.0
14-May-18	0.13	0.35	128	0.55	204	0.41	0.17	63	0.00	0.0
15-May-18	0.23	0.33	120	0.50	185	0.40	0.14	50	0.00	0.0
16-May-18	0.00	0.30	112	0.54	199	0.41	0.16	60	0.00	0.0
17-May-18	0.00	0.27	101	0.47	172	0.39	0.13	46	0.00	0.0
18-May-18	0.00	0.27	98	0.45	167	0.37	0.10	39	0.00	0.0
19-May-18	0.33	0.28	105	0.47	173	0.39	0.11	40	0.00	0.0
20-May-18	0.00	0.29	105	0.48	178	0.39	0.11	41	0.00	0.0
21-May-18	0.48	0.27	101	0.52	191	0.40	0.11	41	0.00	0.0
22-May-18	0.00	0.28	102	0.44	164	0.37	0.12	43	0.00	0.0
23-May-18	0.00	0.24	88	0.38	142	0.34	0.10	35	0.00	0.0
24-May-18	0.00	0.22	81	0.38	140	0.34	0.10	36	0.00	0.0
25-May-18	0.00	0.22	80	0.36	134	0.33	0.07	27	0.00	0.0
26-May-18	0.22	0.21	77	0.36	135	0.34	0.05	19	0.00	0.0
27-May-18	0.00	0.23	84	0.37	136	0.35	0.09	31	0.00	0.0
28-May-18	0.00	0.25	91	0.41	150	0.35	0.05	18	0.00	0.0
29-May-18	0.00	0.23	85	0.40	149	0.35	0.08	30	0.00	0.0
30-May-18	0.17	0.22	81	0.42	155	0.35	0.06	23	0.00	0.0
31-May-18	0.00	0.22	81	0.42	154	0.36	0.07	26	0.00	0.0







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

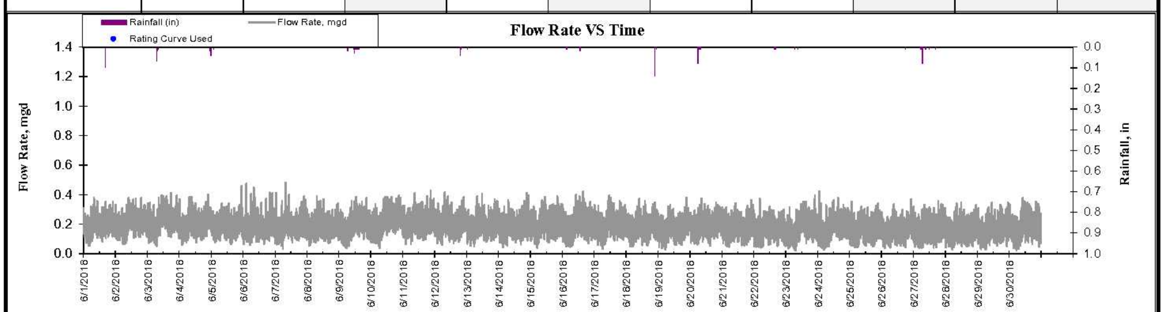
Flow Data for FM04-ESH-12E

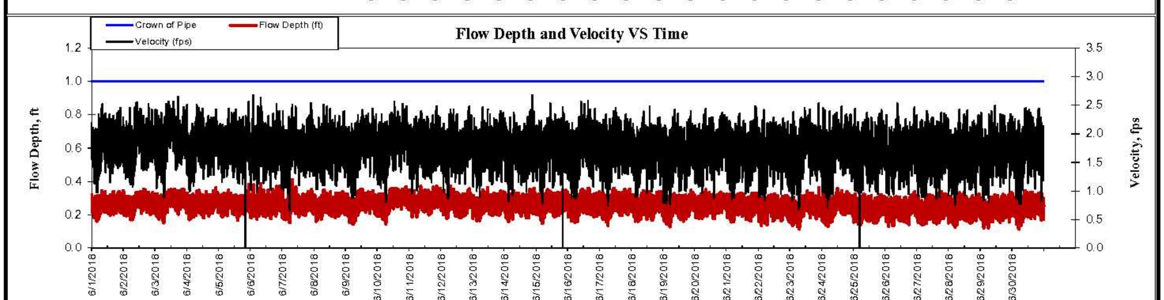
Meter Location: East Shore Drive at Elizabeth Street

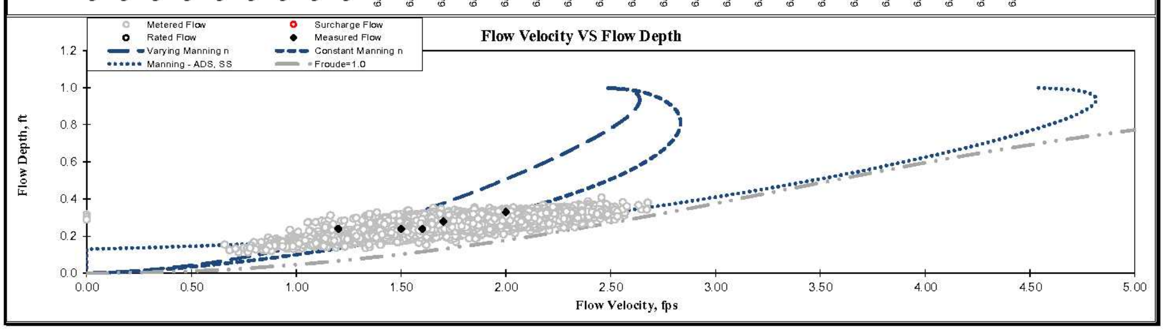
Diameter = 12 in
Slope = 0.30%
Capacity = 1.26 mgd

Area: 730 acres Population: 1,753 Parcels: 758 Rain Gage: RG01-Main

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Jun-18	0.26	0.21	77	0.38	139	0.34	0.05	19	0.00	0.0
2-Jun-18	0.00	0.21	78	0.38	139	0.35	0.06	24	0.00	0.0
3-Jun-18	0.26	0.22	82	0.41	151	0.35	0.05	19	0.00	0.0
4-Jun-18	0.14	0.21	77	0.40	148	0.36	0.06	22	0.00	0.0
5-Jun-18	0.02	0.21	76	0.46	169	0.38	0.06	24	0.00	0.0
6-Jun-18	0.00	0.20	73	0.47	174	0.39	0.06	21	0.00	0.0
7-Jun-18	0.00	0.20	73	0.48	177	0.41	0.03	12	0.00	0.0
8-Jun-18	0.00	0.19	71	0.39	143	0.35	0.06	21	0.00	0.0
9-Jun-18	0.30	0.20	75	0.39	142	0.35	0.04	15	0.00	0.0
10-Jun-18	0.00	0.22	83	0.40	146	0.37	0.04	14	0.00	0.0
11-Jun-18	0.00	0.22	80	0.43	158	0.37	0.06	23	0.00	0.0
12-Jun-18	0.10	0.21	77	0.41	153	0.37	0.06	22	0.00	0.0
13-Jun-18	0.01	0.20	73	0.40	149	0.36	0.05	18	0.00	0.0
14-Jun-18	0.00	0.20	73	0.41	152	0.36	0.04	16	0.00	0.0
15-Jun-18	0.00	0.20	74	0.39	144	0.35	0.04	14	0.00	0.0
16-Jun-18	0.04	0.20	73	0.42	156	0.36	0.05	17	0.00	0.0
17-Jun-18	0.00	0.20	75	0.39	145	0.36	0.03	12	0.00	0.0
18-Jun-18	0.30	0.19	70	0.37	137	0.34	0.05	18	0.00	0.0
19-Jun-18	0.00	0.18	66	0.38	139	0.35	0.03	11	0.00	0.0
20-Jun-18	0.25	0.19	72	0.37	138	0.35	0.05	20	0.00	0.0
21-Jun-18	0.00	0.19	69	0.36	134	0.33	0.05	17	0.00	0.0
22-Jun-18	0.06	0.17	62	0.38	138	0.35	0.04	15	0.00	0.0
23-Jun-18	0.02	0.17	64	0.39	145	0.37	0.02	9	0.00	0.0
24-Jun-18	0.00	0.19	68	0.42	155	0.36	0.03	10	0.00	0.0
25-Jun-18	0.00	0.17	63	0.35	129	0.32	0.04	16	0.00	0.0
26-Jun-18	0.01	0.17	61	0.37	136	0.34	0.04	14	0.00	0.0
27-Jun-18	0.17	0.17	62	0.36	132	0.34	0.04	14	0.00	0.0
28-Jun-18	0.00	0.16	60	0.34	127	0.33	0.03	11	0.00	0.0
29-Jun-18	0.00	0.16	61	0.35	128	0.34	0.03	11	0.00	0.0
30-Jun-18	0.00	0.18	68	0.38	139	0.34	0.02	9	0.00	0.0







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

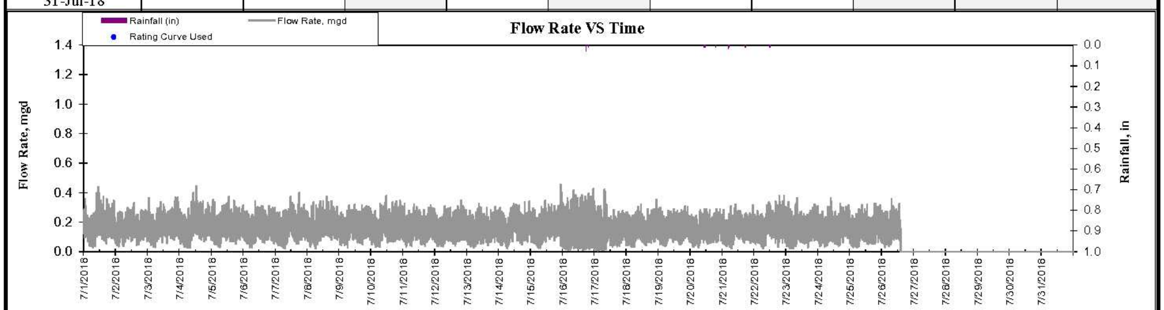
Flow Data for FM04-ESH-12E

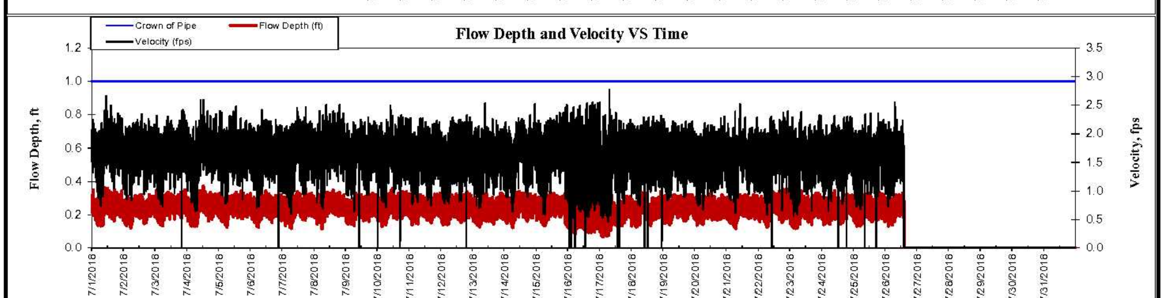
Meter Location: East Shore Drive at Elizabeth Street

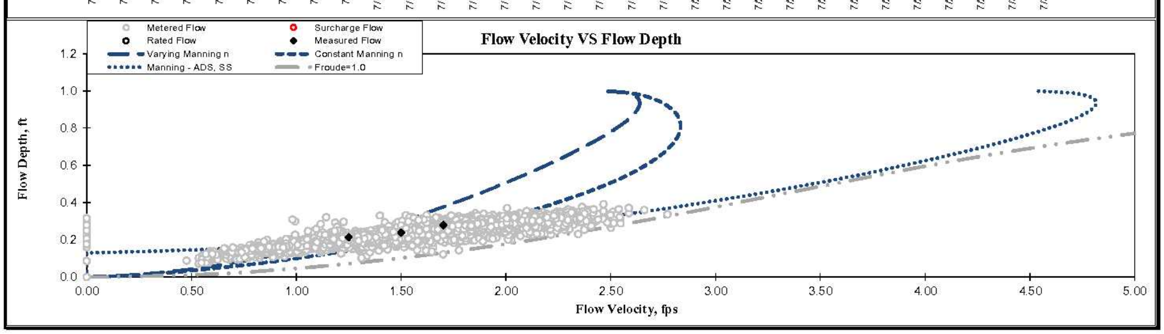
Diameter = 12 in
Slope = 0.30%
Capacity = 1.26 mgd

Area: 730 acres Population: 1,753 Parcels: 758 Rain Gage: RG01-Main

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Jul-18	0.00	0.18	67	0.44	161	0.36	0.03	11	0.00	0.0
2-Jul-18	0.00	0.17	62	0.33	121	0.32	0.04	13	0.00	0.0
3-Jul-18	0.00	0.18	65	0.37	135	0.35	0.03	11	0.00	0.0
4-Jul-18	0.00	0.17	64	0.44	164	0.37	0.03	10	0.00	0.0
5-Jul-18	0.00	0.17	64	0.37	137	0.34	0.03	11	0.00	0.0
6-Jul-18	0.00	0.17	62	0.34	125	0.34	0.03	10	0.00	0.0
7-Jul-18	0.00	0.17	63	0.40	147	0.35	0.02	8	0.00	0.0
8-Jul-18	0.00	0.18	66	0.37	138	0.35	0.02	9	0.00	0.0
9-Jul-18	0.00	0.17	61	0.32	117	0.33	0.03	10	0.00	0.0
10-Jul-18	0.00	0.17	63	0.38	139	0.36	0.03	12	0.00	0.0
11-Jul-18	0.00	0.17	61	0.33	120	0.33	0.03	12	0.00	0.0
12-Jul-18	0.00	0.16	59	0.35	129	0.34	0.04	13	0.00	0.0
13-Jul-18	0.00	0.15	56	0.33	121	0.33	0.03	10	0.00	0.0
14-Jul-18	0.00	0.17	62	0.34	126	0.34	0.02	9	0.00	0.0
15-Jul-18	0.00	0.18	65	0.45	167	0.39	0.02	9	0.00	0.0
16-Jul-18	0.04	0.15	56	0.43	157	0.38	0.01	5	0.00	0.0
17-Jul-18	0.00	0.14	50	0.42	154	0.36	0.01	3	0.00	0.0
18-Jul-18	0.00	0.16	59	0.35	129	0.34	0.03	12	0.00	0.0
19-Jul-18	0.00	0.17	62	0.31	113	0.32	0.04	14	0.00	0.0
20-Jul-18	0.03	0.16	58	0.29	106	0.32	0.03	11	0.00	0.0
21-Jul-18	0.07	0.16	59	0.32	118	0.32	0.02	8	0.00	0.0
22-Jul-18	0.01	0.18	66	0.38	139	0.35	0.02	8	0.00	0.0
23-Jul-18	0.00	0.16	58	0.36	134	0.34	0.02	8	0.00	0.0
24-Jul-18	0.00	0.16	59	0.36	133	0.35	0.03	12	0.00	0.0
25-Jul-18	0.00	0.16	59	0.33	120	0.33	0.03	10	0.00	0.0
26-Jul-18	0.00	0.10	35	0.36	132	0.33	0.00	0	0.00	0.0
27-Jul-18										
28-Jul-18										
29-Jul-18										
30-Jul-18										
31-Jul-18										







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

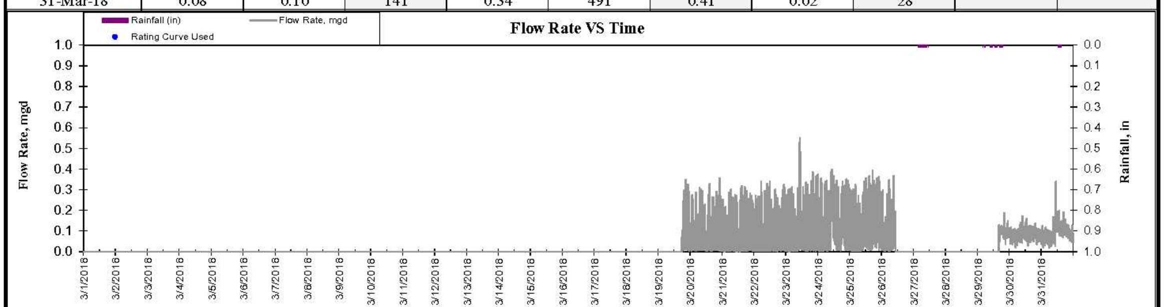
Flow Data for FM05-MAI-12S

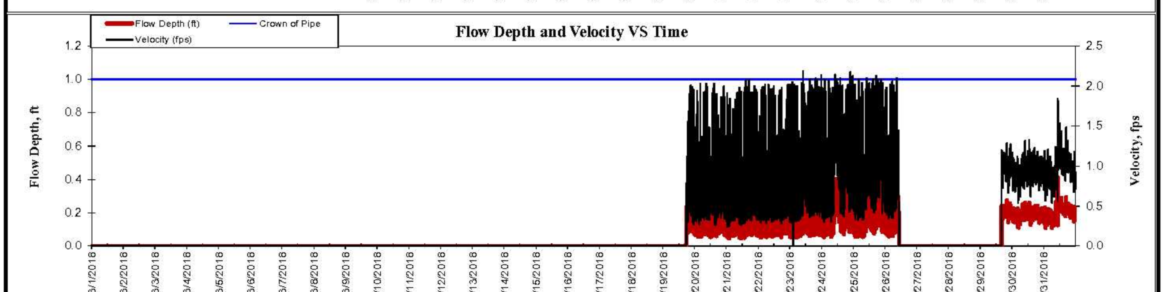
Meter Location: Main St and Schrum at 8185 Main

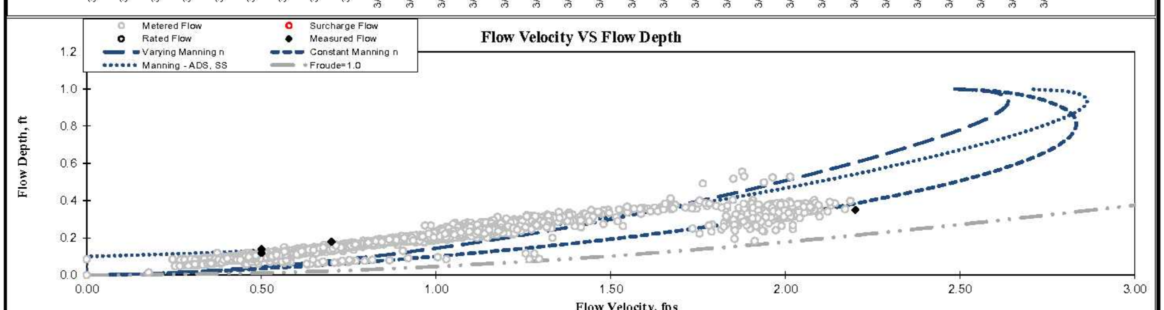
Area: 376 acres Population: 690 Parcels: 685 Rain Gage: RG01-Main

Diameter = 12 in
Slope = 0.30%
Capacity = 1.26 mgd

Date	Daily Rainfall, in	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
		Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Mar-18										
2-Mar-18										
3-Mar-18										
4-Mar-18										
5-Mar-18										
6-Mar-18										
7-Mar-18										
8-Mar-18										
9-Mar-18										
10-Mar-18										
11-Mar-18										
12-Mar-18										
13-Mar-18										
14-Mar-18										
15-Mar-18										
16-Mar-18										
17-Mar-18										
18-Mar-18										
19-Mar-18	0.00	0.02	27	0.35	505	0.38	0.00	0		
20-Mar-18	0.00	0.07	99	0.35	513	0.38	0.00	7		
21-Mar-18	0.00	0.06	94	0.32	460	0.36	0.00	3		
22-Mar-18	0.00	0.07	94	0.34	491	0.37	0.00	4		
23-Mar-18	0.00	0.09	128	0.55	796	0.56	0.00	4		
24-Mar-18	0.00	0.11	166	0.40	577	0.40	0.00	5		
25-Mar-18	0.00	0.10	151	0.39	570	0.40	0.00	5		
26-Mar-18	0.00	0.03	42	0.37	531	0.38	0.00	0		
27-Mar-18	0.32	0.00	0	0.00	0	0.00	0.00	0		
28-Mar-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
29-Mar-18	0.18	0.03	47	0.19	271	0.28	0.00	0		
30-Mar-18	0.00	0.09	133	0.17	250	0.26	0.02	29		
31-Mar-18	0.08	0.10	141	0.34	491	0.41	0.02	28		







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

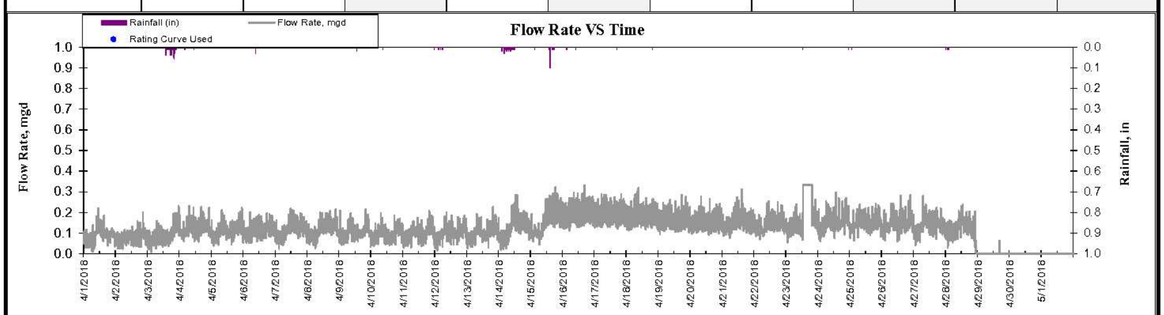
Flow Data for FM05-MAI-12S

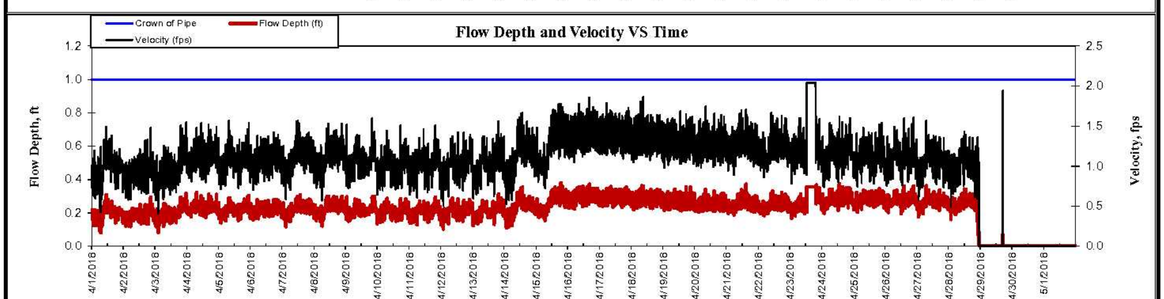
Meter Location: Main St and Schrum at 8185 Main

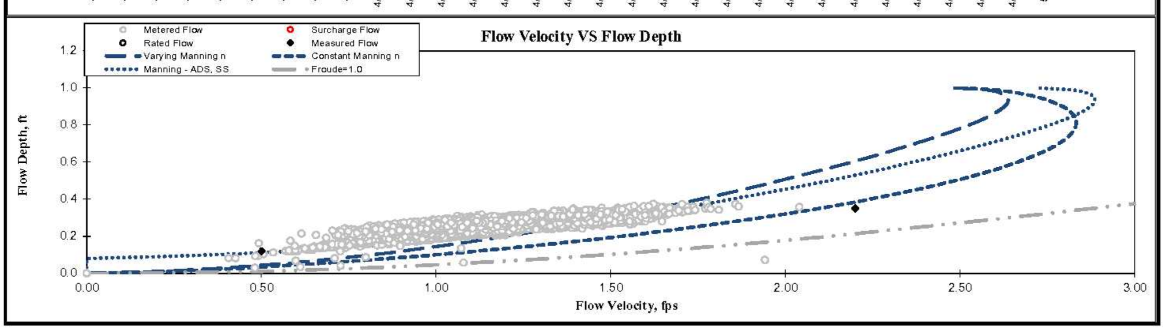
Diameter = 12 in
Slope = 0.30%
Capacity = 1.26 mgd

Area: 376 acres Population: 690 Parcels: 685 Rain Gage: RG01-Main

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Apr-18	0.00	0.09	136	0.22	318	0.31	0.01	14		
2-Apr-18	0.00	0.09	126	0.20	289	0.29	0.02	35		
3-Apr-18	0.77	0.09	136	0.23	336	0.32	0.01	13		
4-Apr-18	0.02	0.12	170	0.23	337	0.32	0.06	85		
5-Apr-18	0.00	0.11	158	0.22	326	0.31	0.04	58		
6-Apr-18	0.10	0.11	157	0.20	289	0.28	0.05	75		
7-Apr-18	0.00	0.11	164	0.22	317	0.31	0.02	35		
8-Apr-18	0.00	0.12	168	0.21	311	0.30	0.02	36		
9-Apr-18	0.05	0.10	152	0.21	310	0.30	0.04	63		
10-Apr-18	0.01	0.10	144	0.20	284	0.29	0.03	47		
11-Apr-18	0.01	0.10	149	0.21	301	0.29	0.03	42		
12-Apr-18	0.03	0.10	147	0.20	290	0.29	0.02	24		
13-Apr-18	0.00	0.10	148	0.23	330	0.31	0.03	38		
14-Apr-18	0.70	0.12	181	0.29	413	0.35	0.02	29		
15-Apr-18	0.19	0.16	226	0.32	468	0.38	0.04	64		
16-Apr-18	0.02	0.19	282	0.33	479	0.37	0.11	163		
17-Apr-18	0.01	0.19	278	0.29	420	0.36	0.12	178		
18-Apr-18	0.01	0.18	264	0.32	461	0.36	0.11	164		
19-Apr-18	0.00	0.16	230	0.29	414	0.36	0.10	139		
20-Apr-18	0.00	0.15	213	0.28	400	0.34	0.09	134		
21-Apr-18	0.00	0.14	210	0.31	454	0.37	0.08	110		
22-Apr-18	0.00	0.14	198	0.25	369	0.33	0.07	102		
23-Apr-18	0.01	0.19	275	0.33	482	0.37	0.05	79		
24-Apr-18	0.01	0.15	216	0.30	430	0.37	0.06	89		
25-Apr-18	0.01	0.15	212	0.24	352	0.34	0.06	93		
26-Apr-18	0.00	0.14	208	0.28	411	0.36	0.06	86		
27-Apr-18	0.00	0.14	202	0.28	406	0.36	0.04	59		
28-Apr-18	0.07	0.13	184	0.24	343	0.34	0.00	0		
29-Apr-18	0.00	0.00	0	0.06	93	0.07	0.00	0		
30-Apr-18	0.00	0.00	0	0.00	0	0.00	0.00	0		







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

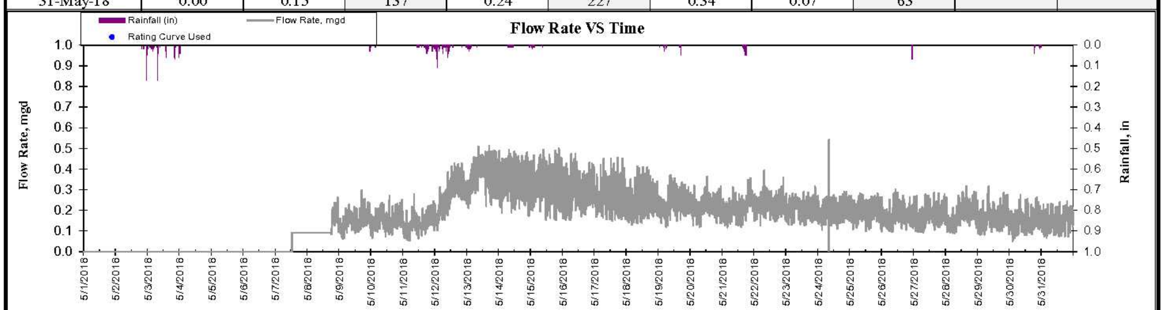
Flow Data for FM05-MAI-12S

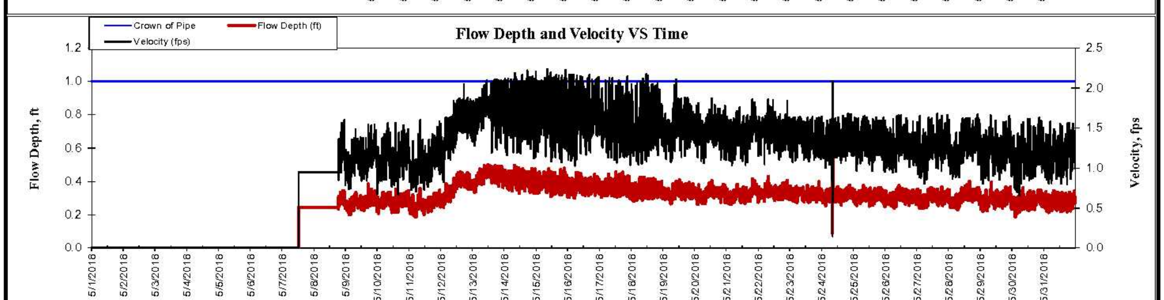
Meter Location: Main St and Schrum at 8185 Main

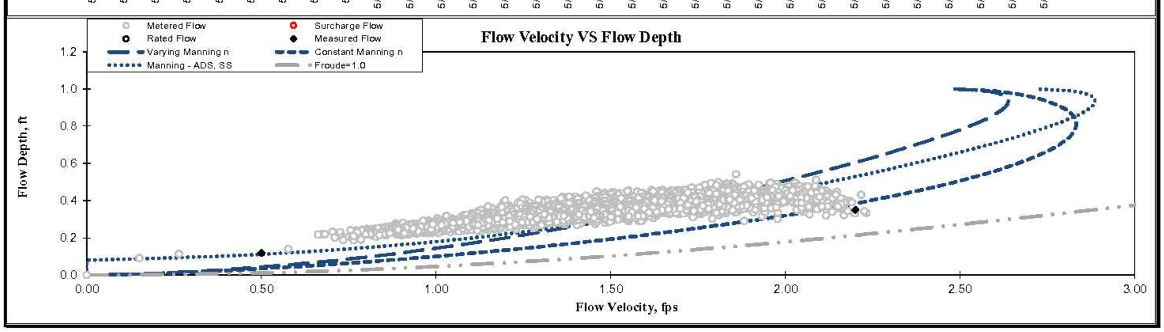
Diameter = 12 in
Slope = 0.30%
Capacity = 1.26 mgd

Area: 376 acres Population: 690 Parcels: 685 Rain Gage: RG01-Main

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-May-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
2-May-18	0.34	0.00	0	0.00	0	0.00	0.00	0		
3-May-18	1.24	0.00	0	0.00	0	0.00	0.00	0		
4-May-18	0.09	0.00	0	0.00	0	0.00	0.00	0		
5-May-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
6-May-18	0.00	0.00	0	0.00	0	0.00	0.00	0		
7-May-18	0.00	0.04	40	0.09	86	0.25	0.00	0		
8-May-18	0.00	0.11	101	0.26	247	0.34	0.08	79		
9-May-18	0.14	0.15	137	0.30	279	0.38	0.06	59		
10-May-18	0.01	0.15	136	0.27	254	0.35	0.07	62		
11-May-18	0.70	0.14	128	0.28	261	0.36	0.05	50		
12-May-18	1.42	0.27	254	0.43	402	0.46	0.10	98		
13-May-18	0.47	0.38	355	0.51	478	0.50	0.21	197		
14-May-18	0.13	0.36	335	0.49	461	0.50	0.17	162		
15-May-18	0.23	0.33	305	0.50	469	0.48	0.15	143		
16-May-18	0.00	0.29	269	0.47	443	0.45	0.15	144		
17-May-18	0.00	0.27	251	0.45	426	0.46	0.15	140		
18-May-18	0.00	0.24	223	0.41	387	0.42	0.13	123		
19-May-18	0.33	0.23	213	0.37	348	0.41	0.12	112		
20-May-18	0.00	0.22	205	0.36	340	0.40	0.12	113		
21-May-18	0.48	0.21	200	0.36	333	0.41	0.12	109		
22-May-18	0.00	0.23	214	0.39	367	0.43	0.13	118		
23-May-18	0.00	0.20	191	0.31	294	0.40	0.13	121		
24-May-18	0.00	0.20	183	0.54	507	0.54	0.00	3		
25-May-18	0.00	0.19	176	0.28	265	0.38	0.10	92		
26-May-18	0.22	0.18	165	0.30	283	0.38	0.10	91		
27-May-18	0.00	0.17	161	0.29	267	0.37	0.09	87		
28-May-18	0.00	0.18	168	0.32	298	0.40	0.09	84		
29-May-18	0.00	0.17	155	0.31	295	0.40	0.08	76		
30-May-18	0.17	0.15	136	0.27	257	0.36	0.05	48		
31-May-18	0.00	0.15	137	0.24	227	0.34	0.07	63		







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

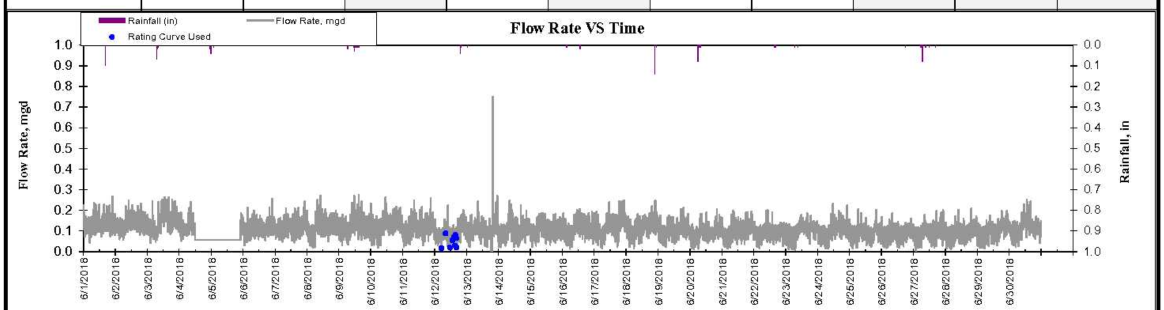
Flow Data for FM05-MAI-12S

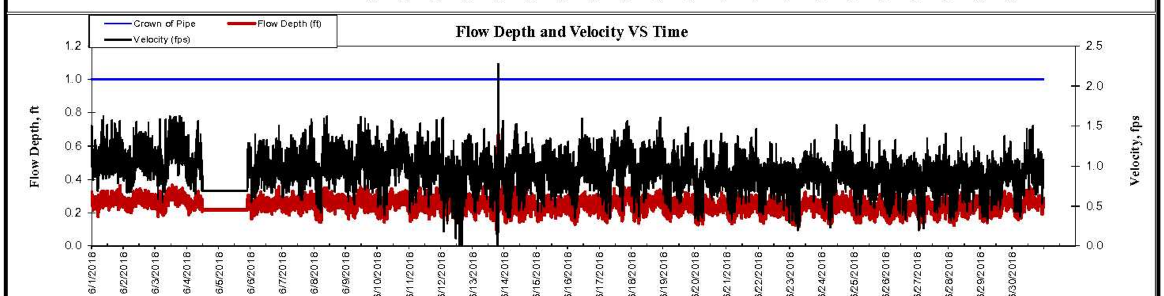
Meter Location: Main St and Schrum at 8185 Main

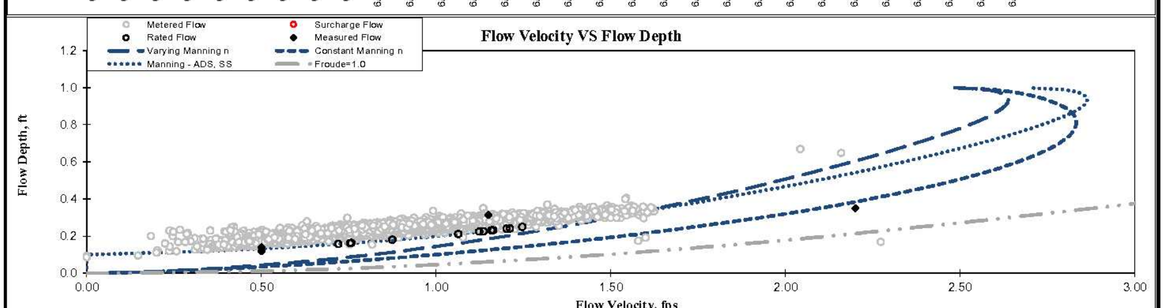
Diameter = 12 in
Slope = 0.30%
Capacity = 1.26 mgd

Area: 376 acres Population: 690 Parcels: 685 Rain Gage: RG01-Main

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Jun-18	0.26	0.14	127	0.27	251	0.36	0.05	42		
2-Jun-18	0.00	0.13	125	0.25	232	0.34	0.06	54		
3-Jun-18	0.26	0.15	137	0.26	246	0.37	0.04	40		
4-Jun-18	0.14	0.09	84	0.24	224	0.33	0.05	49		
5-Jun-18	0.02	0.06	59	0.19	174	0.31	0.06	53		
6-Jun-18	0.00	0.11	107	0.26	240	0.36	0.03	30		
7-Jun-18	0.00	0.12	113	0.24	227	0.33	0.04	41		
8-Jun-18	0.00	0.12	115	0.27	255	0.35	0.02	20		
9-Jun-18	0.30	0.12	117	0.28	258	0.36	0.03	30		
10-Jun-18	0.00	0.13	121	0.26	244	0.34	0.02	18		
11-Jun-18	0.00	0.12	111	0.26	244	0.35	0.02	21		
12-Jun-18	0.10	0.10	90	0.23	211	0.37	0.02	16		
13-Jun-18	0.01	0.11	107	0.75	702	0.67	0.00	3		
14-Jun-18	0.00	0.11	100	0.25	230	0.35	0.02	20		
15-Jun-18	0.00	0.11	100	0.19	174	0.31	0.02	22		
16-Jun-18	0.04	0.11	105	0.21	194	0.32	0.01	13		
17-Jun-18	0.00	0.12	112	0.25	233	0.35	0.02	17		
18-Jun-18	0.30	0.12	111	0.25	233	0.34	0.02	15		
19-Jun-18	0.00	0.11	102	0.21	198	0.32	0.02	22		
20-Jun-18	0.25	0.09	88	0.21	193	0.32	0.01	11		
21-Jun-18	0.00	0.10	94	0.20	187	0.32	0.01	14		
22-Jun-18	0.06	0.10	91	0.20	190	0.31	0.02	16		
23-Jun-18	0.02	0.11	99	0.19	175	0.32	0.01	8		
24-Jun-18	0.00	0.11	100	0.23	216	0.33	0.01	14		
25-Jun-18	0.00	0.10	91	0.21	192	0.33	0.02	17		
26-Jun-18	0.01	0.09	89	0.19	175	0.31	0.02	16		
27-Jun-18	0.17	0.10	93	0.20	188	0.32	0.01	6		
28-Jun-18	0.00	0.10	96	0.21	194	0.32	0.01	11		
29-Jun-18	0.00	0.11	100	0.20	186	0.33	0.02	14		
30-Jun-18	0.00	0.12	113	0.25	237	0.36	0.02	22		







Northfield Township, Michigan
Asset Management Plan
2018 Flow Monitoring Data

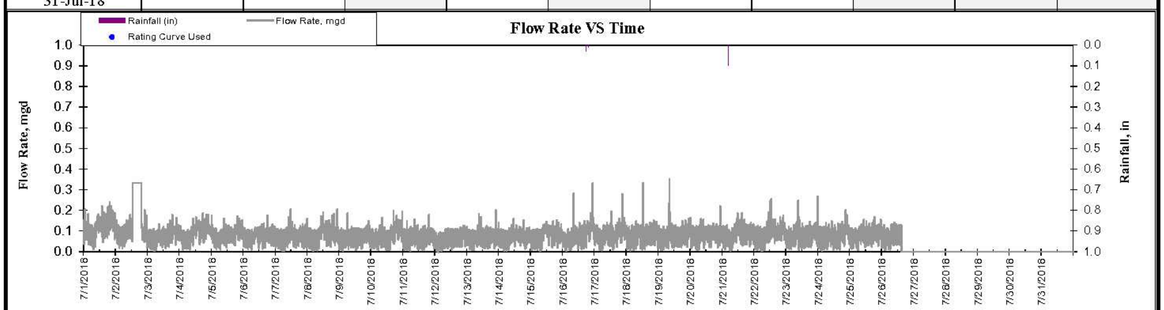
Flow Data for FM05-MAI-12S

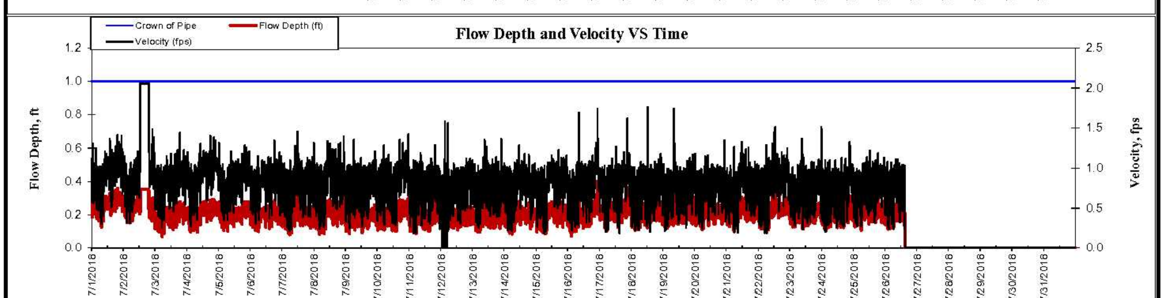
Meter Location: Main St and Schrum at 8185 Main

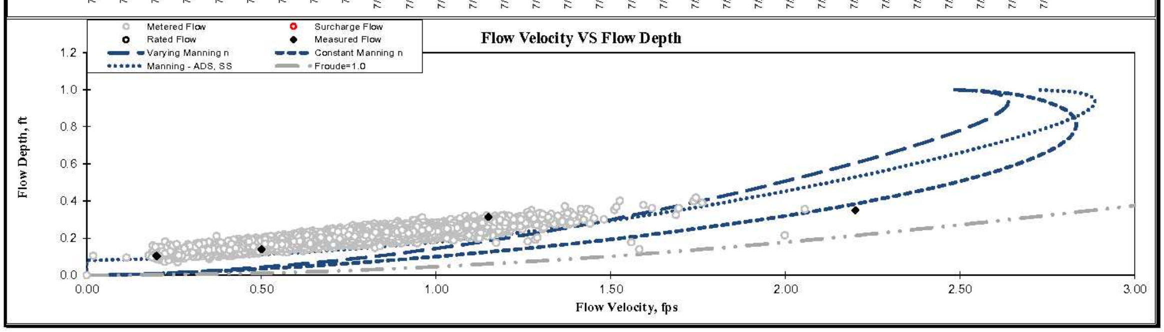
Area: 376 acres Population: 690 Parcels: 685 Rain Gage: RG01-Main

Diameter = 12 in
Slope = 0.30%
Capacity = 1.26 mgd

Date	Daily	Average Day		Maximum Values			Minimum Values		SSOAP RDII Analysis	
	Rainfall, in	Flow, mgd	Flow, gpcd	Flow, mgd	Flow, gpcd	Depth, ft	Flow, mgd	Flow, gpcd	Peak Flow, mgd	Volume, MG
1-Jul-18	0.00	0.12	113	0.24	223	0.36	0.01	10		
2-Jul-18	0.00	0.16	154	0.33	311	0.36	0.02	16		
3-Jul-18	0.00	0.08	75	0.18	166	0.28	0.00	4		
4-Jul-18	0.00	0.09	88	0.19	173	0.29	0.01	9		
5-Jul-18	0.00	0.09	82	0.18	164	0.28	0.01	9		
6-Jul-18	0.00	0.08	76	0.17	164	0.29	0.01	9		
7-Jul-18	0.00	0.08	74	0.21	193	0.31	0.00	4		
8-Jul-18	0.00	0.09	81	0.21	192	0.31	0.01	5		
9-Jul-18	0.00	0.08	71	0.18	173	0.30	0.01	6		
10-Jul-18	0.00	0.08	78	0.20	184	0.30	0.01	8		
11-Jul-18	0.00	0.07	70	0.18	167	0.28	0.00	4		
12-Jul-18	0.00	0.07	67	0.13	118	0.25	0.00	-3		
13-Jul-18	0.00	0.08	72	0.20	187	0.29	0.01	8		
14-Jul-18	0.00	0.08	72	0.16	148	0.28	0.00	4		
15-Jul-18	0.00	0.08	77	0.15	142	0.28	0.01	5		
16-Jul-18	0.04	0.09	83	0.33	312	0.40	0.00	3		
17-Jul-18	0.00	0.09	85	0.28	262	0.36	0.01	6		
18-Jul-18	0.00	0.09	80	0.33	311	0.39	0.01	6		
19-Jul-18	0.00	0.09	82	0.35	328	0.42	0.01	7		
20-Jul-18	0.00	0.09	84	0.22	207	0.32	0.01	7		
21-Jul-18	0.10	0.09	83	0.19	175	0.31	0.01	5		
22-Jul-18	0.00	0.10	90	0.26	239	0.35	0.00	4		
23-Jul-18	0.00	0.09	81	0.27	250	0.37	0.01	8		
24-Jul-18	0.00	0.08	77	0.20	189	0.31	0.01	5		
25-Jul-18	0.00	0.08	79	0.17	156	0.30	0.01	7		
26-Jul-18	0.00	0.05	49	0.14	131	0.28	0.00	0		
27-Jul-18										
28-Jul-18										
29-Jul-18										
30-Jul-18										
31-Jul-18										



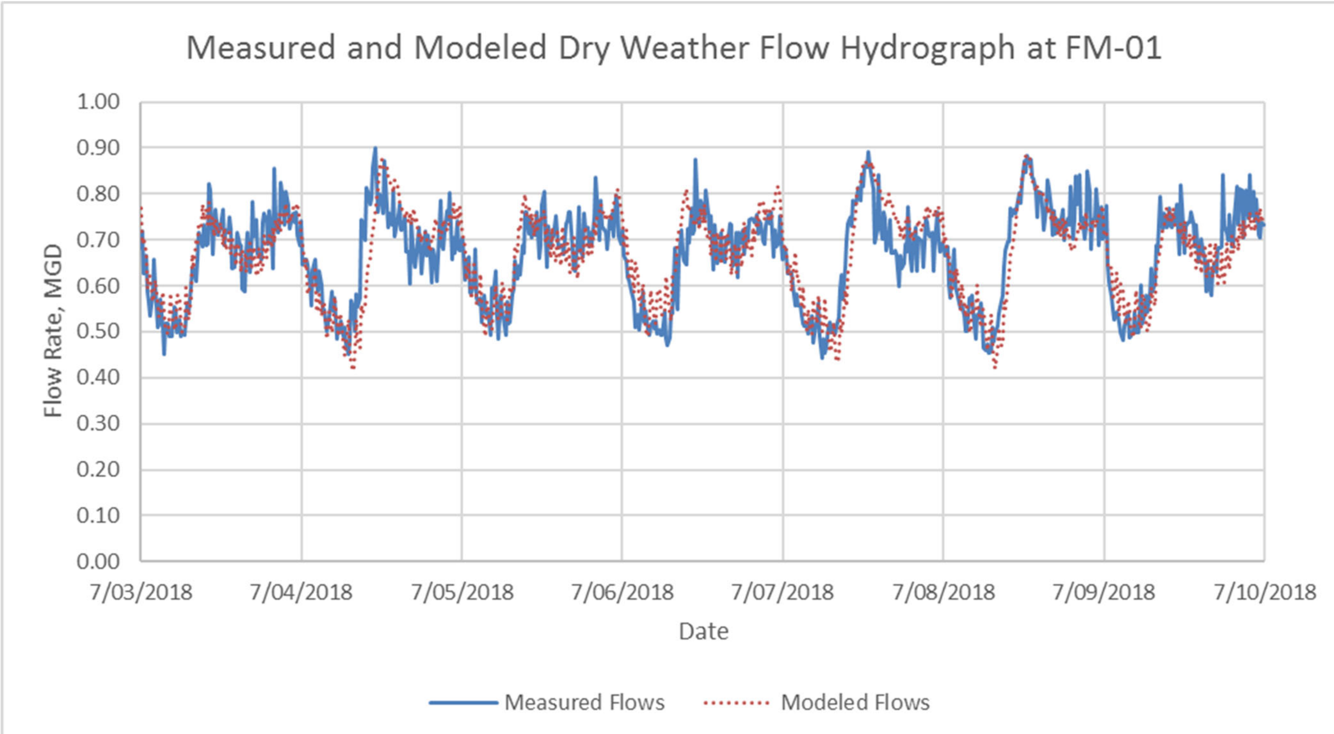


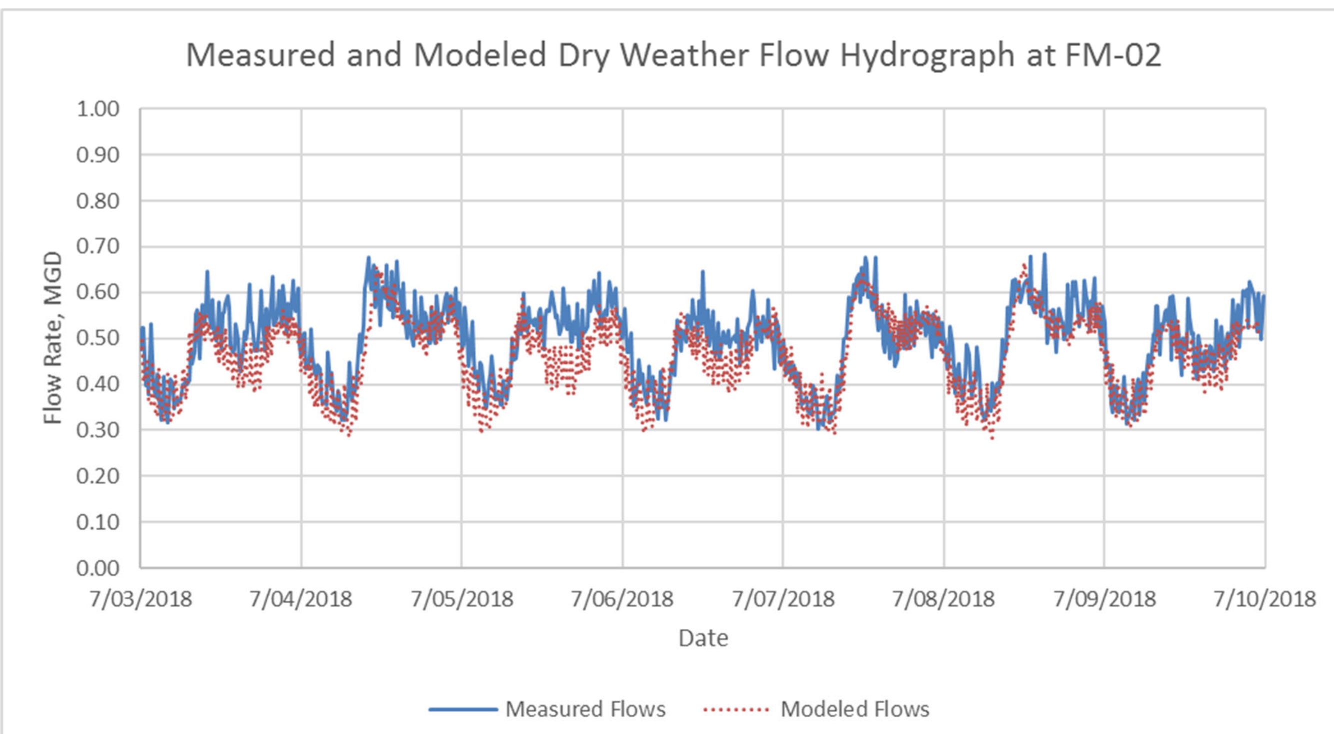


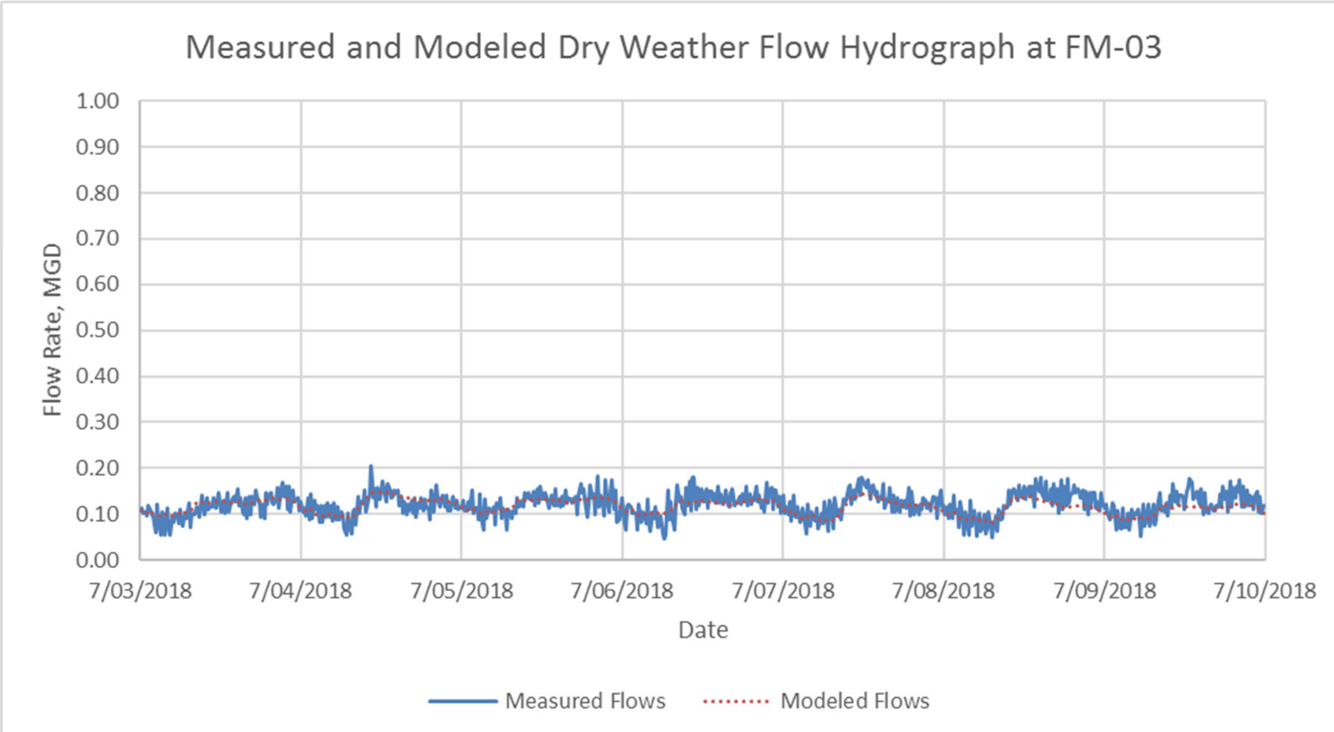
APPENDIX C – SANITARY SEWER SYSTEM CALIBRATION DATA

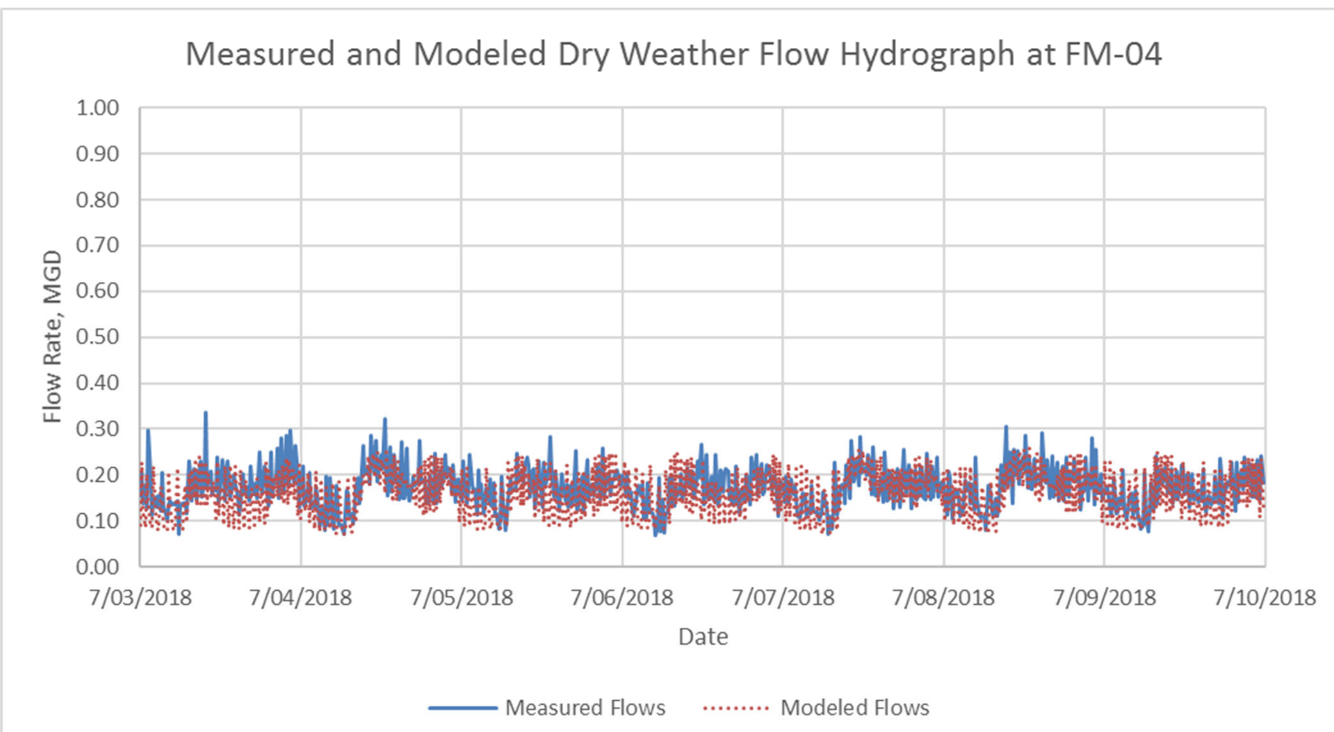
Appendix C Contents

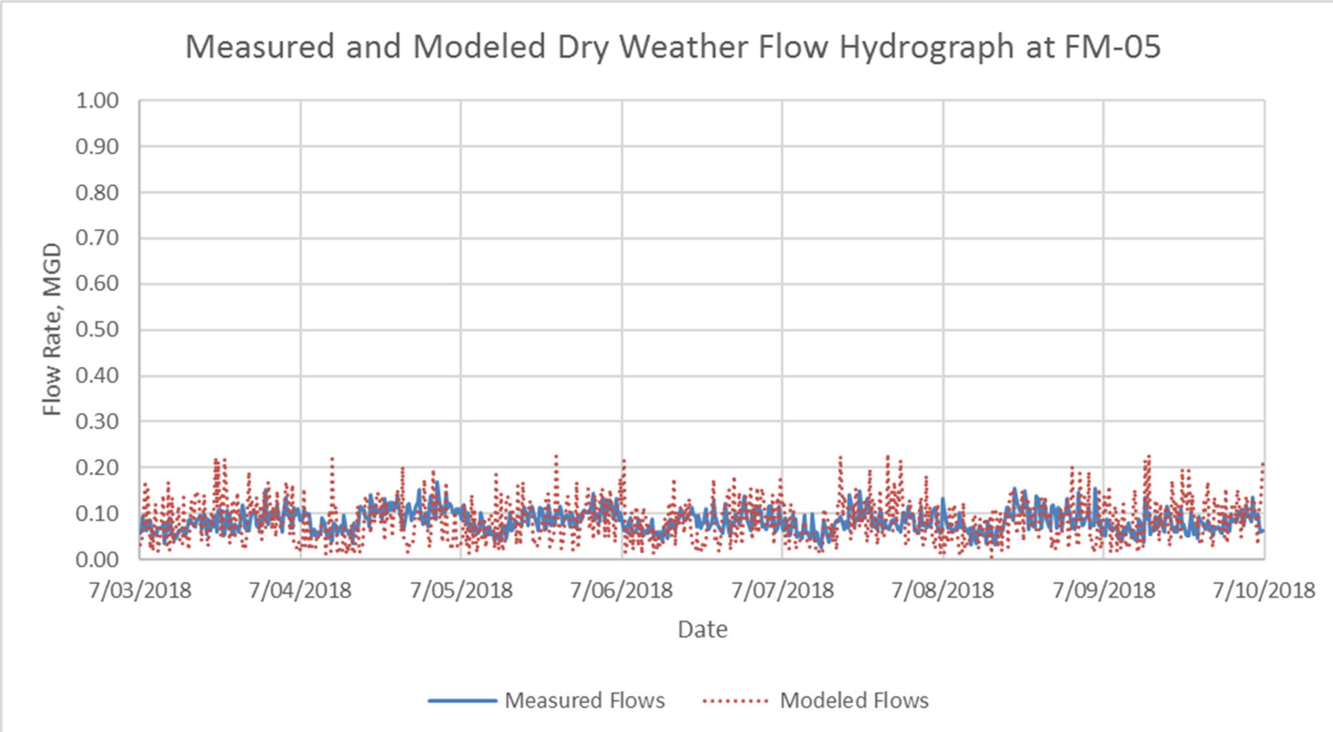
- Hydraulic Model Dry Weather Calibration Hydrographs
- Hydraulic Model Wet Weather Calibration Plots with Summary of all Events


Measured and Modeled Dry Weather Flow Hydrograph at FM-01
Flow Rate, MGD
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
7/03/2018
7/04/2018
7/05/2018
7/06/2018
7/07/2018
7/08/2018
7/09/2018
7/10/2018
Date
Measured Flows
Modeled Flows


Measured and Modeled Dry Weather Flow Hydrograph at FM-02
Flow Rate, MGD
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
7/03/2018
7/04/2018
7/05/2018
7/06/2018
7/07/2018
7/08/2018
7/09/2018
7/10/2018
Date
Measured Flows
Modeled Flows

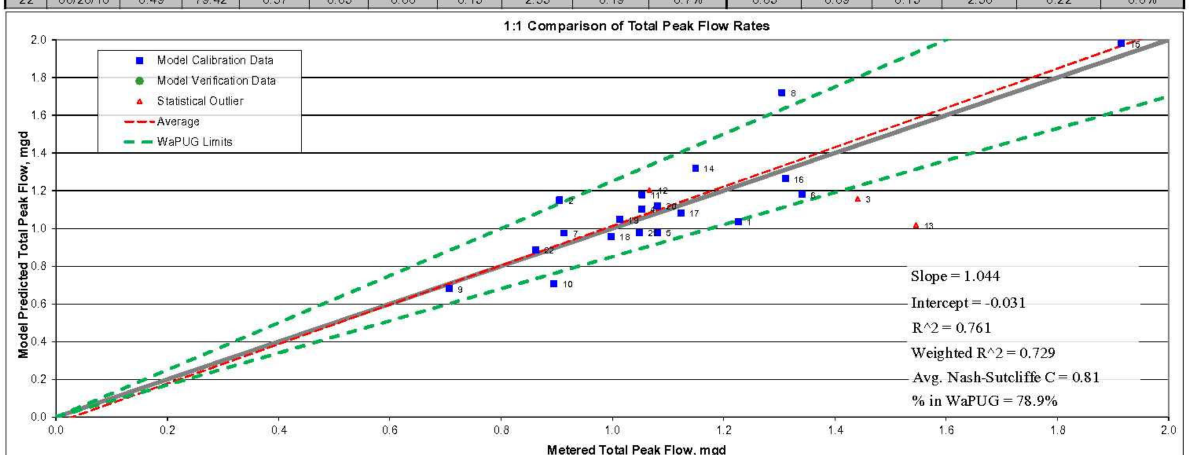

Measured and Modeled Dry Weather Flow Hydrograph at FM-03
Flow Rate, MGD
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
7/03/2018
7/04/2018
7/05/2018
7/06/2018
7/07/2018
7/08/2018
7/09/2018
7/10/2018
Date
Measured Flows
Modeled Flows

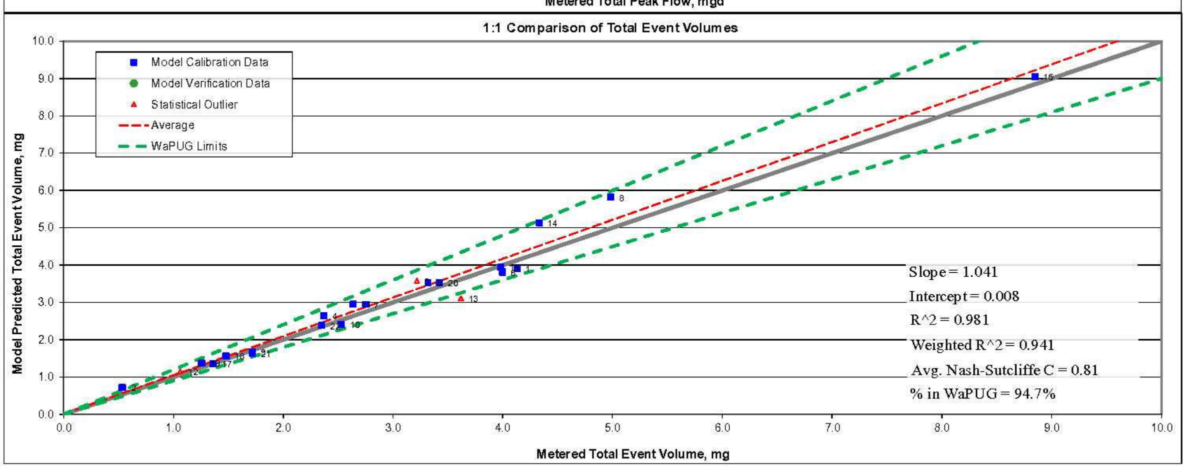

Measured and Modeled Dry Weather Flow Hydrograph at FM-04
Flow Rate, MGD
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
7/03/2018
7/04/2018
7/05/2018
7/06/2018
7/07/2018
7/08/2018
7/09/2018
7/10/2018
Date
Measured Flows
Modeled Flows


Measured and Modeled Dry Weather Flow Hydrograph at FM-05
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Flow Rate, MGD
7/03/2018
7/04/2018
7/05/2018
7/06/2018
7/07/2018
7/08/2018
7/09/2018
7/10/2018
Date
Measured Flows
Modeled Flows

FM-01 - Eight Mile: Hydraulic Model Validation Results

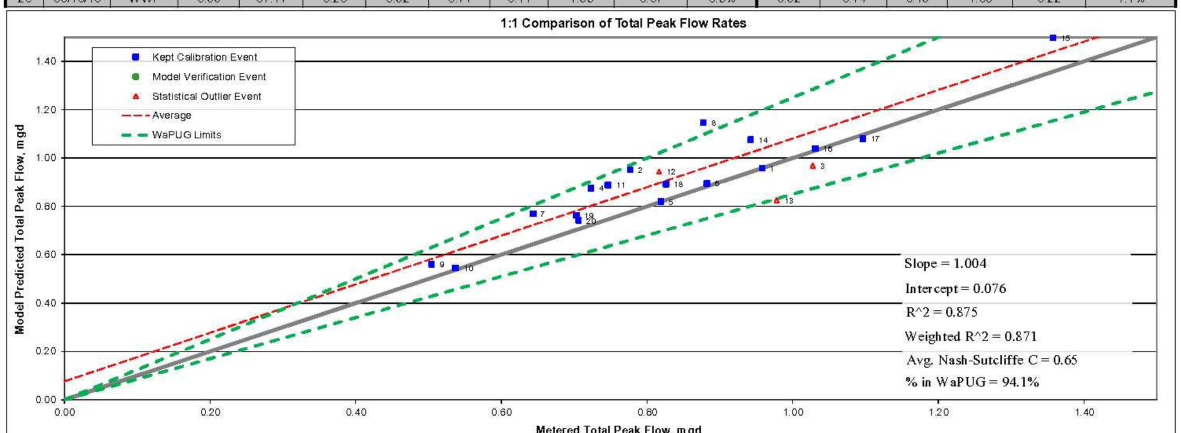
Event ID	Event Date	Rainfall (in)	Duration (hr)	Peak Hour Intensity (in/hr)	Avg. DWF (mgd)	Peak Hour Total Flow (mgd)	Peak Hour WWF (mgd)	Total Vol. (mg)	Wet Weather Vol. (mg)	Percent Capture	Model Average DWF (mgd)	Model Peak Hour Total Flow (mgd)	Model Peak Hour WWF (mgd)	Model Total Vol. (mg)	Model Wet Weather Vol. (mg)	Model Percent Capture
1	04/05/17	0.93	119.58	0.13	0.53	1.23	0.62	4.13	1.47	2.9%	0.57	1.03	0.47	3.90	1.05	2.1%
2	04/19/17	0.89	21.92	0.45	0.44	0.91	0.39	0.54	0.13	0.3%	0.48	1.15	0.60	0.72	0.28	0.6%
3	**04/20/17**	**1.23**	**103.58**	**0.11**	**0.49**	**1.44**	**0.90**	**3.22**	**1.10**	**1.6%**	**0.53**	**1.16**	**0.63**	**3.58**	**1.27**	**1.9%**
4	04/26/17	0.85	75.33	0.78	0.61	1.05	0.51	2.37	0.45	1.0%	0.62	1.10	0.63	2.64	0.70	1.5%
5	04/30/17	0.81	101.75	0.27	0.69	1.08	0.33	3.32	0.38	0.9%	0.70	0.98	0.30	3.52	0.56	1.3%
6	05/04/17	0.73	105.25	0.10	0.73	1.34	0.51	4.00	0.80	2.0%	0.73	1.18	0.34	3.81	0.60	1.5%
7	05/16/17	0.50	99.25	0.42	0.63	0.91	0.18	2.75	0.15	0.6%	0.63	0.97	0.24	2.94	0.32	1.2%
8	05/21/17	1.73	151.00	1.24	0.64	1.31	0.84	4.99	0.93	1.0%	0.65	1.72	1.26	5.81	1.75	1.9%
9	06/22/17	0.29	80.42	0.12	0.46	0.71	0.15	1.72	0.18	1.2%	0.46	0.68	0.09	1.66	0.12	0.8%
10	03/27/18	0.49	102.50	0.08	0.52	0.90	0.29	2.53	0.32	1.2%	0.52	0.71	0.13	2.41	0.21	0.8%
11	04/03/18	0.86	94.58	0.34	0.59	1.05	0.39	2.64	0.33	0.7%	0.58	1.18	0.48	2.95	0.65	1.4%
12	**04/14/18**	**0.68**	**35.17**	**0.13**	**0.60**	**1.07**	**0.29**	**1.06**	**0.17**	**0.5%**	**0.60**	**1.20**	**0.39**	**1.15**	**0.28**	**0.7%**
13	**04/15/18**	**0.65**	**91.83**	**0.45**	**0.69**	**1.55**	**0.85**	**3.62**	**0.98**	**2.8%**	**0.69**	**1.02**	**0.28**	**3.11**	**0.46**	**1.3%**
14	05/02/18	1.66	124.92	0.39	0.63	1.15	0.52	4.33	1.05	1.2%	0.68	1.32	0.67	5.13	1.60	1.8%
15	05/11/18	2.92	181.00	0.42	0.81	1.92	1.17	8.85	2.77	1.8%	0.81	1.98	1.08	9.05	2.92	1.8%
16	05/21/18	0.54	99.17	0.28	0.85	1.31	0.38	3.99	0.47	1.6%	0.85	1.26	0.34	3.94	0.42	1.4%
17	05/26/18	0.35	37.83	0.35	0.82	1.12	0.17	1.37	0.08	0.4%	0.81	1.08	0.11	1.35	0.07	0.4%
18	05/30/18	0.27	44.75	0.15	0.81	1.00	0.10	1.48	-0.03	-0.2%	0.81	0.96	0.05	1.56	0.05	0.3%
19	06/01/18	0.44	38.33	0.44	0.78	1.01	0.08	1.26	0.01	0.0%	0.79	1.05	0.15	1.37	0.11	0.5%
20	06/03/18	0.40	101.58	0.22	0.77	1.08	0.18	3.43	0.16	0.7%	0.77	1.12	0.17	3.53	0.26	1.2%
21	06/09/18	0.33	50.92	0.14	0.72	1.05	0.21	1.72	0.19	1.0%	0.72	0.98	0.12	1.64	0.11	0.6%
22	06/20/18	0.49	79.42	0.37	0.65	0.86	0.15	2.35	0.19	0.7%	0.65	0.89	0.15	2.38	0.22	0.8%

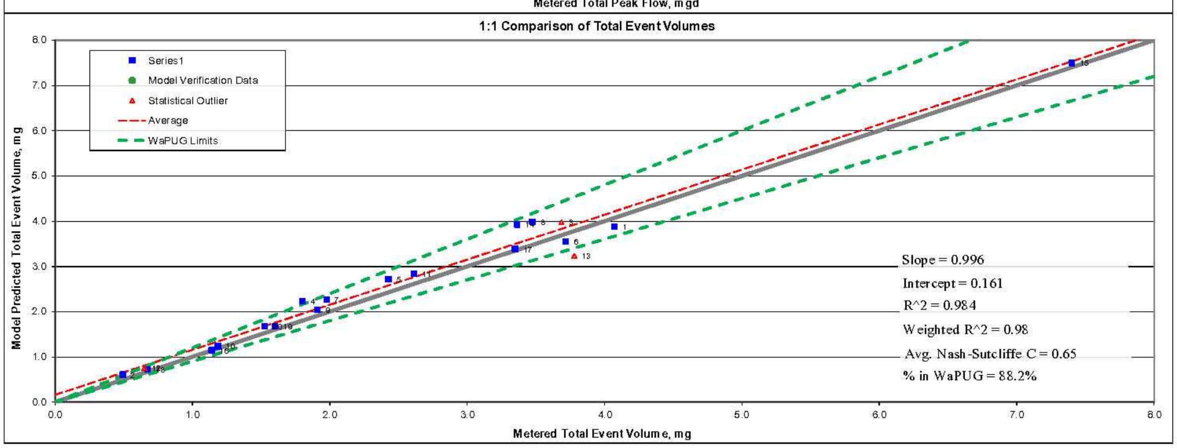




FM02 -Barker 18: Hydraulic Model Validation Results

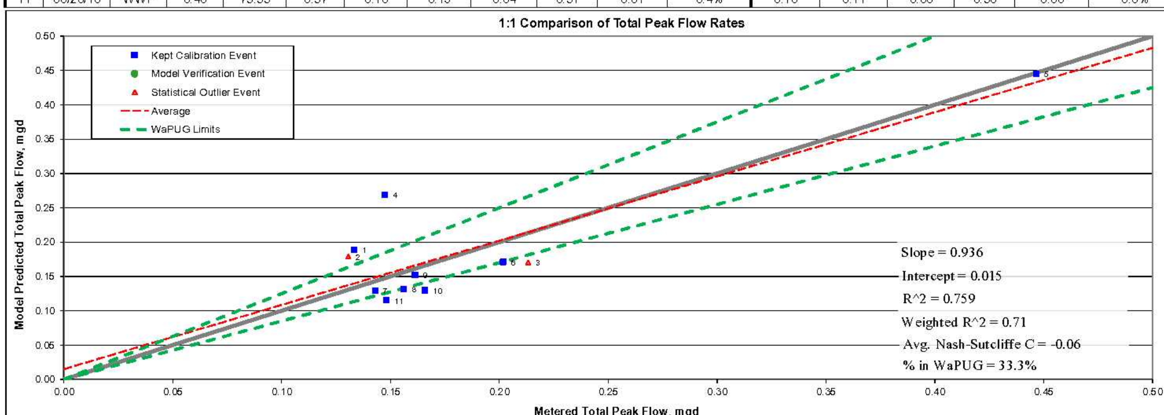
Event ID	Event Date	Event Type	Rainfall (in)	Duration (hr)	Peak Hour Intensity (in/hr)	Avg. DWF (mgd)	Peak Total Hour Flow (mgd)	Peak Hour WWF (mgd)	Total Vol. (mg)	Wet Weather Vol. (mg)	Percent Capture	Model Average DWF (mgd)	Model Peak Hour Total Flow (mgd)	Model Peak Hour WWF (mgd)	Model Total Vol. (mg)	Model Wet Weather Vol. (mg)	Model Percent Capture
1	04/05/17	WWF	0.94	127.92	0.13	0.54	0.96	0.43	4.07	1.18	3.3%	0.55	0.96	0.41	3.87	0.96	2.7%
2	04/19/17	WWF	0.89	20.75	0.45	0.46	0.78	0.26	0.50	0.10	0.3%	0.46	0.95	0.43	0.60	0.20	0.6%
3	**04/20/17**	**WWF**	**1.24**	**134.58**	**0.11**	**0.51**	**1.03**	**0.57**	**3.69**	**0.85**	**1.8%**	**0.51**	**0.97**	**0.48**	**3.97**	**1.11**	**2.4%**
4	04/26/17	WWF	0.85	74.83	0.78	0.53	0.72	0.20	1.80	0.14	0.4%	0.54	0.87	0.45	2.23	0.55	1.7%
5	04/30/17	WWF	0.81	96.83	0.27	0.54	0.82	0.22	2.43	0.27	0.9%	0.54	0.82	0.31	2.71	0.54	1.8%
6	05/04/17	WWF	0.73	131.67	0.10	0.54	0.88	0.28	3.72	0.76	2.8%	0.54	0.89	0.29	3.54	0.56	2.0%
7	05/16/17	WWF	0.50	100.33	0.42	0.46	0.64	0.09	1.98	0.04	0.2%	0.47	0.77	0.23	2.26	0.31	1.6%
8	05/21/17	WWF	1.73	141.08	1.24	0.44	0.88	0.52	3.48	0.88	1.3%	0.44	1.15	0.82	3.98	1.38	2.1%
9	06/22/17	WWF	0.29	125.50	0.12	0.36	0.50	0.11	1.91	0.02	0.1%	0.36	0.56	0.10	2.04	0.14	1.3%
10	06/30/17	WWF	0.27	77.83	0.13	0.35	0.54	0.08	1.19	0.05	0.5%	0.35	0.55	0.07	1.23	0.09	0.9%
11	04/03/18	WWF	0.89	116.08	0.30	0.46	0.75	0.22	2.61	0.37	1.1%	0.46	0.89	0.35	2.84	0.59	1.8%
12	**04/14/18**	**WWF**	**0.71**	**27.67**	**0.13**	**0.48**	**0.82**	**0.18**	**0.65**	**0.09**	**0.3%**	**0.48**	**0.94**	**0.30**	**0.75**	**0.19**	**0.7%**
13	**04/15/18**	**WWF**	**0.22**	**124.25**	**0.12**	**0.54**	**0.98**	**0.42**	**3.78**	**0.97**	**11.6%**	**0.54**	**0.83**	**0.20**	**3.23**	**0.42**	**5.0%**
14	05/02/18	WWF	1.67	108.92	0.33	0.59	0.94	0.35	3.36	0.67	1.1%	0.60	1.07	0.50	3.92	1.22	1.9%
15	05/11/18	WWF	2.95	178.75	0.50	0.70	1.36	0.67	7.40	2.21	2.0%	0.70	1.50	0.75	7.49	2.29	2.1%
16	05/19/18	WWF	0.33	32.83	0.11	0.77	1.03	0.14	1.14	0.08	0.7%	0.78	1.04	0.12	1.14	0.08	0.6%
17	05/21/18	WWF	0.48	100.92	0.22	0.72	1.10	0.28	3.35	0.34	1.9%	0.72	1.08	0.27	3.38	0.37	2.0%
18	06/03/18	WWF	0.26	25.17	0.24	0.59	0.83	0.12	0.67	0.06	0.6%	0.58	0.89	0.17	0.71	0.10	1.0%
19	06/09/18	WWF	0.30	67.50	0.14	0.55	0.70	0.09	1.60	0.06	0.5%	0.55	0.76	0.12	1.67	0.13	1.1%
20	06/18/18	WWF	0.55	67.17	0.28	0.52	0.71	0.11	1.53	0.07	0.3%	0.52	0.74	0.15	1.68	0.22	1.1%

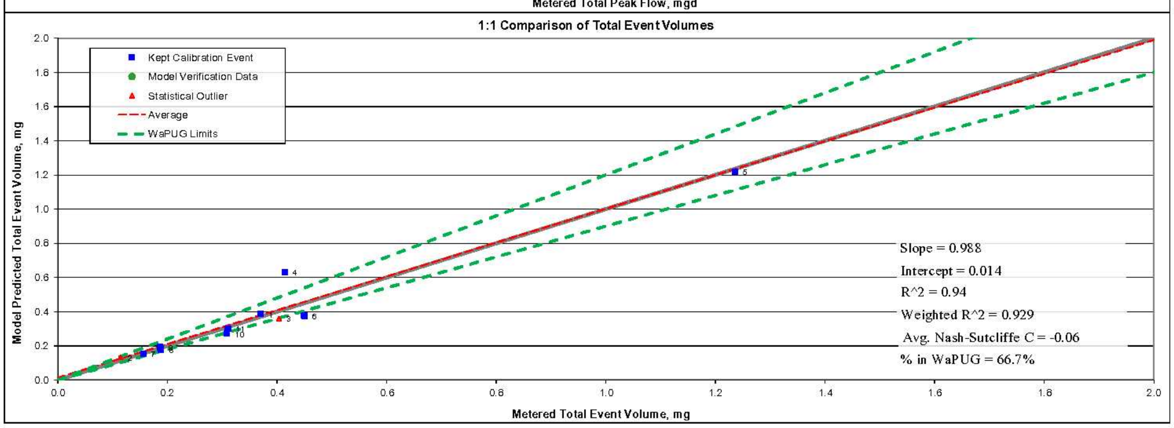




FM03 - Barker 12: Hydraulic Model Validation Results

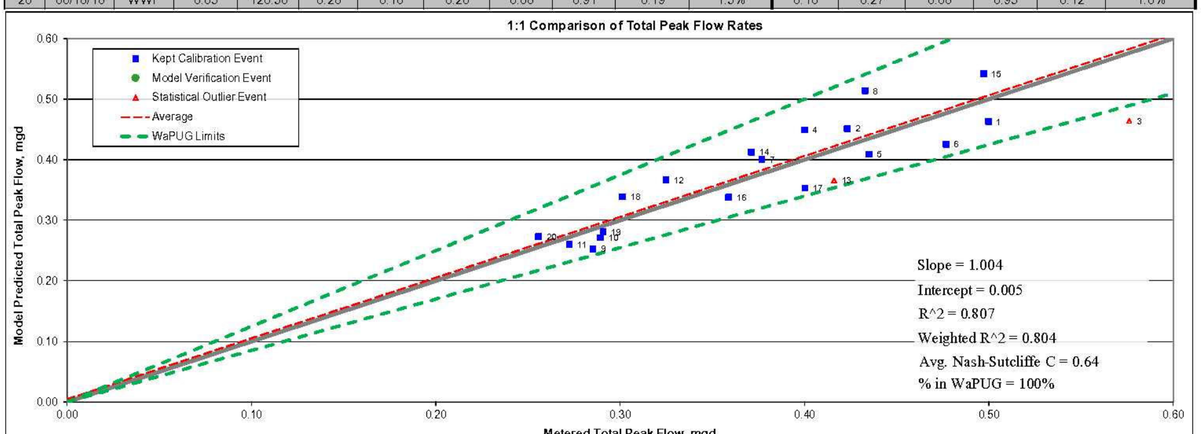
Event ID	Event Date	Event Type	Rainfall (in)	Duration (hr)	Peak Hour Intensity (in/hr)	Avg. DWF (mgd)	Peak Hour Total Flow (mgd)	Peak Hour WWF (mgd)	Total Vol. (mg)	Wet Weather Vol. (mg)	Percent Capture	Model Average DWF (mgd)	Model Peak Hour Total Flow (mgd)	Model Peak Hour WWF (mgd)	Model Total Vol. (mg)	Model Wet Weather Vol. (mg)	Model Percent Capture
1	04/03/18	WWF	0.86	122.83	0.34	0.06	0.13	0.07	0.37	0.08	1.4%	0.06	0.19	0.13	0.38	0.09	1.7%
2	04/14/18	WWF	0.68	34.50	0.13	0.06	0.13	0.04	0.11	0.02	0.5%	0.06	0.18	0.08	0.13	0.04	0.9%
3	04/15/18	WWF	0.65	89.75	0.45	0.07	0.21	0.14	0.40	0.13	3.2%	0.07	0.17	0.09	0.36	0.08	2.1%
4	05/02/18	WWF	1.66	112.58	0.39	0.07	0.15	0.08	0.41	0.07	0.7%	0.07	0.27	0.19	0.63	0.29	2.9%
5	05/11/18	WWF	2.92	164.17	0.42	0.10	0.45	0.34	1.24	0.58	3.3%	0.10	0.44	0.34	1.22	0.56	3.2%
6	05/21/18	WWF	0.54	88.33	0.28	0.09	0.202	0.10	0.45	0.12	3.6%	0.09	0.171	0.07	0.38	0.04	1.4%
7	05/26/18	WWF	0.35	38.08	0.35	0.10	0.143	0.03	0.16	0.00	0.2%	0.10	0.129	0.00	0.15	0.00	0.0%
8	05/30/18	WWF	0.27	37.50	0.15	0.11	0.16	0.03	0.19	0.01	0.6%	0.11	0.13	0.00	0.18	0.00	0.0%
9	06/01/18	WWF	0.44	36.92	0.44	0.12	0.16	0.03	0.19	0.00	0.1%	0.12	0.15	0.02	0.19	0.01	0.4%
10	06/09/18	WWF	0.33	63.75	0.14	0.10	0.17	0.06	0.31	0.04	1.9%	0.10	0.13	0.00	0.27	0.00	0.0%
11	06/20/18	WWF	0.48	73.33	0.37	0.10	0.15	0.04	0.31	0.01	0.4%	0.10	0.11	0.00	0.30	0.00	0.0%

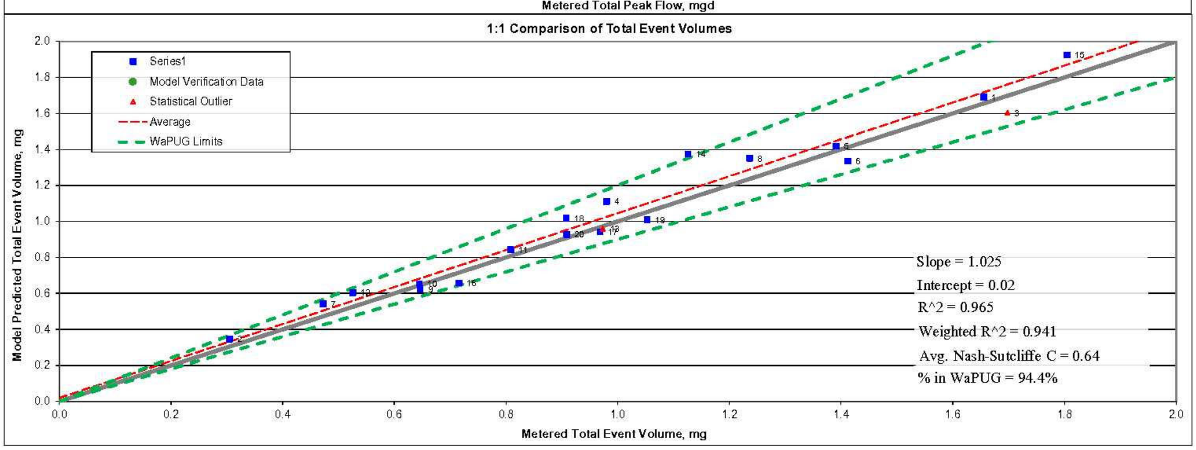




FM04 - East Shore 12": Hydraulic Model Validation Results

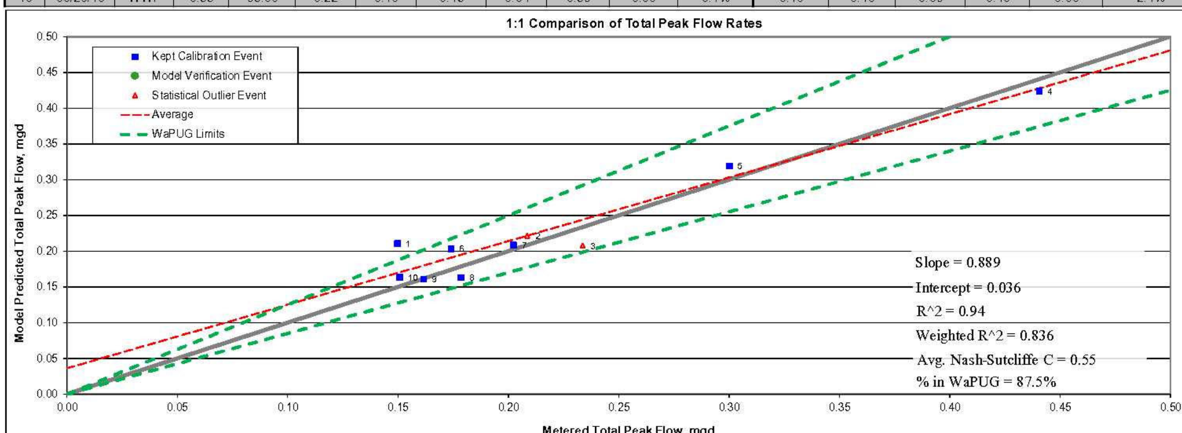
Event ID	Event Date	Event Type	Rainfall (in)	Duration (hr)	Peak Hour Intensity (in/hr)	Avg. DWF (mgd)	Peak Hour Total Flow (mgd)	Peak Hour WWF (mgd)	Total Vol. (mg)	Wet Weather Vol. (mg)	Percent Capture	Model Average DWF (mgd)	Model Peak Hour Total Flow (mgd)	Model Peak Hour WWF (mgd)	Model Total Vol. (mg)	Model Wet Weather Vol. (mg)	Model Percent Capture
1	04/05/17	WWF	0.93	108.75	0.13	0.31	0.50	0.17	1.65	0.31	1.7%	0.32	0.46	0.16	1.69	0.25	1.4%
2	04/19/17	WWF	0.89	22.92	0.44	0.27	0.42	0.13	0.31	0.06	0.3%	0.28	0.45	0.16	0.35	0.08	0.5%
3	**04/20/17**	**WWF**	**0.90**	**108.83**	**0.10**	**0.29**	**0.58**	**0.27**	**1.70**	**0.44**	**2.5%**	**0.29**	**0.46**	**0.18**	**1.60**	**0.29**	**1.6%**
4	04/26/17	WWF	0.85	75.25	0.78	0.29	0.40	0.11	0.98	0.14	0.8%	0.30	0.45	0.18	1.11	0.17	1.0%
5	04/30/17	WWF	0.81	101.58	0.27	0.29	0.44	0.12	1.39	0.25	1.5%	0.29	0.41	0.11	1.42	0.17	1.1%
6	05/04/17	WWF	0.73	95.58	0.10	0.29	0.48	0.16	1.41	0.30	2.1%	0.30	0.43	0.11	1.34	0.15	1.1%
7	05/16/17	WWF	0.48	43.17	0.42	0.26	0.38	0.10	0.47	0.07	0.7%	0.26	0.40	0.11	0.54	0.07	0.8%
8	05/21/17	WWF	1.73	97.50	1.23	0.24	0.43	0.20	1.24	0.31	0.9%	0.25	0.51	0.31	1.35	0.34	1.0%
9	06/22/17	WWF	0.29	79.58	0.12	0.17	0.29	0.09	0.65	0.16	2.8%	0.17	0.25	0.06	0.63	0.06	1.1%
10	06/30/17	WWF	0.27	78.00	0.13	0.18	0.29	0.09	0.64	0.14	2.6%	0.18	0.27	0.05	0.65	0.06	1.0%
11	03/27/18	WWF	0.50	101.25	0.09	0.18	0.27	0.09	0.81	0.16	1.6%	0.18	0.26	0.08	0.84	0.09	0.9%
12	04/03/18	WWF	0.79	57.00	0.30	0.19	0.32	0.09	0.53	0.10	0.7%	0.20	0.37	0.14	0.60	0.14	0.9%
13	**04/14/18**	**WWF**	**0.91**	**87.08**	**0.13**	**0.21**	**0.42**	**0.18**	**0.97**	**0.24**	**1.3%**	**0.21**	**0.37**	**0.11**	**0.96**	**0.18**	**1.0%**
14	05/02/18	WWF	1.67	107.92	0.33	0.23	0.37	0.14	1.13	0.19	0.6%	0.23	0.41	0.18	1.37	0.35	1.0%
15	05/11/18	WWF	2.95	130.08	0.50	0.24	0.50	0.22	1.80	0.54	0.9%	0.24	0.54	0.25	1.92	0.61	1.0%
16	05/19/18	WWF	0.33	61.58	0.11	0.23	0.36	0.10	0.72	0.15	2.2%	0.23	0.34	0.06	0.66	0.06	0.9%
17	05/21/18	WWF	0.48	94.83	0.22	0.21	0.40	0.16	0.97	0.18	1.9%	0.21	0.35	0.11	0.94	0.11	1.2%
18	06/01/18	WWF	0.68	102.75	0.26	0.21	0.30	0.07	0.91	0.12	0.9%	0.21	0.34	0.09	1.02	0.13	1.0%
19	06/09/18	WWF	0.41	119.83	0.14	0.19	0.29	0.09	1.05	0.20	2.5%	0.19	0.28	0.06	1.01	0.08	1.0%
20	06/18/18	WWF	0.63	120.50	0.28	0.16	0.26	0.08	0.91	0.19	1.5%	0.16	0.27	0.08	0.93	0.12	1.0%

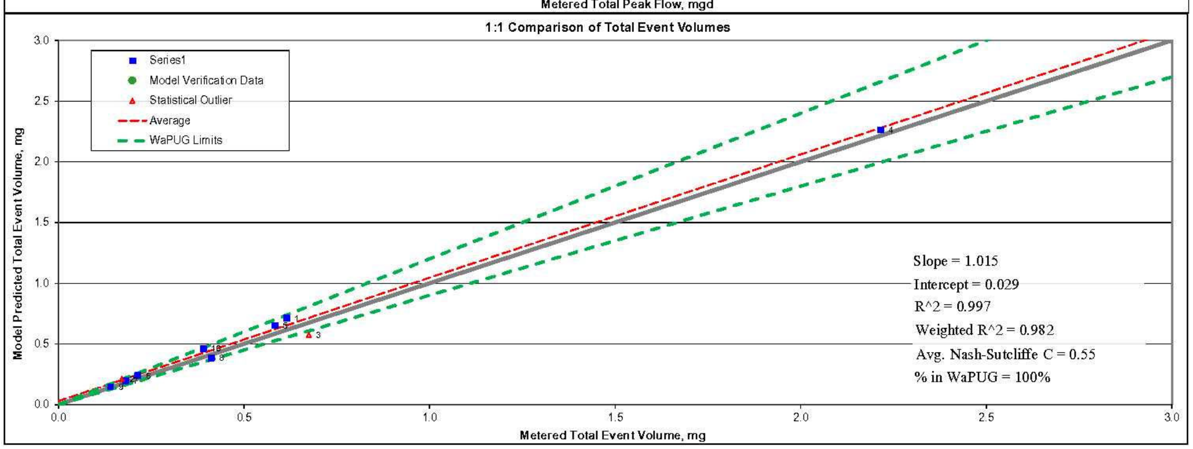




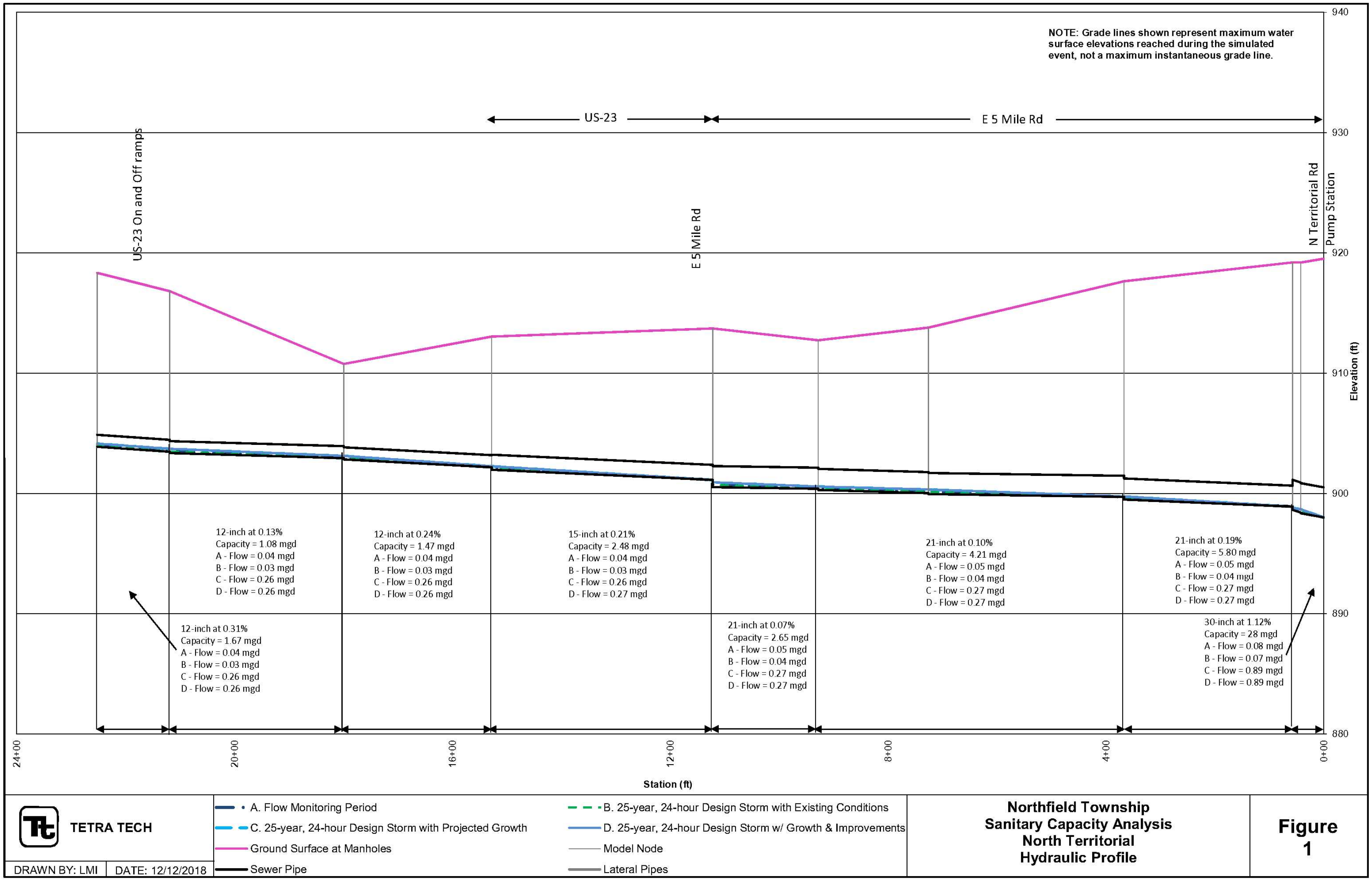
FM05 - Main St 12: Hydraulic Model Validation Results

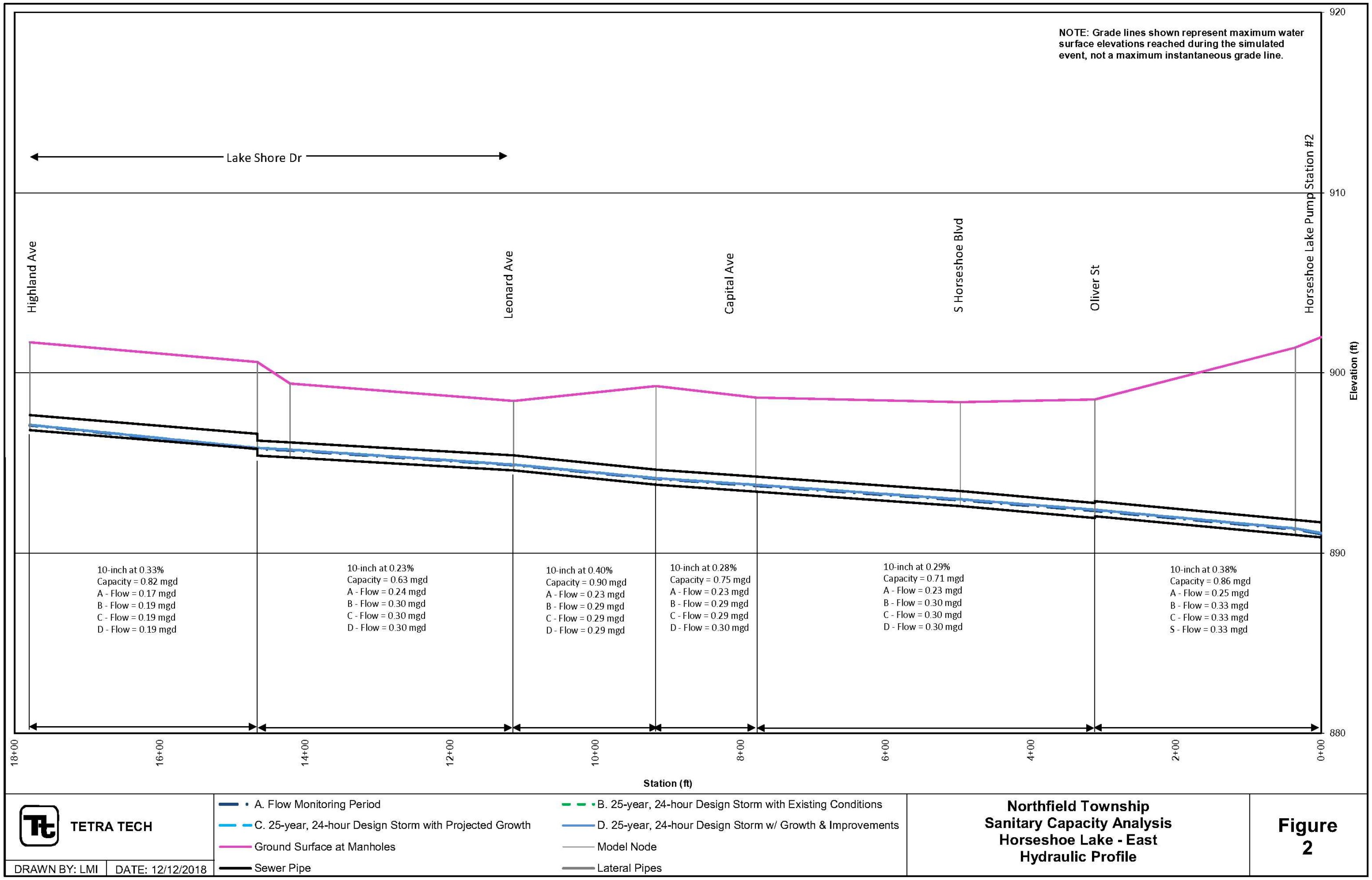
Event ID	Event Date	Event Type	Rainfall (in)	Duration (hr)	Peak Hour Intensity (in/hr)	Avg. DWF (mgd)	Peak Hour Total Flow (mgd)	Peak Hour WWF (mgd)	Total Vol. (mg)	Wet Weather Vol. (mg)	Percent Capture	Model Average DWF (mgd)	Model Peak Hour Total Flow (mgd)	Model Peak Hour WWF (mgd)	Model Total Vol. (mg)	Model Wet Weather Vol. (mg)	Model Percent Capture
1	04/03/18	WWF	0.89	131.42	0.30	0.09	0.15	0.06	0.61	0.13	1.4%	0.09	0.21	0.14	0.71	0.22	2.4%
2	**04/14/18**	**WWF**	**0.71**	**33.50**	**0.13**	**0.10**	**0.21**	**0.09**	**0.17**	**0.04**	**0.5%**	**0.10**	**0.22**	**0.12**	**0.21**	**0.08**	**1.1%**
3	**04/15/18**	**WWF**	**0.22**	**85.08**	**0.12**	**0.12**	**0.23**	**0.11**	**0.67**	**0.23**	**10.4%**	**0.13**	**0.21**	**0.10**	**0.57**	**0.13**	**5.8%**
4	05/11/18	WWF	2.95	182.58	0.50	0.18	0.44	0.28	2.21	0.85	2.8%	0.18	0.42	0.31	2.26	0.90	3.0%
5	05/21/18	WWF	0.48	64.92	0.22	0.20	0.30	0.09	0.58	0.04	0.9%	0.20	0.32	0.11	0.65	0.11	2.3%
6	06/01/18	WWF	0.26	38.00	0.26	0.13	0.17	0.04	0.21	0.00	0.1%	0.13	0.20	0.06	0.24	0.03	1.0%
7	06/03/18	WWF	0.26	30.50	0.24	0.13	0.20	0.06	0.18	0.02	0.8%	0.13	0.21	0.08	0.20	0.04	1.4%
8	06/09/18	WWF	0.30	84.33	0.14	0.10	0.18	0.06	0.41	0.07	2.4%	0.10	0.16	0.10	0.38	0.04	1.4%
9	06/18/18	WWF	0.30	31.50	0.28	0.09	0.16	0.05	0.14	0.02	0.7%	0.10	0.16	0.08	0.15	0.02	0.7%
10	06/20/18	WWF	0.33	93.08	0.22	0.10	0.15	0.04	0.39	0.00	0.1%	0.10	0.16	0.09	0.46	0.08	2.4%

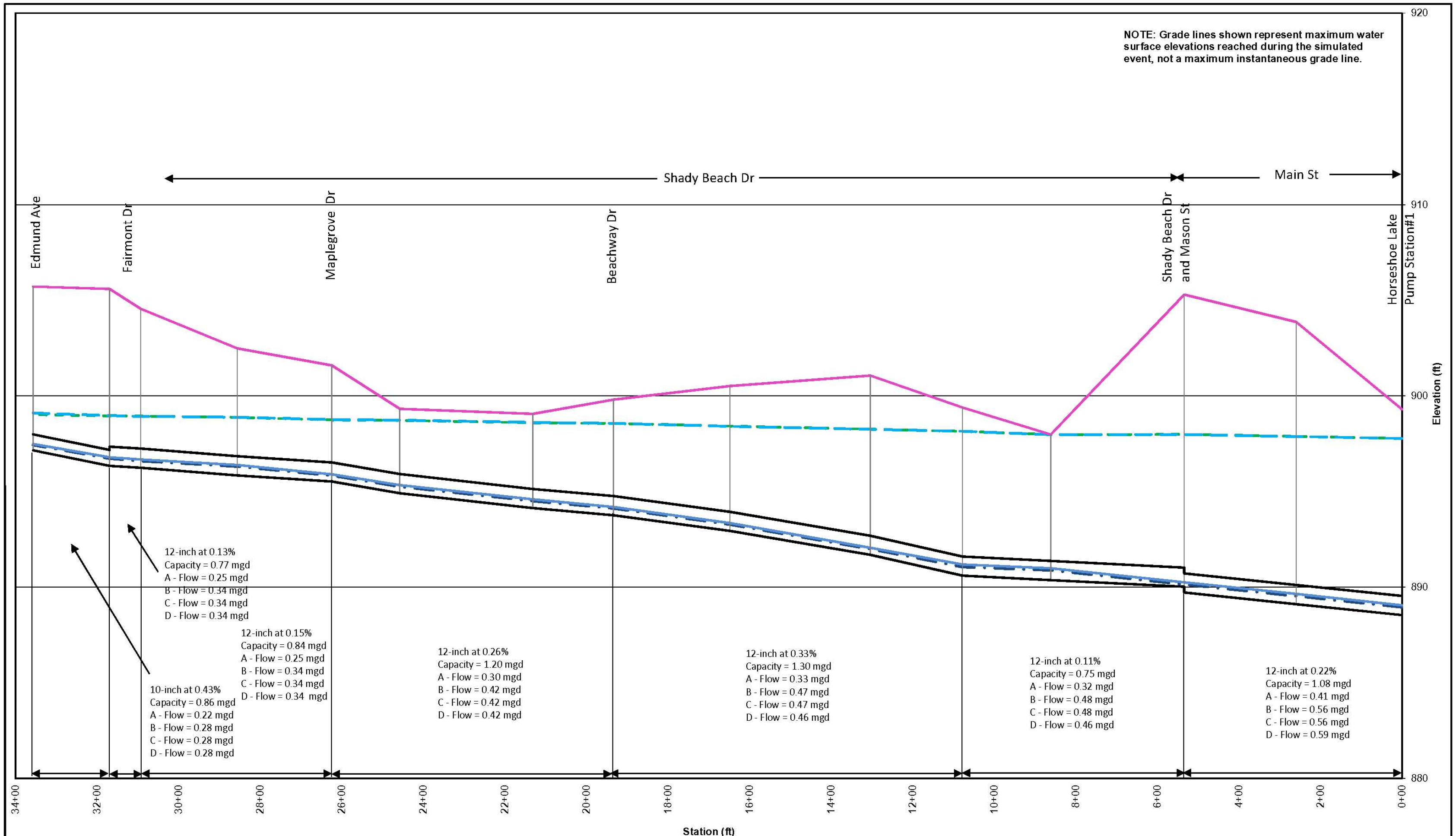




APPENDIX D – SANITARY SEWER HYDRAULIC PROFILES


NOTE: Grade lines shown represent maximum water surface elevations reached during the simulated event, not a maximum instantaneous grade line.
US-23
E 5 Mile Rd
US-23 On and Off ramps
E 5 Mile Rd
N Territorial Rd Pump Station
940
930
920
910
900
890
880
Elevation (ft)
12-inch at 0.13% Capacity = 1.08 mgd A - Flow = 0.04 mgd B - Flow = 0.03 mgd C - Flow = 0.26 mgd D - Flow = 0.26 mgd
12-inch at 0.24% Capacity = 1.47 mgd A - Flow = 0.04 mgd B - Flow = 0.03 mgd C - Flow = 0.26 mgd D - Flow = 0.26 mgd
15-inch at 0.21% Capacity = 2.48 mgd A - Flow = 0.04 mgd B - Flow = 0.03 mgd C - Flow = 0.26 mgd D - Flow = 0.27 mgd
21-inch at 0.10% Capacity = 4.21 mgd A - Flow = 0.05 mgd B - Flow = 0.04 mgd C - Flow = 0.27 mgd D - Flow = 0.27 mgd
21-inch at 0.19% Capacity = 5.80 mgd A - Flow = 0.05 mgd B - Flow = 0.04 mgd C - Flow = 0.27 mgd D - Flow = 0.27 mgd
12-inch at 0.31% Capacity = 1.67 mgd A - Flow = 0.04 mgd B - Flow = 0.03 mgd C - Flow = 0.26 mgd D - Flow = 0.26 mgd
21-inch at 0.07% Capacity = 2.65 mgd A - Flow = 0.05 mgd B - Flow = 0.04 mgd C - Flow = 0.27 mgd D - Flow = 0.27 mgd
30-inch at 1.12% Capacity = 28 mgd A - Flow = 0.08 mgd B - Flow = 0.07 mgd C - Flow = 0.89 mgd D - Flow = 0.89 mgd
24+00
20+00
16+00
12+00
8+00
4+00
0+00
Station (ft)
TETRA TECH
DRAWN BY: LMI
DATE: 12/12/2018
A. Flow Monitoring Period
B. 25-year, 24-hour Design Storm with Existing Conditions
C. 25-year, 24-hour Design Storm with Projected Growth
D. 25-year, 24-hour Design Storm w/ Growth & Improvements
Ground Surface at Manholes
Model Node
Sewer Pipe
Lateral Pipes
Northfield Township Sanitary Capacity Analysis North Territorial Hydraulic Profile
Figure 1


NOTE: Grade lines shown represent maximum water surface elevations reached during the simulated event, not a maximum instantaneous grade line.
Lake Shore Dr
Highland Ave
Leonard Ave
Capital Ave
S Horseshoe Blvd
Oliver St
Horseshoe Lake Pump Station #2
920
910
900
890
880
Elevation (ft)
10-inch at 0.33% Capacity = 0.82 mgd A - Flow = 0.17 mgd B - Flow = 0.19 mgd C - Flow = 0.19 mgd D - Flow = 0.19 mgd
10-inch at 0.23% Capacity = 0.63 mgd A - Flow = 0.24 mgd B - Flow = 0.30 mgd C - Flow = 0.30 mgd D - Flow = 0.30 mgd
10-inch at 0.40% Capacity = 0.90 mgd A - Flow = 0.23 mgd B - Flow = 0.29 mgd C - Flow = 0.29 mgd D - Flow = 0.29 mgd
10-inch at 0.28% Capacity = 0.75 mgd A - Flow = 0.23 mgd B - Flow = 0.29 mgd C - Flow = 0.29 mgd D - Flow = 0.30 mgd
10-inch at 0.29% Capacity = 0.71 mgd A - Flow = 0.23 mgd B - Flow = 0.30 mgd C - Flow = 0.30 mgd D - Flow = 0.30 mgd
10-inch at 0.38% Capacity = 0.86 mgd A - Flow = 0.25 mgd B - Flow = 0.33 mgd C - Flow = 0.33 mgd S - Flow = 0.33 mgd
18+00
16+00
14+00
12+00
10+00
8+00
6+00
4+00
2+00
0+00
Station (ft)
TETRA TECH
DRAWN BY: LMI
DATE: 12/12/2018
A. Flow Monitoring Period
B. 25-year, 24-hour Design Storm with Existing Conditions
C. 25-year, 24-hour Design Storm with Projected Growth
D. 25-year, 24-hour Design Storm w/ Growth & Improvements
Ground Surface at Manholes
Model Node
Sewer Pipe
Lateral Pipes
Northfield Township
Sanitary Capacity Analysis
Horseshoe Lake - East
Hydraulic Profile
Figure 2

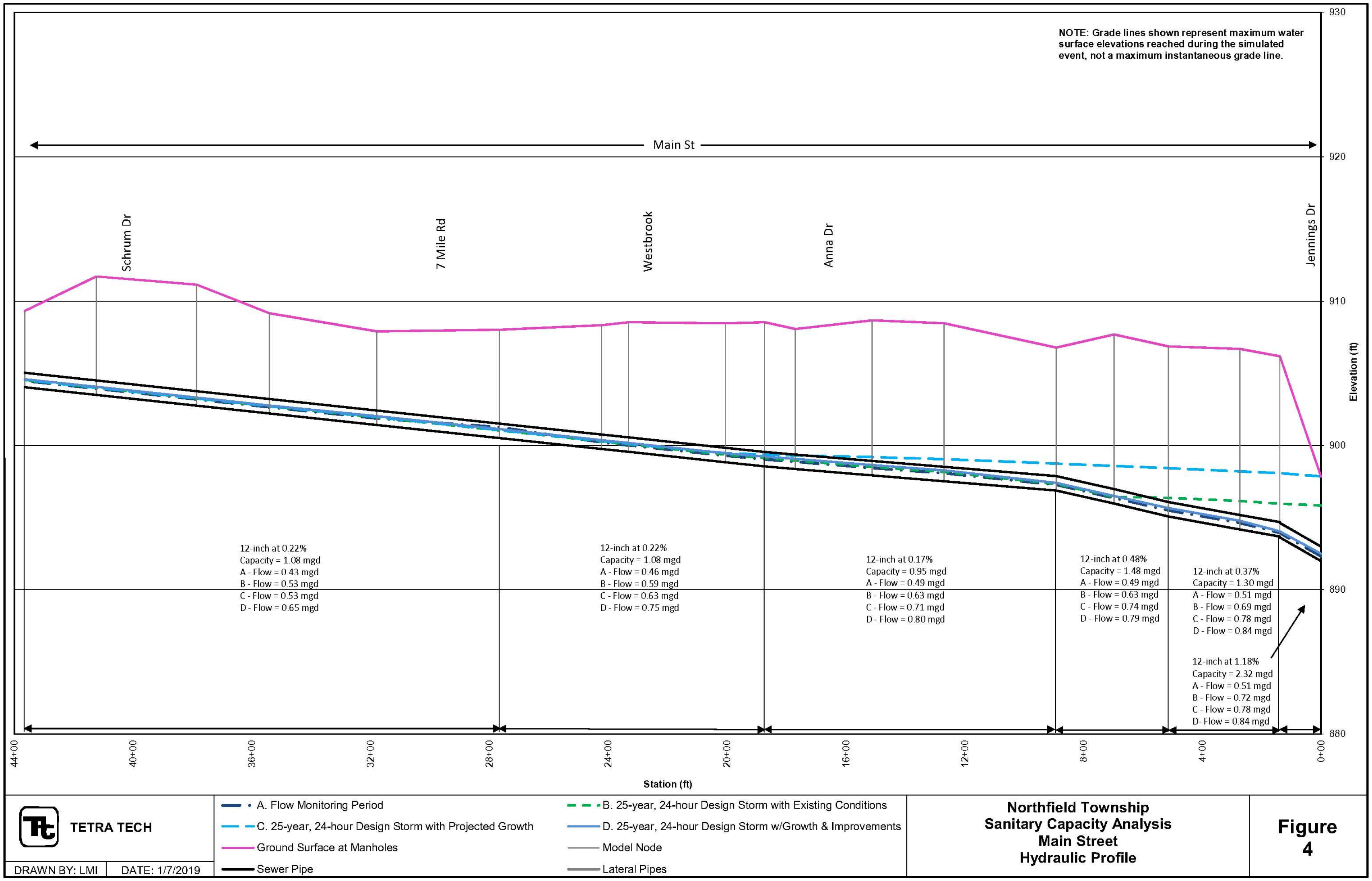


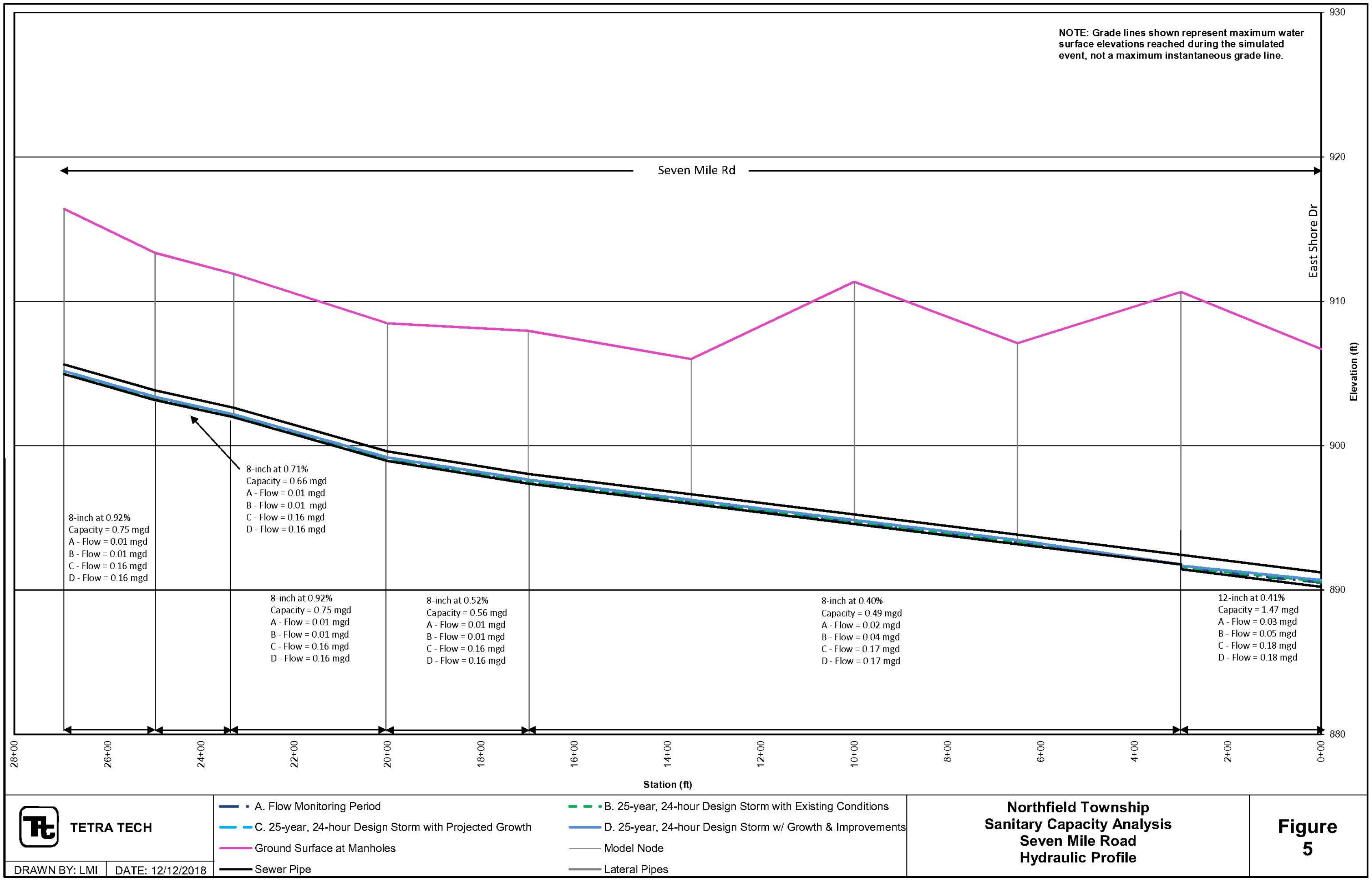
TETRA TECH

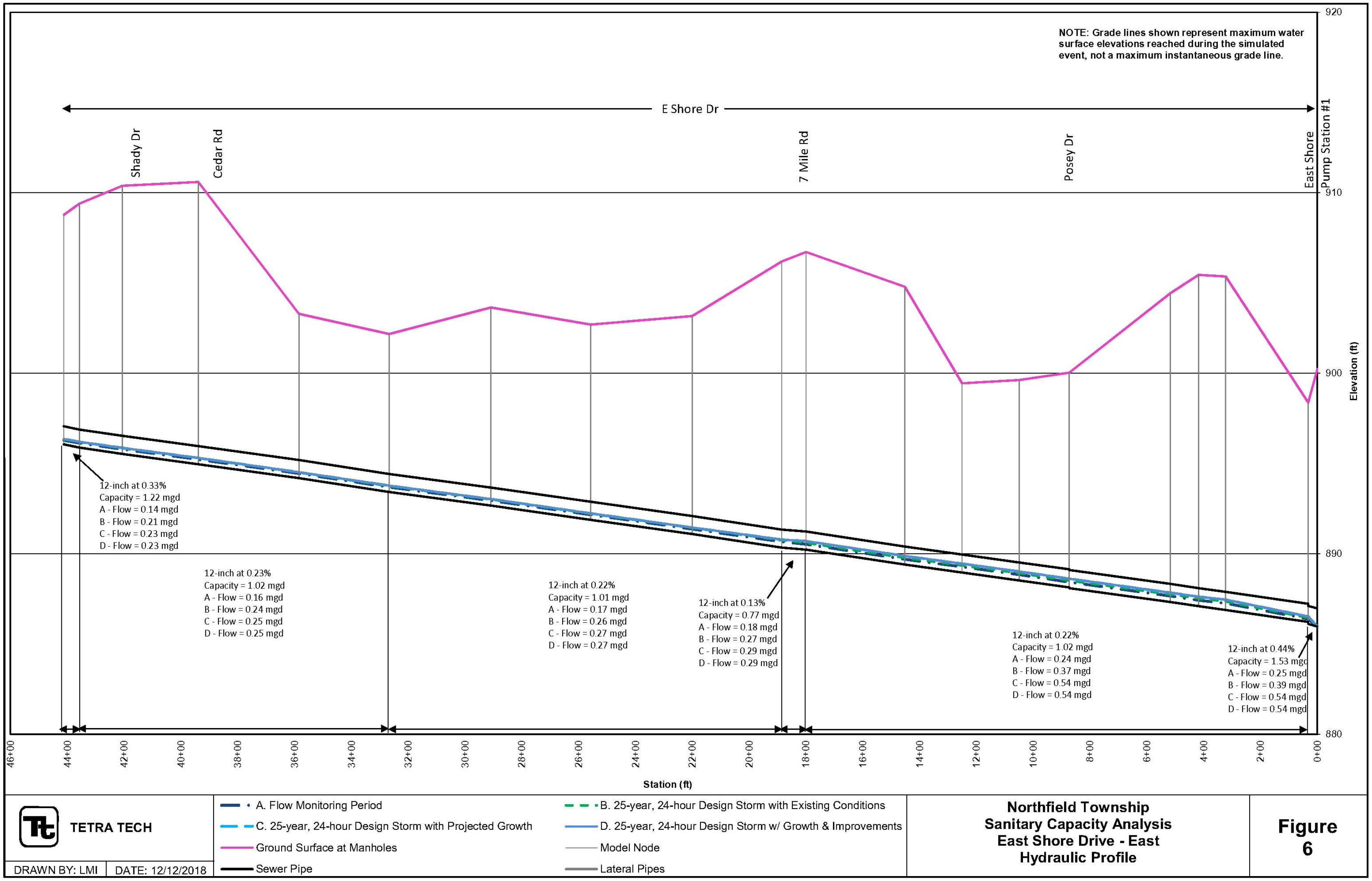
DRAWN BY: LMI | DATE: 12/12/2018

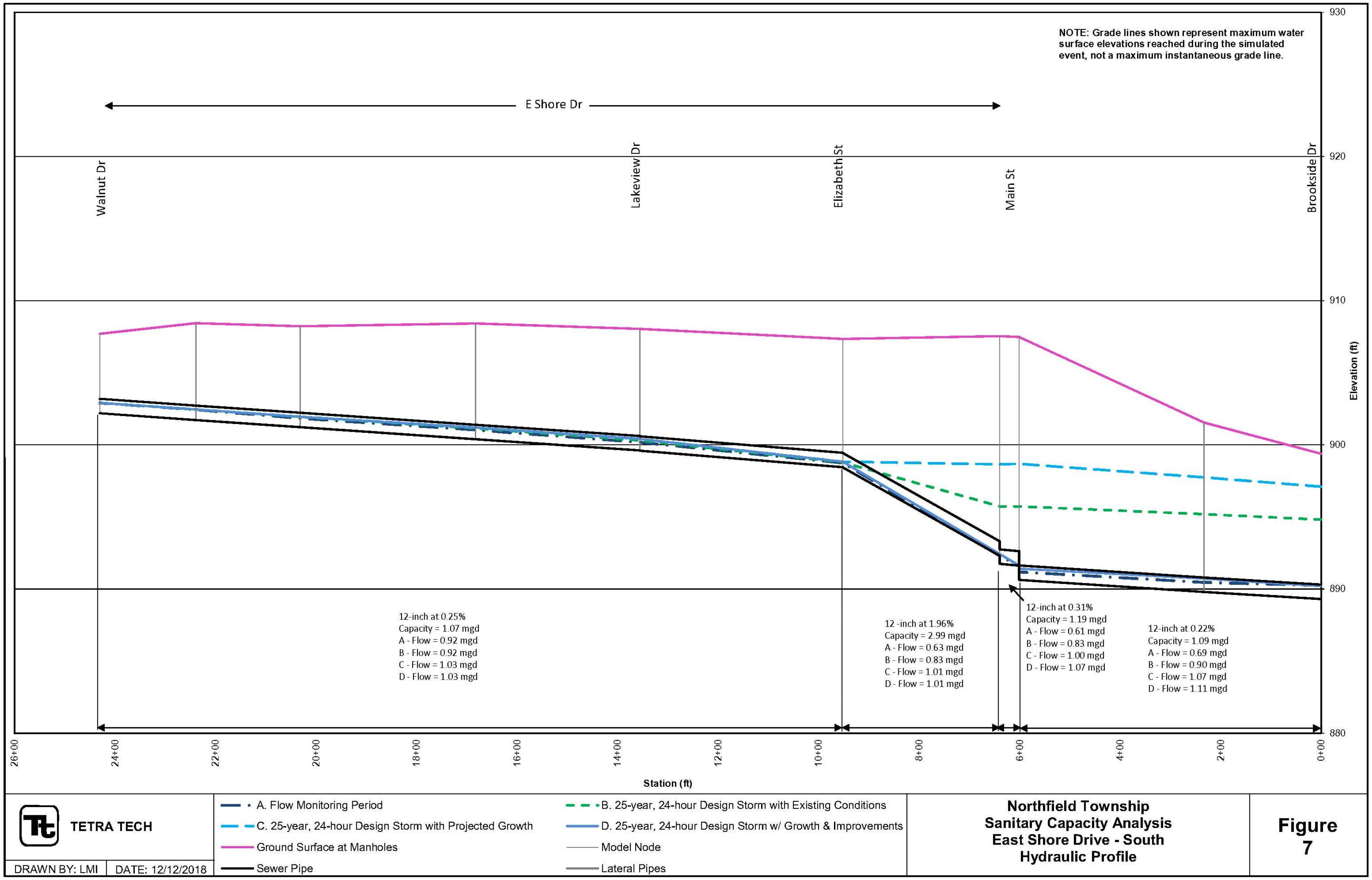
Northfield Township
Sanitary Capacity Analysis
Horseshoe Lake - West
Hydraulic Profile

Figure 3

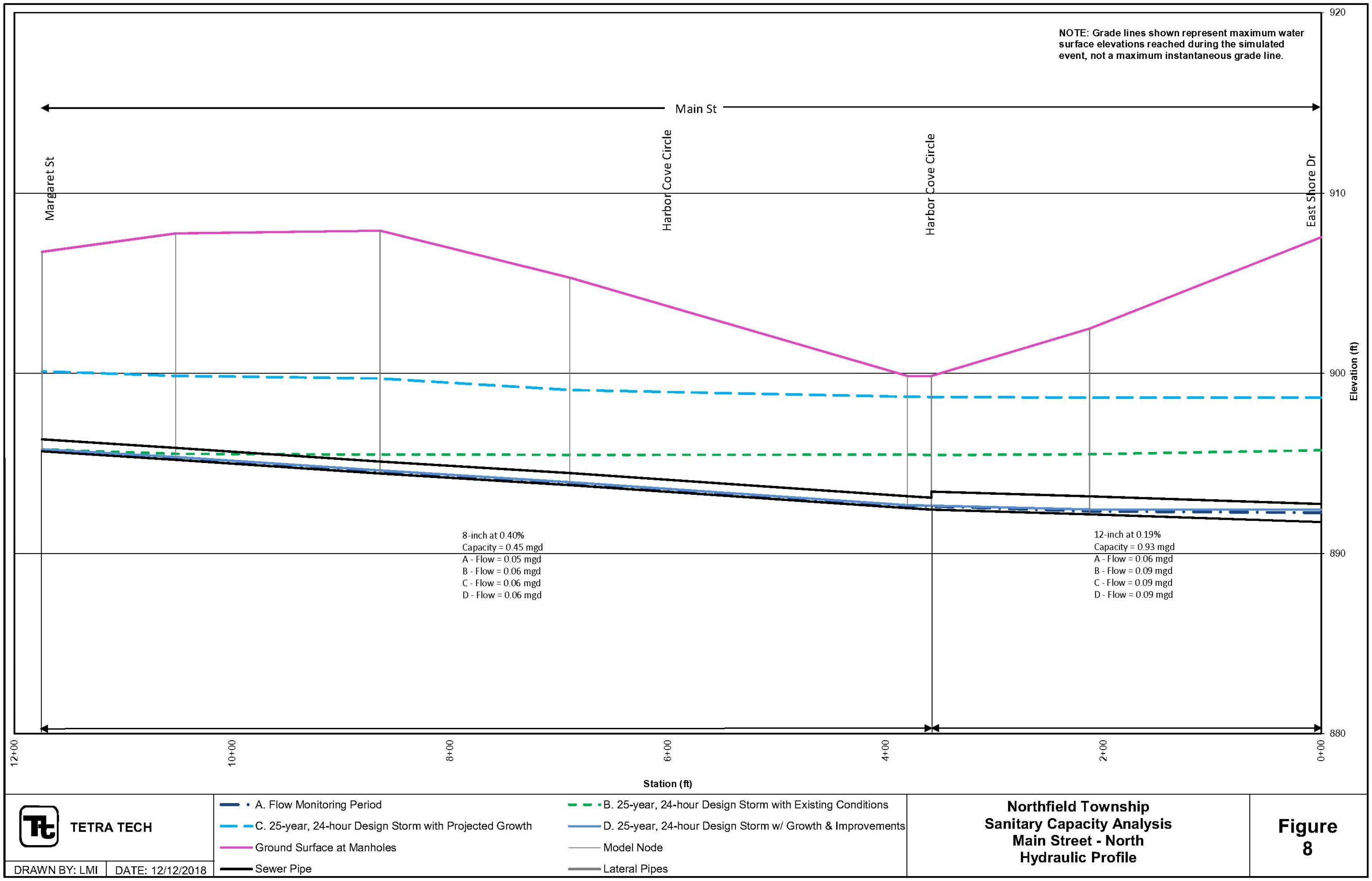

NOTE: Grade lines shown represent maximum water surface elevations reached during the simulated event, not a maximum instantaneous grade line.
Main St
Schrum Dr
7 Mile Rd
Westbrook
Anna Dr
Jennings Dr
930
920
910
900
890
880
Elevation (ft)
12-inch at 0.22%
Capacity = 1.08 mgd
A - Flow = 0.43 mgd
B - Flow = 0.53 mgd
C - Flow = 0.53 mgd
D - Flow = 0.65 mgd
12-inch at 0.22%
Capacity = 1.08 mgd
A - Flow = 0.46 mgd
B - Flow = 0.59 mgd
C - Flow = 0.63 mgd
D - Flow = 0.75 mgd
12-inch at 0.17%
Capacity = 0.95 mgd
A - Flow = 0.49 mgd
B - Flow = 0.63 mgd
C - Flow = 0.71 mgd
D - Flow = 0.80 mgd
12-inch at 0.48%
Capacity = 1.48 mgd
A - Flow = 0.49 mgd
B - Flow = 0.63 mgd
C - Flow = 0.74 mgd
D - Flow = 0.79 mgd
12-inch at 0.37%
Capacity = 1.30 mgd
A - Flow = 0.51 mgd
B - Flow = 0.69 mgd
C - Flow = 0.78 mgd
D - Flow = 0.84 mgd
12-inch at 1.18%
Capacity = 2.32 mgd
A - Flow = 0.51 mgd
B - Flow – 0.72 mgd
C - Flow = 0.78 mgd
D- Flow = 0.84 mgd
44+00
40+00
36+00
32+00
28+00
24+00
20+00
16+00
12+00
8+00
4+00
0+00
Station (ft)
TETRA TECH
DRAWN BY: LMI
DATE: 1/7/2019
A. Flow Monitoring Period
B. 25-year, 24-hour Design Storm with Existing Conditions
C. 25-year, 24-hour Design Storm with Projected Growth
D. 25-year, 24-hour Design Storm w/Growth & Improvements
Ground Surface at Manholes
Model Node
Sewer Pipe
Lateral Pipes
Northfield Township
Sanitary Capacity Analysis
Main Street
Hydraulic Profile
Figure
4

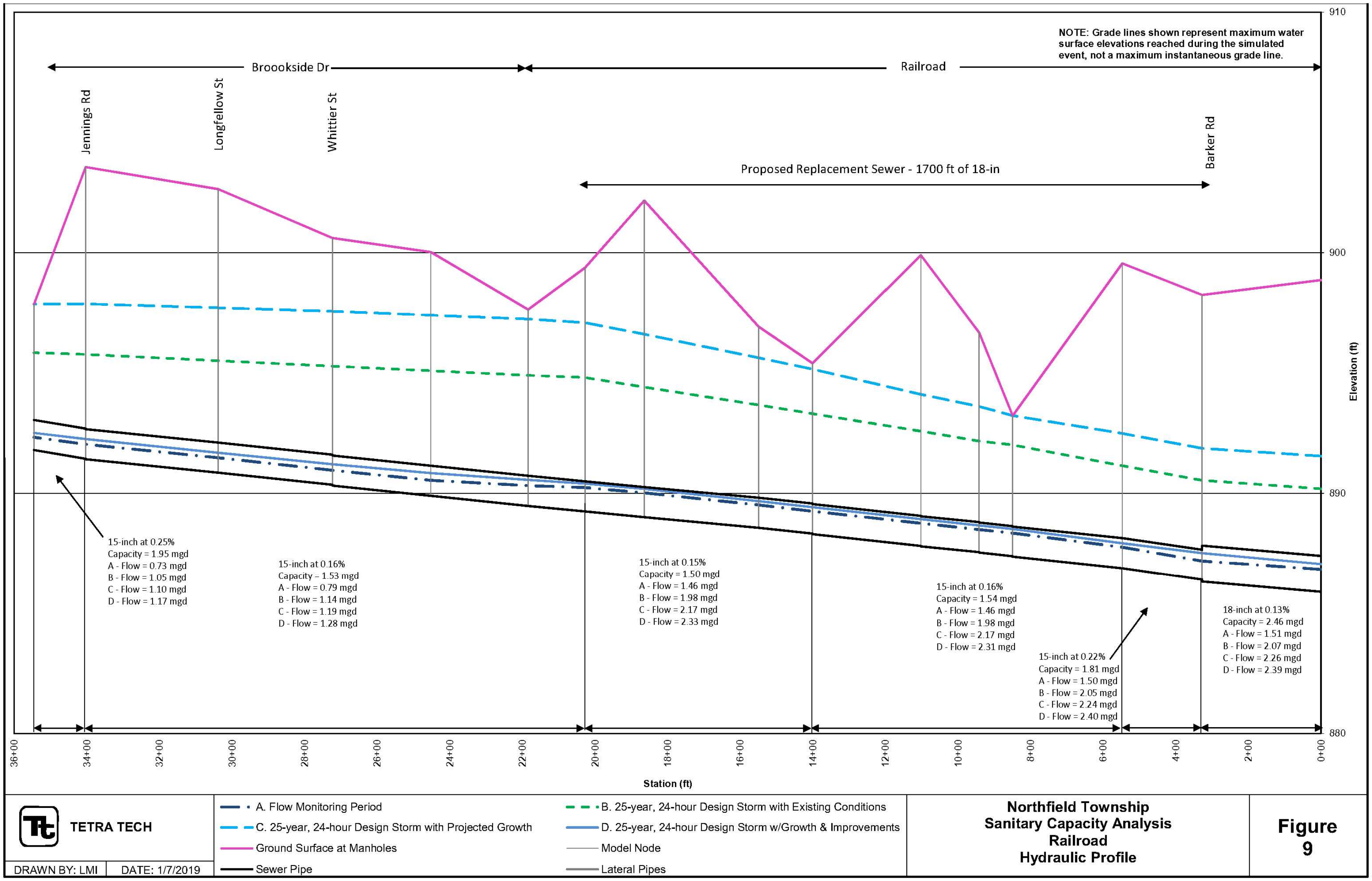

NOTE: Grade lines shown represent maximum water surface elevations reached during the simulated event, not a maximum instantaneous grade line.
Seven Mile Rd
East Shore Dr
Elevation (ft)
Station (ft)
8-inch at 0.92%
Capacity = 0.75 mgd
A - Flow = 0.01 mgd
B - Flow = 0.01 mgd
C - Flow = 0.16 mgd
D - Flow = 0.16 mgd
8-inch at 0.71%
Capacity = 0.66 mgd
A - Flow = 0.01 mgd
B - Flow = 0.01 mgd
C - Flow = 0.16 mgd
D - Flow = 0.16 mgd
8-inch at 0.92%
Capacity = 0.75 mgd
A - Flow = 0.01 mgd
B - Flow = 0.01 mgd
C - Flow = 0.16 mgd
D - Flow = 0.16 mgd
8-inch at 0.52%
Capacity = 0.56 mgd
A - Flow = 0.01 mgd
B - Flow = 0.01 mgd
C - Flow = 0.16 mgd
D - Flow = 0.16 mgd
8-inch at 0.40%
Capacity = 0.49 mgd
A - Flow = 0.02 mgd
B - Flow = 0.04 mgd
C - Flow = 0.17 mgd
D - Flow = 0.17 mgd
12-inch at 0.41%
Capacity = 1.47 mgd
A - Flow = 0.03 mgd
B - Flow = 0.05 mgd
C - Flow = 0.18 mgd
D - Flow = 0.18 mgd
930
920
910
900
890
880
28+00
26+00
24+00
22+00
20+00
18+00
16+00
14+00
12+00
10+00
8+00
6+00
4+00
2+00
0+00
TETRA TECH
DRAWN BY: LMI
DATE: 12/12/2018
A. Flow Monitoring Period
B. 25-year, 24-hour Design Storm with Existing Conditions
C. 25-year, 24-hour Design Storm with Projected Growth
D. 25-year, 24-hour Design Storm w/ Growth & Improvements
Ground Surface at Manholes
Model Node
Sewer Pipe
Lateral Pipes
Northfield Township
Sanitary Capacity Analysis
Seven Mile Road
Hydraulic Profile
Figure
5

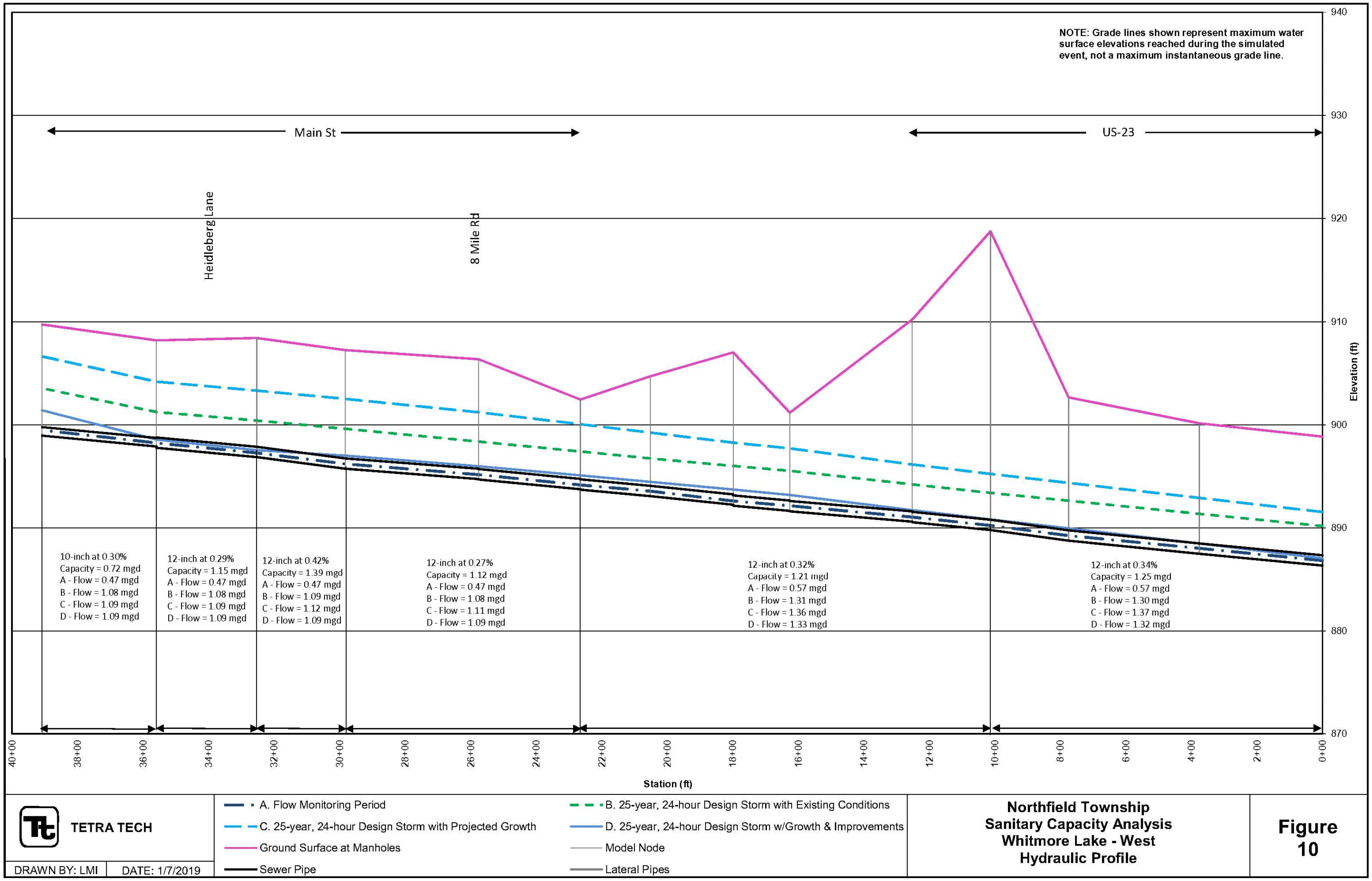

NOTE: Grade lines shown represent maximum water surface elevations reached during the simulated event, not a maximum instantaneous grade line.
E Shore Dr
Shady Dr
Cedar Rd
7 Mile Rd
Posey Dr
East Shore Pump Station #1
12-inch at 0.33%
Capacity = 1.22 mgd
A - Flow = 0.14 mgd
B - Flow = 0.21 mgd
C - Flow = 0.23 mgd
D - Flow = 0.23 mgd
12-inch at 0.23%
Capacity = 1.02 mgd
A - Flow = 0.16 mgd
B - Flow = 0.24 mgd
C - Flow = 0.25 mgd
D - Flow = 0.25 mgd
12-inch at 0.22%
Capacity = 1.01 mgd
A - Flow = 0.17 mgd
B - Flow = 0.26 mgd
C - Flow = 0.27 mgd
D - Flow = 0.27 mgd
12-inch at 0.13%
Capacity = 0.77 mgd
A - Flow = 0.18 mgd
B - Flow = 0.27 mgd
C - Flow = 0.29 mgd
D - Flow = 0.29 mgd
12-inch at 0.22%
Capacity = 1.02 mgd
A - Flow = 0.24 mgd
B - Flow = 0.37 mgd
C - Flow = 0.54 mgd
D - Flow = 0.54 mgd
12-inch at 0.44%
Capacity = 1.53 mgd
A - Flow = 0.25 mgd
B - Flow = 0.39 mgd
C - Flow = 0.54 mgd
D - Flow = 0.54 mgd
920
910
900
890
880
Elevation (ft)
46+00
44+00
42+00
40+00
38+00
36+00
34+00
32+00
30+00
28+00
26+00
24+00
22+00
20+00
18+00
16+00
14+00
12+00
10+00
8+00
6+00
4+00
2+00
0+00
Station (ft)
TETRA TECH
DRAWN BY: LMI
DATE: 12/12/2018
A. Flow Monitoring Period
B. 25-year, 24-hour Design Storm with Existing Conditions
C. 25-year, 24-hour Design Storm with Projected Growth
D. 25-year, 24-hour Design Storm w/ Growth & Improvements
Ground Surface at Manholes
Model Node
Sewer Pipe
Lateral Pipes
Northfield Township
Sanitary Capacity Analysis
East Shore Drive - East
Hydraulic Profile
Figure
6

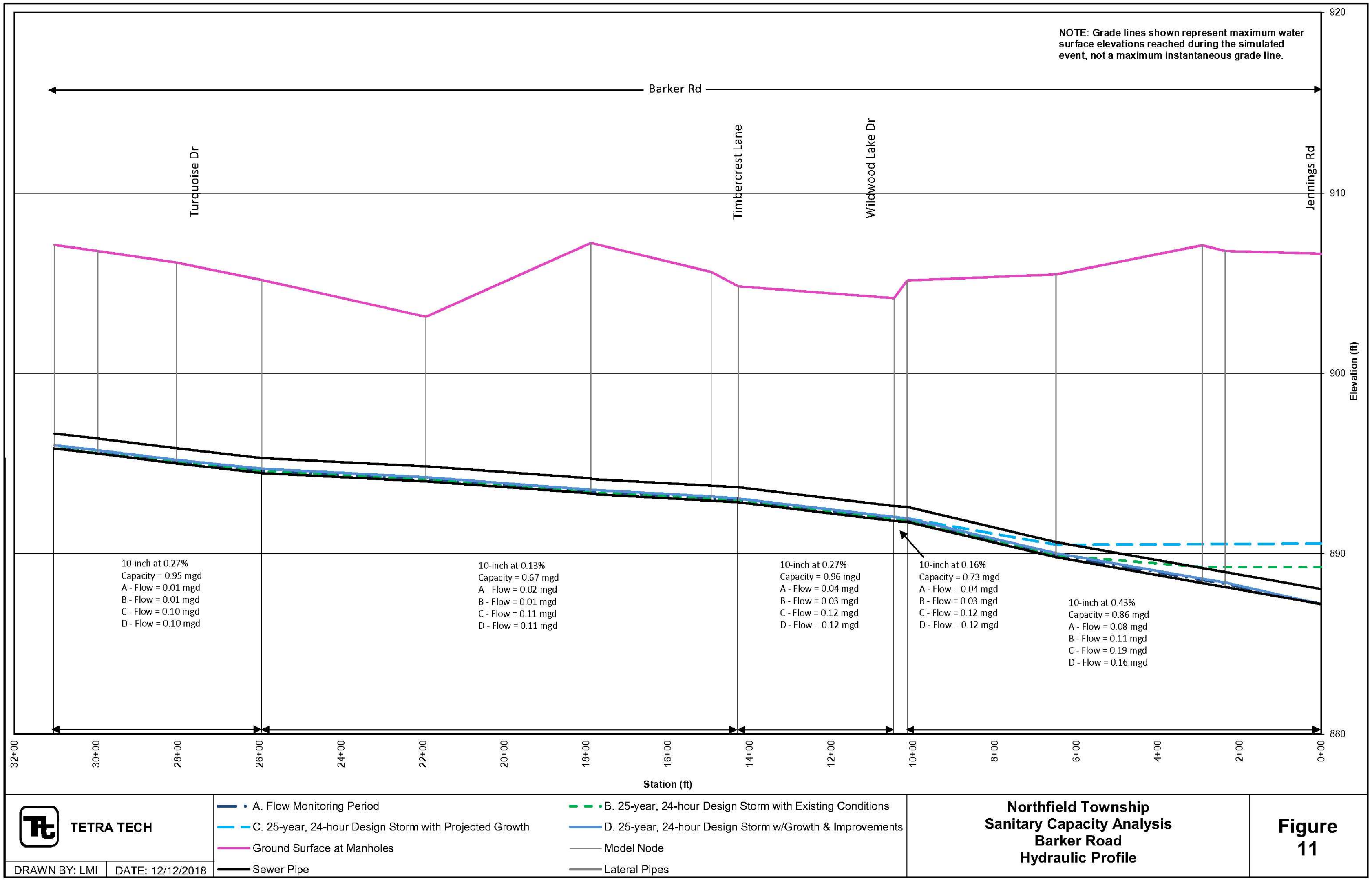


TETRA TECH		Northfield Township Sanitary Capacity Analysis East Shore Drive - South Hydraulic Profile	Figure 7
DRAWN BY: LMI	DATE: 12/12/2018		

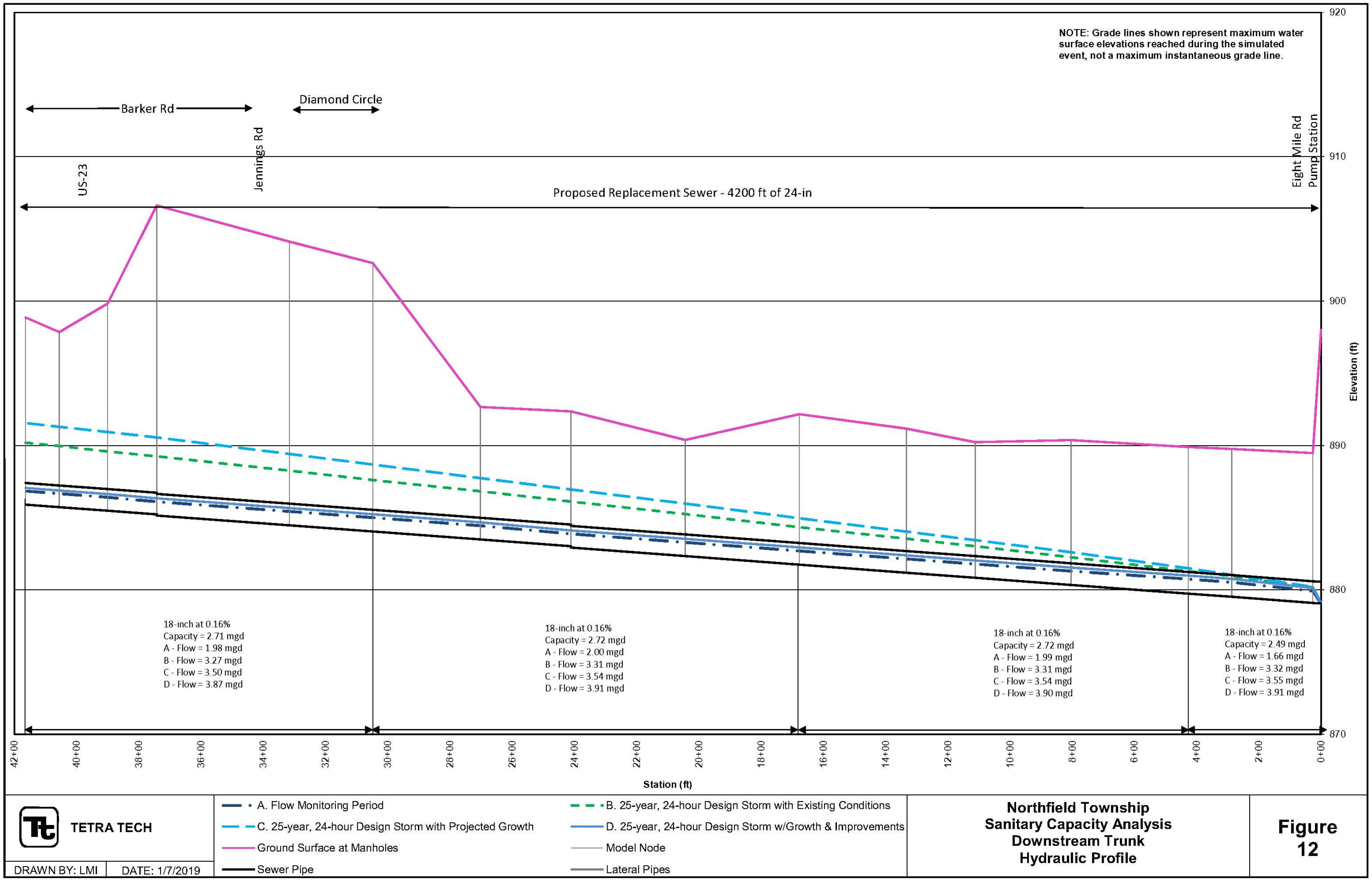

NOTE: Grade lines shown represent maximum water surface elevations reached during the simulated event, not a maximum instantaneous grade line.
Main St
Margaret St
Harbor Cove Circle
Harbor Cove Circle
East Shore Dr
8-inch at 0.40%
Capacity = 0.45 mgd
A - Flow = 0.05 mgd
B - Flow = 0.06 mgd
C - Flow = 0.06 mgd
D - Flow = 0.06 mgd
12-inch at 0.19%
Capacity = 0.93 mgd
A - Flow = 0.06 mgd
B - Flow = 0.09 mgd
C - Flow = 0.09 mgd
D - Flow = 0.09 mgd
920
910
900
890
880
Elevation (ft)
12+00
10+00
8+00
6+00
4+00
2+00
0+00
Station (ft)
TETRA TECH
DRAWN BY: LMI
DATE: 12/12/2018
A. Flow Monitoring Period
B. 25-year, 24-hour Design Storm with Existing Conditions
C. 25-year, 24-hour Design Storm with Projected Growth
D. 25-year, 24-hour Design Storm w/ Growth & Improvements
Ground Surface at Manholes
Model Node
Sewer Pipe
Lateral Pipes
Northfield Township
Sanitary Capacity Analysis
Main Street - North
Hydraulic Profile
Figure
8


NOTE: Grade lines shown represent maximum water surface elevations reached during the simulated event, not a maximum instantaneous grade line.
Broookside Dr
Railroad
Jennings Rd
Longfellow St
Whittier St
Barker Rd
Proposed Replacement Sewer - 1700 ft of 18-in
15-inch at 0.25%
Capacity = 1.95 mgd
A - Flow = 0.73 mgd
B - Flow = 1.05 mgd
C - Flow = 1.10 mgd
D - Flow = 1.17 mgd
15-inch at 0.16%
Capacity – 1.53 mgd
A - Flow = 0.79 mgd
B - Flow = 1.14 mgd
C - Flow = 1.19 mgd
D - Flow = 1.28 mgd
15-inch at 0.15%
Capacity = 1.50 mgd
A - Flow = 1.46 mgd
B - Flow = 1.98 mgd
C - Flow = 2.17 mgd
D - Flow = 2.33 mgd
15-inch at 0.16%
Capacity = 1.54 mgd
A - Flow = 1.46 mgd
B - Flow = 1.98 mgd
C - Flow = 2.17 mgd
D - Flow = 2.31 mgd
15-inch at 0.22%
Capacity = 1.81 mgd
A - Flow = 1.50 mgd
B - Flow = 2.05 mgd
C - Flow = 2.24 mgd
D - Flow = 2.40 mgd
18-inch at 0.13%
Capacity = 2.46 mgd
A - Flow = 1.51 mgd
B - Flow = 2.07 mgd
C - Flow = 2.26 mgd
D - Flow = 2.39 mgd
910
900
890
880
Elevation (ft)
36+00
34+00
32+00
30+00
28+00
26+00
24+00
22+00
20+00
18+00
16+00
14+00
12+00
10+00
8+00
6+00
4+00
2+00
0+00
Station (ft)
TETRA TECH
DRAWN BY: LMI
DATE: 1/7/2019
A. Flow Monitoring Period
B. 25-year, 24-hour Design Storm with Existing Conditions
C. 25-year, 24-hour Design Storm with Projected Growth
D. 25-year, 24-hour Design Storm w/Growth & Improvements
Ground Surface at Manholes
Model Node
Sewer Pipe
Lateral Pipes
Northfield Township
Sanitary Capacity Analysis
Railroad
Hydraulic Profile
Figure
9

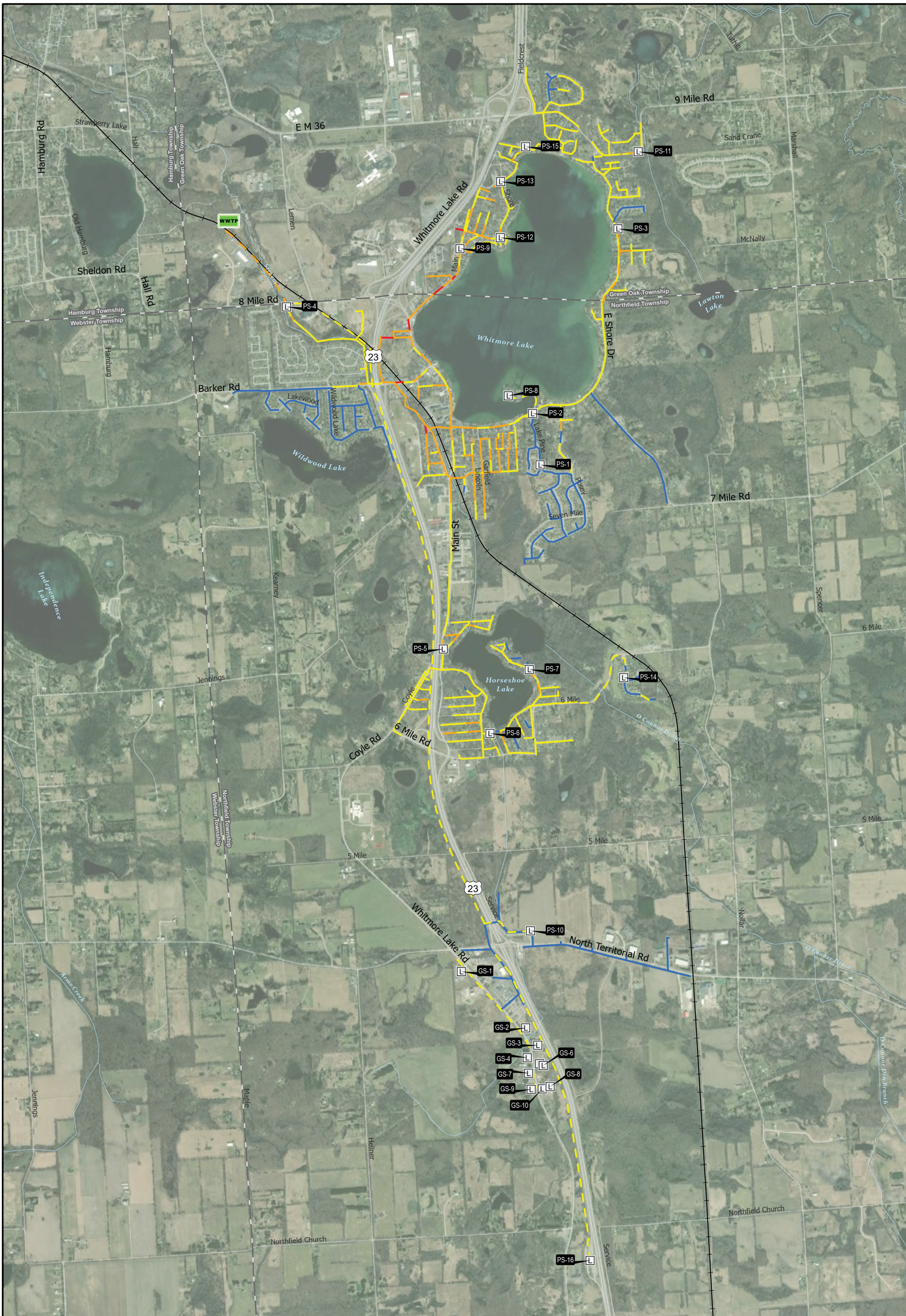

NOTE: Grade lines shown represent maximum water surface elevations reached during the simulated event, not a maximum instantaneous grade line.
Main St
US-23
Heidleberg Lane
8 Mile Rd
940
930
920
910
900
890
880
870
Elevation (ft)
10-inch at 0.30%
Capacity = 0.72 mgd
A - Flow = 0.47 mgd
B - Flow = 1.08 mgd
C - Flow = 1.09 mgd
D - Flow = 1.09 mgd
12-inch at 0.29%
Capacity = 1.15 mgd
A - Flow = 0.47 mgd
B - Flow = 1.08 mgd
C - Flow = 1.09 mgd
D - Flow = 1.09 mgd
12-inch at 0.42%
Capacity = 1.39 mgd
A - Flow = 0.47 mgd
B - Flow = 1.09 mgd
C - Flow = 1.12 mgd
D - Flow = 1.09 mgd
12-inch at 0.27%
Capacity = 1.12 mgd
A - Flow = 0.47 mgd
B - Flow = 1.08 mgd
C - Flow = 1.11 mgd
D - Flow = 1.09 mgd
12-inch at 0.32%
Capacity = 1.21 mgd
A - Flow = 0.57 mgd
B - Flow = 1.31 mgd
C - Flow = 1.36 mgd
D - Flow = 1.33 mgd
12-inch at 0.34%
Capacity = 1.25 mgd
A - Flow = 0.57 mgd
B - Flow = 1.30 mgd
C - Flow = 1.37 mgd
D - Flow = 1.32 mgd
40+00
38+00
36+00
34+00
32+00
30+00
28+00
26+00
24+00
22+00
20+00
18+00
16+00
14+00
12+00
10+00
8+00
6+00
4+00
2+00
0+00
Station (ft)
TETRA TECH
DRAWN BY: LMI
DATE: 1/7/2019
A. Flow Monitoring Period
B. 25-year, 24-hour Design Storm with Existing Conditions
C. 25-year, 24-hour Design Storm with Projected Growth
D. 25-year, 24-hour Design Storm w/Growth & Improvements
Ground Surface at Manholes
Model Node
Sewer Pipe
Lateral Pipes
Northfield Township
Sanitary Capacity Analysis
Whitmore Lake - West
Hydraulic Profile
Figure
10



NOTE: Grade lines shown represent maximum water surface elevations reached during the simulated event, not a maximum instantaneous grade line.
Barker Rd
Turquoise Dr
Timbercrest Lane
Wildwood Lake Dr
Jennings Rd
920
910
900
890
880
Elevation (ft)
10-inch at 0.27%
Capacity = 0.95 mgd
A - Flow = 0.01 mgd
B - Flow = 0.01 mgd
C - Flow = 0.10 mgd
D - Flow = 0.10 mgd
10-inch at 0.13%
Capacity = 0.67 mgd
A - Flow = 0.02 mgd
B - Flow = 0.01 mgd
C - Flow = 0.11 mgd
D - Flow = 0.11 mgd
10-inch at 0.27%
Capacity = 0.96 mgd
A - Flow = 0.04 mgd
B - Flow = 0.03 mgd
C - Flow = 0.12 mgd
D - Flow = 0.12 mgd
10-inch at 0.16%
Capacity = 0.73 mgd
A - Flow = 0.04 mgd
B - Flow = 0.03 mgd
C - Flow = 0.12 mgd
D - Flow = 0.12 mgd
10-inch at 0.43%
Capacity = 0.86 mgd
A - Flow = 0.08 mgd
B - Flow = 0.11 mgd
C - Flow = 0.19 mgd
D - Flow = 0.16 mgd
32+00
30+00
28+00
26+00
24+00
22+00
20+00
18+00
16+00
14+00
12+00
10+00
8+00
6+00
4+00
2+00
0+00
Station (ft)
TETRA TECH
DRAWN BY: LMI
DATE: 12/12/2018
A. Flow Monitoring Period
B. 25-year, 24-hour Design Storm with Existing Conditions
C. 25-year, 24-hour Design Storm with Projected Growth
D. 25-year, 24-hour Design Storm w/Growth & Improvements
Ground Surface at Manholes
Model Node
Sewer Pipe
Lateral Pipes
Northfield Township
Sanitary Capacity Analysis
Barker Road
Hydraulic Profile
Figure
11


NOTE: Grade lines shown represent maximum water surface elevations reached during the simulated event, not a maximum instantaneous grade line.
Barker Rd
Diamond Circle
US-23
Jennings Rd
Eight Mile Rd Pump Station
Proposed Replacement Sewer - 4200 ft of 24-in
18-inch at 0.16%
Capacity = 2.71 mgd
A - Flow = 1.98 mgd
B - Flow = 3.27 mgd
C - Flow = 3.50 mgd
D - Flow = 3.87 mgd
18-inch at 0.16%
Capacity = 2.72 mgd
A - Flow = 2.00 mgd
B - Flow = 3.31 mgd
C - Flow = 3.54 mgd
D - Flow = 3.91 mgd
18-inch at 0.16%
Capacity = 2.72 mgd
A - Flow = 1.99 mgd
B - Flow = 3.31 mgd
C - Flow = 3.54 mgd
D - Flow = 3.90 mgd
18-inch at 0.16%
Capacity = 2.49 mgd
A - Flow = 1.66 mgd
B - Flow = 3.32 mgd
C - Flow = 3.55 mgd
D - Flow = 3.91 mgd
920
910
900
890
880
870
Elevation (ft)
42+00
40+00
38+00
36+00
34+00
32+00
30+00
28+00
26+00
24+00
22+00
20+00
18+00
16+00
14+00
12+00
10+00
8+00
6+00
4+00
2+00
0+00
Station (ft)
TETRA TECH
DRAWN BY: LMI
DATE: 1/7/2019
A. Flow Monitoring Period
B. 25-year, 24-hour Design Storm with Existing Conditions
C. 25-year, 24-hour Design Storm with Projected Growth
D. 25-year, 24-hour Design Storm w/Growth & Improvements
Ground Surface at Manholes
Model Node
Sewer Pipe
Lateral Pipes
Northfield Township
Sanitary Capacity Analysis
Downstream Trunk
Hydraulic Profile
Figure 12

APPENDIX G: COLLECTION SYSTEM CRITICALITY MAPS



LEGEND

WWTP Wastewater Treatment Plant

Lift Station

Railroad

Water

Township Boundary

Gravity Main POF*

1 - 2

3 - 4

5 - 6

7 - 10

*Dashed lines are force mains

N

0 1

Miles

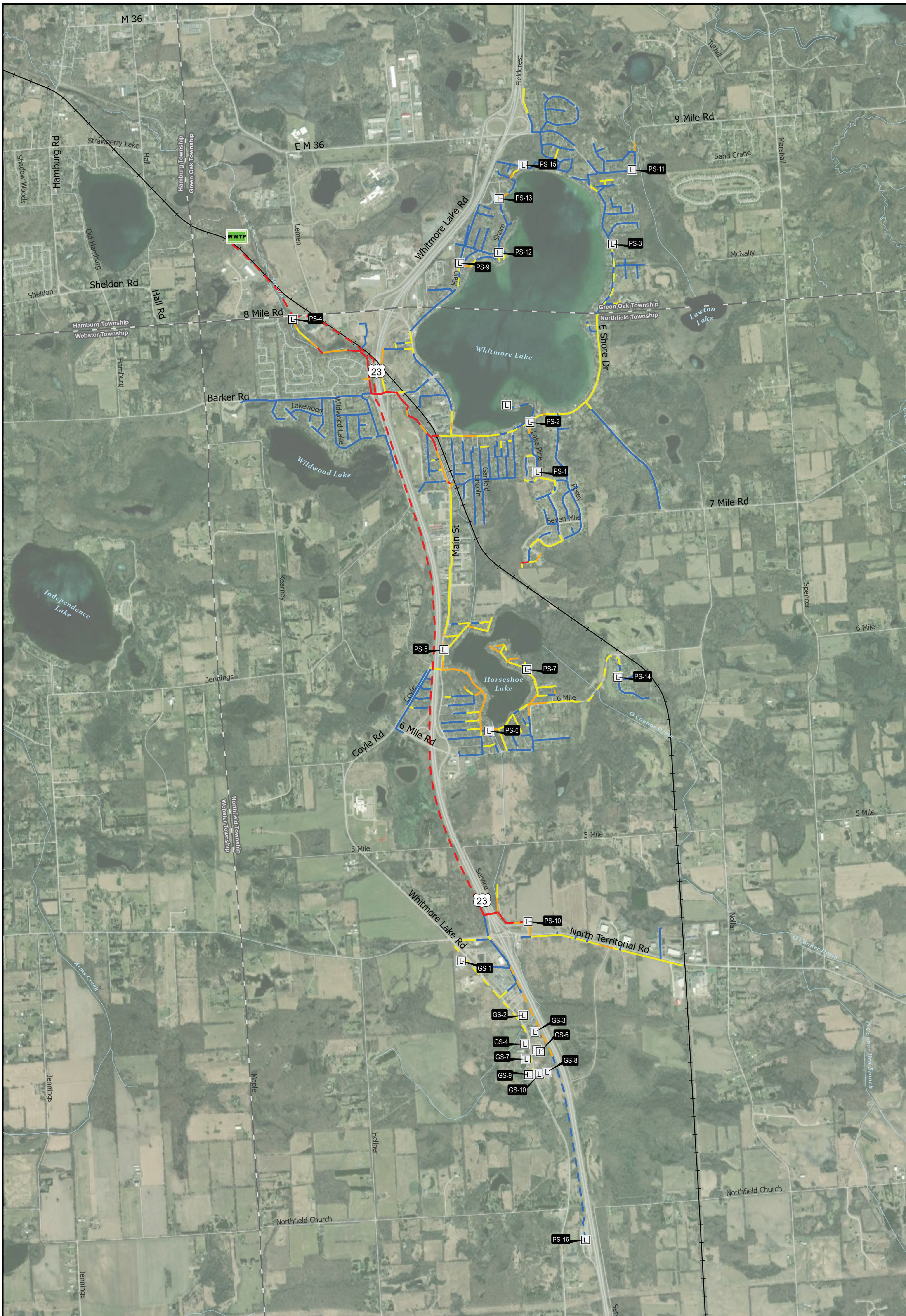
NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION CRITICALITY MAP - GRAVITY MAIN & FORCE MAIN PROBABILITY OF FAILURE

TETRA TECH

Source: Northfield Township; Tetra Tech, Inc.; ESRI

O:\Projects\Ann Arbor\IER\12748\200-12789-17001\GIS\Maps\Report_Figures\ [DARRYL.ALBERT 9/3/2020]



LEGEND

WWTP Wastewater Treatment Plant

Lift Station

Railroad

Water

Township Boundary

Gravity Main COF*

1 - 2

3 - 4

5 - 6

7 - 10

*Dashed lines are force mains

N

0 1

Miles

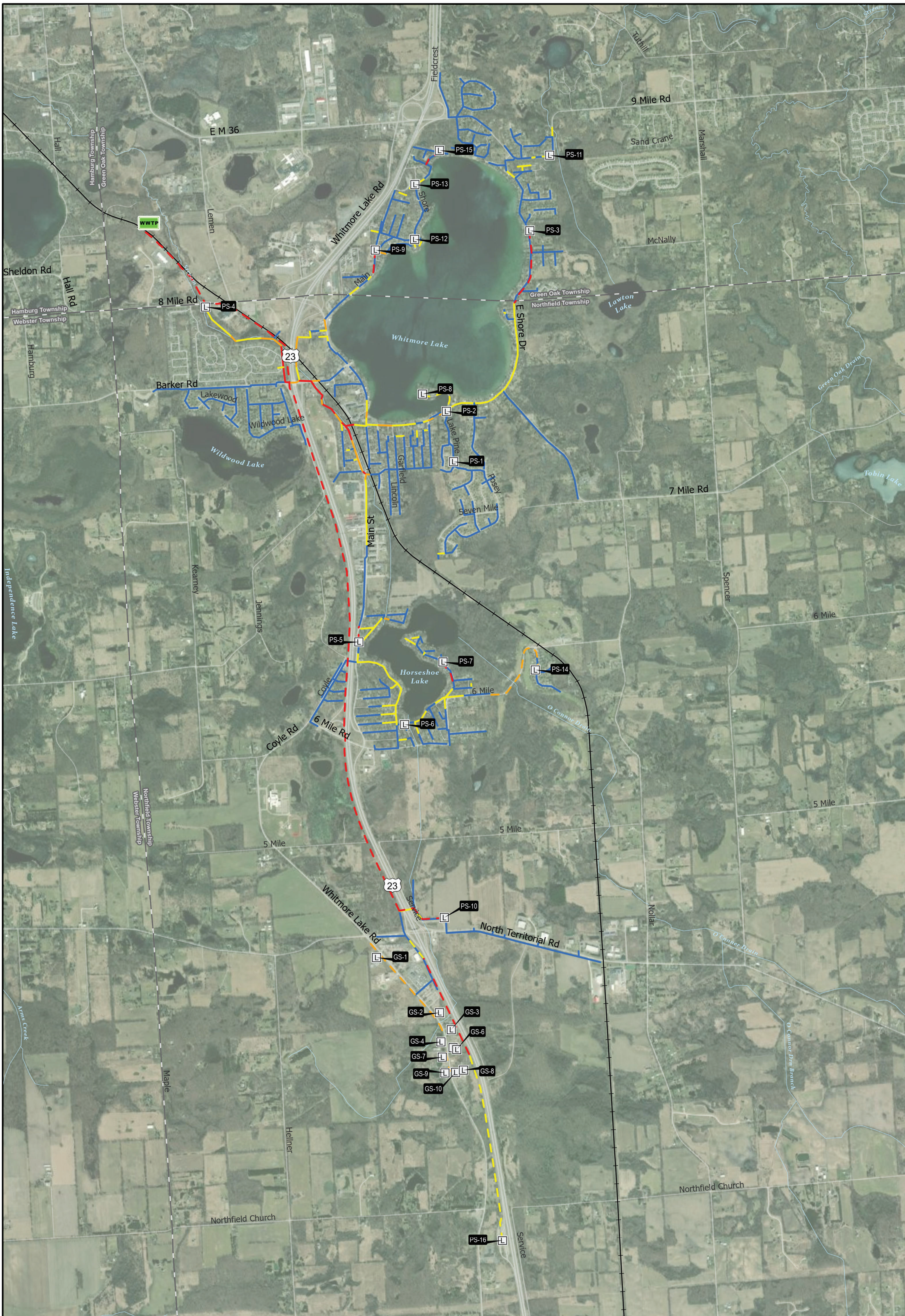
NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION CRITICALITY MAP - GRAVITY MAIN & FORCE MAIN CONSEQUENCE OF FAILURE

TETRA TECH

Source: Northfield Township; Tetra Tech, Inc.; ESRI

O:\Projects\Ann Arbor\IER\12748\200-12789-17001\GIS\Maps\Report_Figures\ [DARRYL.ALBERT 9/3/2020]



LEGEND

- WWTP Wastewater Treatment Plant
- L Lift Station
- Railroad
- Water
- Township Boundary

Gravity Main BRE*

- Very Low 1 - 6
- Low 7 - 12
- Medium 14 - 18
- High 20 - 30

*Dashed lines are force mains

N

0 1
Miles

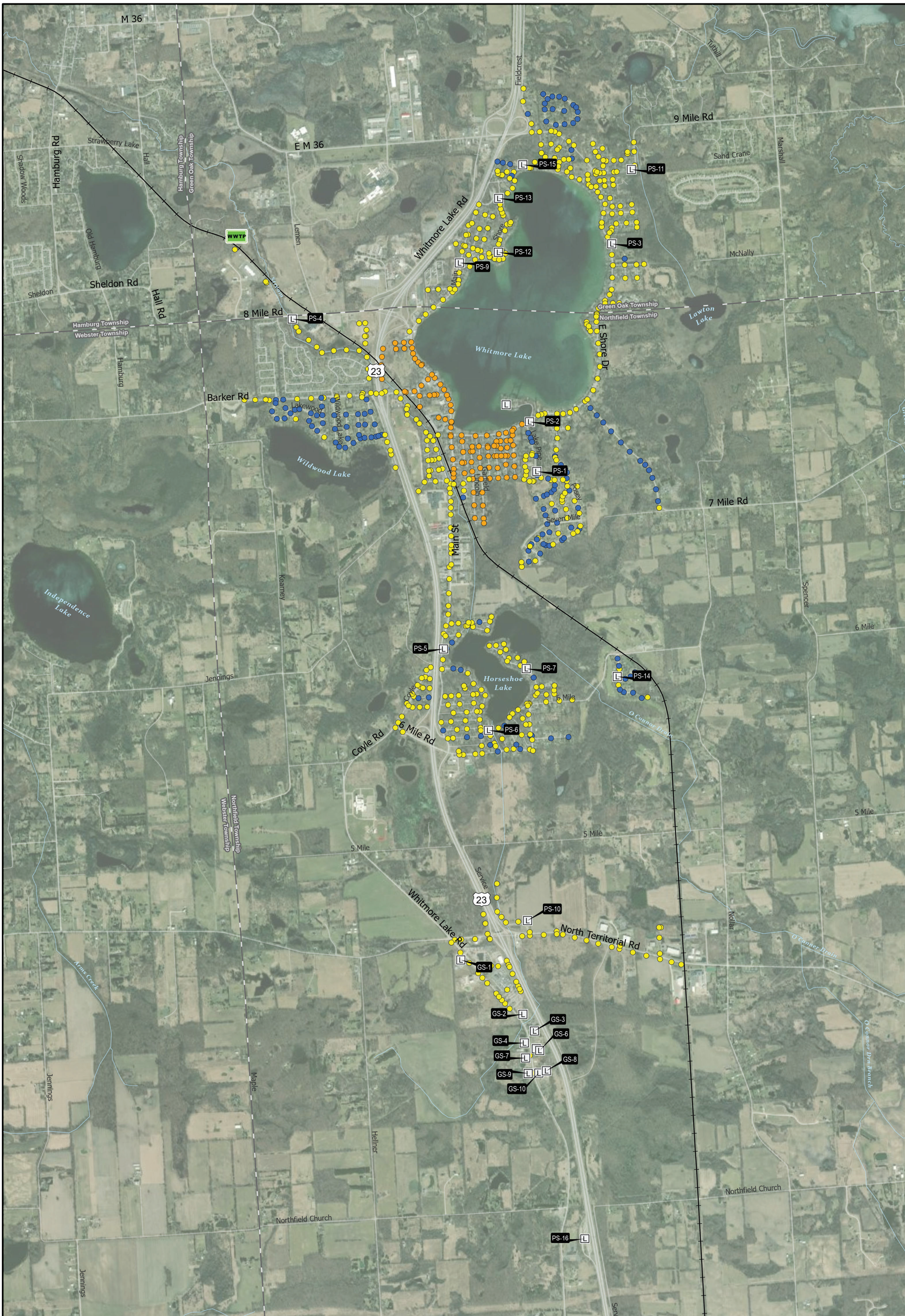
NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION CRITICALITY MAP - GRAVITY MAIN & FORCE MAIN BUSINESS RISK EXPOSURE

TETRA TECH

Source: Northfield Township; Tetra Tech, Inc.; ESRI

O:\Projects\Ann Arbor\IER\12748\200-12789-17001\GIS\Maps\Report_Figures\ [DARRYL.ALBERT 9/3/2020]



LEGEND

- WWTP Wastewater Treatment Plant
- L Lift Station
- Railroad
- Water
- Township Boundary

Sewer Manholes POF

- 1 - 2
- 3 - 4
- 5 - 6
- 7 - 10

N

0 1

Miles

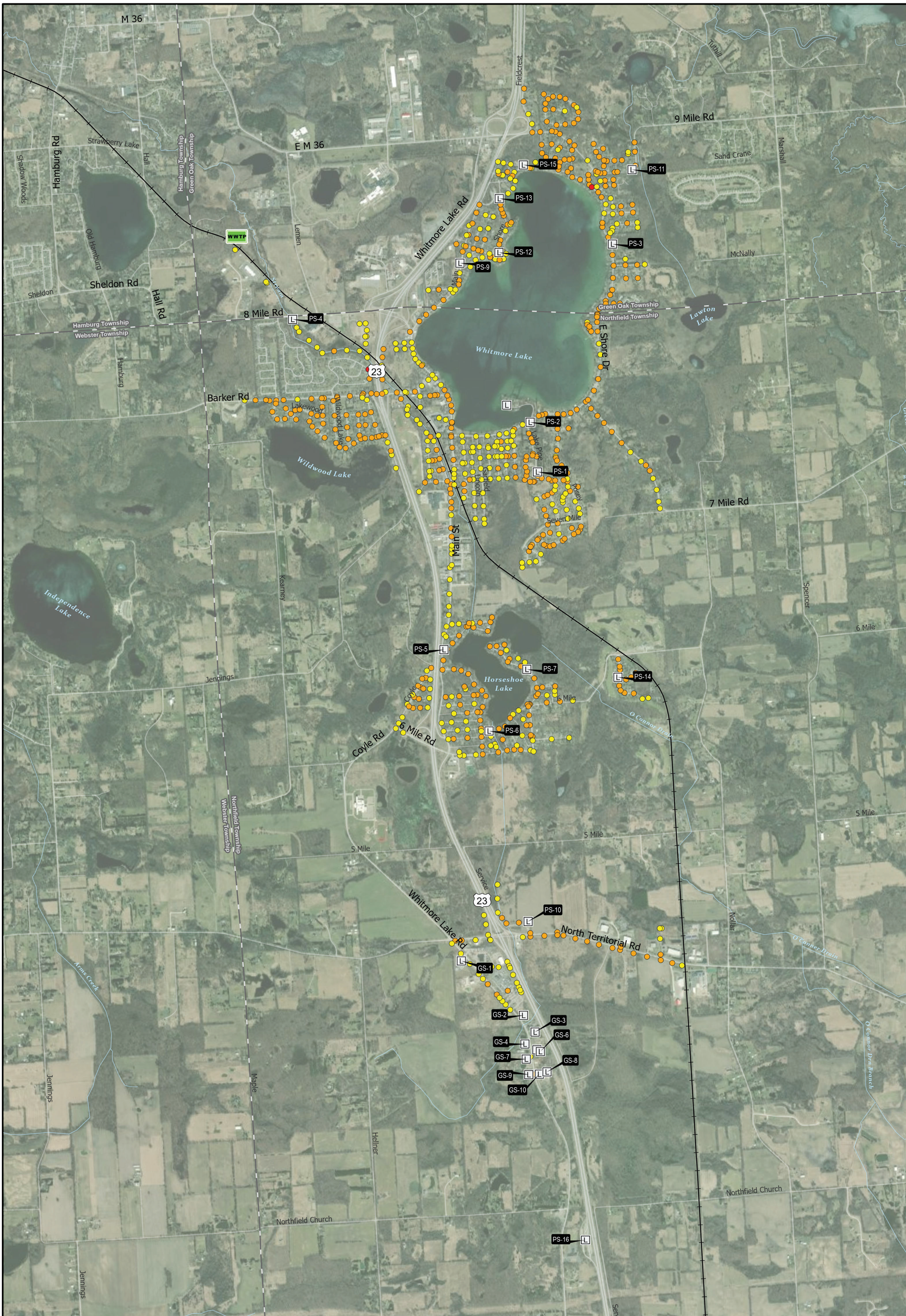
NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION CRITICALITY MAP - MANHOLE PROBABILITY OF FAILURE

TETRA TECH

Source: Northfield Township; Tetra Tech, Inc.; ESRI

O:\Projects\Ann Arbor\IER\12748\200-12789-17001\GIS\Maps\Report_Figures\ [DARRYL.ALBERT 9/3/2020]



LEGEND

- Wastewater Treatment Plant
- Lift Station
- Railroad
- Water
- Township Boundary

Sewer Manholes COF
- 1 - 2
- 3 - 4
- 5 - 6
- 7 - 10

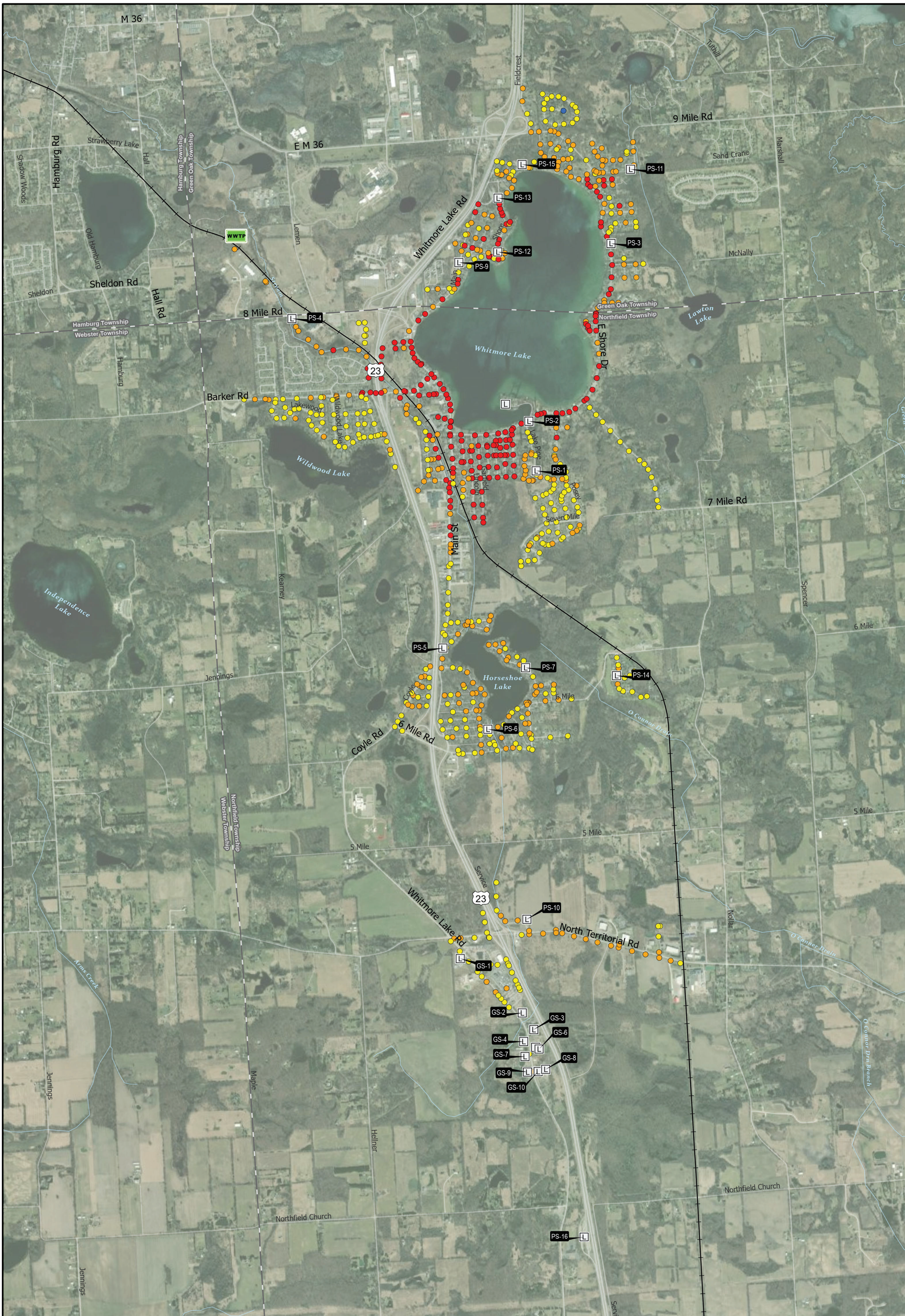
NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION CRITICALITY MAP - MANHOLE CONSEQUENCE OF FAILURE

TETRA TECH

Source: Northfield Township; Tetra Tech, Inc.; ESRI

O:\Projects\Ann Arbor\IER\12748\200-12789-17001\GIS\Maps\Report_Figures\ [DARRYL.ALBERT 9/3/2020]



LEGEND

Wastewater Treatment Plant
Lift Station
Railroad
Water
Township Boundary

Sewer Manholes BRE
- Very Low 1 - 6
- Low 8 - 12
- Medium 14 - 18
- High 20 - 36

N

0 1
Miles

NORTHFIELD TOWNSHIP ASSET MANAGEMENT PLAN

WASTEWATER COLLECTION CRITICALITY MAP - MANHOLE BUSINESS RISK EXPOSURE

TETRA TECH

Source: Northfield Township; Tetra Tech, Inc.; ESRI

O:\Projects\Ann Arbor\IER\12748\200-12789-17001\GIS\Maps\Report_Figures\ [DARRYL.ALBERT 9/3/2020]

APPENDIX H: REVENUE STRUCTURE REPORT AND APPROVAL LETTER

WASTEWATER AMP FUNDING STRUCTURE AND RATE METHODOLOGY

FY 2019-20 (July 1, 2019 to June 30, 2020)

Northfield Township

Washtenaw County, Michigan

January 2020

Prepared by Tetra Tech

710 Avis Drive

Ann Arbor, MI 48108

INTRODUCTION

This Northfield Township Wastewater Asset Management Program (AMP) funding structure and rate methodology has been prepared to fulfill the Michigan Department of Environment, Great Lakes, and Energy (EGLE) requirements for Wastewater AMPs under the Stormwater, Asset Management and Wastewater (SAW) grant program. This document is a part of Northfield Township's Wastewater AMP.

Northfield Township's 2019-20 fiscal year runs from July 1, 2019 to June 30, 2020. This funding structure and rate methodology is based on FY 2019-20 expenses.

EGLE requires that Northfield Township's wastewater rates provide sufficient revenue to cover the expenses of the wastewater system. This analysis shows that the current Northfield Township wastewater rates (effective July 1, 2018) cover the FY 2019-20 operating expenses of the wastewater system.

The current (effective July 1, 2018) Wastewater Rate Resolution is included in Appendix A

Northfield Township is located in the northeastern corner of Washtenaw County and is home to 8,728 residents (2018 census). The Township consists of approximately 36 square miles of incorporated area. The Township provides wastewater collection and treatment services within a designated service area. Sewers serve the area along the North Territorial Road/US-23 interchange, as well as a majority the residential areas around Horseshoe Lake, Whitmore Lake, and Wildwood Lake. In addition, the wastewater from the rest stop south of Northfield Church Road is also treated at the Northfield wastewater treatment plant (WWTP). Approximately 3,294 households and commercial/industrial customers are served.

The collection system has an 8-inch force main and a 12-inch force main that conveys the Township's sanitary sewage flow to the headworks of the WWTP. The 8-inch force main serves the Woodland Correctional Center. The 12-inch force main carries the majority of the flow to the WWTP.
The Township's Wastewater Treatment Plant (WWTP) is located just north of the Township in Livingston County and was constructed in 1964 to serve portions of Green Oak and Northfield Townships. The northern portion of Whitmore Lake extends into Green Oak Township. Major WWTP expansions were completed in 1978 and 1997. The facility has a design flow rate of 1.3 million gallons per day (MGD) and a peak sustained treatment rate of 2.5 MGD. The current average daily flow is 0.8 MGD.

FUNDING STRUCTURE AND RATE METHODOLOGY

The revenue structure consists of Tables 1 to 6 (Appendix B) as described below:

Table 1, Current and Minimum Calculated FY 2019-20 Wastewater Rates:

This table compares the current wastewater rates to the minimum required rates calculated in Tables 2 to 6. The table shows that the current rates are higher than the minimum rates needed to meet the Township's wastewater system expenses. Therefore, there is no revenue shortfall.

Table 2, Equipment Replacement Fund Contribution:

This table develops the minimum annual amount required to be contributed to the dedicated wastewater equipment replacement fund. The minimum requirement calculates to $97,252. In FY 2019-20 the Township budgeted $169,000 as the contribution to the equipment replacement fund, therefore exceeding the minimum amount required.

Table 3, Wastewater System Expenditures, Other Revenue Sources and Required Usage Fee Revenue:

This table totals the FY 2019-20 wastewater expenses to be $1,857,226. There are several offsetting revenues which total to $485,500. Therefore, the net total wastewater revenue required to be recovered by the wastewater rates is $1,857,226 less $485,500, or $1,371,726.

Table 4, Billing Unit Projections:

The Township has 13 metered users which used approximately 34,315 thousand-gallon units in calendar year 2019. These users are billed a metered rate of $6.00 per 1,000 gallons. Unmetered users are billed based on their individual number of Residential Equivalent Users (REUs). The total number of REUs in the system is approximately 3,464. A usage of 60-thousand gallons per year per REU is assumed. This equals an equivalent usage of 207,860 thousand gallon units per year for the unmetered users. Adding the metered usage to the REU equivalent usage totals to 242,175 thousand gallon units per year.

Table 5, Minimum Required Wastewater Rate Calculations:

This table first calculates a metered rate for all users by dividing the total revenue required by the total billable flow. This equates to $5.66 per 1,000 gallons and represents the minimum required metered rate.

The quarterly flat REU rate is calculated by deducting the estimated revenue from metered users based on the current $6.00 per 1,000 gallon rate from the total revenue required to determine the revenue that needs to be recovered from the unmetered users. This amount ($1,165,836) is divided by the number of REUs which is then divided by 4 to determine the minimum flat rate per REU which calculates to $84.13 per quarter per REU.

Table 6, Proof of Revenue Sufficiency Based on Current Rates

This table shows that the current rates generate $84,097 more than the minimum $1,371,726 amount required to be generated by rates. This proves that the FY 2019-20 adopted wastewater rates are sufficient and there is no revenue gap for the current fiscal year.

APPENDIX A

Wastewater Rate Resolution

NORTHFIELD TOWNSHIP
Township Board
Minutes
August 28, 2018

CALL TO ORDER

The meeting was called to order at 7:08 P.M. by Supervisor ~~Checkley~~ Chockley at 8350 Main Street.

PLEDGE

Supervisor ~~Hockley~~ Chockley led those present in the Pledge of Allegiance.

ROLL CALL

Marlene Chockley, Supervisor	Present
Kathleen Manley, Clerk	Present
Lenore Zelenock, Treasurer	Present
Tawn Beliger, Trustee	Absent with notice
Janet Chick, Trustee	Present
Wayne Dockett, Trustee	Absent with notice
Jacki Otto, Trustee	Present (arrived at 7:15 P.M.)

Also present:
- Public Safety Director William Wagner
- Wastewater Treatment Plant Superintendent Dan Willis
- Township Manager Steven Aynes
- Recording Secretary Lisa Lemble
- Members of the community

ADOPT AGENDA

▶ **Motion:** Chick moved, Manley supported, that the agenda be adopted as presented.
Motion carried 4—0 on a voice vote.

[Otto arrived].

FIRST CALL TO THE PUBLIC

Nancy Reichenback, 11767 Julia Drive, George Brown, 7868 Shady Beach, Mary Tummins, 254 East Shore, Margaret Riddell, 65141 W. Eight Mile Road, Terry Webb, 285 Waterlily, and Shannon Koenig, 9540 Main, asked for support of Kiwanis (and thanked Chockley, Aynes, Vidya Krishnan and Mary Bird for their assistance), and also made comments about the local food pantry, the proposed sewer basin, and Michigan Senate Bill 637 regarding expanding 5G service.

BOARD MEMBER COMMENTS

Board members responded briefly to comments made during Call to the Public, reported 6-8 emails have been received from residents in support of a sewer retention basin, and thanked the Township staff for their hard work.

CORRESPONDENCE AND ANNOUNCEMENTS

Chockley invited the public to participate in the Goofy Golf high school fundraiser on September 18th at 1:00 P.M. at The Links, and Trunkapalooza on September 16th from 1:00 P.M. to 4:00 P.M. at North Village.

ADOPTION OF MINUTES

▶ **Motion:** Chockley moved, Otto supported, that the minutes of the regular and special meetings of August 14, 2018, be adopted as presented.
Motion carried 5—0 on a voice vote.

AGENDA ITEMS

1.
Application for David and Susan Cavanaugh, 1515 East Joy Road, for a Farmland Agreement with the State of Michigan's Farmland and Open Space Preservation Program

▶ **Motion:** Chockley moved, Otto supported, to approve the application for a Farmland Agreement, formerly known as PA 116, for David and Susan Cavanaugh at 1515 E. Joy Road.
Motion carried 5—0 on a voice vote.

2.
Authorization to Hire a Part-time Front Desk Clerk

▶ **Motion:** Chockley moved, Manley supported, to authorize the hiring of Leisa DeVaney at $15/hour for 30 hours/week to begin September 5, 2018 for the Front Desk Clerk position.
Motion carried 5—0 on a voice vote.

3.
Ability to Return Community Mental Health Millage to Township Taxpayers

The Board discussed the possibility of returning to taxpayers taxes collected through the County Mental Health Millage. Comments included:

- If the Township refuses the money it is distributed by the County to other communities in the County; Northfield Township property owners still pay taxes.
- It is theoretically possible to reduce the Police millage by the amount received from the County millage, but the Police Department is underfunded.
- There are other County millages that have not been approved by Northfield Township millages, but we are

a part of the County, and this millage should not be treated differently from the others.

- The income will help support the cost of paying for the Public Safety Building.
- The funds are needed to help people in the community.

Chief Wagner related two stories (about a homeless, disable veteran , mental illness, and threats in public schools) supporting the need for the funds from this millage.

▶ **Motion:** Otto moved, Chick supported, to accept the Community Mental Health millage.
Motion carried 5—0 on a voice vote.

4.
Sewer Billing Quarterly Fee Increase Recommended to Support Base Level Operations

Chockley referred to the memo from Aynes of August 8, 2018, listing quarterly sewer usage fees for the next five years, with and without funding for a $3 million capital improvement project such as a retention tank.

▶ **Motion:** Chockley moved, Chick supported, to set the quarterly sewer rate at $87 for the current fiscal year.

Discussion included whether to approve this increase and/or future year increases or to wait until a decision is made about whether to approve a capital improvement project, what additional financial information is needed in addition to the completed rate study to make a decision about future rates, the merits of building a sewage retention basin, and experiences of other communities.

Motion withdrawn.

▶ **Amended motion:** Chick moved, Otto supported, to raise the baseline sewer rate to the constant rate of $90.20 for all five fiscal years through 2022/23.
Motion carried 3—2 on a roll call vote, Zelenock and Manley opposed.

▶ **Motion:** Zelenock moved, Chockley supported, to table items 5 and 6 to about 8:30 P.M. to follow Item 7.
Motion carried 5—0 on a voice vote.

5.
Revised Employee Handbook

The Board reviewed the proposal revised draft of the Employee Handbook. Comments included:

- Inconsistent language about benefits awarded and PTO time accrual during the probationary period should be eliminated.
- Specific reimbursement dollar amounts should be removed from the Benefits section as they are changeable from year-to-year.
- The reference to PTO accrual prior to 2013 can be removed because it does not apply to any current employees.
- Part-time employees should receive half the PTO days of full-time (32 or more hours) employees.
- The second to last paragraph on page 23 should read "With the adoption of this Employee Handbook, [end of sentence deleted], all current and future department heads....".
- Language should be clarified to make it clear when overtime is paid (e.g. in a week including a holiday), who approves it, etc.
- It should be made clear that work hours can differ among departments (e.g. WWTP).
- PTO accrual should be limited to one year for new hires.
- Limited time off without pay should be allowed with approval after all PTO is used.
- The Paydays page should be updated to reflect current options for receiving pay and be based on current law.
- Accrued time off is a liability to the Township; whether the current maximum of 150 hours should be decreased was discussed, as well as the option of paying overtime rather than awarding comp time which can be accrued.
- The time period to turn in expense reports should be increased from 15 to 30 days.

It was agreed to present a further revised document to Board members for additional review.

6.
Bids for Improvements to Public Safety Building Administrative Offices

Aynes reported that five proposals have been submitted, but he is still checking references. Board members asked that information about the bids be provided to them.

▶ **Motion:** Chockley moved, Zelenock supported, that the topic of Public Safety Building Administrative Offices bids be tabled to the next meeting.
Motion carried 5—0 on a voice vote.

7.
Bids for a Design Engineer to Assess and Recommend Improvements to 75 Barker Road

Aynes reported that the amounts of the two bids submitted were very similar, so the decision is to choose the contractor.

▶ **Motion:** Zelenock moved, Chick supported, to authorize Township Manager Aynes to enter into an agreement with one of the two bidders to hire a design engineer to assess and recommend improvements to 75 Barker Road after reviewing their qualifications, doing the inspections, and consulting with attorney Burns as to what would be the appropriate agreements to enter into.

There was discussion about how to fund the work, and Aynes reported that he has not yet been able to secure appraisals of the property, but he will continue to pursue that. He noted that one architect indicated it would cost more to raze and rebuild than to repair the existing building.

Motion carried 5—0 on a roll call vote.

8.
Civic Event Application for Trunk or Treat

- **Motion:** Chockley moved, Zelenock supported, that the Civic Event Application for the Trunk or Treat event on October 28, 2018, be approved as presented.
  Motion carried 5—0 on a voice vote.

- **Motion:** Chockley moved, Otto supported, to put a portable toilet on the North Village site for two months, cost not to exceed $200/month.
  Motion carried 5—0 on a voice vote.

SECOND CALL TO THE PUBLIC

None present.

BOARD MEMBER COMMENTS

Comments included:

- Pending confirmation of a Parks and Recreation Board quorum, a joint meeting with them is scheduled for the beginning of the Township Board meeting of September 11th.
- The end of the extended RFP review period for North Village will be September 25th and the developer who submitted a proposal would like to meet with the Board.
- Interest from the public should be considered when determining the order of agenda items.

ADJOURNMENT

- **Motion:** Chockley moved, Otto supported, that the meeting be adjourned.
  Motion carried 5—0 on a voice vote.

The meeting adjourned at 9:54 P.M.

Submitted by Lisa Lemble.

Corrections to the originally issued minutes are indicated as follows:
Wording removed is ~~stricken through~~;
Wording added is underlined.

Approved by the Township Board on September 11, 2018.

____
Kathleen Manley, Clerk

Official minutes of all meetings are available on the Township's website at http://www.twp-northfield.org/government/township_board_of_trustees/

APPENDIX B

Funding Structure and Rate Methodology

Table 1
Current and Minimum Calculated FY 2019-20 Wastewater Rates

	Current, Effective Aug 1, 2018	Minimum Calculated from Table 5
Budget Year:		**FY 2019-20**
Metered Rates (per 1,000 gallons):		
All flow per quarterly period, Total	$6.00	**$5.66**
Flat Rates (per Billed Residential Equivalent Unit):		
Total per quarterly period	$90.20	**$84.13**

Table 2
Equipment Replacement Fund Contribution

Source	Item	Year Acquired	Original Cost, $	Life (Years)	Annual Equipment Replacement Fund Contribution, $
Aynes	Tertiary traveling bridge filters (2)	1998	108,000	20	5,400
Aynes	Aeration Hoffman centrifigal blowers (3) (Filter Building 1)	1976 (Upgraded 1990 and 2008)	150,000	30	5,000
Aynes	Hycor solids separator	1998 (New screw shaft in 2008)	70,000	20	3,500
Aynes	Cyclone solids separator	1998	70,000	20	3,500
Aynes	Grit Conveyor	1998	60,000	20	3,000
Aynes	30-foot Final Clarifier: Mechanisms (2)	1976	20,000	30	667
Aynes	40-foot Final Clarifier: Mechanism	1991	20,000	30	667
Aynes	Gravity Thickener Tank: Mechanism	1976	20,000	30	667
Aynes	30-foot Diameter Circular Clarifier (Intermediate Settling Tank): Mechanism	1962	20,000	30	667
Aynes	104-ft Diameter Trickling Filter: Mechanism	1962 (Upgraded 1991, 2008)	20,000	30	667
Aynes	F350 Pick-up Truck	2001	32,000	10	3,200
Aynes	F250 Snow Plow Truck	2006	28,000	10	2,800
Aynes	Eight Mile PS: 2,000 GPM pumps (4)	2001 (1 new pump $27,000 in 2012)	120,000	20	6,000
Aynes	North Territorial PS: Pumps (2)	2002	25,000	20	1,250
Aynes	Horseshoe Lake #1 PS: Pumps (2)	2010	15,000	20	750
Aynes	Horseshoe Lake #2 PS: Pumps (2)	1978	15,000	20	750
Aynes	Horseshoe Lake #3 PS: Pumps (2)	2010	15,000	20	750
Aynes	Shadowoods PS: Pumps (2)	1996	15,000	20	750
Aynes	Nine Mile Rd. PS: Pumps (2)	1978	15,000	20	750
Aynes	East Shore #1 PS: Pumps (2)	2007	15,000	20	750
Aynes	East Shore #2 PS: Pumps (2)	1969	15,000	20	750
Aynes	Lake Point Dr Grinder PS: Pumps (2)	2004	8,880	20	444
Aynes	Eagle Gardens PS: Pumps (2)	2001	10,000	20	500
Aynes	Main Street PS: Pumps (2)	1969	15,000	20	750
Aynes	Northshore #1 PS: Pumps (2)	1969	10,000	20	500
Aynes	Northshore #2 PS: Pumps (2)	1985	10,000	20	500
2014 report	Elmcrest PS: Pumps (2)	1978	10,000	20	500
Aynes	WWTP: 250 kW Cummins Diesel Generator	2008	72,730	30	2,424
Aynes	Eight Mile PS: 200 kW Cummins Generator	1999	49,000	30	1,633
Aynes	North Territorial PS: 85 kW Cummins Generator	2004	18,000	30	600
Aynes	East Shore #1 PS: 85 kW Cummins Generator	2007	65,000	30	2,167
Aynes	East Shore #2 PS: 35 kW Cummins Generator	2011	30,000	30	1,000
Aynes	Horseshoe Lake #1 PS: 20 kW Cummins Generator	2004	25,000	30	833
Aynes	Horseshoe Lake #2 PS: 20 kW Cummins Generator	2004	25,000	30	833
Aynes	Horseshoe Lake #3 PS: 20 kW Cummins Generator	2004	25,000	30	833
Aynes	Katolite 125 kW Portable generator (storage shed)	2001	50,000	20	2,500
Aynes	Onan 100kW Portable generator (storage shed)	1985	50,000	20	2,500
Aynes	Pipeline Inspection Trailer and Cameras	2005	40,000	20	2,000
Aynes	JCB 214 Backhoe (storage shed)	2000	65,000	20	3,250
Aynes	High pressure pipe cleaning machine (storage shed)	2002	65,000	20	3,250
Aynes	Komatsu forklift (storage shed)	2003	25,000	20	1,250
Aynes	Primary effluent pumps (3) (3 new VFD drives)	1991	45,000	20	2,250
Aynes	Carter 11" piston sludge pump	1993	40,000	20	2,000
Aynes	Carter piston sludge pumps (4)(Office, digester, filter buildings)	1969 (2nd pump added to Office Bldg 1991)	60,000	20	3,000
Aynes	Filter influent pumps (2)(Filter Bldg #1)	1998	12,000	20	600
Aynes	Marlow return sludge pumps (3)	1976 (New impellers)	15,000	20	750
Aynes	Variable frequency drives (3)	2009	25,000	20	1,250
Aynes	Laboratory Equipment	2010	35,000	10	3,500
Aynes	Kewanee boilers (2) (Digester Bldg + Boiler Room)	1979 (2nd boiler in 1990)	40,000	20	2,000
Aynes	East Primary Tanks #3 and #4: Equipment	2007	118,000	20	5,900
Aynes	Primary Tanks #1 and #2: Equipment	2010	75,000	20	3,750
Aynes	Multi-Aqua Individual Room Air Conditioner	2003	15,000	20	750
Aynes	Variable Frequency Drives (2)(Filter Bldg #1)	1998	20,000	20	1,000
	TOTAL (Minimum Annual Contribution)				**97,252**
	FY 2019-20 Requested Budget				**169,000**

Table 3
Wastewater System Expenditures, Other Revenue Sources and Required Usage Fee Revenue

Source		571: Wastewater Treatment Fund	
		Account Name	**Requested FY 2019-20, $**
		EXPENDITURES	
		Dept: 226 PERSONNEL	
Yvette Starbuck	701	Salaries - Superintendent	68,833
Yvette Starbuck	702	Salaries - Full Time	189,008
Yvette Starbuck	711	Salaries - Overtime	19,282
Yvette Starbuck	715	Social Security	21,200
Yvette Starbuck	716	Hospitalization	123,118
Yvette Starbuck	717	Life/Disability Insurance	3,983
Yvette Starbuck	718	Pension	25,784
Yvette Starbuck	720	Banked PTO	0
Yvette Starbuck	731	Workers Comp Insurance	6,616
Yvette Starbuck	747	ON-CALL WAGES	10,950
Yvette Starbuck	957	Training & Development	5,000
		PERSONNEL	**473,774**
		Dept: 228 INFORMATION TECHNOLOGY	
Yvette Starbuck	948	Computer Services	500
		INFORMATION TECHNOLOGY	**500**
		Dept: 270 LEGAL/PROFESSIONAL	
Yvette Starbuck	722	Controller (35% of Total Cost)	0
Yvette Starbuck	802	Audit Fees (35% of Total Cost)	6,300
Yvette Starbuck	803	Legal	500
Yvette Starbuck	806	Engineer	25,000
		LEGAL/PROFESSIONAL	**31,800**
		Dept: 301 OPERATING COSTS	
Yvette Starbuck	727	Supplies	2,500
Yvette Starbuck	740	Operating Supplies	50,000
Yvette Starbuck	741	Uniforms/Gear and Allowance	3,500
Yvette Starbuck	807	Membership Dues	880
Yvette Starbuck	817	Lab & Testing	7,000
Yvette Starbuck	819	Collection System Annual Maintenance	55,000
Yvette Starbuck	825	Sewer Administration Fees (Paid to General Fund for Processing Utility Bills)	55,912
Yvette Starbuck	850	Communication	7,000
Yvette Starbuck	851	Postage (Utility Bill Postage)	3,000
Yvette Starbuck	900	Printing & Publications	200
Yvette Starbuck	907	Refunds and Rebate	0
Yvette Starbuck	910	Insurance & Bonds	25,350
Yvette Starbuck	920	Utilities	100,000
Yvette Starbuck	929	Grant Expense (Assume 90% Reimbursable SAW Grant)	170,000
Yvette Starbuck	930	Repairs & Maintenance	110,000
Yvette Starbuck	940	Rental Equipment	1,585
Yvette Starbuck	950	Land Leasing	0
Yvette Starbuck	956	Miscellaneous	500
		OPERATING COSTS	**592,427**
		Dept: 333 TRANSPORTATION	
Yvette Starbuck	860	Fuel & Mileage	7,000
Yvette Starbuck	930	Repairs & Maintenance	1,500
		TRANSPORTATION	**8,500**
		Dept: 528 O & M - BOND & INTEREST + DEPT 000 Bond Principal Payments	
Tt Assumed	954	Paying Agent Fees (assume $700 from last study)	700
Bond schedule	989	1992 Junior Lien Bond Principal/2004 $660,000 Refunding Bond Interest (Final Payment in FY 2021-2022)	6,525
Bond schedule	571-000-302	1992 Junior Lien Bond Principal/2004 $660,000 Refunding Bond Principal (Final Payment in 2022)	45,000
		O & M - BOND & INTEREST + DEPT 000 Bond Principal Payments	**52,225**
		Dept: 900 CAPITAL OUTLAY	
	800	Other Professional Fees	200,000
Table 2	970	Equipment Replacement Fund Contribution (from Table 2)	169,000
	971	Renovations (Assumed Cash Outlay Paid from Unrestricted Fund Balance)	326,000
	972	Computer	3,000
		CAPITAL OUTLAY	**698,000**
		TOTAL EXPENDITURES	**1,857,226**
		OFFSETTING REVENUES	
		Dept 000 - ESTIMATED REVENUES	
	445	Penalty & Interest on Taxes	0
	500	Tap-In Fees	0
	665	Interest Income	5,000
	671	Reimbursement/Other Income = (90% of "$170,000 SAW Grant Expense") + $1,500	154,500
	672	SAD Interest	0
	673	Sale of Fixed Assets	0
		ESTIMATED REVENUES (Net of Account line 651, Usage Fees)	**159,500**
		Dept 336 - CONTRIBUTIONS	
	588	Contributions from Other Funds (from Unrestricted Fund Balance)	326,000
		CONTRIBUTIONS	**326,000**
		REQUIRED USAGE FEES (TOTAL EXPENDITURES LESS OFFSETTING REVENUES)	**1,371,726**
		UNRESTRICTED FUND BALANCE - BEGINNING OF YEAR	**1,234,011**
		ADDITIONS TO UNRESTRICTED FUND BALANCE	0
		WITHDRAWALS FROM UNRESTRICTED FUND BALANCE	326,000
		UNRESTRICTED FUND BALANCE - END OF YEAR	**908,011**
		DEDICATED EQUIPMENT REPLACEMENT FUND BALANCE - BEGINNING OF YEAR	**0**
		ADDITIONS TO DEDICATED EQUIPMENT REPLACEMENT FUND	169,000
		WITHDRAWALS FROM DEDICATED EQUIPMENT REPLACEMENT FUND	0
		DEDICATED EQUIPMENT REPLACEMENT FUND BALANCE (Assumes $0 starting fund balance and $0 withdrawal)	**169,000**

Table 4
Billing Unit Projections

Total of Flat Rate and Metered Rate User Charge Revenue (from FY 2016-17 Audited Financial Statement)		$ 1,356,181
Estimated billable flow in calendar year 2019 (1,000 gallon units per year):		
Elementary School	929	
Whitmore Lanes	199	
Middle School	767	
Regency	1,810	
High School	1,011	
Washtenaw County Road Commission	128	
Department of Transportation Rest Area	517	
Captain Joe's	760	
Best Western	930	
Dirt Squirt	1,048	
McDonald's	818	
Woodland Correctional Center	25,234	
Northfield Township Office	164	
Total Metered User Billable Flow, Calendar Year 2019	**34,315**	
Total of Metered Rate User Charge Revenue @$5.60/1,000 Gal		$ 192,164
Total of Flat Rate User Charge Revenue = Total Revenue Less Metered Revenue		$ 1,164,017
Number of REUs Based on $84.00 per REU per Quarter		3,464
Equivalent 1,000 Gallon Units per Year based on 60 1,000 Gallon Units per REU per Year:		207,860
Total Equivalent Billable Flow		**242,175**

Table 5
Minimum Required Wastewater Rate Calculations

Item	FY 2019-20
Total Usage Fees Required (Table 3)	$1,371,726
Total Equivalent Billable Flow (1,000 Gallon Units) (Table 4)	242,175
Minimum Metered Rate, per 1,000 Gallons	**$5.66**
Adopted Metered Rate, per 1,000 Gallons (Table 1)	$6.00
Metered Billable Flow, 1,000 Gallon Units (Table 4)	34,315
Revenue generated from metered customers using adopted metered rate per 1,000 Gallons	$205,890
Revenue Required from Flat Rate Users	$1,165,836
Number of REUs (Table 4)	3,464
Minimum Flat Rate, per REU, per Quarter	**$84.13**

Table 6
Proof of Revenue Sufficiency Based on Current Rates

FY 2019-20				
Projected Revenue Required From Rates	**Customer Type**	**Current Rates**	**Projected Annual Billing Units**	**Projected Revenue Generated from Current Rates**
	Metered Customers	$ 6.00	34,315	$ 205,890
	REU (Flat Rate) Customers	$ 90.20	13,857	$ 1,249,933
$ 1,371,726	**TOTAL**			**$ 1,455,823**
Proof of Rate Sufficiency (Revenue Generated Less Revenue Required):				$ 84,097

APPENDIX I: CAPITAL IMPROVEMENT PLAN COST OPINIONS

OPINION OF PROBABLE PROJECT COST
TETRA TECH

710 Avis Drive, Ann Arbor 48108 **Telephone: (734) 665-6000 FAX: (734) 665-2570**

PROJECT:	**Northfield Township Asset Management Plan**	**DATE:**	**3/6/2019**
LOCATION:	**Northfield Twp, MI**	**PROJECT NO.**	**200-12748-18002**
BASIS FOR ESTIMATE:	**[x] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL**	**ESTIMATOR:**	**JTM**
WORK:	**CS-1: Grade 5 Defect Repairs**	**CHECKED BY:**	**JCS**
		CURRENT ENR:	**11311**

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	Mobilization (5% of Pipe Construction Cost)	1	LS	$ 3,000.00	$ 3,000.00
2	Audio Visual	1	LS	$ 4,000.00	$ 4,000.00
3	Utility Allowance (2% of Construction Cost)	1	LS	$ 1,000.00	$ 1,000.00
4	General Conditions (2% of Construction Cost)	1	LS	$ 1,000.00	$ 1,000.00
5	Soil Erosion/Sedimentation Control (1% of	1	LS	$ 1,000.00	$ 1,000.00
6	**Construction Cost)**				
	Sewer and Manhole Work				
7	CIPP Sewer Lining, 8-inch	230	FT	$ 60.00	$ 13,800.00
8	CIPP Sewer Lining, 10-inch	86	FT	$ 70.00	$ 6,020.00
9	Root Control, Misc.	316	FT	$ 8.00	$ 2,528.00
10	Spot Liner, 12 inch	5	EA	$ 4,000.00	$ 20,000.00
11	Clean and Seal Lateral Connection, 8 inch	1	EA	$ 3,000.00	$ 3,000.00
				Subtotal	**$ 45,348.00**
				Work Subtotal	**$ 46,000.00**
				Construction and General Costs	**$ 56,000.00**
		Construction Contingency (15% Construction Cost)			**$ 9,000.00**
		Construction Engineering / Testing (8% Construction Cost)			**$ 5,000.00**
	Construction Engineering / Testing Contingency (15%)				**$ 1,000.00**
	Legal, Administration and Financing (8% Construction Total)				**$ 5,000.00**
	Design Engineering (8% Construction Cost)				**$ 5,000.00**
	Design Engineering Contingency (15%)				**$ 1,000.00**
	TOTAL PROJECT COST				**$ 82,000.00**

OPINION OF PROBABLE CONSTRUCTION COST
TETRA TECH

710 Avis Rd. Ann Arbor, MI 48108
Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township Asset Management Plan	DATE:	9/23/2019
LOCATION:	Northfield Township	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	JTM
WORK:	CS-2: Main Street Pump Station Replacement	CHECKED BY:	JCS
		CURRENT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
	General				
1	Mobilization (5% of Construction Cost, Max $150,000)	1	LS	-	$ 13,800.00
2	Traffic Control (3% of Construction Cost)	1	LS	-	$ 8,300.00
3	Audio Visual	1	LS	$ 5,000.00	$ 5,000.00
4	SESC (1% of Construction Cost)	1	LS	-	$ 2,800.00
5	Utility Allowance (2% of Construction Cost)	1	LS	-	$ 5,600.00
6	General Conditions (2% of Construction Cost)	1	LS	-	$ 5,600.00
7	UIS Programming Allowance	1	LS	-	$ 10,000.00
	Construction Cost				
8	Silt Fence	160	FT	$ 5.00	$ 800.00
9	Gravel Access Approach	1	EA	$ 3,000.00	$ 3,000.00
10	Pit Excavation	200	CY	$ 100.00	$ 20,000.00
11	Groundwater Dewatering	1.0	Mo	$ 15,000.00	$ 15,000.00
12	Bypass Pumping	0.5	Mo	$ 10,000.00	$ 5,000.00
13	Bypass Connection	1	LS	$ 5,000.00	$ 5,000.00
14	DIP Forcemain and Fittings	100	LF	$ 200.00	$ 20,000.00
15	Plug Valve and Box	2	EA	$ 7,500.00	$ 15,000.00
16	Influent Sewer Reconnection PVC	10	FT	$ 150.00	$ 1,500.00
17	Sanitary MH Tap	1	EA	$ 5,000.00	$ 5,000.00
18	Precast Concrete Wet Well	1	EA	$ 30,000.00	$ 30,000.00
19	Precast Concrete Valve Vault	1	EA	$ 10,000.00	$ 10,000.00
20	Hatches	2	EA	$ 5,000.00	$ 10,000.00
21	100 GPM Duplex Station Pumps	2	EA	$ 15,000.00	$ 30,000.00
22	Interior Piping and Pressure Valving	1	LS	$ 20,000.00	$ 20,000.00
23	Pump Controls	1	LS	$ 50,000.00	$ 50,000.00
24	Raceway, Cabling, Enclosures, Terminations, and Misc. Electrical Items (Includes Reconnection)	1	LS	$ 15,000.00	$ 15,000.00
25	Existing PS Abandonment	1	LS	$ 15,000.00	$ 15,000.00
26	Site Restoration	1	LS	$ 5,000.00	$ 5,000.00
	Construction Subtotal				**$ 275,300.00**
	Construction Subtotal (Rounded to Nearest Thousand)				**$ 327,000.00**
	Construction Contingencies (15% Construction Cost)				$ 50,000.00
	Construction Engineering / Testing (8% Construction Total)				$ 4,000.00
	Construction Engineering / Testing Contingency (15%)				$ 1,000.00
	Legal, Administration and Financing (8% Construction Total)				$ 27,000.00
	Design Engineering (8% Current Construction Cost)				$ 27,000.00
	Design Engineering Contingency (15%)				$ 5,000.00
	ASSUMPTIONS				
1.	Existing control building, electrical feed and generator to remain for reuse.				
2.	Abandonment of existing station to be based on filling with flowable fill and remaining portions below grade.				
	TOTAL PROJECT COST				**$ 441,000.00**

OPINION OF PROBABLE PROJECT COST
TETRA TECH

710 Avis Drive, Ann Arbor 48108 — Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township Asset Management Plan	DATE:	3/6/2019
LOCATION:	Northfield Twp, MI	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[x] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	JTM
WORK:	CS-3: Grade 4 Defect Repairs	CHECKED BY:	JCS
		CURRENT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	**Mobilization (5% of Pipe Construction Cost)**	**1**	**LS**	**$ 7,000.00**	**$ 7,000.00**
2	**Audio Visual**	**1**	**LS**	**$ 4,000.00**	**$ 4,000.00**
3	**Utility Allowance (2% of Construction Cost)**	**1**	**LS**	**$ 3,000.00**	**$ 3,000.00**
4	**General Conditions (2% of Construction Cost)**	**1**	**LS**	**$ 3,000.00**	**$ 3,000.00**
5	**Soil Erosion/Sedimentation Control (1% of Construction Cost)**	**1**	**LS**	**$ 2,000.00**	**$ 2,000.00**
	Lining Work				
6	CIPP Sewer Lining, 8-inch	910	FT	$ 60.00	$ 54,600.00
7	Spot Liner, 8 inch	25	FT	$ 800.00	$ 20,000.00
8	Root Control, 8 inch	3500	FT	$ 8.00	$ 28,000.00
9	Root Control, 10 inch	560	FT	$ 10.00	$ 5,600.00
10	Root Control, 12 inch	350	FT	$ 12.00	$ 4,200.00
11	Pressure Test Joint	215	EA	$ 30.00	$ 6,450.00
12	Chemical Grout Joints, 8 inch	10	EA	$ 30.00	$ 300.00
13	Chemical Grout Joints, 12 inch	5	EA	$ 85.00	$ 425.00
14	Clean and Seal Lateral, 8 inch	1	EA	$ 1,000.00	$ 1,000.00
15	Heavy Clean	600	FT	$ 10.00	$ 6,000.00
				Subtotal	**$ 126,575.00**
				Work Subtotal	**$ 127,000.00**
			Construction and General Costs		**$ 146,000.00**
	Construction Contingency (15% Construction Cost)				**$ 22,000.00**
	Construction Engineering / Testing (8% Construction Cost)				**$ 13,000.00**
	Construction Engineering / Testing Contingency (15%)				**$ 2,000.00**
	Legal, Administration and Financing (8% Construction Total)				**$ 12,000.00**
	Design Engineering (8% Construction Cost)				**$ 12,000.00**
	Design Engineering Contingency (15%)				**$ 2,000.00**
	TOTAL PROJECT COST				**$ 209,000.00**

OPINION OF PROBABLE PROJECT COST
TETRA TECH

710 Avis Rd. Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township Asset Management Plan	DATE:	11/5/2019
LOCATION:	Northfield Township, Michigan	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	J. Siwek/J.Moore
WORK:	CS-4: 24-inch Cross Lot Sewer Replacement	CHECKED BY:	B. Rubel
		CURRENT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
	General				
1	Mobilization (5% of Pipe Construction Cost, Max $50,000)	1	LS	$ 62,000.00	$ 62,000.00
2	Traffic Control (2% of Pipe Construction Cost)	1	LS	$ 26,000.00	$ 26,000.00
3	Audio Visual	1	LS	$ 4,000.00	$ 4,000.00
4	SESC (2% of Pipe Construction Cost)	1	LS	$ 25,000.00	$ 25,000.00
5	General Conditions (2% of Pipe Construction Cost)	1	LS	$ 25,000.00	$ 25,000.00
	Pipe Construction Cost				
6	Remove Existing Sewer	4,200	LF	$ 10.00	$ 42,000.00
7	Remove Existing Manhole	16	EA	$ 1,000.00	$ 16,000.00
8	24" PVC SDR 26 Sanitary Sewer, < 20' Deep	4,200	LF	$ 200.00	$ 840,000.00
9	48" Sanitary Sewer Manhole, < 20' Deep	16	EA	$ 7,500.00	$ 120,000.00
10	Connect to Existing Sewers	7	EA	$ 4,500.00	$ 31,500.00
11	Bypass Pumping	1	LS	$ 50,000.00	$ 50,000.00
12	Barker Road Pavement Replacement	700	LF	$ 250.00	$ 175,000.00
13	Cleanup and Restoration	4,500	LF	$ 5.00	$ 22,500.00
	Pipe Construction Subtotal				**$ 1,297,000.00**
	Construction Subtotal (Rounded to Nearest Thousand)				**$ 1,439,000.00**
	Construction Contingencies (15% Construction Cost)				$ 216,000.00
	Construction Engineering / Testing (8% Construction Total)				$ 116,000.00
	Construction Engineering / Testing Contingency (15%)				$ 18,000.00
	Legal, Administration and Financing (8% Construction Total)				$ 116,000.00
	Design Engineering (8% Current Construction Cost)				$ 116,000.00
	Design Engineering Contingency (15%)				$ 18,000.00
	ASSUMPTIONS				
1.	Private Service Connection costs detailed on individual basis.				
2.	Cleanup and restoration includes topsoil, seed, and mulch.				
	TOTAL PROJECT COST				**$ 2,039,000.00**

OPINION OF PROBABLE CONSTRUCTION COST
TETRA TECH

710 Avis Rd. Ann Arbor, MI 48108

Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township Asset Management Plan	DATE:	9/23/2019
LOCATION:	Northfield Township	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE: [X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL		ESTIMATOR:	JTM
WORK:	CS-5: East Shore 2 Pump Station Replacement	CHECKED BY:	JCS
		CURRENT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
	General				
1	Mobilization (5% of Construction Cost, Max $150,000)	1	LS	-	$ 19,100.00
2	Traffic Control (3% of Construction Cost)	1	LS	-	$ 11,500.00
3	Audio Visual	1	LS	$ 5,000.00	$ 5,000.00
4	SESC (1% of Construction Cost)	1	LS	-	$ 3,900.00
5	Utility Allowance (2% of Construction Cost)	1	LS	-	$ 7,700.00
6	General Conditions (2% of Construction Cost)	1	LS	-	$ 7,700.00
7	UIS Programming Allowance	1	LS	-	$ 10,000.00
	Construction Cost				
8	Silt Fence	250	FT	$ 5.00	$ 1,250.00
9	Pit Excavation	200	CY	$ 100.00	$ 20,000.00
10	Groundwater Dewatering	1.0	Mo	$ 15,000.00	$ 15,000.00
11	Bypass Pumping	0.5	Mo	$ 10,000.00	$ 5,000.00
12	Asphalt Pavement	486	SY	$ 100.00	$ 48,600.00
13	Bypass Connection	1	LS	$ 5,000.00	$ 5,000.00
14	DIP Forcemain and Fittings	100	LF	$ 200.00	$ 20,000.00
15	Plug Valve and Box	2	EA	$ 7,500.00	$ 15,000.00
16	Influent Sewer Reconnection PVC	10	FT	$ 150.00	$ 1,500.00
17	Sanitary MH Tap	1	EA	$ 5,000.00	$ 5,000.00
18	Precast Concrete Wet Well	1	EA	$ 30,000.00	$ 30,000.00
19	Precast Concrete Valve Vault	1	EA	$ 10,000.00	$ 10,000.00
20	Hatches	2	EA	$ 5,000.00	$ 10,000.00
21	300 GPM Duplex Station Pumps	2	EA	$ 45,000.00	$ 90,000.00
22	Interior Piping and Pressure Valving	1	LS	$ 20,000.00	$ 20,000.00
23	Pump Controls	1	LS	$ 50,000.00	$ 50,000.00
24	Raceway, Cabling, Enclosures, Terminations, and Misc. Electrical Items (Includes Reconnection)	1	LS	$ 15,000.00	$ 15,000.00
25	Existing PS Abandonment	1	LS	$ 15,000.00	$ 15,000.00
26	Site Restoration	1	LS	$ 5,000.00	$ 5,000.00
	Construction Subtotal				**$ 381,350.00**
	Construction Subtotal (Rounded to Nearest Thousand)				**$ 447,000.00**
	Construction Contingencies (15% Construction Cost)				$ 68,000.00
	Construction Engineering / Testing (8% Construction Total)				$ 36,000.00
	Construction Engineering / Testing Contingency (15%)				$ 6,000.00
	Legal, Administration and Financing (8% Construction Total)				$ 36,000.00
	Design Engineering (8% Current Construction Cost)				$ 36,000.00
	Design Engineering Contingency (15%)				$ 6,000.00
	ASSUMPTIONS				
1.	Existing control building, electrical feed and generator to remain for reuse.				
2.	Abandonment of existing station to be based on filling with flowable fill and remaining portions below grade.				
	TOTAL PROJECT COST				**$ 635,000.00**

OPINION OF PROBABLE CONSTRUCTION COST
TETRA TECH

710 Avis Rd. Ann Arbor, MI 48108

Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township Asset Management Plan	DATE:	9/23/2019
LOCATION:	Northfield Township	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	JTM
WORK:	CS-6: North Shore 1 Pump Station Replacement	CHECKED BY:	JCS
		CURRENT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
	General				
1	Mobilization (5% of Construction Cost, Max $150,000)	1	LS	-	$ 15,200.00
2	Traffic Control (3% of Construction Cost)	1	LS	-	$ 9,100.00
3	Audio Visual	1	LS	$ 5,000.00	$ 5,000.00
4	SESC (1% of Construction Cost)	1	LS	-	$ 3,100.00
5	Utility Allowance (2% of Construction Cost)	1	LS	-	$ 6,100.00
6	General Conditions (2% of Construction Cost)	1	LS	-	$ 6,100.00
7	UIS Programming Allowance	1	LS	-	$ 10,000.00
	Construction Cost				
8	Silt Fence	200	FT	$ 5.00	$ 1,000.00
9	Pit Excavation	200	CY	$ 100.00	$ 20,000.00
10	Groundwater Dewatering	1.0	Mo	$ 15,000.00	$ 15,000.00
11	Bypass Pumping	0.5	Mo	$ 10,000.00	$ 5,000.00
12	Bypass Connection	1	LS	$ 5,000.00	$ 5,000.00
13	DIP Forcemain and Fittings	100	LF	$ 200.00	$ 20,000.00
14	Plug Valve and Box	2	EA	$ 7,500.00	$ 15,000.00
15	Influent Sewer Reconnection PVC	10	FT	$ 150.00	$ 1,500.00
16	Sanitary MH Tap	1	EA	$ 5,000.00	$ 5,000.00
17	Precast Concrete Wet Well	1	EA	$ 30,000.00	$ 30,000.00
18	Precast Concrete Valve Vault	1	EA	$ 10,000.00	$ 10,000.00
19	Hatches	2	EA	$ 5,000.00	$ 10,000.00
20	200 GPM Duplex Station Pumps	2	EA	$ 30,000.00	$ 60,000.00
21	Interior Piping and Pressure Valving	1	LS	$ 20,000.00	$ 20,000.00
22	Pump Controls	1	LS	$ 50,000.00	$ 50,000.00
23	Raceway, Cabling, Enclosures, Terminations, and Misc. Electrical Items (Includes Reconnection)	1	LS	$ 15,000.00	$ 15,000.00
24	Existing PS Abandonment	1	LS	$ 15,000.00	$ 15,000.00
25	Site Restoration	1	LS	$ 5,000.00	$ 5,000.00
	Construction Subtotal				**$ 302,500.00**
	Construction Subtotal (Rounded to Nearest Thousand)				**$ 358,000.00**
	Construction Contingencies (15% Construction Cost)				$ 54,000.00
	Construction Engineering / Testing (8% Construction Total)				$ 29,000.00
	Construction Engineering / Testing Contingency (15%)				$ 5,000.00
	Legal, Administration and Financing (8% Construction Total)				$ 29,000.00
	Design Engineering (8% Current Construction Cost)				$ 29,000.00
	Design Engineering Contingency (15%)				$ 5,000.00
	ASSUMPTIONS				
1.	Existing control building, electrical feed and generator to remain for reuse.				
2.	Abandonment of existing station to be based on filling with flowable fill and remaining portions below grade.				
	TOTAL PROJECT COST				**$ 509,000.00**

OPINION OF PROBABLE CONSTRUCTION COST
TETRA TECH

710 Avis Rd. Ann Arbor, MI 48108
Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township Asset Management Plan	DATE:	9/23/2019
LOCATION:	Northfield Township	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	JTM
WORK:	CS-7: Horshoe Lake 1 Pump Station Replacement	CHECKED BY:	JCS
		CURRENT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
	General				
1	Mobilization (5% of Construction Cost, Max $150,000)	1	LS	-	$ 20,100.00
2	Traffic Control (3% of Construction Cost)	1	LS	-	$ 500.00
3	Audio Visual	1	LS	$ 5,000.00	$ 5,000.00
4	SESC (1% of Construction Cost)	1	LS	-	$ 4,100.00
5	Utility Allowance (2% of Construction Cost)	1	LS	-	$ 8,100.00
6	General Conditions (2% of Construction Cost)	1	LS	-	$ 8,100.00
7	UIS Programming Allowance	1	LS	-	$ 10,000.00
	Construction Cost				
8	Silt Fence	200	FT	$ 5.00	$ 1,000.00
9	Pit Excavation	200	CY	$ 100.00	$ 20,000.00
10	Groundwater Dewatering	1.0	Mo	$ 15,000.00	$ 15,000.00
11	Bypass Pumping	0.5	Mo	$ 10,000.00	$ 5,000.00
12	Asphalt Pavement	95	SY	$ 100.00	$ 9,500.00
13	Bypass Connection	1	LS	$ 5,000.00	$ 5,000.00
14	DIP Forcemain and Fittings	100	LF	$ 200.00	$ 20,000.00
15	Plug Valve and Box	2	EA	$ 7,500.00	$ 15,000.00
16	Influent Sewer Reconnection PVC	10	FT	$ 150.00	$ 1,500.00
17	Sanitary MH Tap	1	EA	$ 5,000.00	$ 5,000.00
18	Precast Concrete Wet Well	1	EA	$ 30,000.00	$ 30,000.00
19	Precast Concrete Valve Vault	1	EA	$ 10,000.00	$ 10,000.00
20	Hatches	2	EA	$ 5,000.00	$ 10,000.00
21	400 GPM Duplex Station Pumps	2	EA	$ 60,000.00	$ 120,000.00
22	Generator	1	EA	$ 30,000.00	$ 30,000.00
23	Interior Piping and Pressure Valving	1	LS	$ 20,000.00	$ 20,000.00
24	Pump Controls	1	LS	$ 50,000.00	$ 50,000.00
25	Raceway, Cabling, Enclosures, Terminations, and Misc. Electrical Items (Includes Reconnection)	1	LS	$ 15,000.00	$ 15,000.00
26	Existing PS Abandonment	1	LS	$ 15,000.00	$ 15,000.00
27	Site Restoration	1	LS	$ 5,000.00	$ 5,000.00
	Construction Subtotal				**$ 402,000.00**
	Construction Subtotal (Rounded to Nearest Thousand)				**$ 458,000.00**
	Construction Contingencies (15% Construction Cost)				$ 69,000.00
	Construction Engineering / Testing (8% Construction Total)				$ 37,000.00
	Construction Engineering / Testing Contingency (15%)				$ 6,000.00
	Legal, Administration and Financing (8% Construction Total)				$ 37,000.00
	Design Engineering (8% Current Construction Cost)				$ 37,000.00
	Design Engineering Contingency (15%)				$ 6,000.00
	ASSUMPTIONS				
1.	Existing control building, electrical feed and generator to remain for reuse.				
2.	Abandonment of existing station to be based on filling with flowable fill and remaining portions below grade.				
	TOTAL PROJECT COST				**$ 650,000.00**

OPINION OF PROBABLE PROJECT COST
TETRA TECH

710 Avis Rd. Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township Asset Management Plan	DATE:	11/5/2019
LOCATION:	Northfield Township, Michigan	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	J. Siwek/J. Moore
WORK:	CS-9: 18-inch Cross-Lot Trunk Sewer Replacement	CHECKED BY:	B. Rubel
	(Modeling Report Study Segment C)	CURRENT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
	General				
1	Mobilization (5% of Pipe Construction Cost, Max $50,000)	1	LS	$ 20,000.00	$ 20,000.00
2	Traffic Control (5% of Pipe Construction Cost)	1	LS	$ 22,000.00	$ 22,000.00
3	Audio Visual	1	LS	$ 4,000.00	$ 4,000.00
4	SESC (2% of Pipe Construction Cost)	1	LS	$ 8,000.00	$ 8,000.00
5	General Conditions (2% of Pipe Construction Cost)	1	LS	$ 8,000.00	$ 8,000.00
	Pipe Construction Cost				
6	Remove/Abandon Existing Sewer	1,705	LF	$ 10.00	$ 17,050.00
7	Remove Existing Manhole	12	EA	$ 1,000.00	$ 12,000.00
8	18" PVC SDR 26 Sanitary Sewer, < 20' Deep	1,705	LF	$ 175.00	$ 298,375.00
9	48" Sanitary Sewer Manhole, < 20' Deep	6	EA	$ 7,500.00	$ 45,000.00
10	Connect to Existing Sewers	3	EA	$ 4,500.00	$ 13,500.00
11	Bypass Pumping	1	LS	$ 30,000.00	$ 30,000.00
12	Cleanup and Restoration	1,705	LF	$ 5.00	$ 8,525.00
	Pipe Construction Subtotal				**$ 424,450.00**
	Construction Subtotal (Rounded to Nearest Thousand)				**$ 487,000.00**
	Construction Contingencies (15% Construction Cost)				$ 74,000.00
	Construction Engineering / Testing (8% Construction Total)				$ 39,000.00
	Construction Engineering / Testing Contingency (15%)				$ 6,000.00
	Legal, Administration and Financing (8% Construction Total)				$ 39,000.00
	Design Engineering (8% Current Construction Cost)				$ 39,000.00
	Design Engineering Contingency (15%)				$ 6,000.00
	ASSUMPTIONS				
1	Private Service Connection costs detailed on individual basis.				
2	Sewer across RR tracks to be jack and bored inside 30" steel casing.				
3	Cleanup and restoration includes topsoil, seed, and mulch.				
	TOTAL PROJECT COST				**$ 690,000.00**

OPINION OF PROBABLE CONSTRUCTION COST
TETRA TECH

710 Avis Rd. Ann Arbor, MI 48108
Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township Asset Management Plan	**DATE:**	9/23/2019
LOCATION:	Northfield Township	**PROJECT NO.**	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	**ESTIMATOR:**	JTM
WORK:	CS-10: North Shore 2 Pump Station Replacement	**CHECKED BY:**	JCS
		CURRENT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
	General				
1	Mobilization (5% of Construction Cost, Max $150,000)	1	LS	-	$ 18,900.00
2	Traffic Control (3% of Construction Cost)	1	LS	-	$ 11,400.00
3	Audio Visual	1	LS	$ 5,000.00	$ 5,000.00
4	SESC (1% of Construction Cost)	1	LS	-	$ 3,800.00
5	Utility Allowance (2% of Construction Cost)	1	LS	-	$ 7,600.00
6	General Conditions (2% of Construction Cost)	1	LS	-	$ 7,600.00
7	UIS Programming Allowance	1	LS	-	$ 10,000.00
	Construction Cost				
8	Silt Fence	225	FT	$ 5.00	$ 1,125.00
9	Pit Excavation	200	CY	$ 100.00	$ 20,000.00
10	Groundwater Dewatering	1.0	Mo	$ 15,000.00	$ 15,000.00
11	Bypass Pumping	0.5	Mo	$ 10,000.00	$ 5,000.00
12	Asphalt Pavement	350	SY	$ 100.00	$ 35,000.00
13	Bypass Connection	1	LS	$ 5,000.00	$ 5,000.00
14	DIP Forcemain and Fittings	100	LF	$ 200.00	$ 20,000.00
15	Plug Valve and Box	2	EA	$ 7,500.00	$ 15,000.00
16	Influent Sewer Reconnection PVC	10	FT	$ 150.00	$ 1,500.00
17	Sanitary MH Tap	1	EA	$ 5,000.00	$ 5,000.00
18	Precast Concrete Wet Well	1	EA	$ 30,000.00	$ 30,000.00
19	Precast Concrete Valve Vault	1	EA	$ 10,000.00	$ 10,000.00
20	Hatches	2	EA	$ 5,000.00	$ 10,000.00
21	455 GPM Duplex Station Pumps	2	EA	$ 50,000.00	$ 100,000.00
22	Interior Piping and Pressure Valving	1	LS	$ 20,000.00	$ 20,000.00
23	Pump Controls	1	LS	$ 50,000.00	$ 50,000.00
24	Raceway, Cabling, Enclosures, Terminations, and Misc. Electrical Items (Includes Reconnection)	1	LS	$ 15,000.00	$ 15,000.00
25	Existing PS Abandonment	1	LS	$ 15,000.00	$ 15,000.00
26	Site Restoration	1	LS	$ 5,000.00	$ 5,000.00
	Construction Subtotal				**$ 377,625.00**
	Construction Subtotal (Rounded to Nearest Thousand)				**$ 442,000.00**
	Construction Contingencies (15% Construction Cost)				$ 67,000.00
	Construction Engineering / Testing (8% Construction Total)				$ 36,000.00
	Construction Engineering / Testing Contingency (15%)				$ 6,000.00
	Legal, Administration and Financing (8% Construction Total)				$ 36,000.00
	Design Engineering (8% Current Construction Cost)				$ 36,000.00
	Design Engineering Contingency (15%)				$ 6,000.00
	ASSUMPTIONS				
1.	Existing control building, electrical feed and generator to remain for reuse.				
2.	Abandonment of existing station to be based on filling with flowable fill and remaining portions below grade.				
	TOTAL PROJECT COST				**$ 629,000.00**

OPINION OF PROBABLE CONSTRUCTION COST
TETRA TECH

710 Avis Rd. Ann Arbor, MI 48108 **Telephone: (734) 665-6000 FAX: (734) 665-2570**

PROJECT:	**Northfield Township Asset Management Plan**	**DATE:**	**9/23/2019**
LOCATION:	**Northfield Township**	**PROJECT NO.**	**200-12748-18002**
BASIS FOR ESTIMATE:	**[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL**	**ESTIMATOR:**	**JTM**
WORK:	**CS-12: Horshoe Lake 2 Pump Station Replacement**	**CHECKED BY:**	**JCS**
		CURRENT ENR:	**11311**

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
	General				
1	Mobilization (5% of Construction Cost, Max $150,000)	1	LS	-	$ 16,300.00
2	Traffic Control (3% of Construction Cost)	1	LS	-	$ 9,800.00
3	Audio Visual	1	LS	$ 5,000.00	$ 5,000.00
4	SESC (1% of Construction Cost)	1	LS	-	$ 3,300.00
5	Utility Allowance (2% of Construction Cost)	1	LS	-	$ 6,600.00
6	General Conditions (2% of Construction Cost)	1	LS	-	$ 6,600.00
7	UIS Programming Allowance	1	LS	-	$ 10,000.00
	Construction Cost				
8	Silt Fence	200	FT	$ 5.00	$ 1,000.00
9	Pit Excavation	200	CY	$ 100.00	$ 20,000.00
10	Gravel Access Drive	1	EA	$ 3,000.00	$ 3,000.00
11	Groundwater Dewatering	1.0	Mo	$ 15,000.00	$ 15,000.00
12	Bypass Pumping	0.5	Mo	$ 10,000.00	$ 5,000.00
13	Bypass Connection	1	LS	$ 5,000.00	$ 5,000.00
14	DIP Forcemain and Fittings	100	LF	$ 200.00	$ 20,000.00
15	Plug Valve and Box	2	EA	$ 7,500.00	$ 15,000.00
16	Influent Sewer Reconnection PVC	10	FT	$ 150.00	$ 1,500.00
17	Sanitary MH Tap	1	EA	$ 5,000.00	$ 5,000.00
18	Precast Concrete Wet Well	1	EA	$ 30,000.00	$ 30,000.00
19	Precast Concrete Valve Vault	1	EA	$ 10,000.00	$ 10,000.00
20	Hatches	2	EA	$ 5,000.00	$ 10,000.00
21	150 GPM Duplex Station Pumps	2	EA	$ 25,000.00	$ 50,000.00
22	Generator	1	EA	$ 30,000.00	$ 30,000.00
23	Interior Piping and Pressure Valving	1	LS	$ 20,000.00	$ 20,000.00
24	Pump Controls	1	LS	$ 50,000.00	$ 50,000.00
25	Raceway, Cabling, Enclosures, Terminations, and Misc. Electrical Items (Includes Reconnection)	1	LS	$ 15,000.00	$ 15,000.00
26	Existing PS Abandonment	1	LS	$ 15,000.00	$ 15,000.00
27	Site Restoration	1	LS	$ 5,000.00	$ 5,000.00
	Construction Subtotal				**$ 325,500.00**
	Construction Subtotal (Rounded to Nearest Thousand)				**$ 384,000.00**
	Construction Contingencies (15% Construction Cost)				$ 58,000.00
	Construction Engineering / Testing (8% Construction Total)				$ 31,000.00
	Construction Engineering / Testing Contingency (15%)				$ 5,000.00
	Legal, Administration and Financing (8% Construction Total)				$ 31,000.00
	Design Engineering (8% Current Construction Cost)				$ 31,000.00
	Design Engineering Contingency (15%)				$ 5,000.00
	ASSUMPTIONS				
1.	Existing control building, electrical feed and generator to remain for reuse.				
2.	Abandonment of existing station to be based on filling with flowable fill and remaining portions below grade.				
	TOTAL PROJECT COST				**$ 545,000.00**

OPINION OF PROBABLE PROJECT COST

TETRA TECH, CBE

710 Avis Drive, Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Wet Weather Storage Tank Improvements	DATE:	1/22/2020
LOCATION:	Northfield Twp., MI	PROJECT NO.	200-12748-19003
BASIS FOR ESTIMATE:	[ ] CONCEPTUAL [ ] PRELIMINARY [X] FINAL	ESTIMATOR:	JM, JY, RK, RS
WORK:	WWTP-1: WET WEATHER STORAGE TANK IMPROVMENTS	CHECKED BY:	
	SUMMARY BY DIVISION	CURRENT ENR:	11,392

ITEM NO.	DESCRIPTION	TOTAL AMOUNT
1	**Division 1 General Requirements**	$ 431,000.00
2	**Division 2 Site Construction**	$ 507,000.00
3	**Division 3 Concrete**	$ 499,000.00
4	**Division 4 Masonry**	$ -
5	**Division 5 Metals**	$ 17,000.00
6	**Division 6 Wood and Plastic**	$ -
7	**Division 7 Thermal and Moisture Protection**	$ 5,000.00
8	**Division 8 Doors and Windows**	$ 32,000.00
9	**Division 9 Finishes**	$ 4,000.00
10	**Division 10 Specialties**	$ -
11	**Division 11 Equipment**	$ 241,000.00
12	**Division 12 Furnishings**	$ -
13	**Division 13 Special Construction**	$ 875,000.00
14	**Division 14 Conveying Systems**	$ -
15	**Division 15 Mechanical**	$ 575,000.00
16	**Division 16 Electrical and Instrumentation**	$ 370,000.00
17		
18	**Sub Total**	$ 3,556,000.00
19	**Contingency 30%**	$ 1,066,500.00
20		
21		
22		
	TOTAL CONSTRUCTION COST	**$ 4,622,500.00**

OPINION OF PROBABLE CONSTRUCTION COST

TETRA TECH, CBE

710 Avis Drive, Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Wet Weather Storage Tank Improvements	DATE:	1/22/2020
LOCATION:	Northfield Twp., MI	PROJECT NO.	200-12748-19003
BASIS FOR ESTIMATE:	[ ] CONCEPTUAL [ ] PRELIMINARY [X] FINAL	ESTIMATOR:	See Summary Pg.
WORK:	WWTP-1: WET WEATHER STORAGE TANK IMPROVMENTS	CHECKED BY:	See Summary Pg.
	Division 01 - 16	CURRENT ENR:	11392

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
22	**Division 1 General Requirements**				
23	Permits	1	LS	$ 1,000.00	$ 1,000.00
24	Allowance for Electrical Power Line Relocation	1	LS	$ 10,000.00	$ 10,000.00
25	Allowance for Unforseen Site Conditions	1	LS	$ 90,000.00	$ 90,000.00
26	Crane Rental	1	MO	$ 60,000.00	$ 60,000.00
27	Construction Sequencing and Difficulty Factor	1	LS	$ 20,000.00	$ 20,000.00
28	Bonds, Insurance, Temporary Facilities, etc.	8	%		$ 250,000.00
29	**TOTAL**				**$ 431,000.00**
30					
31	**Division 2 Site Construction**				
32	Demo Existing Pumps at 8 Mile Pumps 1 and 4	2	EA	$ 2,500.00	$ 5,000.00
33	Remove Grit and Screen Bldg Exterior Stairs	1	LS	$ 3,000.00	$ 3,000.00
34	Saw Cut Slab Opening for PEW Pump	1	LS	$ 5,000.00	$ 5,000.00
35	Valve and Meter Vault Excavation	420	CYD	$ 40.00	$ 16,800.00
36	Backfill	250	CYD	$ 30.00	$ 7,500.00
37	Haul from Site	170	CYD	$ 35.00	$ 5,950.00
38	Site Grading - Fill Around Vault	75	CYD	$ 30.00	$ 2,250.00
39	Clean Out MH, 4' Dia	1	EA	$ 4,000.00	$ 4,000.00
40	Custom Flat Lid	1	EA	$ 1,000.00	$ 1,000.00
41	Valve Vault, 6' Dia	1	EA	$ 6,500.00	$ 6,500.00
42	Custom Flat Lid	1	EA	$ 2,000.00	$ 2,000.00
43	Silt Fence	1,667	FT	$ 5.00	$ 8,335.00
44	Site Clearing	1.5	ACR	$ 20,000.00	$ 30,000.00
45	Remove Existing Fence	500	FT	$ 5.00	$ 2,500.00
46	Chain Link Fence with Barbed Wire	695	FT	$ 35.00	$ 24,325.00
47	XX-foot Double-Swing Gate (Access to Staging Area)	1	EA	$ 5,000.00	$ 5,000.00
48	Pavement Removal	670	SYD	$ 5.00	$ 3,350.00
49	HMA Pavement, 13A	220	TON	$ 250.00	$ 55,000.00
50	Aggregate Base, Modified, 8 inch	1,350	SYD	$ 10.00	$ 13,500.00
51	Sidewalk, Rem	25	SYD	$ 10.00	$ 250.00
52	Sidewalk, Conc, 4 inch	1,000	SFT	$ 5.00	$ 5,000.00
53	Geotextile Fabric	90	SYD	$ 5.00	$ 450.00
54	Dumpster Pad, Concrete, 8 inch	180	SFT	$ 10.00	$ 1,800.00
55	Dumpster Enclosure, 8'x19'	1	LS	$ 10,000.00	$ 10,000.00
56	Curb and Gutter, Conc	100	FT	$ 15.00	$ 1,500.00
57	Extend Existing CMP Culvert, X-inch	25	FT	$ 65.00	$ 1,625.00
58	North Detention Basin	1	LS	$ 50,000.00	$ 50,000.00
59	South Detention Basin	1	LS	$ 40,000.00	$ 40,000.00
60	Swale	1	LS	$ 25,000.00	$ 25,000.00
61	Erosion Control, Check Dam, Stone	35	FT	$ 30.00	$ 1,050.00
62	Riprap, Swale Inlets and Outlets	3	CYD	$ 500.00	$ 1,500.00
63	Turf Restoration (Including Topsoil, Seed and Mulch)	11,000	SYD	$ 10.00	$ 110,000.00
64	Erosion Control, Gravel Access Approach	1	EA	$ 2,000.00	$ 2,000.00

OPINION OF PROBABLE CONSTRUCTION COST

TETRA TECH, CBE

710 Avis Drive, Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Wet Weather Storage Tank Improvements	DATE:	1/22/2020
LOCATION:	Northfield Twp., MI	PROJECT NO.	200-12748-19003
BASIS FOR ESTIMATE:	[ ] CONCEPTUAL [ ] PRELIMINARY [X] FINAL	ESTIMATOR:	See Summary Pg.
WORK:	WWTP-1: WET WEATHER STORAGE TANK IMPROVMENTS	CHECKED BY:	See Summary Pg.
	Division 01 - 16	CURRENT ENR:	11392

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
65	Excavation/Topsoil Stripping for Tank Fill	585	CYD	$ 20.00	$ 11,700.00
66	Tank Subbase Fill, Class II, CIP	2,300	CYD	$ 15.00	$ 34,500.00
67	Drainage Fill, 6 inches	220	TON	$ 40.00	$ 8,800.00
68					
69	**TOTAL**				**$ 507,000.00**
70					
71	**Division 3 Concrete**				
72	Valve and Meter Vault Base Slab	17	CYD	$ 450.00	$ 7,650.00
73	Walls	34	CYD	$ 650.00	$ 22,100.00
74	Supported Slab	14	CYD	$ 800.00	$ 11,200.00
75	Sump	13	CYD	$ 700.00	$ 9,100.00
76	WWST Foundation	1,040	CYD	$ 425.00	$ 442,000.00
77	Footing for Tank Stair	1	EA	$ 1,500.00	$ 1,500.00
78	Footings for Grit Bldg Stair	2	EA	$ 1,500.00	$ 3,000.00
79	Misc Concete Work at PEW Pump Hatch	1	LS	$ 1,500.00	$ 1,500.00
80	**TOTAL**				**$ 499,000.00**
81					
82	**Division 4 Masonry**				
83					$ -
84	**TOTAL**				**$ -**
85					
86	**Division 5 Metals**				
87	Reinstall Grit Bldg Exterior Stairs	1	LS	$ 2,000.00	$ 2,000.00
88	Valve and Meter Vault Guard Rail	50	LF	$ 125.00	$ 6,250.00
89	Bollards	2	EA	$ 3,500.00	$ 7,000.00
90	Grating and Support Angles	2	EA	$ 750.00	$ 1,500.00
91	**TOTAL**				**$ 17,000.00**
92					
93	**Division 6 Wood and Plastic**				
94					$ -
95	**TOTAL**				**$ -**
96					
97	**Division 7 Thermal and Moisture Protection**				
98	Waterproofing Exteriior Meter and Valve Vault Structure	860	SF	$ 5.00	$ 4,300.00
99	Waterproofing Exteriior Valve Vault	170	SF	$ 5.00	$ 850.00
100	**TOTAL**				**$ 5,000.00**
101					
102	**Division 8 Doors and Windows**				
103	Valve and Meter Vault 3.5'x3.5' Floor Door w/ Safety Grating	4	EA	$ 5,000.00	$ 20,000.00
104	Clean Out and Valve MH 3' x 3' Floor Door w/Safety Grating	2	EA	$ 400.00	$ 800.00
105	Ladders	44	VLF	$ 250.00	$ 11,000.00
106					$ -
107	**TOTAL**				**$ 32,000.00**

OPINION OF PROBABLE CONSTRUCTION COST

TETRA TECH, CBE

710 Avis Drive, Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Wet Weather Storage Tank Improvements	DATE:	1/22/2020
LOCATION:	Northfield Twp., MI	PROJECT NO.	200-12748-19003
BASIS FOR ESTIMATE:	[ ] CONCEPTUAL [ ] PRELIMINARY [X] FINAL	ESTIMATOR:	See Summary Pg.
WORK:	WWTP-1: WET WEATHER STORAGE TANK IMPROVMENTS	CHECKED BY:	See Summary Pg.
	Division 01 - 16	CURRENT ENR:	11392

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
108					
109	**Division 9 Finishes**				
110	Painting	1	LS	$ 4,000.00	$ 4,000.00
111					$ -
112					$ -
113	**TOTAL**				**$ 4,000.00**
114					
115	**Division 10 Specialties**				
116	**TOTAL**				**$ -**
117					
118	**Division 11 Equipment**				
119					
120	WWTP				
121	PEW Pump, Submersible	1	LS	$ 12,000.00	$ 12,000.00
122	Installation, Confined Space	1	LS	$ 4,800.00	$ 4,800.00
123	Valve and Meter Vault Sump Pump	1	:LS	$ 3,000.00	$ 3,000.00
124	8 Mile PS			.	
125	New Pumps, Submersible	2	LS	$ 85,000.00	$ 170,000.00
126	Installation, Confined Space	2	LS	$ 25,500.00	$ 51,000.00
127					$ -
128	**TOTAL**				**$ 241,000.00**
129					
130	**Division 12 Furnishings**				
131	**TOTAL**				**$ -**
132					
133	**Division 13 Special Construction**				
134					$ -
135	WWST, Bolted Steel w/ Dormer, Stairs Roof Walkway, Installed	1	LS	$ 865,000.00	$ 865,000.00
136	Contractor Coordination & Exterior Mounted Utilities	1	LS	$ 10,000.00	$ 10,000.00
137	**TOTAL**				**$ 875,000.00**
138					
139	**Division 14 Conveying Systems**				
140	**TOTAL**				**$ -**
141					
142	**Division 15 Mechanical**				
143	WWTP				
144	14" RS - Pipe (MJ)	60	LF	$ 280.00	$ 16,800.00
145	Concrete Encasement	15	CYD	$ 300.00	$ 4,500.00
146	14" RS - Fittings	4	EA	$ 2,800.00	$ 11,200.00
147	14" Plug Valve - manual	1	EA	$ 5,000.00	$ 5,000.00
148	12" FM - Pipe (MJ)	55	LF	$ 200.00	$ 11,000.00
149	12" FM - Pipe (FJ)	45	LF	$ 200.00	$ 9,000.00
150	12" FM - Fittings	12	EA	$ 2,000.00	$ 24,000.00

OPINION OF PROBABLE CONSTRUCTION COST

TETRA TECH, CBE

710 Avis Drive, Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Wet Weather Storage Tank Improvements	DATE:	1/22/2020
LOCATION:	Northfield Twp., MI	PROJECT NO.	200-12748-19003
BASIS FOR ESTIMATE:	[ ] CONCEPTUAL [ ] PRELIMINARY [X] FINAL	ESTIMATOR:	See Summary Pg.
WORK:	WWTP-1: WET WEATHER STORAGE TANK IMPROVMENTS	CHECKED BY:	See Summary Pg.
	Division 01 - 16	CURRENT ENR:	11392

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
151	12" Wall Penetration	2	EA	$ 3,000.00	$ 6,000.00
152	12" Plug Valve - TH, Floor Stand, Ext, Stem, Motor Operated	2	EA	$ 25,000.00	$ 50,000.00
153	12" Check Valve	1	EA	$ 10,000.00	$ 10,000.00
154	12" Plug Valve - Manual	3	EA	$ 7,000.00	$ 21,000.00
155	8" FM - Pipe (MJ)	35	LF	$ 160.00	$ 5,600.00
156	8" FM - Pipe (FJ) and Spools	10	LF	$ 350.00	$ 3,500.00
157	8" FM - Fittings	4	EA	$ 1,600.00	$ 6,400.00
158	8" Wall Penetration	1	EA	$ 2,500.00	$ 2,500.00
159	8" Plug Valve - Manual	2	EA	$ 3,800.00	$ 7,600.00
160	10" Pipe (MJ)	15	LF	$ 195.00	$ 2,925.00
161	10" Pipe (FJ), and Spools	20	LF	$ 450.00	$ 9,000.00
162	10" Fittings	3	EA	$ 1,950.00	$ 5,850.00
163	10" Plug Valve - Manual	1	EA	$ 5,000.00	$ 5,000.00
164	10" Wall Penetration	3	EA	$ 2,500.00	$ 7,500.00
165	12" OF - Pipe (FJ) and Spools	30	LF	$ 500.00	$ 15,000.00
166	12" OF - Pipe (MJ)	700	LF	$ 240.00	$ 168,000.00
167	12" OF - Fittings	12	EA	$ 2,400.00	$ 28,800.00
168	12" Wall Penetration	1	EA	$ 3,000.00	$ 3,000.00
169	6" Pipe (FJ) and Spools	5	LF	$ 250.00	$ 1,250.00
170	6" Throttling Plug Valve, Floor Stand, Ext, Stem, Motor Operated	1	EA	$ 18,000.00	$ 18,000.00
171	4" D Pipe	10	LF	$ 100.00	$ 1,000.00
172	4" D Fittings	3	EA	$ 1,000.00	$ 3,000.00
173	4" D Valve	1	EA	$ 2,000.00	$ 2,000.00
174	4" Wall Penetration	1	EA	$ 2,000.00	$ 2,000.00
175	Hydrant	2	EA	$ 2,500.00	$ 5,000.00
176	Sump Pump	1	EA	$ 2,000.00	$ 2,000.00
177	3" PEW DI (FJ), Fittings and Spools	30	LF	$ 150.00	$ 4,500.00
178	3" PEW DI (MJ)	800	LF	$ 80.00	$ 64,000.00
179	3" PEW Cu	30	LF	$ 80.00	$ 2,400.00
180	3" PEW PVC	100	LF	$ 50.00	$ 5,000.00
181	3" B'fly Valves w/ Ext Bonnets	3	EA	$ 800.00	$ 2,400.00
182	3" Check Valve	1	EA	$ 1,000.00	$ 1,000.00
183	3" Fittings	25	EA	$ 300.00	$ 7,500.00
184	3" Wall Penetration	1	EA	$ 2,000.00	$ 2,000.00
185	2" D Pipe	15	LF	$ 50.00	$ 750.00
186	2" Wall Penetration	1	EA	$ 1,700.00	$ 1,700.00
187	8 Mile PS				
188	Pipe Rework	2	LS	$ 5,000.00	$ 10,000.00
189	**TOTAL**				**$ 575,000.00**
190					
191	**Division 16 Electrical and Instrumentation**				
192	WWTP				
193	Manual Motor Starter	3	EA	$ 440.00	$ 1,320.00

OPINION OF PROBABLE CONSTRUCTION COST

TETRA TECH, CBE

710 Avis Drive, Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Wet Weather Storage Tank Improvements	DATE:	1/22/2020
LOCATION:	Northfield Twp., MI	PROJECT NO.	200-12748-19003
BASIS FOR ESTIMATE:	[ ] CONCEPTUAL [ ] PRELIMINARY [X] FINAL	ESTIMATOR:	See Summary Pg.
WORK:	WWTP-1: WET WEATHER STORAGE TANK IMPROVMENTS	CHECKED BY:	See Summary Pg.
	Division 01 - 16	CURRENT ENR:	11392

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
194	60 amp disconnect	1	EA	$ 875.00	$ 875.00
194	30 amp fused disconnect	1	EA	$ 965.00	$ 965.00
195	60 amp fused disconnect	1	EA	$ 1,250.00	$ 1,250.00
196	30 amp fuses	6	EA	$ 25.00	$ 150.00
197	Level Transmitter with remote display	1	EA	$ 6,000.00	$ 6,000.00
198	Flow Transmitter	1	EA	$ 12,000.00	$ 12,000.00
199	Float switch	1	LOT	$ 800.00	$ 800.00
200	MCP control panel Upgrade	1	LOT	$ 30,000.00	$ 30,000.00
201	20 hp VFD with NEMA4 enclosure	1	EA	$ 10,450.00	$ 10,450.00
202	J-Boxes	5	EA	$ 550.00	$ 2,750.00
203	I/I isolators	16	EA	$ 600.00	$ 9,600.00
204	strut/hardware	1	LOT	$ 6,500.00	$ 6,500.00
205	Light Fixtures	2	EA	$ 620.00	$ 1,240.00
206	Recepts and Switches	2	EA	$ 300.00	$ 600.00
207	Lightning Protection	1	LOT	$ 5,892.00	$ 5,892.00
208	Grounding	1	LOT	$ 12,300.00	$ 12,300.00
209	3/4" RMC	510	LF	$ 14.15	$ 7,216.50
210	2" RMC	240	LF	$ 36.25	$ 8,700.00
211	1" RMC	1,120	LF	$ 18.80	$ 21,056.00
212	#14 awg	370	CLF	$ 65.00	$ 24,050.00
213	#12 awg	55	CLF	$ 94.00	$ 5,170.00
214	#8 awg	5	CLF	$ 120.00	$ 600.00
215	2/C#18SH	120	CLF	$ 130.00	$ 15,600.00
216	Trenching with chain trencher	800	LF	$ 3.00	$ 2,400.00
217	Demolition and MCP labor	480	HR	$ 100.00	$ 48,000.00
218	Programming by Tt	1	LS	$ 15,000.00	$ 15,000.00
219					
220	8 Mile PS				
221	125 hp VFD with NEMA1 enclosure	3	EA	$ 24,625.00	$ 73,875.00
222	200 amp MCC circuit breaker replacement	2	EA	$ 2,250.00	$ 4,500.00
223	2-1/2" RMC	40	LF	$ 36.00	$ 1,440.00
224	#4/0 awg	8	CLF	$ 250.00	$ 2,000.00
225	Demolition and VFD enclosure work	320	HR	$ 100.00	$ 32,000.00
226	Programming by Tt	1	LS	$ 5,000.00	$ 5,000.00
227					
228					
202	**TOTAL**				**$ 370,000.00**
203					

OPINION OF PROBABLE PROJECT COST
TETRA TECH

710 Avis Drive, Suite 100, Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township WWTP Asset Management WWTP – 2	DATE:	9/19/2019
LOCATION:	Northfield Township	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	BGB
WORK:	WWTP-2: Aeration Improvements and Blower Replacement	CHECKED BY:	
		CURRENT ENR:	

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1	**AERATION IMPROVEMENTS**				
2	Remove Existing Diffusers	1	LS	$ 2,000.00	$ 2,000.00
3	Fine Bubble Diffusers	1	LS	$ 40,250.00	$ 40,250.00
4	Diffuser Installation	1	LS	$ 6,000.00	$ 6,000.00
5	Valve - Motorized	3	EA	$ 6,000.00	$ 18,000.00
6	Piping	3	EA	$ 2,000.00	$ 6,000.00
7	Air Flowmeter	3	EA	$ 1,500.00	$ 4,500.00
8	Dissolved Oxygen Probe	3	EA	$ 4,500.00	$ 13,500.00
9	Concrete Core	6	EA	$ 500.00	$ 3,000.00
10	Electrical (conduit, wire, disconnect, fittings, strut, installation)	1	LS	$ 55,000.00	$ 55,000.00
11					
12	**Subtotal**				$ 149,000.00
13					
14	**BLOWER REPLACEMENTS**				
15	Remove Existing Blower	1	EA	$ 1,000.00	$ 1,000.00
16	350 CFM Blower w/ vfd	1	EA	$ 40,250.00	$ 40,250.00
17	Blower Installation	1	EA	$ 10,000.00	$ 10,000.00
18	Base modification	1	EA	$ 1,000.00	$ 1,000.00
19	Piping	1	EA	$ 5,000.00	$ 5,000.00
20	Valves	1	EA	$ 4,500.00	$ 4,500.00
21	Electrical	1	EA	$ 30,000.00	$ 30,000.00
22	Programming and Controls	2	LS	$ 15,000.00	$ 30,000.00
23	**Subtotal**				$ 122,000.00
24					
25	General Conditions	10	%		$ 27,100.00
26	Contingencies	15	%		$ 40,650.00
27					
28					
	TOTAL PROJECT COST				**$ 339,000.00**

OPINION OF PROBABLE PROJECT COST
TETRA TECH

710 Avis Drive, Suite 100, Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	**Northfield Township WWTP Asset Management WWTP – 3**	**DATE:**	**9/27/2019**
LOCATION:	**Northfield Township**	**PROJECT NO.**	**200-12748-18002**
BASIS FOR ESTIMATE:	**[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL**	**ESTIMATOR:**	**DGW**
WORK:	**WWTP-3: Secondary Settling Tanks Restoration**	**CHECKED BY:**	
		CURRENT ENR:	**11311**
		PROJECT ENR:	**11311**

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1					
2	**30 ft diameter Intermediate Tank**				
3	Remove Collection Mechanism	1	LS	$ 5,000.00	$ 5,000.00
4	New Collection Mechanism	1	LS	$ 75,000.00	$ 75,000.00
5	Electrical (conduit, wire, disconnect, fittings, strut, installation)	1	LS	$ 4,000.00	$ 4,000.00
6	Painting (Bridge, I-beams, etc)	1	LS	$ 5,000.00	$ 5,000.00
7	Painting Handrail	200	LF	$ 10.00	$ 2,000.00
8	Weir Cleaning Assembly or Cover	1	LS	$ 20,000.00	$ 20,000.00
9					
10	**Final Settling Tanks (Two - 30 ft diameter, One 40 ft diameter)**				
11	Remove Collection Mechanism (Final Clarifier 1 Only)	1	LS	$ 5,000.00	$ 5,000.00
12	New Collection Mechanism (Final Clarifier 1 Only)	1	LS	$ 75,000.00	$ 75,000.00
13	Electrical (conduit, wire, disconnect, fittings, strut, installation)	1	LS	$ 4,000.00	$ 4,000.00
14	Painting (Bridge, I-beams, etc) (1& 2)	2	LS	$ 5,000.00	$ 10,000.00
15	Painting Handrail (1 & 2)	650	LF	$ 10.00	$ 6,500.00
16	Weir Cleaning Assembly or Cover (1 & 2)	2	LS	$ 20,000.00	$ 40,000.00
17					
18					
19	**Subtotal**				$ 251,500.00
20					
21	General Requirements	10	%		$ 26,000.00
22	Engineering and Administration	20	%		$ 51,000.00
23	Contingencies	30	%		$ 76,000.00
24					
TOTAL PROJECT COST (ADJUSTED FOR PROJECTED CONSTRUCTION YEAR)					**$ 405,000.00**

OPINION OF PROBABLE PROJECT COST
TETRA TECH

710 Avis Drive, Suite 100, Ann Arbor, MI 48108
Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township WWTP Asset Management WWTP – 4	DATE:	9/27/2019
LOCATION:	Northfield Township	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	DGW
WORK:	WWTP-4: Filter Building No. 1 Rehabilitation	CHECKED BY:	
		CURRENT ENR:	11311
		PROJECT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1					
2	**Filter Building**				
3	Replace Piston Pump	1	EA	$ 18,750.00	$ 18,750.00
4	Filter Influent Check Valve Replacement (1 & 2)	2	EA	$ 28,000.00	$ 56,000.00
5	Unit Heater Replacement	4	EA	$ 2,300.00	$ 9,200.00
6	Electrical (conduit, wire, disconnect, fittings, installation)	1	LS	$ 7,000.00	$ 7,000.00
7					
8	**Grit/Screen Building**				
9	Forced Air Furnace	1	LS	$ 2,300.00	$ 2,300.00
10					
11					
12					
13					
14					
15					
16					
17					
18	**Subtotal**				$ 93,250.00
19					
20	General Requirements	10	%		$ 10,000.00
21	Engineering and Administration	20	%		$ 19,000.00
22	Contingencies	30	%		$ 28,000.00
23					
24					
25					
26					
27					
28					
TOTAL PROJECT COST (ADJUSTED FOR PROJECTED CONSTRUCTION YEAR)					**$ 151,000.00**

OPINION OF PROBABLE PROJECT COST
TETRA TECH

710 Avis Drive, Suite 100, Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township WWTP Asset Management WWTP – 5	DATE:	9/27/2019
LOCATION:	Northfield Township	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	RWS
WORK:	WWTP-5: Controls Replacements	CHECKED BY:	
		CURRENT ENR:	11311
		PROJECT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1					
2	**SCADA/Controls/SCADA Replacement**				
3	Control Panels	1	LS	$ 112,500.00	$ 112,500.00
4	SCADA System Programming	1	LS	$ 48,000.00	$ 48,000.00
5	Misc Devices	1	LS	$ 40,000.00	$ 40,000.00
6	Contuit/Wire/FO	1	LS	$ 79,000.00	$ 79,000.00
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18	**Subtotal**				$ 279,500.00
19					
20	General Requirements	10	%		$ 28,000.00
21	Engineering and Administration	20	%		$ 56,000.00
22	Contingencies	30	%		$ 84,000.00
23					
24					
25					
26					
27					
28					
TOTAL PROJECT COST (ADJUSTED FOR PROJECTED CONSTRUCTION YEAR)					**$ 448,000.00**

OPINION OF PROBABLE PROJECT COST
TETRA TECH

710 Avis Drive, Suite 100, Ann Arbor, MI 48108
Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township WWTP Asset Management WWTP – 6	DATE:	9/27/2019
LOCATION:	Northfield Township	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	RWS
WORK:	WWTP-6: Primary Switchgear Replacement	CHECKED BY:	
		CURRENT ENR:	11311
		PROJECT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1					
2	**Primary Switch and Transformer Replacement**				
3	Primary Switch	1	EA	$ 150,000.00	$ 150,000.00
4	Transformer	1	LS	$ 148,000.00	$ 148,000.00
5	Electrical (conduit, wire, fittings)	1	LS	$ 31,200.00	$ 31,200.00
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18	**Subtotal**				$ 329,200.00
19					
20	General Requirements	10	%		$ 33,000.00
21	Engineering and Administration	20	%		$ 66,000.00
22	Contingencies	30	%		$ 99,000.00
23					
24					
25					
26					
27					
28					
TOTAL PROJECT COST (ADJUSTED FOR PROJECTED CONSTRUCTION YEAR)					**$ 528,000.00**

OPINION OF PROBABLE PROJECT COST
TETRA TECH

710 Avis Drive, Suite 100, Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township WWTP Asset Management WWTP – 7	DATE:	9/27/2019
LOCATION:	Northfield Township	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	DGW
WORK:	WWTP-7: Miscellaneous Pump Replacement	CHECKED BY:	
		CURRENT ENR:	11311
		PROJECT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1					
2	**Pumps**				
3	Grit Pump	1	EA	$ 29,100.00	$ 29,100.00
4	Thickener Dilution Water Pump (1)	1	EA	$ 15,000.00	$ 15,000.00
5	Service Water System Pumps (2)	2	EA	$ 4,000.00	$ 8,000.00
6	Electrical (conduit, wire, disconnect, fittings, installation)	1	LS	$ 7,000.00	$ 7,000.00
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18	**Subtotal**				$ 59,100.00
19					
20	General Requirements	10	%		$ 6,000.00
21	Engineering and Administration	20	%		$ 12,000.00
22	Contingencies	30	%		$ 18,000.00
23					
24					
25					
26					
27					
28					
TOTAL PROJECT COST (ADJUSTED FOR PROJECTED CONSTRUCTION YEAR)					**$ 96,000.00**

OPINION OF PROBABLE PROJECT COST
TETRA TECH

710 Avis Drive, Suite 100, Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township WWTP Asset Management WWTP – 8	DATE:	9/27/2019
LOCATION:	Northfield Township	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	RWS
WORK:	WWTP-8: MCCs Replacement	CHECKED BY:	
		CURRENT ENR:	11311
		PROJECT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1					
2	**Motor Control Center Replacements**				
3	Replace MCC sections	28	EA	$ 12,000.00	$ 336,000.00
4	Replace Lighting Panels and transformers	1	LS	$ 60,000.00	$ 60,000.00
5					
6					
7					
8	Electrical (conduit, wire, disconnect, fittings, strut, installation)	1	LS	$ 40,500.00	$ 40,500.00
9					
10					
11					
12					
13					
14					
15					
16					
17					
18	**Subtotal**				$ 436,500.00
19					
20	General Requirements	10	%		$ 44,000.00
21	Engineering and Administration	20	%		$ 88,000.00
22	Contingencies	30	%		$ 131,000.00
23					
24					
25					
26					
27					
28					
TOTAL PROJECT COST (ADJUSTED FOR PROJECTED CONSTRUCTION YEAR)					**$ 700,000.00**

OPINION OF PROBABLE PROJECT COST
TETRA TECH

710 Avis Drive, Suite 100, Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township WWTP Asset Management WWTP – 9	DATE:	9/27/2019
LOCATION:	Northfield Township	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	DGW
WORK:	WWTP-9: Roof Refurbishment	CHECKED BY:	
		CURRENT ENR:	11311
		PROJECT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1					
2	**Office/Lab/Garage (aka Service Bldg and Garage)**				
3	Roof	2,600	SF	$ 25.00	$ 65,000.00
4	Doors and Windows	1	LS	$ 6,000.00	$ 6,000.00
5	**Digester Building**				
6	Roof	950	SF	$ 25.00	$ 23,750.00
7	Doors and Windows	1	LS	$ 15,000.00	$ 15,000.00
8	**Grit/Screen Building**				
9	Roof	1,060	SF	$ 25.00	$ 26,500.00
10	Garage Door	1	LS	$ 10,000.00	$ 10,000.00
11	**Filter Building No. 1**				
12	Roof	2,390	SF	$ 25.00	$ 59,750.00
13	Doors and Windows	1	LS	$ 3,000.00	$ 3,000.00
14					
15					
16	Misc Electrical for Garage Door	1	LS	$ 1,500.00	$ 1,500.00
17					
18	**Subtotal**				$ 210,500.00
19					
20	General Requirements	10	%		$ 22,000.00
21	Engineering and Administration	20	%		$ 43,000.00
22	Contingencies	30	%		$ 64,000.00
23					
24					
25					
26					
27					
28					
TOTAL PROJECT COST (ADJUSTED FOR PROJECTED CONSTRUCTION YEAR)					**$ 340,000.00**

OPINION OF PROBABLE PROJECT COST
TETRA TECH

710 Avis Drive, Suite 100, Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township WWTP Asset Management WWTP – 10	DATE:	9/27/2019
LOCATION:	Northfield Township	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	DGW
WORK:	WWTP-10: Digester Building Improvements	CHECKED BY:	
		CURRENT ENR:	11311
		PROJECT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1					
2	**Digester Building**				
3	Sludge Triplex Pump Rehab	1	LS	$ 10,000.00	$ 10,000.00
4	Sludge (Simplex) Transfer Pump Rehabilitation	1	LS	$ 10,000.00	$ 10,000.00
5	**Digester 1 Rehabilitation**				
6	Internal Components	1	LS	$ 175,000.00	$ 175,000.00
7	**Digester 2 Rehabilitation**				
8	Internal Components	1	LS	$ 175,000.00	$ 175,000.00
9					
10	**Electrical (conduit, wire, disconnect, fittings, strut, installation)**	1	LS	$ 35,000.00	$ 35,000.00
11					
12					
13					
14					
15					
16					
17					
18	**Subtotal**				$ 405,000.00
19					
20	General Requirements	10	%		$ 41,000.00
21	Engineering and Administration	20	%		$ 81,000.00
22	Contingencies	30	%		$ 122,000.00
23					
24					
25					
26					
27					
28					
TOTAL PROJECT COST (ADJUSTED FOR PROJECTED CONSTRUCTION YEAR)					**$ 649,000.00**

OPINION OF PROBABLE PROJECT COST
TETRA TECH

710 Avis Drive, Suite 100, Ann Arbor, MI 48108
Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township WWTP Asset Management WWTP – 11	DATE:	9/27/2019
LOCATION:	Northfield Township	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	RWS
WORK:	WWTP-11: Generator Replacement	CHECKED BY:	
		CURRENT ENR:	11311
		PROJECT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1					
2	**Permanent Standby Generator Replacement**				
3	250kW Diesel Generator	1	LS	$ 220,000.00	$ 220,000.00
4	Electrical (conduit, wire, disconnect, fittings, strut, installation)	1	LS	$ 10,200.00	$ 10,200.00
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18	**Subtotal**				$ 230,200.00
19					
20	General Requirements	10	%		$ 24,000.00
21	Engineering and Administration	20	%		$ 47,000.00
22	Contingencies	30	%		$ 70,000.00
23					
24					
25					
26					
27					
28					
TOTAL PROJECT COST (ADJUSTED FOR PROJECTED CONSTRUCTION YEAR)					**$ 372,000.00**

OPINION OF PROBABLE PROJECT COST
TETRA TECH

710 Avis Drive, Suite 100, Ann Arbor, MI 48108 Telephone: (734) 665-6000 FAX: (734) 665-2570

PROJECT:	Northfield Township WWTP Asset Management WWTP – 12	DATE:	2/3/2020
LOCATION:	Northfield Township	PROJECT NO.	200-12748-18002
BASIS FOR ESTIMATE:	[X] CONCEPTUAL [ ] PRELIMINARY [ ] FINAL	ESTIMATOR:	KMT
WORK:	WWTP-12: Tertiary Filters Replacement	CHECKED BY:	
		CURRENT ENR:	11311
		PROJECT ENR:	11311

ITEM NO.	DESCRIPTION	QUANT.	UNIT	UNIT AMOUNT	TOTAL AMOUNT
1					
2	**Filter Replacement**				
3					
4	Remove Existing equipment	2	EA	$ 5,000.00	$ 10,000.00
5	Equipment Pad	2	EA	$ 2,000.00	$ 4,000.00
6	Filter Equipment	2	EA	$ 290,000.00	$ 580,000.00
7	Filter Installation	2	LS	$ 87,000.00	$ 174,000.00
8	Piping and Valves	1	LS	$ 95,000.00	$ 95,000.00
9	Misc Piping	1	LS	$ 25,000.00	$ 25,000.00
10					
11	Electrical (15% of Filter Equipment and Installation)	1	LS	$ 134,000.00	$ 134,000.00
12					
13					
14	**Subtotal**				$ 1,022,000.00
15					
16	General Requirements	10	%		$ 103,000.00
17	Engineering and Administration	20	%		$ 205,000.00
18	Contingencies	30	%		$ 307,000.00
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
TOTAL PROJECT COST (ADJUSTED FOR PROJECTED CONSTRUCTION YEAR)					**$ 1,637,000.00**

APPENDIX J: ANNUAL ASSET MANAGEMENT REPORTS AND TEMPLATE

ANNUAL ASSET MANAGEMENT REPORT

NORTHFIELD TOWNSHIP

DATE

1. STAFFING LEVELS

The following staffing were maintained in the last year:

2. INSPECTIONS, MAINTENANCE AND CORRECTIVE ACTIONS

Collection System

The following inspections were conducted:

___feet of sewer televising

The following maintenance activities were performed:

___feet of sewer rodding

___feet of jet cleaning

The following system repairs were performed:

Treatment Works

The following inspections were conducted:

The following maintenance activities were performed:

The following repairs were performed:

3. EXPENDITURES

Collection System

Maintenance $

Corrective Actions $

Capital Improvements $

Treatment Works

Maintenance $

Corrective Actions $

Capital Improvements $

4. ASSETS IDENTIFIED FOR INSPECTION/ACTION IN NEXT YEAR

Collection System

Asset	Inspection/Action

Treatment Works

Asset	Inspection/Action

5. MAINTENACE AND CAPITAL IMPROVEMENT BUDGET FOR NEXT YEAR

<u>Collection System</u>

Maintenance	$
CIP	$

<u>Treatment Works</u>

Maintenance	$
CIP	$

6. UPDATED ASSET INVENTORY

The following updates have been made to the inventory:

7. UPDATED OM&R BUDGET

The updated rate schedule is attached.